

Rhodes University

Department of Education

**Improving explanation writing skills of Junior Secondary
Learners in Life Sciences: A case study.**

Submitted by

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Abstract

Learners in the Junior Secondary Phase (Grades 8 to 10) are often required to answer open-ended questions which require a response in the form of an explanation. As frequently reported in the external examiners' reports of Life Sciences, learners do not write adequate explanations as responses to explanatory questions. This thesis reports on action research based on my experience as a Life Sciences teacher trying to address this problem. Therefore, the purpose of this study was to develop suitable, manageable and effective strategies that I could implement in order to improve my teaching of explanation writing skills of in the Junior Secondary school learners with a view to enhance curriculum content knowledge in Life Sciences.

The intervention was carried out in a Grade 10 Life Sciences class which consisted of 35 learners. The first cycle consisted of seven lessons carried out over two weeks in normal school time. The main sources of data from my lesson interventions were the learners' written work, their journal entries, the researcher's journal, the field notes from the non-participant observer and interviews with two focus groups. Both the interviews and the lessons were recorded and transcribed.

The research data reveals that the ability of the Junior Secondary learners to write explanations was hindered by language problems. In addition, a lack of integration of language issues into the subject content was a contributing factor to their inadequate writing skills. Spelling errors and lack of expression in English second language contribute to the problem of writing good explanations. The data has also revealed that learners' writing skills can be improved by implementing suitable teaching strategies, such as the curriculum cycle as proposed by Gibbons (2002). The curriculum cycle can be modified to fit the learners' needs and the real teaching situation. The amount of practice required to master the skill of writing in the genre of explanations should be considered.

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Finally, I extend my gratitude to my daughter Tutaamba Mewiliko Shatika for her patience during this challenging time. I sincerely acknowledge and appreciate my family, friends and fellow MEd GETP students for their encouragement and support in this research project.

Declaration of originality

I, HELENA M. N. JOSUA declare that the work contained in this thesis is my original work and has not been previously submitted for a degree in any other university. Where I have drawn on the words or ideas of others, these have been acknowledged using complete references according to departmental Guidelines.

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(Signature and Date)

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Chapter 1

Introduction

1.1 Introduction

The purpose of this study was to develop suitable, manageable and effective strategies in order to improve my teaching of explanation writing skills of Grades 10 Life Sciences learners in the Junior Secondary School. In this chapter, I first describe the research context; I then explain and justify the research goal. This is followed by a description of the research site. Lastly, I provide an overview of the thesis.

1.2 The research context

Assessment in schools consists of a variety of approaches or types, such as selected response items, constructed responses, performance and process-focused assessment (Namibia. Ministry of Basic Education and Culture (MBEC), 1998). In Namibian schools, the most common approach is the constructed response that is used in tests and examinations. In the science curriculum this type of assessment approach asks learners to generate brief written responses to open-ended questions (Namibia. MBEC, 1998), which often take the form of explanations.

One of the three Junior Secondary Life Sciences syllabus assessment objectives is to “be able to demonstrate knowledge with understanding” (Namibia. Ministry of Education (MOE), 2006c, p. 36). This objective is thought to be achieved if learners know how to give reasons in answers to open-ended questions (Namibia. MOE, 2006c), which often require an oral or written explanation. Another assessment objective in Life Sciences is that learners should be able to solve problems using written materials that require learners to explain concepts (Namibia. MOE, 2006c).

From the start of my teaching career in Junior Secondary Life Sciences in 2003, I have experienced problems with the way learners approach open-ended questions. I have observed that they often „under-answer“, with insufficient focus on, or understanding of, the questions. I have also noted that the problem is primarily related to language, which in this case is English, a second language for most Namibian learners. This has also been reflected repeatedly in the Life Sciences Examiners“ reports from 2000 to 2007. The 2007 report stated, “It would appear that the overall performance of candidates is limited by the English Language” (Namibia. MOE, 2007b). This specific comment referred to the instructional words such as list, describe, explain, suggest, etc. This problem is not unique to Namibia; Howie (2001), cited in Probyn (2006) stated that the majority of South African learners could not communicate their scientific conclusions in English or Afrikaans. They had difficulty in articulating their answers to open-ended questions and had trouble in comprehending several of the questions. This problem of learners struggling to express themselves when writing explanations of phenomena, concepts, etc. in Science led me to my research topic: Improving the explanation writing skills of Junior Secondary learners in Life Sciences.

Specific attention is not given to teaching explanations in the Junior Secondary phase. The English syllabus states, “All learners are expected to be able to interact meaningfully, express themselves clearly in a variety of genres and situations, read and critically interpret a variety of texts” (Namibia. MOE, 2006b, p. 1). One of the objectives is that “Learners will write a variety of well-structured paragraphs” (Namibia. MOE, 2006b, p. 13), no specific reference, however, is made to the genre of explanation.

Learners need to understand the purpose and structure of explanations. The purpose of explanation is to show how something works or state the reasons why some phenomenon occurs (Derewianka, 1996; Dinaledi, 2007; Moline, 1995). The two basic types of explanation focus on „how“ and „why“ questions. According to Derewianka (2006, p. 22) there is a “need to make distinctions between justification, which attempts to give reasons for a certain special behaviour... and explanations that attempt to explicate some more generalised phenomenon”. My research focused on the latter, as this is the type of explanation commonly used in Life Sciences, which are specifically to answer questions in examinations and tests.

This research addressed the problems that I face as a Life Sciences teacher who has scant knowledge of how to approach questions requiring explanations. Osborne and Wellington (2001) confirm that the teaching of how to explain is exacerbated when the teachers' own skills are not well developed, and they are of the opinion that science teachers need to be aware of the language of explanation. This research, therefore, is aimed at developing materials that would be useful in guiding me, as a teacher, in supporting my learners in writing explanations.

Since the purpose of this research was to improve the practice of teaching explanations, I chose to carry out action research to enable me to reflect on and improve my practice. The intention of action research "is that one person improves their work for their own benefit and the benefit of the others" (McNiff, 2007, unpagged), which is the prime reason I chose this approach.

1.3 Research goal

To investigate ways to improve the practice of teaching explanation writing skills in Grade 10 Life Sciences with the view to enhance subject content knowledge.

1.4 The research site: school and learners' profile

The secondary school in which I carried out the action research is in Omusati Region of Namibia. It is located in a semi-rural area in Anamulenge constituency, near Outapi town.

The school was established in the 1960s, but it was closed down by the colonial regime of the South African government in the 1980s. After independence it was re-opened. In 2003 it was given a licence to run as a private school with a full subsidy from the Namibian government.

The school accommodates approximately 370 learners, from Grades 8 to 12, with an average of 36 learners per class. There are two Grade 10 classes. More than 90% of Grade 10s are accommodated in a hostel within the school premises, and the rest stay with their parents or guardians in the villages surrounding the school.

There are 11 classrooms, a Science laboratory, a library and a computer room with 25 computers with internet connection. Neither the library nor the laboratory is fully equipped. The classrooms are in good condition. Electricity is connected and there is enough ventilation inside the classrooms. There are two photocopier machines, one overhead projector, video player, DVD player, and a 35cm television set. Due to a lack of building space, all this equipment is kept in the limited space of the Science laboratory. There is no projector screen making it difficult for the overhead projector to be used effectively.

1.5 The structure and outline of the thesis

This thesis consists of five chapters:

Chapter 1 introduces the research study by giving the rationale and context of the research. It also states my research goal and describes the research site. Lastly, I provide the overview and structure of the thesis.

Chapter 2 reviews the literature about explanation writing skills. It shows the significance of teaching explanation writing skills by relating it to the Namibian curriculum. The chapter discusses the importance of teaching explanation writing skills to Junior Secondary learners. It also provides a theoretical framework and strategies for teaching explanation.

Chapter 3 describes the research design and the methods I used to collect the data. It also describes how I selected the research participants and how I analysed the data. Finally, I briefly discuss the validity of the research and how I addressed ethical issues.

In Chapter 4, I present and analyse the data, and discuss my findings. I highlight the positive and negative points of each lesson. I also make suggestions about how to improve the lessons for future use. This chapter also describes and discusses the pre-test and post-test results. Finally, I present a comprehensive discussion of my findings during the single cycle of research, and reflect on my intervention.

Chapter 5 concludes the thesis by stating the lessons learned from my action research project. I also discuss the research limitations and highlight what might be useful for other teachers teaching Life Science. Finally, I suggest what needs to be explored in future research related to this subject.

Chapter 2

Literature Review

2.1 Introduction

Methods of assessment have changed in Namibia with the paradigm shift from a behaviourist to a more constructivist curriculum. As a result, Namibian learners in Grade 8-10 Life Sciences classes are often required to construct written responses to open-ended questions. Open-ended questions play an important role not only in assessing learners' understanding of Science but also of building their understanding (Osborne & Wellington, 2001). Trends revealed in the Life Sciences Junior Secondary Certificate external examination examiners' report for 2000 to 2007, have shown that the overall performance of candidates is limited by the way in which they answer open-ended questions.

My focus in this chapter therefore is to briefly discuss the assessment tools - including questions - used in assessing logical and critical thinking and how these contribute to knowledge building. I then explore the importance of questions in teaching and learning and link this to the focus of my research by considering the nature of open-ended questions.

In particular, I single out questions that require explanatory answers as they are common in Sciences and are important in that they lead to a better understanding of the world around us. Although the examiners' reports do not specifically single out answers to questions requiring explanation as those which cause difficulty, in my experience this is the case. I will therefore give some examples of these questions and analyse comments they prompted from the examiners and markers. I will also look at the common mistakes that learners make with regard to the questions and the possible causes of these errors.

I then discuss the role that a Science teacher plays as a language teacher. Under this section, I explain the term „language across the curriculum“. Bullock (1975) cited in Osborne &

Wellington, (2001, p. 4), advocates that “all teachers should see themselves as teachers of language” irrespective of the subject they teach. I then explore the importance of language in Science, since writing is a domain of language education. This is followed by a discussion of the role of writing in learning. In this section, I explain the concept of writing-to-learn in relation to learning with understanding and the development of critical thinking which prepares learners to become self-reliant which is central to learner-centred education. The writing exercise should not encourage learners to duplicate the information that is available to them but should rather enable them to build on it to produce something new and authentic. Hence teachers should consider the manner in which they teach their learners how to write explanatory texts in response to open-ended questions in the examination and tests. I conclude this section by highlighting the challenges that might hinder the science teacher’s effectiveness in teaching language aspects such as explanation writing skills in the science classroom.

Explanation is a genre or type of text used in Science; therefore, I explain the difference between the genre of explanations and other genres such as information reports, in terms of the grammar of the texts, their structure and their purpose. In order to understand what explanations are, I also highlight the difference between two types of explanation genre commonly required as responses to Life Sciences examination questions.

The next section discusses the importance of visual aids in writing explanations texts. It is important to encourage learners to supplement their texts with diagrams to effectively explain processes.

The penultimate section discusses the role of the Science teacher in teaching explanation writing skills. This section reviews the different strategies that are suitable in teaching explanations. I then conclude the chapter by giving suggestions supporting a range of strategies on how to teach explanations.

2.2 Assessment in Namibian schools

This section does not aim to discuss assessment comprehensively, but rather to give the reasons why Namibia opted to keep written examinations and to discuss how the quality of written examinations can be improved. In the second part of this section, I focus on the importance of questions in teaching and learning and link this to the types of questions that encourage logical thinking and contribute to knowledge building. I focus largely on written open-ended performance tasks such as providing explanations in Life Sciences phenomenon.

2.2.1 Assessment in the reform curriculum

In the pre-independence education system, summative assessment - usually at the end of the year - was generally regarded as the sole measure of success for the learners. The examination results were used to measure how well the learners had done. The focus was placed on “recall of disconnected bits of information” (Namibia. Ministry of Education and Culture (MEC), 1996, p. 125). This assessment in the examinations did not encourage the development of the learners’ capacity for critical thinking. Secondly, it mostly measured “Students’ mastery of the language of the questions posed” (Namibia. MEC, 1996, p. 125-126). For this reason the learners who could not express themselves well in English and could not memorise the language often failed. Thirdly, the questions posed did not encourage learners to reflect on their own knowledge and understanding of the world around them and express this in writing.

In the new learner-centred Namibian curriculum, assessment policy discourages reliance on end of the year examinations, and focuses on a variety of assessment tasks as part of the continuous teaching and learning process (Namibia. NIED, 2003). Nevertheless, the Namibian curriculum has not removed written examinations from the process altogether. This is stressed in the Ministry of Basic Education Guide to Continuous Assessment, “In Grade 8-10, no less than 33% and no more than 50% of the final promotion grade should be based on the continuous assessment mark. The remaining percentage should be based on the examination mark” (Namibia. MBEC, 1998, p. 25). This is because examinations are the “Simplest to administer and least costly” (Namibia. NIED, 2003, p. 27). However, we cannot ignore the weakness of

examinations; we should focus on trying to improve their quality and effectiveness in assessing learning. In continuous preparation for the examinations, the learners need to practice writing skills, especially those needed to answer open-ended questions.

The constructivist philosophy underpinning education reform in Namibia requires us to integrate assessment with teaching and learning in order to encourage learners to think critically, to incorporate their knowledge in the answers they provide to questions and to discourage memorisation of previously synthesised ideas. Shepard (2000) advocates that the act of integrating assessment into teaching directs learners to become self-reliant in solving problems, to think and reason critically and to be able to connect classroom situations to the outside world. In order to achieve these goals a range of assessment tools, which should include open-ended questions, must become part of teaching and learning repertoires.

According to Black, Harrison, Lee, Marshall & William (2003, p.3), “The first priority for assessment is of promoting students’ learning”. However in Namibian schools in the Junior Secondary phase, this is not always the case to prepare learners. The aim might be known, but it is difficult to fulfil. This is because, according to examiners and markers (Namibia. MBESC, 2001; 2002; 2003b; Namibia. MOE, 2004b; 2005b; 2006d; 2007b), a large number of learners do not know how to approach and answer high-level questions, especially in Grade 10 Life Sciences.

2.2.2 Assessment tools: Types of questions

According to the Longman Dictionary of Contemporary English a question is a “Sentence or phrase that asks for information”. The sentence may end with a question mark or it may be an instructing statement that would require a response. Explanatory questions are often in the form of an instructing statement e.g. Explain how urea is removed from the blood. For the purpose of this thesis, I refer to this kind of statement as an explanatory question.

Questions are used to assess the achievement of learning goals. They are used in the process of developing learners’ thinking skills to higher levels. Questions requiring explanations can also be ordered from lower to higher levels of cognitive skills, from comprehension questions that

require learners' basic understanding of the material or concepts to synthesis questions that require learners to put parts of the subject together.

The table below summarises levels of questions using Bloom's taxonomy cited in (Levels and types of questions, n.d., unpagged). The table shows the location of explanation questions according to Bloom's levels.

Table 1.

Questioning category	Bloom's category	Student activity	Stem words
Lower level	Knowledge	Remembering: facts, terms, definitions, concepts, principles etc.	What, list, name, define, describe etc.
	Comprehension	Understanding the meaning of the material.	Explain, interpret, summarise, give examples... etc.
	Application	Selecting a concept or skill and using it to solve a problem.	Compute, solve apply, modify, construct etc.
Higher level	Analysis	Breaking material down into its parts and explaining the hierarchical relations.	How does... apply? How does... relate to...? Why does...?
	Synthesis	Producing something original after having broken the material down into its component parts.	How does the data support...? What predictions can you make based upon the data?
	Evaluation	Making a judgement based upon a pre- established set of criteria.	What judgement can you make..? Compare and contrast...?

One can see from the table that explanation questions are significant to analysis and synthesis in terms of Bloom's taxonomy.

Questions are also classified as open or closed. The two classes are each ordered into lower levels and higher levels of questions. “An open question is one in which there are many acceptable answers” (Levels and types of questions, n.d., unpagged), while a closed question is one in which the possible answers are limited. Questions that lead to understanding are, however, mostly on a higher level and are mostly open-ended. The explanation questions are located in these categories.

2.2.3 Open-ended questions in Life Science

One of the aims in the Life Sciences curriculum is to enhance learning with understanding in order to help learners develop self-confidence, self-knowledge and understanding of the world in which they live through meaningful scientific activities. In order to attain this goal, the curriculum is designed to provide learners with knowledge and understanding through some of the assessment tools, such as questions, that develop the learners’ thinking skills. Questions that develop learners’ thinking skills are open-ended questions.

Below are some open-ended questions taken from the question papers the for external Grade 10 Junior Secondary Certificate examination:

- Explain the effects that global warming may have in low lying coastal areas (Namibia. MBESC, 2003a, p. 9).
- Suggest the role of (sic) coronary artery during a heart attack (Namibia. MBESC, 2004a, p. 15).
- Describe how CO₂, released by the cells reach (sic) the alveolus of the lungs (Namibia. MOE, 2005a p. 12).
- Suggest why high chimneys as a method of sulphur oxide disposal does (sic) not really get rid of this problem (Namibia. MOE, 2006a, p. 7).
- Suggest why water loss from the skin is higher during summer (Namibia. MOE, 2006a, p. 9).
- Explain how the contraceptive pill functions to prevent pregnancy (Namibia. MOE, 2006a, p.13).

- Explain why a fourteen-year old boy needs more energy than an old man (Namibia. MOE, 2007a, p. 13).
- Explain the influence that the increase of CO₂ in the atmosphere has on global warming (Namibia. MOE, 2007a, p. 17).

The table below categorises the types of responses required and shows the markers' and examiners' comments with regard to the students' actual answers.

Table 2: Questions and comments

Year	Questions	Types of Explanations	Comments
2003	1. Explain the effects that global warming may have in low lying coastal areas. [2]	Causal	Although the question asked for the effect on low-lying coastal areas, too many learners described the other effects of global warming such as drought, extinction and diseases (Namibia. MBESC, 2003b, p. 50).
2004	2. Suggest the role of (sic) coronary artery during a heart attack. [2]	Sequential	Most candidates found this question difficult, and only a handful of candidates could state that the coronary artery gets blocked, therefore could not supply the heart muscle with oxygen or glucose (Namibia. MBESC, 2004b, p. 120).
2005	3. Describe how CO ₂ , released by the cell reaches the alveolus of the lungs. [3]	Sequential	This was a very high level question and many candidates did not understand it... From this question it became clear that very few teachers teach across the syllabus...Candidates must understand the link between the different topics (Namibia. MOE, 2005b, p. 128).
2007	4. Explain why a fourteen-year old boy needs more energy than an old man. [3]	Causal	Fairly answered (Namibia. MOE, 2007b, p. 151).
2007	5. Explain the influence that the increase of CO ₂ in the atmosphere has on global warming. [3]	Sequential	Poorly answered, candidates misinterpreted the question (Namibia. MOE, 2007b, p.152).

These questions all require either sequential or causal explanations (discussed further in this chapter). Furthermore, they require learners to think critically, incorporate their knowledge in the

answers and discourage memorisation. This research aims to improve the quality and the effectiveness of these tools in assessing learning in the light of the comments that the questions were poorly answered.

The possible causes of poor responses to open-ended questions could be the following:

- Lack of content knowledge
- Lack of expressive writing skills
- Inability to express ideas in English
- Inability to comprehend the questions

Some of the variables above are interrelated e.g. if learners have problems in communicating in English, it will be difficult to read and understand the questions and to express their ideas in written English. It is important to note that performance in response to open-ended questions such as explanations is affected by two major variables, namely: lack of subject content and language problems. Therefore, the teaching of writing skills should become central to teaching in Science.

2.2.4 The importance of questions in teaching and learning

Questions such as the ones in Table 2 are central to teaching and learning; they bring learners to a deeper understanding of the subject they are dealing with. Farrant (1980, p. 190) maintains that questions serve the purpose of stimulating “thought that leads to a deeper understanding”. He claims that the stem words such as „how“ and „why“ are often used in questions that cultivate understanding.

Kyriacou (1991) and Good and Brophy (2000), both cited in Monyai (2006, p. 87) also state that there are many reasons for asking questions such as

...to stimulate learners to think about the content, connect it to their prior knowledge and begin to explore its applications; and to get the learners to make the content their own by letting them rephrase it in their own words.

I regard these purposes to be central to explanatory questions as defined in this thesis.

It is, however, important to note that questioning can be used in two different modes, speaking and writing. Speaking has the disadvantage that learners might not feel comfortable answering questions in front of their classmates, hence putting limitations on answers involving long explanations (Monyai, 2006, p. 87). It is for this reason that it is wise for teachers to require answers in writing from their learners; this will also give learners a chance to practice writing and prepare for similar tasks in written examinations. It also provides the teacher with a suitable platform to give individual feedback to the learners.

2.3 Practicing language across the curriculum

Language is central to the whole curriculum process. Oral and written languages are the agents of the thinking process, which must take place across the curriculum. Fillion (1991) cited in Curriculum Guide – Language Arts (n.d., unpagged) wrote, “Language across the curriculum stresses concern for how people learn to use the language, how they use language to achieve understanding and how language influences cognitive development”. The document further stated that language across the curriculum “does not mean that each subject teacher must take responsibility for teaching sentence structures, grammar and composition skills in the subject area”, but rather as the fulfilment of understanding within each subject area.

Following Fillion’s (1991) definition of language across the curriculum, what would be the duties of the Science teachers in teaching language across the curriculum? The role that a Science teacher plays in teaching language is as great as that of a pure language teacher. Science teachers have the role of teaching scientific skills using the English language as medium of instruction and in order to do that they need to guide learners with the appropriate vocabulary for Science. If educators are convinced that they use language to achieve understanding, then all subject areas should strive to include the teaching of language to enhance understanding and critical thinking in learners. Science teachers should not be bound to the prescribed curriculum, but they should seek ways to develop activities that facilitate learning.

I therefore see language across the curriculum as a holistic approach to teaching language skills, not as a self-contained subject but rather integrated in all subject areas across the curriculum, including Science. Language across the curriculum should be seen as a strategy to stimulate every teacher's responsibility in an attempt to promote learning with understanding. A Science teacher could incorporate aspects of language in their lessons by, for example, teaching learners to write explanations, including the grammar required. Firstly, it benefits learners in terms of their general understanding of Science, and secondly, it benefits them in the development of language skills such as writing and reading which are useful during examinations and in general communication.

The Namibian Junior Secondary (Grade 8-10) English syllabus states that language learning underpins the entire curriculum and that the language activities should have cross-curricular links (Namibia. MOE, 2006). The four language skills, in which writing and language usage is included, should be integrated during teaching and learning.

Similarly, the National Curriculum for England (1999) cited in Osborne and Wellington (2001, p. 5) maintains that, "Pupils should be taught the technical and specialist vocabulary of subjects... these include the construction of sentences, paragraphs and texts", that are often used in any subject.

2.3.1 Challenges in teaching language across the curriculum

Despite its effectiveness in enhancing learners' understanding, the practice of language across the curriculum is accompanied by challenges that may hamper its effectiveness. Stephen (1998) identified the following challenges:

- Language across the curriculum learning materials: Some of the learning materials such as textbooks and workbooks are not readily available to the teacher and learners. The identification and preparation of materials for use by the learners takes time and effort on the part of the teacher.
- Faculty roles: Different departments at school may feel threatened in their workload. In addition to that, they may fear that the educational objectives as outlined in their subject

curriculum will suffer with the addition of language issues. The language department may fear that high level language skills may never be attained.

- Learners' motivation: Learners may also have difficulties in mastering language across the curriculum in different subject areas. Junior Secondary phase learners are exposed to different subjects areas (Natural Sciences, Social Sciences, Mathematics, Commercial Sciences, etc.) making it difficult to master each subject's language style (Stephen, 1998).

There are similar challenges in Namibia, which constitute potential limitations to incorporating writing skills in Science lessons. Developing and preparing suitable teaching materials to be used in Science lessons could take time. Also some teachers may feel that their curricular objectives may not be reached as they will have additional language objectives to fulfil.

May and Wright (2007) focus on the challenges and possibilities of literacy across the curriculum. They have identified several challenges, of which I will mention two.

Firstly, because language across the curriculum takes time to implement, it also takes time to be aligned to positive changes in student achievement. With regard to the teaching of explanation writing skills in Science, the effects of an intervention may not reveal themselves immediately.

The second challenge is that language across the curriculum remains a slogan in many educational departments. Corson (1990) cited in May and Wright (2007, p. 372), observed that,

School language policies are increasingly viewed by a growing number of educationists as an integral and necessary part of the administrative and curriculum practice of modern schools, yet relatively few schools anywhere have seriously tackled the problem of introducing them.

This is also the case in Namibia where language across the curriculum has been adapted as a policy with little effect in the classrooms. In short there is no link between policy and practice. As a result, it may be difficult to justify putting time aside to help learners to write short explanations in response to explanatory questions in preparation for Science examinations and tests.

In Namibia, addressing the challenges of teaching language across the curriculum needs a holistic approach from the administrative stakeholders in education such as the curriculum developers, language faculties, non-language faculties, advisory services, school management and teachers.

May (1997) in May and Wright (2007, p. 373) has identified the following aspects as essential to the implementing of what he terms school language policy (a) the central involvement of school management, (b) sufficient time and resources to effect real change and (c) the crucial role of staff development in providing initial and ongoing support. In Namibia it requires policy makers and administrators in education to ensure that the current policy is implemented.

2.4 The importance of language in Science

Since writing is a domain in language education, I explore the importance of language in science by linking the concept of writing-to-learn to my research goals. Language is an integral part of Science but at the same time it is “A major barrier to most learners in learning Science” (Osborne & Wellington, 2001, p. 2); therefore, assisting learners to cross this barrier can improve their understanding of Science.

Bisanz, Hand and Yore (2003, p. 691) maintain that “Written language is the symbol system most often used by scientists to construct, describe and present Science claims and arguments”; thus language is a means to doing Science and to constructing scientific understanding. Similarly, Florence, Pearson, Weaver and Yore (2006, p. 113) write that “Language is an end in that it is used to communicate the inquiries, procedure and Science understanding to the people”.

Therefore Science teachers should have adequate knowledge and skills to support their students in developing their language for Science. This means that learning to write explanations and other genres is central to future scientists’ knowledge in order to prepare and help them carry out their research, set research questions, present their research findings, persuade their audiences and share their experiences with other scientists, and carry out other important activities in the jurisdiction of Science.

2.4.1 The role of writing in learning Science

Writing is one of the common activities in every school or learning environment. The term „writing-to-learn“ implies that learners are writing and the outcome is learning. This is a dual

outcome; learners will learn how to write a specific genre to better understand scientific phenomena, and at the same time develop their English language skills (Treagust & Yore, 2006).

I am of the opinion that writing should not be seen only as an activity to get the message across or merely as a means of communication such as writing examinations and tests and copying notes, but it should stimulate the thinking process of the learner. Conolly, cited in Bisanz et al. (2003, p. 700) emphasises that “writing-to-learn is not most importantly about grammar across the curriculum, or about making spelling count in the Biology paper. It is not to reinforce Standard English usage... it is about the value of knowledge”. Therefore, writing should be incorporated as a holistic approach to learning and it should be used to promote learning with understanding. Hand and Hohenshell (2006) share this view that writing needs critical thinking, it requires reflection on the content, while it enhances personal understanding and development of processing skills. Rivard (1994) cited in Hand and Hohenshell (2006, p. 262) claims that learners become “more aware of language usage, demonstrate better understanding and better recall, and show more complex thinking about content” when they engage in writing-to-learn activities. With regard to the explanation genre, which is the core of my study, Orr & Schutte (1992) claim that explanations require effective use of information and logical organisation of ideas. Chambliss, Christenson & Parker (2003) also argue that writing explanations of scientific phenomena can enhance the writer’s scientific reasoning and understanding.

Nevertheless effective writing skills do not just develop automatically. They need proper guidance from resources such as books and worksheets, and scaffolding from the teacher. Research done on writing-to-learn reveals that the problems that arise are not with writing as a skill, but with the strategies used to improve meaningful writing with understanding (Hand & Hohenshell, 2006; Bisanz et al., 2003). Such strategies include prior discussion of the writing exercise, scaffolding prompts and support materials for writing such as experiments, graphs, etc. Hand and Hohenshell, (2006), for example, found that with appropriate support learners “improved the logical organisation of arguments in their explanations, which were more in line with those accepted by the scientific community” (Hand & Hohenshell, 2006, p. 263). However, these scholars are of the opinion that such strategies need to be researched in order to clarify the link between writing and learning.

The exercise of writing explanations as responses to questions during examinations and tests is opposed to writing for learning, because learners tend to follow what is termed to be a knowledge-telling model of writing. The knowledge-telling writing model does not promote the writing-to-learn approach (Bisanz et al., 2003) because learners tend to memorise and reproduce what the teacher has given them as notes or summaries in response to some open-ended questions such as those requiring explanations. It is important that learners are discouraged from using the knowledge-telling model when writing short explanations of the kind required during examinations and tests.

2.5 Written genres

Generally, written genres are classified in two categories: technological and scientific texts. In this section I describe the differences in some genres commonly used in Science. These are explanations and information reports. These two genres are included because they help to differentiate and locate explanatory texts. I discuss each genre by looking at its purpose, language features and text structure. My interest is focused on the genre of explanations which are short written responses given to questions in examination and tests.

2.5.1 What is a genre?

Almost all written texts take conventionalised forms (or genres). Genres, sometimes referred to as text types, are “texts that share the same purpose and have many of the same features” (Dinaledi, 2007, p. 41). Similarly, Derewianka (1996, p. 7) describes genres as “different types of texts which are used in a particular culture to achieve specific purposes”. Genres can be presented in different modes: written, oral or visual, or a combination (Dinaledi, 2007). In my research I focus on the written mode.

2.5.2 Different genres

There are many types of genres which are used in the written mode. Each genre is however distinguished from the other by the purpose, structure and the language features and the register it uses. As highlighted before, their difference lies in the goals they intend to achieve and their social purpose. There are some genres which are significant to technological contexts and others to scientific contexts (Rose, 1997). Veel (1997) reveals that the scientific context is mostly used in school science education.

Veel (1997) and Martin and Miller (1998) cited in Osborne and Wellington (2001, p. 67) argue that the major genres of school science are:

- Explanations
- Reports
- Experimental accounts and
- Expositions

Open-ended questions which ask for explanations usually involve a written response using the genre of explanation (2 types). However, occasionally they might require an information report. Students do need to understand the difference in purpose between an information report (describe) and an explanation (explain). Getting learners used to different genres serves an important role when we want to link writing to learning.

Martin and Miller (1998) cited in Osborne and Wellington (2001) state that under each major genre there are „sub genres“ with minor differences in purpose. There are six types of explanations genres. Among these are „why“ and „how“ explanations. These are explored further in this section.

For the purpose of this thesis I will distinguish between the genres commonly used in secondary science education, namely explanations and information reports. I have chosen these because I personally have observed that learners have limited skill in writing short texts, especially explanations as answers to open-ended questions during examinations and tests. The difference between these genres will be drawn based on their purpose, text structure and language features.

2.5.2.1 Explanations

Generally, the explanation genre differs from the report genre in that it has a higher proportion of action verbs and is ordered in terms of time and a cause-and-effect sequence. Explanations require effective use of information and logical organisation of ideas (Orr & Schutte, 1992); thus before the construction of an explanation, the writer needs detailed information about the topic that they are writing about.

Veel (1997, p. 168) highlights the six types of explanation genre used in school science: “Sequential explanations, causal explanations, theoretical explanations, factorial explanations, consequential explanations and explorations”. This study focuses on both causal (why) and sequential (how) explanations since they are the ones required as answers to questions such as the ones highlighted in the previous section.

Genre	Social purpose	Stage
Sequential explanation	To explain how something occurs or is produced - usually observable sequences of activities which take place on a regular basis.	Phenomenon identification Explanation sequence
Causal explanation	To explain why an abstract and/or not readily observable process occurs	Phenomenon identification Explanation sequence
Factorial explanation	To explain events for which there are a number of simultaneously occurring causes	Phenomenon identification Factor
Theoretical explanation	To introduce and illustrate theoretical principle and/or to explain events which are counter-intuitive	Phenomenon identification Elaboration
Consequential explanation	To explain events which have a number of simultaneously occurring effects	Phenomenon identification Effects
Exploration	To account for events for which there are two or more viable explanations	Issues Explanations

Table 3: Types of explanations (Veel, 1997, p. 172)

Box 1. Example of a sequential explanation

Genre: Explanation	
How the circulatory system works?	1. Heading
To explain how the circulatory system works we show what happens to the blood, what the heart does as the blood passes through it, and where the blood goes.	2. Explanation Statement
<p>First the whole heart relaxes. This is called a diastole. During the diastole blood flows into the right and left atria from the vena cava and the pulmonary artery.</p> <p>After about 0.1 seconds, the muscles in the atria wall contract, squeezing down the blood into the ventricles. The blood cannot go back into the veins, because there are valves in the veins, which stop it flowing backwards.</p> <p>Finally, the walls of the left and right ventricles contract. During this contraction the blood is pushed into the pulmonary artery and aorta.</p> <p>When the blood is pushed into the pulmonary artery it then goes into the lungs. While in the lungs it gives out carbon dioxide and picks up oxygen. From the lungs, the oxygen-rich blood goes in the pulmonary vein, which carries blood to the left atrium, then to the left ventricles.</p> <p>Then, the left ventricle sends oxygen rich blood to all parts of the body. The vena cava collects carbon dioxide-rich blood from the rest of the body to the right atrium, and then into the right ventricles and so the circulation continues.</p> <p>The blood goes through the heart twice in one complete circulation. For this reason the system is called a double circulatory system.</p>	<p>3. Language features</p> <p>Sequences/ order of events</p> <p>Time Connectives (e.g. first, during, after, finally, when, while)</p> <p>Passive voice and simple present tense (e.g. relaxes, contract, is pushed, picks, carries, collects)</p> <p>Exact details (e.g. 0.1 seconds, twice)</p> <p>Generalised Participants (e.g. the heart , the lungs etc.)</p> <p>Technical terms (e.g. diastole, double circulatory system, ventricles, atria, vena cava, aorta)</p>

The purpose of explanations

The purpose of sequential explanation texts is “to give an account of how something works or reasons for some phenomenon” (Derewianka, 1990). They give accounts of more general behaviours or phenomena. Sequential explanations “describe observable sequences of activities which take place on a regular basis and are either naturally occurring phenomena (Veel, 1997, p. 177). Such phenomena in the Life Sciences syllabus include the human anatomy, reproduction in plants, etc. Causal explanations, on the other hand, “explain why abstract processes occur” (Veel, 1997, p. 172). They describe events that are not accessible to learners’ immediate observation or learners’ experience and are designed to give a set of detailed reasons why something happens e.g. why do plants transpire, why do we have global warming (Derewianka, 1996; Veel, 1997).

The purpose of explanations is closely related to those of justification; therefore a distinction needs to be drawn. Justification “attempts to give a simple reason for specific behaviour” (Derewianka, 1996, p. 22); for example, can you explain why you are late? Justifications are mostly used for everyday communication purposes, while explanations are mostly for academic purposes that add to the depth of knowledge.

Text structure of explanations

Sequential explanations contain:

- A general statement of the phenomenon to introduce the topic
- A description of the thing to be explained outlining its parts and their functions
- A series of logical steps explaining how something occurs

They are mostly ordered in a time sequence.

According to Veel (1997, p. 176), sequential explanations “tend to be limited in depth”. This is one possible reason why this genre is commonly required in Junior Secondary Life Sciences examinations and tests, because of the limitation in the marks to be awarded and the time restriction. For example, the response to the question, how does oxygenated blood reach the body

cells from the lungs, would require a short explanation as a response such as the one given in Box 2 below (This text was developed as a possible response to a pre-test).

Box 2: An example of a sequential explanation

First, during the contraction of the right ventricle, deoxygenated blood flows into the lungs from the heart through the pulmonary artery. While in the lungs it gives away the carbon dioxide and picks up the oxygen. From the lungs, the oxygenated blood goes into the pulmonary vein, which carries blood to the left atrium, then to the left ventricles. Finally, the left ventricles sends oxygen rich blood to all parts of the body to different body cells.

I developed a sequential explanation writing frame (Box 3) below, which could guide learners in writing this type of explanation and to enable them to identify its structure easily.

Box 3: An example of a sequential explanation writing frame

Title

Phenomena statement

First...

Thereafter...

As a result...

During/while...

Finally...

Causal explanations contain:

- A discussion of the significance of the phenomenon
- A set of reasons justifying the occurrence of the phenomenon

Causal explanations are mostly ordered in a cause and effect sequence. They are usually longer than „how“ explanations because of the amount of detail they contain. Despite their length, they

also seem to be common in the Junior Secondary Life Sciences examinations as illustrated in Section 2.2.

A frame (Box 4) of a „why“ explanation adopted from Osborne & Wellington (2001), shows its structure.

Box 4: Causal explanation writing frame (Osborne & Wellington, 2001)

Title

I want to explain why...

The chief reason for why this happens is that...

Another reason is ...

A further reason is...

Therefore, this is why...

Language features of explanations

Explanation genres usually use the following language features (for an example see Box 2):

- Generalised participants (e.g. the heart, the lungs etc.)
- Technical terms (e.g. diastole, double circulatory system, atria, vena cava, aorta, etc.)
- Time connectives (e.g. first, after, during, after, when, while, finally, then, next etc.)
- Action verbs (e.g. squeezes, picks, carries, collects, etc.)
- Timeless present tense and passive voice (e.g. is sent, is put, is mixed etc.) (Derewianka, 1996; Dinaledi, 2007 and Progression in explanatory texts, n.d.).

Sequential explanations mostly use time connectives such as the ones illustrated in the text in Box 3, while causal explanations use causal connectives, for example, because, so, this causes.

2.5.2.2 Information Reports

Box 5: An example of information reports (Chikarango, 2007)

The heart

The heart is a pumping organ of the blood around the body. It is enclosed in the thorax between the right and left lungs. It has thick walls made of cardiac muscles which contract and relax rhythmically and involuntarily for pumping blood around the body.

The heart muscles are supplied with blood rich in oxygen and glucose nutrients for respiration through the coronary arteries. The coronary arteries branch off from the aorta.

The heart is made of four chambers that include two upper chambers (atria or auricles) and two lower chambers (ventricles). The atria or auricles receive blood from body organs through veins and they pump it into the relaxed ventricles. The ventricles pump blood out of the heart to the body organs. The right ventricle pumps blood to the lungs only and its walls are relatively thinner. The left ventricle pumps blood to the rest of all body organs and its walls are thicker to create the needed high pressure to pump blood.

The information report genre is different from reports that are used in day-to-day life. It does not necessarily report on events that have happened. The information report provides information around a certain key concept or theme. For example, in case of „the heart“ as a theme, the above text provides a description of the heart and its constituent parts. It could include the functions of the different parts of the heart and their characteristics. Information reports are designed to provide “information about general class of things” in a descriptive way (Derewianka, 1996). They “describe the way things are” (Dinaledi, 2007, p. 43).

Text structure of information reports

- Some reports would give a short explanation of the phenomenon and how it occurs
- Some reports would include the functions of the different parts of the thing reported
- There is no specific sequence in which the text has to be arranged, but the ideas have to be presented coherently. They move from general to more specific descriptions
- There is an opening statement or “general classification” that classifies the item in the report e.g. a heart is a pumping organ of the blood around the body
- Different parts of the item in the report are discussed under sub-headings and in paragraphs

Language features of information reports

Information reports usually have the following features (for an example see Box 5):

- Relating verbs (e.g. the heart is a pumping organ)
- Generalised participants (e.g. muscles, ventricles, organs, etc.)
- Technical terms (e.g. ventricles, aorta, auricles, cardiac, etc.)
- Present tense (e.g. receive, pumps are supplied, etc.)
- Exemplification (e.g. that include), (Derewianka, 1996; Dinaledi, 2007).

2.6 Visual aids in writing explanation texts

Paivio (1971, 1986) cited in Burton and Miller (1994), developed the dual code model which stated that verbal information and visual information are encoded by separate subsystems. Even though separate, they are “inter-connected so that a concept represented as an image in the visual system can also be converted to a verbal label in the other system” (Klatzky, cited in Burton & Miller, 1994). Therefore learning is more effective when both systems are used (Iding & Klemm n.d.). According to Burton and Miller’s (1994) statement, Paivio argued that visual pictures are often remembered better than verbal information. Hence, “diagrams can serve as visual aids to learning because they can display usually certain information that will be stored as both visual and verbal information” (Burton & Miller, 1994). They further state that a text without pictures

can be difficult to comprehend. Diagrams and flow charts are examples of visual texts used to support explanations.

Moline (1995) advocates the use of analytic diagrams such as cross-sections (Figure 1) and synthetic diagrams such as flow diagrams (Figure 2) in order to better our understanding of the subjects under review. These two approaches would help to show, for example, how the heart and kidney function. A cross-section diagram “reveals the inside of its subject in one plane only” (Moline, 1995, p. 43). The prime purpose of using cross-section diagrams is to illuminate subjects that we cannot physically open e.g. a human heart and a human kidney. These diagrams will help to understand the difference between the internal and external structures of the subject.

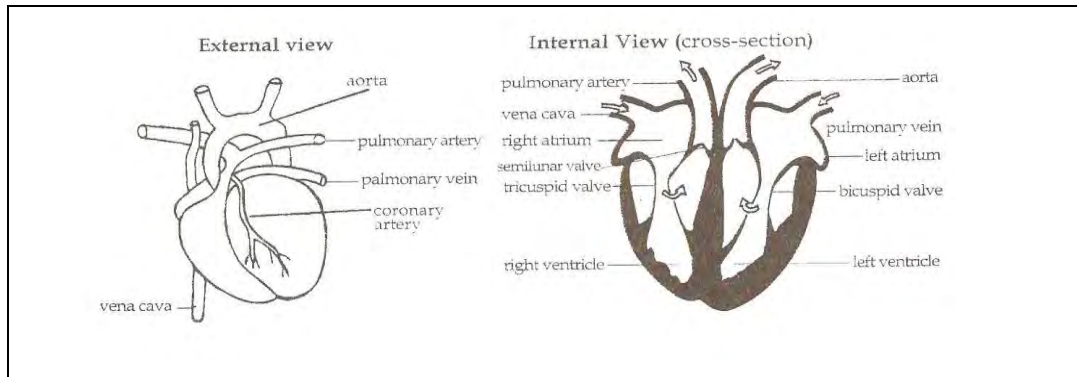


Figure 1. Cross-section of a human heart.

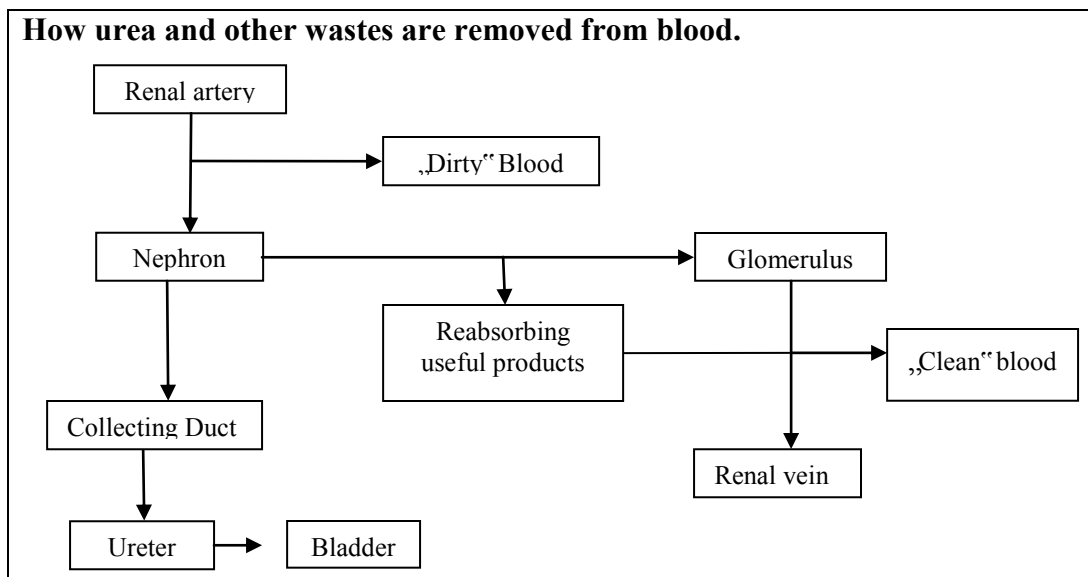


Figure 2. Flow diagram

Flow diagrams show connections between the parts of a process. They are also used for showing cause and effect (Moline, 1995, p. 49). Sequencing and cause and effect are significant characteristics of explanations; thus flow diagrams would help in simplifying the teaching and learning of explanation writing skills.

The prime purpose of flow diagrams is to “explain, define or summarise a process and to show cause and effect over time” (Moline, 1995, p. 50). The information in the flow diagram can be transferred into a written text such as an explanation. The use of diagrams will support learners’ understanding; they would then be able to use the understanding and knowledge they gained to answer explanation questions in a limited time, such as during examinations and tests.

It might be useful for learners to supplement their texts with diagrams when answering some of the explanation questions, because written language can be inadequate when explaining some scientific processes. Hence, the learners can be encouraged to integrate diagrams and flowcharts with written words to ensure their explanations are truly effective (National Literacy Strategy, n.d.).

2.7 Teaching explanation writing skills

2.7.1 The Science teacher’s role in teaching explanation writing skills

Osborne and Wellington (2001) advocate that writing skills do not emerge without a clear lead from the teacher in demonstrating the structure of scientific writing. Teaching explanation writing skills requires the teacher’s scaffolding, which provides clues as to how to organise the writing and the style of writing required. Teachers need to know the kind of genre suitable to the questions highlighted on section 2.3.1. They need to understand what is required in response to causal and sequential explanatory questions (Veel, 1997) as discussed in Section 2.5. Only once they have this understanding can they clearly make distinctions among types of explanation genres and other scientific genres regarding their purposes, language features and text structures.

In all the activities it is the responsibility of the teacher to be careful when giving instructions to learners. Instructions should give a clear indication of the aim of the activity and what to do with the text. The instructions should be simple and easy to understand to ensure that learners are focused on the activity and not diverted from it.

2.7.2 How to teach the writing of explanations

Teaching explanation writing skills requires the teacher's creativity and dedication; it also requires proper planning.

Dinaledi (2007) suggests a series of steps:

1. Learners are introduced to a text or genre. They examine the text and consider the social purpose of the text.
2. They analyse the structure of the text and its language features. The teacher might give learners texts to analyse on their own individually or in groups.
3. Learners can be given the chance to practice the language used in explanation texts.
4. Learners then produce their own explanation text.
5. Learners may be asked to evaluate each other's texts using criteria e.g. language features, text structure and the purpose of the text.
6. Learners write their own texts that a teacher can evaluate (Dinaledi, 2007, pp. 49-50).

These steps are guides in teaching how to write explanations. They are the first step to the integration of writing explanations in the Science lesson; thereafter learners should be given practice in using the genre in the examination context.

These steps can be modified to suit the learners' needs, depending on their age and capability. The teacher can start from writing simple explanations of everyday experiences, leading up to complex explanations of scientific phenomena. This provides an opportunity for teachers, together with learners, to explore the difference between the „why“ and „how“ explanations.

Gibbons (2002, p. 60) has simplified the steps suggested by Dinaledi (2007) by putting them into a four stage curriculum cycle. She suggests that the four stages should “be made explicit to students” in order to develop their writing skills.

At this point, it is however worth mentioning that this curriculum cycle may take longer. It is not a one lesson task. Secondly, it should be integral to the subject curriculum, “it should not be seen as an „add-on“ to what you would normally be teaching” (Gibbons, 2002, p. 61). In order to realistically integrate the curriculum cycle into teaching explanation writing skills, not all of the four stages could be repeated with every topic or theme. National Literacy Strategy (n.d.) advises that the writing skills could be taught during the literacy hour and thereafter the skills would be applied and practiced in different subjects. This however would not be realistic in the context of the Namibian curriculum as it is not part of the curriculum plan. Therefore, it is up to the teacher to develop lesson units that link the two.

The four stages of Gibbons’ (2002) curriculum cycle are:

- Stage 1: Building up the field

This stage “aims to make sure that your students have enough background knowledge of the topic to be able to write about it” (Gibbons, 2002, p. 60).

The teacher will unpack what learners know and what they need to know before starting the writing exercise. The teacher needs to teach the functions of different parts involved in the process to be explained and explain the meaning of new vocabulary to learners before they start with the actual writing activity. For example, in teaching learners to explain how the circulatory system works, different parts of the system are articulated with their functions during introductory lessons on the theme.

It is also important for learners to become familiar with the to-be-explained concept through concrete experience. Where possible the teachers must stimulate the learners’ thinking through guided experiments and demonstrations in order to create a real experience before presenting the explanation. In some instances, discussions and oral explanations would be essential to precede the writing of explanations. An oral explanation could be used following an experiment in order

to simplify a complex concept, making it possible for learners to become more conscious of the content details they write in their explanations.

- Stage 2: Modelling the text type

This stage involves giving a written explanation text to learners. This will provide examples of the linguistic features, the structure and the purpose of the explanation texts.

During this stage a teacher can develop a directed activity related to texts (DARTs) (Osborne & Wellington, 2001), in order to familiarise the learners with the genre. For example, learners can identify the time connectives from the text; they can outline the purpose of the text before it is given by the teacher etc.

“DARTs are generally known... to support the learning of science thorough reading” (Osborne & Wellington, 2001, p. 95). In the examples below learners may be given activities that would enable them to identify an explanatory text. In Example 1, Box 7, learners would re-arrange the jumbled sentences to create an explanation of how the build up of cholesterol in the circulatory system can lead to functional disorder. In Example 2, Box 8, learners would fill in the words provided in the correct space to complete an explanation. These activities could be done in pairs or as individual work. When necessary, the answers could be discussed by the whole class.

Box 7. Example 1 of DARTs

How the build up of cholesterol in the circulatory system can lead to functional disorder.

Both arteriosclerosis and thrombosis may block the flow of blood in the coronary artery. Secondly, the cholesterol in blood may lead to clumping of blood platelets in the coronary artery resulting in thrombosis.

As a result, the heart will stop pumping blood due a lack of energy.

This will prevent the supply of enough oxygen and glucose to the heart muscles.

This is called a heart attack.

First, the fat layer is deposited on the walls of the arteries.

This reduces the diameter of the artery resulting in arteriosclerosis.

Box 8. : Example 2 of DARTs

<p>How does oxygenated blood reach the body cells from the lungs?</p>	<p>Heading</p>
<p>_____, during the _____ of the right ventricle, deoxygenated blood flows into the lungs from the heart through the _____. _____ in _____ it _____ away the carbon dioxide and _____ up the oxygen. From the lungs, the oxygenated blood goes in the _____, which carries blood from to the left atrium, then to the left ventricles. _____, the left ventricles sends oxygen rich blood to all parts of the body to different body cells.</p>	<p>Explanation Language features</p> <ul style="list-style-type: none"> - first - while - finally - gives - picks - the lungs - pulmonary veins - pulmonary artery - contraction

- Stage 3: Joint construction

“Here the teacher and students write the text together, so that students can see how the text is written” (Gibbons, 2002, p. 61).

At this stage learners should be able to construct some sentences when they are given the keywords. A framework such as the one given in Box 4 would be a good guide in this exercise. However the scaffolding will depend on the nature of the explanation to be written and the learners’ knowledge on the topic. Diagrams and flow charts can also be used to stimulate the learners’ ideas and guide them through writing explanations.

- Stage 4: Independent writing

At this stage the students write their texts without the teacher’s guidance. They however need scaffolding from various sources such as diagrams, flow charts, classroom discussions and pre-writing activities.

Moline (2000) devised the following checklist that learners could use to assess their explanation texts. The learners may tick off or write comments against the checklist as illustrated in Box 9 below.

Box 9. An explanation text checklist (Moline, 2000)

Checklist	Comments
<input type="checkbox"/> Starts with a statement or question that need to be explained	
<input type="checkbox"/> Arranges explanation in a sequence of steps.	
<input type="checkbox"/> Uses time connectives: first, then, finally etc and passive voice, timeless present: are grown / is sent	
<input type="checkbox"/> Uses generalized participants (talks about “dogs” rather than “my dog”)	
<input type="checkbox"/> Uses exact, technical language.	
<input type="checkbox"/> Check: Spelling, Vocabulary Punctuation Capitals	
<input type="checkbox"/> Are sentences in the best order? Cut or connect some sentences?	

This rubric would reveal the skill of sequencing events in the explanation. It would assess learners’ grammar skills and other language aspects such as spelling. It would also assess if learners have adequate content information on the question they are answering. This rubric would also be a useful tool in giving feedback to individual learners.

2.8 Conclusion

Specific attention is not given to teaching explanations especially not in the Junior Secondary phase in the Namibian curriculum. The English syllabus states, “all learners are expected to be able to interact meaningfully, express themselves clearly in a variety of genres and situations, read and critically interpret a variety of texts” (Namibia. MOE, 2006b, p. 1). There is no specific reference made to the genre of explanation or any other genre.

This is a matter of concern if learners are to progress well and become true scientists. A balance between scientific knowledge and writing across the curriculum must be achieved. Hand and Hohenshell (2006), claim that research suggests that teaching writing in Science enhances understanding.

Little has been researched in the field of writing in Namibia, especially in the Science classroom. The Namibian curriculum emphasises the teaching of writing, but there are no learner or teacher support materials developed for teaching different genres of writing.

Teachers need to explore the strategies that are suitable to teach explanation writing skills and integrate these strategies in teaching the subject content.

In the next chapter, I describe the research method and procedures I followed in my teaching intervention in order to explore strategies suitable to teach explanation writing skills in Life Sciences.

Chapter 3

Methodology

3.1 Introduction

In this chapter, I describe the research procedures that I followed in order to achieve the goals of my research. I describe and justify the research paradigm and method which I used: an interpretive case study using action research. I explain how I selected my research participants and justify my choices. My data collection techniques are then briefly described. The chapter then clarifies the procedures followed in analysing the data collected. Finally, I reflect on ethical issues and consider validity and the limitations of my research.

3.2 Research paradigm and methods

I have chosen to do a piece of action research, located within an interpretive paradigm. Interpretive research is done in a natural situation, such as a classroom, where researchers try to understand and make meaning of the data that unfolds. Connole (1998, p. 14) holds the view that the task of the interpretive researcher “becomes that of understanding what is going on” in the world of the participants. Similarly Janse van Rensburg (2001, p. 16) states that interpretivist researchers “are interested in the meaning that people make of a phenomenon” which in my case is Science learners’ ability to produce short explanations in response to examination and test paper questions.

Action research is chosen for this study because it involves, “trying out an idea in practice with a view to improving... and trying to have a real effect on the situation” (Ebbut, cited in Hopkins, 1993, p. 45). Teachers employ classroom action research in order to discover what works best in their own classroom situation (Mettetal, 2002). Hopkins (1993, p. 44), characterises formalised action research as:

- An action disciplined by inquiry

- A research procedure
- A personal attempt
- Understanding while engaged in a process of improvement

I have sought to make these four characteristics of action research the pillars of my research methodology as my goal in this research study is to improve my practice of teaching explanation writing skills to Junior Secondary Life Sciences learners.

My aim was to try out a series of ideas to improve the explanation writing skills of Grade 10 learners. McNiff (2007, unpagged) emphasises that action research “involves reflecting on your own work” with the aim of making improvement or change. I reflected on the actions I took to improve my learners’ explanation writing skills. Similarly, Mettetal (2002) claims that action research is the best way to discover what works in a particular situation and in the process it allows informed decisions about teaching. This is the prime intention of this research: to discover what teaching approaches or strategies are most suitable to teach explanation writing skills.

In trying to reach my goal I followed the steps of the action research as suggested by McNiff (2007, unpagged):

- Review the current practice
- Identify an aspect you want to investigate
- Imagine a way forward
- Try it out
- Take stock of what happens (evaluate)
- Modify what you are doing
- Monitor what you do
- Evaluate the modified action

Hopkins (1993, pp. 44-45, 50-51) has outlined several models of action research, which all have at their core an action based on the evaluation of a situation. My approach to action research was similar to the McKernan’s model (cited in Hopkins, 1993, p. 50) as illustrated in Figure 3 below. McKernan’s model of action research puts each action plan in a single cycle. Each cycle defines the problem at hand, assesses the problem, creates a hypothesis, develops a plan of action, implements the plan, evaluates the action and takes a decision. In the next cycle the researcher

redefines the problem based on the evaluation results of the previous cycle’s action and so the chain continues.

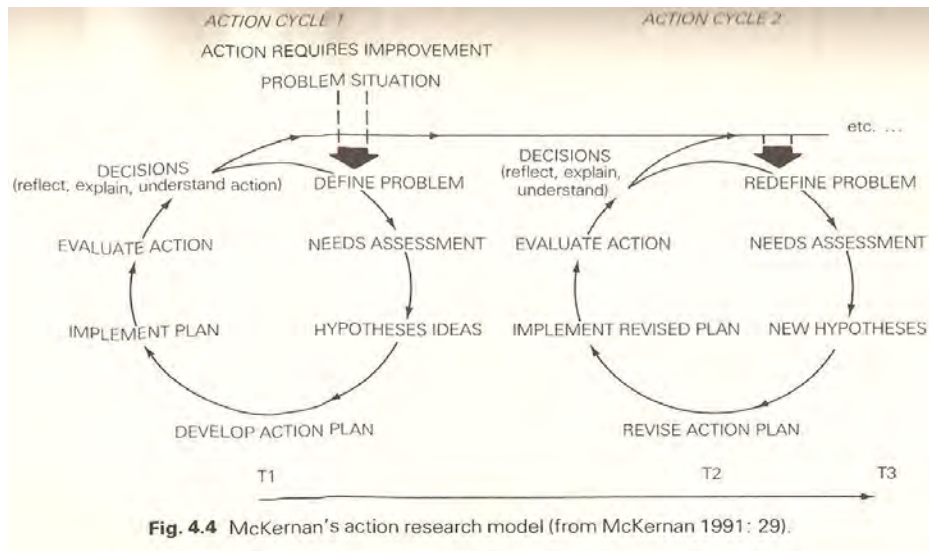


Figure 3.

My research involved the following steps:

- I identified a problem pertaining to the way learners approach open-ended questions, particularly those involving explanations.
- I gave a pre-intervention assessment activity to Grade 10 learners, which required them to write explanations in response to two questions.
- I analysed the results of the pre-intervention assessment.
- I planned and designed a series of lessons on two topics (Blood circulation and Excretion and water balance) in an attempt to improve their explanation writing skills.
- I implemented the teaching interventions.
- I gave a post-intervention assessment activity to the same learners.
- I did the evaluation and analysis.

Because of the time constraints in a coursework thesis, only one cycle of action research was implemented (see McKernan’s action research model on above). However, I intend to continue with the second cycle in order to improve the effectiveness of and make a contribution to, my learners’ writing skills

3.2.1 Curriculum cycles

The series of lessons consisted of seven lessons on two themes, namely the circulatory system and the excretory system. Both topics involve explanations; they are also topics on which learners may be asked examination questions, in answer to which they would be required to give short explanations. The seven lessons followed the four stages of the curriculum cycle discussed on page 40 (Gibbons, 2002, p. 60). These four stages are:

- **Building up the field**
This stage involves gathering information about the topic which you want to write on. It gathers all pre-knowledge skills and information on the topic.
- **Modelling the text type**
The second stage familiarises learners with the text type. It involves exposure to the overall structure and linguistic features of the text type.
- **Joint construction**
Here the learners are given guided practice by the teacher in writing the text.
- **Independent writing**
At this last stage the students independently write their text. They may be guided by support materials to build up their ideas.

In my case with regard to the action research cycle, I first gave the pre-intervention assessment based on the respiratory system to create a baseline data with which to compare the learners at the end of the cycle. I then implemented the four stages of the curriculum cycle. The first to the third stages were based on the circulatory system and the last stage was based on the excretory system.

3.3 Sampling

The research involved one Grade 10 class consisting of 36 learners, 16 boys and 20 girls studying Life Sciences. This is one of the four Junior Secondary classes which I teach Life Sciences. Grade 10 was purposely selected (Cohen, Manion & Morrison, 2000) because this is the grade which received criticism pertaining to writing skills in response to open-ended questions in the examiners' report (discussed on page 20). At this level the learners' ability to write explanations

is not yet fully developed, but they write sufficiently competently that the reader can understand what they are writing about. I particularly chose this class group because I had taught them the previous year and I was aware of their learning abilities. The class was also conveniently chosen because I have access to the group during normal teaching hours (Cohen et al., 2000). There was only one learner repeating Grade 10; the rest of the learners were promoted from Grade 9.

The learners, together with the researcher spoke dialects of Oshiwambo, including Oshindonga, Oshikwanyama, Oshimbalantu, Otshikwambi and Oshimbandja as their mother tongue. All the teachers teaching this class spoke Oshiwambo as their mother tongue except for the English teacher, who spoke Silozi. The learners communicated well in English. Their writing skills were not however fully developed which became the focus of my research.

All the teachers teaching this class were professional teachers, holding a Bachelors Degree in Education (B Ed) or a Basic Education Teacher's Diploma (BETD). Most of the teachers were BETD holders. There was one unqualified computer instructor.

Nine promotional subjects were offered in Grade 10: Life Science, Physical Science, Mathematics, Agriculture, Geography, History, Oshindonga First Language and English Second Language. There were four non-promotional subjects, i.e. Physical Education, Life Skills, Basic Information Science and Religious and Moral Education. Life Science has four 40 minute periods on a five-day cycle timetable. The general performance of this class in Life Science was well above average. All learners had 40 minutes access to the computer per week.

All the learners in the research class were seated in rows facing the front of the class; learners could shift desks and chairs to form groups when requested, however this made walking around the classroom a difficult manoeuvre.

Out of this class I chose four learners to interview: two who performed well in terms of language and subject knowledge on the tasks in the intervention (the "strong learners") and two who performed less well (the "average learners"). I collected journal entries (see Appendix 5b) each day from the learners. I did this in order to have a view of the learners' feelings about each

lesson. However, not all the journal entries were useful with regard to my research goals as outlined in the literature chapter.

I decided to have a non-participant observer in the teaching cycle for the same reasons expressed by Hopkins (1993, p. 76) that classroom observation generally supports the professional growth of the teachers, through linking the reflections of the observer and of the observed. I wanted the non-participant observer to assist me in reflecting on the lessons I taught during the teaching interventions. I chose the non-participant observer because we are colleagues who teach the same subject (Life Sciences) in the same phase, at the same school, although she teaches Grade 8. We were already critical friends who discussed our teaching prior to the commencement of the research. She is also a familiar figure to the learners since she had taught them the previous year and still taught them Agriculture. She had been setting circuit based examinations for Grade 8 Life Sciences for close to three years and for Agriculture for close to five years.

3.4 Research tools

In the process of collecting data, I used the following tools:

3.4.1 Non-participant observation

As I explained above, a non-participant observer was part of my research strategy to help me reflect on the lessons I taught.

As Hopkins (2003) suggests, the observation had a planning phase (refer to Figure 4 below); I used this opportunity to meet with my observer and discuss the focus of my lessons designed to improve the writing of explanations. I wanted her to focus on the following aspects:

- The level/type of questions asked
- How learners responded to different questions
- Learners' understanding
- The development of the lesson
- Strategies used by the teacher

There was no specific observation sheet for this purpose. Instead I advised her to take field notes focusing on the topics I had given her.

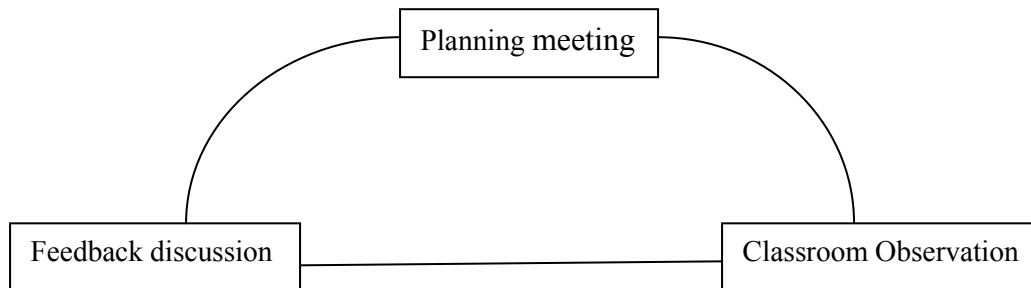


Figure 4.

After the first observation, we had an informal discussion for her to give feedback about the lesson. It was informal because we talked about the lesson on our way to the staffroom just after the lesson and it was not audio recorded. This was done because we both had tight schedules after the lesson and after school and it was best if we discussed the lesson within 24 hours.

At that point she referred to the notes which she had taken in the class, which were very minimal. She had focused on classroom management. I then advised her to take the “every thing counts” focus (Hopkins, 1993, p. 78); she should note down and describe all the events happening during the lesson. I did this in order to obtain useful information regarding my research focus that is discussed in the analysis chapter.

Five of the lessons were fully video taped and the remaining one was audio recorded as the cameraman did not turn up. These recordings have not been transcribed fully but I have watched them repeatedly and verbatim extracts will be used in the report of my findings in Chapter 4. The purpose for watching the videos was to allow for an in depth interpretation of the lessons.

Hopkins (1993, p. 120) gives the following reasons for recording lessons for research purposes:

- As a general diagnostic tool for identifying aspects of one’s teaching
- For providing detailed evidence of specific aspects of teaching through the use of transcripts, and
- As an additional source of evidence for classroom assessment

3.4.2 Interviews

Gillham (2000, p. 62) maintains that “people will disclose things in a face-to-face interview” that they would not disclose in any other ways of gathering the data from them. In my case it would be difficult to get learners’ views of the lessons during the teaching interventions or from their journals. For this reason I used semi-structured interviews to collect the data from the four learners referred to in Section 3.3 above. The four learners were interviewed in pairs (the two strong learners together, and the two average learners together). This gave them the confidence to talk; as Fernandez (1995) in Madriz (2000, p. 835) suggests “focus groups allow access to research participants who may find one-on-one ... interactions scary or intimidating”. All the interview sessions were tape-recorded and transcribed. Both the CDs and the transcripts are kept in the research archive.

The interview with the learners was pre-planned but it allowed room for probing. Just before the interview I called the learners and we talked about general issues that were not related to the research focus in order to create a free environment during the interview. This part of the interview was not recorded.

The purpose of the interview was to get the views of the learners regarding the lessons on learning to write explanations. It was also to get evidence from the learners about their skills before and after the teaching interventions (see Appendix 6).

3.4.3 Document analysis

I collected data from documents such as the learners’ written work, the learners’ journals and the JSC Life Sciences syllabus and my lesson plans. Hopkins (1993, p. 141) maintains that this form of data “provides context, background and understanding of issues that would not otherwise be available”. It also strengthens the triangulation of the data.

3.4.3.1 The learners' written work

In the data collection process, I gave a pre-intervention assessment activity and post-intervention assessment activity. I selected the learners' work and made copies with their consent and the principal's consent in order to keep within ethical guidelines.

3.4.3.2 The learners' journals

In order to get rich data from the learners, I involved them in the research. I requested them to keep a journal in which I wanted them to reflect on their lessons. I explained the purpose of a journal to them and gave them a note which they stuck on the first page of their journal books in order to remind them of what they were expected to write. I expected them to write about:

- What the teacher wants us to learn
- What I learned
- What I need to know more about or learn
- How I plan to learn
- Other (questions, materials etc)

After the teaching intervention, I made copies of all of the learner's journal entries. I selected the ones which were useful for the data analysis (see Appendix 5b). They are all kept in the research archive.

3.5 Data analysis

This section outlines how the collected data was organised and analysed for interpretation.

First of all, I reviewed the seven video and tape-recorded lessons one by one to focus on what was successful and what was not. While viewing I took notes and made some transcriptions of important incidents in the lessons for verbatim quoting.

Each lesson was analysed in order to identify positive elements to retain in future lessons, negative points to be eliminated from future lessons and suggestions to improve any similar lesson to be taught in future. Field notes by the non-participant observer, learners' journal entries and my research journal were used to triangulate the data. When writing up the analysis, I used verbatim extracts as evidence to support the claims I made.

After I had viewed and listened to all the lessons, I also read the learners' journals. I selected some learners' daily journal entries that contained important issues.

Secondly, I compared the learners' writing in the pre-intervention assessment and post-intervention assessment activity to see whether there was any change in performance for the entire class. I then selected the three best, three average and three worst samples of learners' work in order to get a sense of the full range of the learners' performance. I subjected these samples to detailed analysis.

I then read the interview transcriptions for evidence to explain the results of my teaching intervention as indicated by the differences between the pre-intervention and post-intervention assessment performance of the learners.

The comparison between the pre- and post-intervention assessment results was used to evaluate the effectiveness of this intervention. I used extracts from the interview in order to support the claims I made on the effectiveness of my teaching interventions.

3.6 Validity

According to Leedy and Ormrod (2005), to ensure the validity of the research a variety of data collecting methods should be used. I have used multiple sources of data in order to validate the data as described in this chapter under sub-section 3.4 Research tools. I have also been as honest as possible and given a true reflection on my actions; Cohen et al. (2000, p. 105) declare that "in qualitative research data validity might be addressed through the honesty... of the researcher".

3.7 Research ethics

In order to respect my participants' privacy and rights, I explained my research intentions in a letter that I sent to the Ministry of Education's Permanent Secretary. I also discussed the ethical issues with the principal of the school and requested his permission to carry out the research during normal school hours. The letters of request and authorisation are in the appendices (see Appendix 1). However, in my discussion with the principal he told me not to send letters requesting consent from the parents as he assured me it was in order, as long as I provided proof that I was studying and that my study required research to be carried out. I followed his suggestion but also informed the learners of my intention.

3.8 Conclusion

In this chapter I discussed and described the methods and procedures that I used in order to collect the data and carry out the research.

I first located my research paradigm and justified my choice. I further discussed the selection of the research participants and explained the decisions taken. I also described how I collected the data, how I recorded the data and how I accessed the data. In the last section I discussed the validity of the research outcomes and the ethical issues concerning my participants.

In the next chapter I present the results and analysis of the research followed by a brief but detailed discussion on the issues that arose from the study.

Chapter 4

Data presentation, analysis and discussion

4.1 Introduction

In this chapter I begin by justifying the topics and lesson objectives selected for the purpose of the study. I present data from the pre-test activity for all 36 learners and then outline the content of each lesson of my teaching intervention, highlighting what it aimed to achieve. The teaching interventions are then evaluated to identify the positive and negative aspects of each lesson and improvements are suggested. As evidence of the product of my intervention, I present the data from the post-test activity for all 36 learners. Lastly, I analyse and discuss the findings.

4.2 Selection of the lesson unit

As explained in Chapter 3, the intervention consisted of seven 40 minute lessons that formed four stages of the curriculum cycle. The lessons covered two themes, namely: blood circulation, and excretion and water balance. These are outlined in the Grade 10 Life Sciences syllabus (Namibia. MOE, 2006c).

The Life Sciences syllabus describes the learning content in terms of learning objectives and basic competencies. I selected the learning objectives and the basic competencies for my teaching interventions from the table below taken from the syllabus.

Table 4: Learning objectives

Topic	Learning objectives Learners will:	Basic competencies Learners should be able to:
Blood circulation	<ul style="list-style-type: none"> - know the structures of the circulatory system and understand the functions of the heart, capillaries, arteries, veins and the components of blood - realise how the build up of cholesterol leads to functional disorder 	<ul style="list-style-type: none"> - identify and name the structure of the circulatory system - outline the functions of the heart, arteries, veins, capillaries and components of blood - suggest how the build up of cholesterol in the circulatory system can lead to functional disorder
Excretion and water balance	<ul style="list-style-type: none"> - know the structure of the excretory system - realise the involvement of the lungs, skin and renal system in excretion 	<ul style="list-style-type: none"> - define excretion as the process of removing the waste products of cellular respiration from the body - identify the structures of the excretory system - discuss the functions of the lungs, skin and renal system in excretion - identify the waste products expelled from the organs involved in excretion

The learning objectives are “the general knowledge, understanding and demonstration of skills” (Namibia. MOE, 2006c, p. 6); and the basic competencies are “the basic cognitive operations, skills and attitudes and values that all learners... are expected to demonstrate, and which can be assessed” (Namibia. MOE, 2006c, p. 2). Although there is no word „explain“ under the basic

competencies column, some of the competencies are assessed using questions that need short explanations and this is the reason why I chose them. Examples of such questions are:

- How does oxygenated blood reach the body cells from the lungs?
- Explain how the build up of cholesterol leads to functional disorder?
- How is urea removed from the blood?

I selected basic competencies for which I could easily obtain teaching resources such as additional textbooks for the texts and diagrams. I have also taught these topics before in Grade 10, using a different approach from the one I used for the purpose of this research. Another reason I selected these topics was because they were the next to be taught in my scheme of work.

4.3 Pre-test results

The aim of the pre-test was to reveal any weaknesses that learners might have in writing explanations and also to provide a baseline to judge the effectiveness of my teaching of explanation writing. I built on the explanations given by the learner as responses to the pre-test to inform them of the intentions of my research. As I explained in Chapter 3, the pre-test was based on a topic that was not included in the teaching interventions, the respiratory system. This topic features in the Grade 10 Life Sciences Syllabus (Namibia. MOE, 2006c) and involves questions that need short explanations. The question used in pre-test was, “suggest and explain how different levels of activity can influence the breathing rate”. The table below shows the overall performance of learners in response to the question.

Table 5

Rating of the answer	Number of learners
Good	1
Average	8
Poor	27

I assessed the learners' pieces of writing by using a rubric (see Box 10) based on Moline's (2000) (see Box 9) explanation checklist. The same criteria were used to assess the explanations produced in the post-test.

Box 10: Explanation marking rubric

Name: _____		Grade: _____	Date: _____
Topic/Question: _____			
A		Arranges explanation in a sequence of steps.	
B		Uses time connectives (e.g. first, then, finally), passive voice and timeless present.	
C		Evidence of knowledge of subject content.	
D		Uses exact, technical language and appropriate vocabulary	
E		Arranges sentences in the best order	
F		Correct sentence structures.	
G		Correct spelling and punctuation	

The following are samples of learners' explanations before my teaching interventions.

A good explanation:

It increase the breathing rate
 When you increase your physical activity or do exercise, you increase the demand for energy. In order to supply this extra energy your rate of respiration must be increased, which in turn increases the rate breathing.

This is a good explanation because the learner has arranged the explanation in a coherent sequence and the sentences are constructed correctly. The learner uses the appropriate vocabulary; only makes minor spelling mistakes and uses punctuation correctly. There is evidence that the learner knows the subject content: he uses the example of doing exercise to illustrate the effects of an increased demand for energy in a human body.

An average explanation:

Carrying heavy loads – This will influence the rate of breathing due to heavy loads that a person carrying. This will deliver oxygen as fast as possible to the active cells and take away carbon dioxide produced during carrying.

This explanation is rated average for the evidence of knowledge of subject content. The sentences are well ordered. There is however lack of technical language and poor sentence structures with fewer spelling errors.

A poor explanation:

The breathing rate increase with the intensity of activity – The more intense the activity the high the breathing rate.

This answer is rated poor because the learners seemed to not understand the question. The learner did not attempt to explain.

4.4 Teaching interventions

The teaching intervention consisted of seven lessons divided into the four stages of the curriculum cycle (see Chapter 2, Section 2.7). These lessons were planned daily in order to allow flexibility so that issues arising from a previous lesson could be addressed. I intended to concentrate mainly on the language features, the sequence and the subject content of the explanations.

Below is a description of each lesson and what I intended to achieve under the four stages of the curriculum cycle:

4.4.1 Stage 1: Building up the field

Lesson 1 (see Appendix 2a)

In order to reach the learning objectives as outlined in the Life Sciences Syllabus (see Table 4) that learners would know the structures of the circulatory system and understand the functions of

the heart, capillaries, arteries, veins and the components of blood, the lesson objectives were that by the end of the lesson learners should be able to:

- (a) Identify and name the structures of the circulatory system
- (b) Identify and name the structures of the heart
- (c) Outline the function of the structure of the heart.

As this was the first lesson in the cycle described in Chapter 2, it aimed at gathering basic information about the circulatory system. It aimed at stimulating learners to recall what they already knew about the circulatory system.

I wanted the learners to differentiate between the heart and the circulatory system. In order to achieve this I prepared the following questions to lead and guide the learners' thinking:

- What are the organs involved in the circulatory system?
- What is the main function of the circulatory system?

I gave two different activities to the learners to work on in pairs. They were as follows:

Activity 1

The learners were asked to label the external and internal (cross-section) structures of the heart (see Appendix 3a). As the learners had studied the structure of the heart in Grade 9, this activity was intended to help them recall and identify the structure of the heart as outlined in the lesson objective.

I provided labelled diagrams below as answers to the activity.

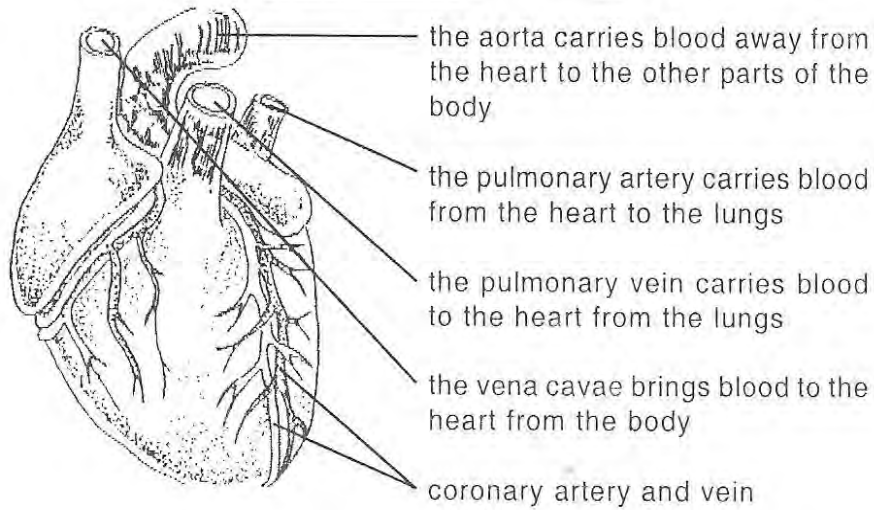


Figure 5: The external structure of the heart

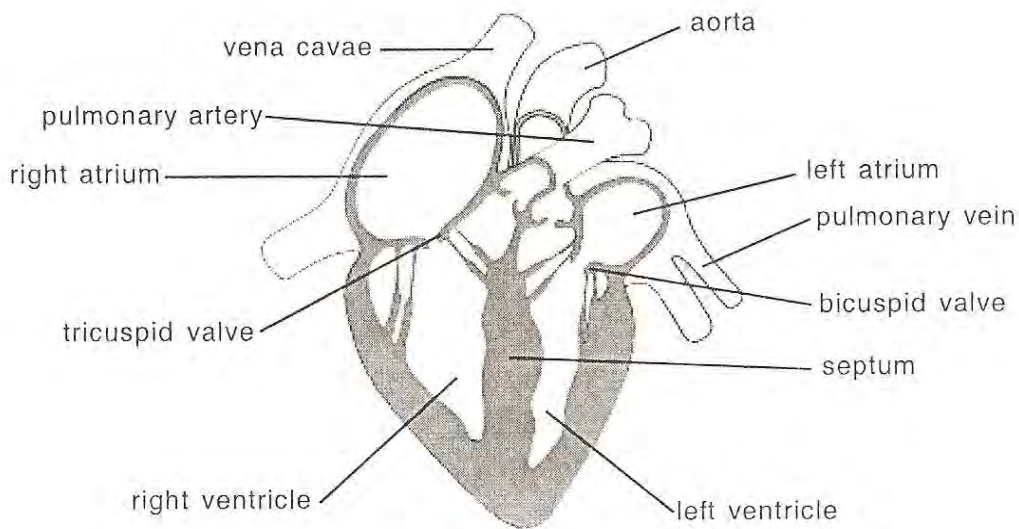


Figure 6: The internal structure of the heart

Activity 2

I set this activity in order to familiarise the learners with the functions of different parts of the heart. Figure 6 above was intended to help the learners match the labelled parts to their functions

(see Appendix 3b). The learners were given homework to compare the left ventricle and the right ventricle and state the reason for the difference in size.

Lesson 2 (Appendix 2b)

In this lesson I wanted the learners to outline the functions of the arteries, veins, capillaries and blood components. The purpose of this lesson was to complete a block of background knowledge relating to the topic they were going to write about: the circulatory system.

Only one activity was given. The learners were given a handout with illustrations and short texts about arteries, veins, capillaries, and blood components. My intention with this activity was that learners would read to answer the questions related to the articles (see Appendix 3c).

4.4.2 Stage 2: Modelling the text type

Lesson 3 (Appendix 2c)

The purpose of this lesson was to present an explanation text to the learners and familiarise them with the purpose, language features and the structure of an explanation text. The lesson objective was that learners would be able to identify an explanation text by its structure, purpose and language features.

A pre-reading activity was given. I purposefully designed this activity with cross-section diagrams (see Appendix 3d) discussed in Chapter 2, in order to help the learners follow the sequence of an explanation in the text that was going to be provided.

A reading text entitled „How the circulatory system works“, was used with the aim of describing its structure, to map out its purpose and outline the language features that are unique to the explanatory text.

Lesson 4 (Appendix 2d)

This lesson was a continuation of Lesson 3. I wanted the learners to identify the explanation texts that might be possible answers to examination questions. To show an example of a possible test or examination explanation, I gave the two activities below. I felt that Lesson 3, which aimed at identifying the unique features of explanation text, had not been successful; in Lesson 4 I therefore focused on the language features of explanation texts.

Activity 1 (Appendix 3e)

This activity required learners to fill in the words in the blank spaces to complete an examination type explanation. The text used was a possible answer to the question, „How does oxygenated blood reach the body cells from the lungs?“ The activity also helped learners to identify the specific language features for explanations as outlined in Chapter 2.

Activity 2 (Appendix 3f)

This activity required learners to re-write a jumbled explanation in the correct order. The text used was a possible answer to the examination type question, „Explain how the build up of cholesterol in the circulatory system can lead to functional disorder“. The activity would help learners to figure out the structure and sequence of an explanation guided by the words such as time connectives, which were learned in the previous lesson. It was also used to introduce learners to causal explanations.

Lesson 5 (Appendix 2e)

This purpose of this lesson was originally to allow learners to write explanations with my help, but it emerged as a platform to provide feedback on the learners' performance on Activity 2 described above, and to give them a chance to correct their mistakes. This was because the lesson did not go as planned due to time constraints and the learners' pace of learning. It was therefore part of stage two of the curriculum cycle.

Nevertheless, as part of the feedback, I defined the new vocabulary to the learners. I also explained the flow diagram discussed in Chapter 2, illustrating how a heart attack occurs as a result of cholesterol build up in human body. I did this in order to simplify the activity and make it more understandable to the learners.

4.4.3 Stage 3: Joint construction

Lesson 6 (Appendix 2f)

This lesson represents stage three of the curriculum cycle. During this stage the teacher and learners write the text together, so that the learners can take the example and practice how to write an explanation (Gibbons, 2002). This did occur with this lesson as one of the objectives I set for this lesson was; “Learners will be able to write their own explanations with the teacher’s help” (see Appendix 2f).

I wanted the learners to be able to identify the type of explanation required in any given question, especially the „how“ type, which often describes the process from the cause to the effect.

I also used a flow diagram illustrating how a heart attack occurs as a result of cholesterol build up in the human body in order to help the learners write an explanation on the role of the coronary artery during a heart attack. I wanted the learners to write short explanations; thus I guided their writing by giving them the words on which to build their sentences. These words were:

First....

As a result....

4.4.4 Stage 4: Independent writing

Lesson 7 (Appendix 2g)

This lesson was based on a different theme, excretion and water balance. A different theme was chosen because the learners were bored by the previous theme. The aim of this lesson was to enable the learners to write an explanation without the teacher's help. It involved three stages, gathering the information, doing the pre-writing activity and writing the explanation.

The lesson objectives of this lesson were that learners would be able to:

- (a) Identify the structures of the excretory system
- (b) Identify the waste products expelled from the organs involved in excretion
- (c) State the functions of the lungs, skin and renal system in excretion
- (d) Explain the function of the urinary system in excretion

4.5 Evaluation and reflection on the teaching interventions

The analysis of these lessons is directed by the research goal which was to improve my way of teaching explanation writing skills to my Grade 10 learners.

The analysis is based on the seven lessons described earlier in this chapter, focusing on the following aspects which were used to evaluate and reflect on the teaching intervention:

- Positive points
- Negative points
- Aspects to be improved

4.5.2 Lesson 1

4.5.2.1 Positive points about the lesson

I stimulated the learners' background knowledge through questioning. I scaffolded the topic with questions in order to help the learners recall the facts they already knew. Most of the questions I used were knowledge questions and they helped learners to recall the facts on the circulatory system, which they had previously learned in Grade 9. This included labelling the diagrams of the heart and outlining the functions of the part of the heart.

I did this in order to remind the learners of the important facts about the circulatory system. I asked the following questions:

- What are the organs involved in the circulatory system?
- What is the main function of the circulatory system?
- Where can we find the heart in our body?
- What material is the heart made of?
- What do we call the muscles in the heart?

The non-participant observer commented positively on my use of questions in the lesson. She noted that I used scaffolding in order to assist the learners with some answers to questions I posed (see Appendix 5c).

These questions helped to focus learners' attention on the lesson as this learner noted in her journal:

We learn about circulatory system which is very important. I learn more that the heart is divided into many parts and each part has its own functions (see Appendix 5b).

Another positive aspect of the lesson was that I attempted to remove the misconception that learners have in differentiating between the circulatory system and the heart as an organ. This included labelling the diagrams of the heart and outlining the functions of the parts of the heart. This is noted by one learner in his journal,

Teacher wanted us to learn the three organs which are involved in the circulatory system and how they work. But in those three organs we only take one which we do in class (see Appendix 5b).

Similarly another learner wrote in her journal:

The teacher wants us to learn about circulatory system. This system have some organs and they are blood vessels and the heart. She teach us only one organ which is the heart (see Appendix 5b).

Although some learners could not readily identify the structure of the internal parts of the heart, it became clear to them with the help of others in the class and through teacher guided feedback. Most learners could easily identify the external features of the heart. Following on the activity to identify the external and internal features of the heart, I gave each learner handouts with labelled parts of the heart (see Figure 6 above) as answers to the activity.

I also gave the learners an activity to work on in pairs, to match the parts of the heart with their functions with the help of the diagram illustrating the internal and external structure of the heart. This activity was to reinforce their knowledge of the functions of different parts of the heart. It was completed successfully and more quickly than I had expected by most learners.

4.5.2.2 Negative points about the lesson

Giving learners the diagrams of the heart did not give them a sense of what the heart really is. For example, in answer to a question I asked “what material” is the heart made of.

A learner confidently responded, “It is a cartilage” (see Appendix 6c).

I came to the lesson with the assumption that the majority of the learners would have seen the heart of an animal e.g. a goat or a cow in their homes. However, this was not the case for some learners. “I did not see the heart of an animal,” said one learner. The non-participant observer noted in her field notes, “No comparisons to real life mentioned”; in addition to this, one learner wrote in his journal,

I thing I learned a very thing I need to know nothing else I would like to know, but would like to see the part really one from goat (see Appendix 5b).

The activity whereby learners were asked to identify the internal and external structure of the heart was not given adequate time and the difference between the two was not emphasised sufficiently. During the lesson most of the learners could identify the external parts but could not identify the internal parts. Three learners wrote in their journals:

I want to learn more on the external and internal structure of the heart, I plan to study hard on their functions as they are so confusing (see Appendix 5b).

I have difficulties on identifying some parts of the heart using the internal structure (see Appendix 5b).

I need to more about external structure of the heart and internal structure of the heart and to know the difference between two (see Appendix 5b).

This aspect of the lesson was not effective because although the learners were given the diagrams, they seemed to be unfamiliar with them, and there was limited time for them to understand what they represented.

Furthermore, I stopped the learners who were slow and were not able to finish the activity which involved matching the parts of the heart with their functions. I assumed they would get feedback from their fellow learners, and I did not give them a chance to express their ideas. In response, the non-participant observer noted that I stopped the learners without letting them finish their activities, and that I could have given them assistance during the activity rather than letting them do it on their own (see Appendix 5c).

Another issue is that I spent too much time talking and giving guidance to the learners. This was because of the reaction I got from the class. As a result, there was little interaction between the learners and myself.

Lastly, before I could realise the time, the bell rang to indicate the end of the period. The next teacher was waiting outside. This caused me to lose concentration in giving the last activity, which was to compare the left ventricle and right ventricle and state the reasons for the

difference. The non-participant observer said during our discussion, “I noticed you lost concentration at the end of the lesson and I don’t think the learners got the homework task” (see Appendix 5c). This was also a matter of time management; because I ran over time, I diverged from the lesson plan and made the last activity become the homework.

4.5.2.3 Aspects to be improved

Time management is one aspect that needs to be improved both by myself and the learners. Time was lost during the activity of identifying external and internal structures of the heart for the following reasons:

- I was reluctant to limit time at the beginning of the activity, because I wanted the learners to engage with the diagrams and identify them without me interrupting them.
- The activity proved too difficult for most learners.

I, however, could have given a time limit for this activity. I could first have described each part orally, and then the learners could have figured out which part was which with ease. This was suggested by the non-participant observer: “Suppose to explain parts first before functions” (see Appendix 5c). In the second activity which needed time management, I could have speeded the learners up by assisting them as they worked in their pairs.

To make this lesson a real learning experience in future, I would bring the heart of a goat, sheep or cow from a local butchery to class. The heart could be dissected according to the diagrams to show its internal structure.

4.5.3 Lesson 2

4.5.3.1 Positive points about the lesson

I linked this lesson to the previous one by reminding the learners that the main focus was to answer the question, “how does the circulatory system work?” I then told the learners that in order to answer this question they needed to gather more information on other organs that make

up the circulatory system. I wanted them to notice that there was a connection with what they had done the previous day. One learner wrote in her journal, “the teacher taught us about the circulatory system (continuous)” (see Appendix 5b).

Learners worked successfully in groups of three. A learner wrote in his journal that “the lesson was good, because we were in groups, doing together and share our opinions” (see Appendix 5b). I gave them handouts with questions (see Appendix 3c), which they were to read and answer in groups. I wanted them to gather more information regarding the organs of the circulatory system. These learners showed in their journals what they had learned in the lesson:

The teacher taught us about the structure and function of the blood components (see Appendix 5b).

The period was good ...we studied about the blood vessels (see Appendix 5b).

Thursday is a good day when it comes to the lesson, because I learned about the blood vessels and how blood vessels consist of veins, artery and capillaries and their function and also the components of the blood cells (see Appendix 5b).

In Life Science we learned about arteries, vein and capillaries. I learned that arteries carries blood away from the heart and the veins comes the blood to the heart while capillaries allow blood to pass close to every body all. There are four blood components and they are plasma, red blood cells, white blood cells and platelets. They have different functions (see Appendix 5b).

The activity was successful because learners had to read with understanding and search for their own information. The questions I set helped them to find the necessary information in the text. I set most of the comprehension questions on a lower level in order to make it easier for the learners to understand and be able use the information for the next lesson (see Appendix 3c). One learner wrote in her journal about the reading activity, “the period of today was very good as we do the exercise that help us to understand” (see Appendix 5b); another learner wrote, “Everything was good and clear” (see Appendix 5b).

Another thing which made this lesson successful was that after the group work learners had to give their answers and I had to give feedback to the whole class where necessary through class discussion. A learner wrote in praise of the lesson, “our teacher gave us class work to do in the

groups of three people and after we have finished we discussed it with the whole class and the lesson for today was very good” (see Appendix 5b). Another learner wrote, “The period was perfect and I understood most of the things” (see Appendix 5b).

The lesson generated curiosity regarding some facts about the circulatory system, which had not been planned for in the lesson. This showed that the lesson was successful as it stimulated critical inquiry among learners. Some learners wrote in their journal of what they needed to learn more and questions to which they needed to find answers about the facts on the circulatory system:

- “If one part (organ of the circulatory system) is not working or damaged what will happen” (see Appendix 5b)?
- “Now my questions are as follow:
 1. Why are white blood cells bigger than red blood cells?
 2. Why is the formation of clots important?
 3. What is the role of fibrin in the formation of clots?” (see Appendix 5b)?
- “I want to do more on how the colour of the blood is formed especially the red colour” (see Appendix 5b).
- “I want to know what colour the blood turns if you are HIV positive, does it remain the same or what does it really look like. And the difference between the blood of humans and that of animals” (see Appendix 5b).
- “But I still insist on if blood doesn’t go to the nails and hair, then how do they grow if energy doesn’t go there” (see Appendix 5b)?

4.5.3.2 Negative points about the lesson

I asked the learners to give their answers to the homework from the previous lesson. However, I did not give individuals a chance to present their answers. As a result it was difficult for me to assess if all the learners had the correct answer. During our unrecorded discussion, the non-participant observer commented, “you didn’t give a chance to a number of learners to read out their answers, I think you were supposed to ask, even if not all of them, to give their answers

otherwise they could be discouraged” (see Appendix 5c). However, this homework was discrete from the current lesson; there was no direct link between the two lessons.

I underestimated the learners’ capability with regard to the lesson content. I got some challenging questions from one learner that I could not readily answer during the lesson; for example, “Do nails and hair have blood, how do they grow?” (see Appendix 5a). During my lesson preparation, I did not consider learners with different learning abilities as is the case with this class group.

Time management was again a problem for this lesson. As a result the last question of the activity, to find the functions of each blood component, was not discussed. Some learners reflected in their journal that they needed to find more information about the components of blood and that they were confused. They wrote:

- “What I need to know are the function and structure of blood” (see Appendix 5b).
- “These things are quite easy but confusing and I need to make sure that I know each of them and differentiate them thoroughly” (see Appendix 5b).
- “I need to know about phagocytes and platelets” (see Appendix 5b).
- “I want to learn more about white and red blood cells” (see Appendix 5b).

The non-participant observer also noted in her field notes, “time was not enough” (see Appendix 5c). Time constraints had forced me to give homework which had not been planned for in the lesson preparation. I said, “Read more and find out what gives the blood a red colour and find out the functions of the blood components” (see Appendix 5a). There was therefore a lot of work to be done in addition to the homework which I had planned to give them, which was to write a rough draft of how the circulatory system works.

4.5.3.3 Aspects to be improved

In future, in order to cater for the learning needs of all learners, I would give hand-outs with general information regarding the circulatory system (see Appendix 4c) to capable learners when

questions such as the one pointed out in Lesson 1 arise. I would refer learners to the library, or the internet in order to find the necessary information they need. I would, however, give direct guidance, for example, the specific topic/subject which they need to focus on in the internet or in the library book.

In order to cover a lot of content in a 40 minute lesson with the stated objectives, I should have given less time to knowledge questions such as, “What is the function of arteries, vein capillaries?” and discussed them with the entire class rather than in groups followed by feedback. It would have benefited the learners if the reading comprehension task had been done prior to the lesson as homework.

With regard to the homework, it would have worked better if had been part of Lesson 1 as initially planned. The homework also required learners to know the facts about the heart.

4.5.3 Lesson 3

4.5.3.1 Positive points about the lesson

Firstly, the introduction of the lesson gathered together all the required information about the circulatory system. I asked the following questions in order to remind the learners of the facts dealt with during the two previous lessons:

- Which vessel carries oxygenated blood and deoxygenated blood to the lungs?
- What is the function of the valve?
- Which vessel carries oxygenated blood and deoxygenated blood to all parts of the body?

The responses from the learners were recorded on the chalkboard and I added some which the learners were not able to provide.

Secondly, after the information about the circulatory system was jotted down on the chalkboard, the learners were given a pre-reading activity that helped them to follow the sequence of an explanation. I explained the importance of the activity to the learners:

That activity is going to help you to know what is happening. For you to be able to do an explanation you need to understand the details (see Appendix 6c).

I led the learners into the activity by explaining what they were supposed to do. I described each diagram and gave an example of the first picture:

Like in picture 1, they said all the muscles of the heart relax, when the muscles in the heart relax what is happening to the blood in the heart? Where does it go? Some of the arrows are there to help you (see Appendix 6c).

The learners were divided into groups of three, and they described what was happening in each diagram that was presented to them. They positively identified the cross-section diagrams of the heart and they wrote about the flow of the blood and its direction - whether it comes from the lungs to the heart or from the heart to all parts of the body and vice-versa. While the learners were busy doing the activity, I continued giving assistance to individual groups.

Thirdly, I introduced the pre-written explanation text to the learners (see page 31). Each learner received a copy of an explanation entitled „How the circulatory system works“. Referring to this text, I reminded them that the aim of the activity was for them to learn how to write clear explanations. I further explained the language features involved in the exemplary text.

The lesson objectives were partially achieved, as my non-participant observer commented during our informal discussion. I noted in my journal that she could see the direction I was going in during the lesson and that she took some ideas that she could emphasise in teaching Agriculture.

4.5.3.2 Negative points about the lesson

The classroom arrangement caused some time to be wasted when learners shifted chairs and desks to sit in groups of three. This arrangement also prevented free movement of the teacher from group to group.

Although I have stated under the positive points that the lesson objectives were partially achieved, the main objectives were not achieved. I did not guide the learners to figure out the purpose of explanation texts and the text structure of the explanation text as planned.

The learners seemed not to notice the link between the activity which was done earlier in groups and the explanation text provided. Although the aim of the pre-reading activity was to help the learners to bring all the facts together in order to build detailed explanations, this exercise did not achieve that. For example some learners wrote in their journals:

Today the lesson was somehow, because I just don't understand what we were taught in the lesson. All I understand is how to explain when ever you are ask an explanation but I don't understand the activity" (see Appendix 5b).

I just don't understand what the teacher was teaching. The teacher taught us about how the circulatory system work and I don't really get the point, so I need the teacher's explanation. We did the activity in the class but it was taught because I just don't understand" (see Appendix 5b).

During the lesson, I also observed and noted in my journal that one group seemed unsure of what was happening; they could not see the connection between the information gathered on the board, the diagrams and the explanation text provided (see Appendix 5a).

The exemplary text given to the learners would not be an acceptable answer to a question in an examination or test because it was too long. I commented on this to the learners during the lesson presentation, "This one is too long", I said. I also noted in my journal:

She [the non-participant observer] advised that however the explanation given as an example was too long to be provided in the examination she suggested we give another shorter example (see Appendix 5a).

Again, time management was an issue. The activity (described in Lesson 3) did not take 10 minutes as planned; it took more than 15 minutes to complete. As a result there was no feedback from the learners to expose each other's responses to the rest of the class. The non-participant observer noted, "No answers given from groups. She was supposed to hear learners' explanation,

so that she can give hers, the clear one” (see Appendix 5c). I used up 10 minutes of the break time, totalling 50 minutes in all, and yet no formal conclusion of the lesson was made.

4.5.3.3 Aspects to be improved

To save time the class could be arranged for learners to sit in pairs or groups of four to avoid re-arranging the chairs and desks during the lesson. This would give time for learners to concentrate on the pre-reading activity and finish the task. Also it would allow the learners to discuss their answers and give feedback to each other.

The learners could also do another activity in order to familiarise themselves with the content and order the sequence of an explanation. Enough time would give the learners the opportunity to realise the link between the pre-reading activity and the explanation to be written.

In addition to that, instead of me identifying the language features such as time connectives, technical terms, and simple present tense, the learners could identify these on their own. Perhaps two examples of the texts could be used whereby one text could be used to show the examples and in the other one the learners would identify these features on their own, without the teacher’s help. I could guide and scaffold the learning to enable the learners to see the purpose of a „how“ explanation text.

4.5.4 Lesson 4

4.5.4.1 Positive points about the lesson

The text given as an example in the previous lesson was read aloud. This was to refresh the focus of the previous lesson and link the two lessons.

Based on the comments from the non-participant observer that the example given in the previous lesson was too long to be given in a test, I gauged the learners’ feelings about this by asking them

to suggest the marks that they would award to such an explanation. Several learners suggested 20 marks out of 20 because they claim that the explanation is clear but too long.

Some learners felt the two activities were easy to understand. These learners wrote in their journals:

Miss still explained more on how we can shorten our explanations for them to be short and clear... We got to know how to use language features like first, while finally and other related words. It was easy to understand (see appendix 5b).

Today the lesson was enjoyable, because I understand what the teacher taught us in class" (see appendix 5b).

During the first activity, I gave individual support to some pairs and scaffolded the activity in order to simplify it for them. I asked the opinion of two pairs of learners on the explanation, to which one learner answered, "This is a good one" (see Appendix 6c).

I also explained to the learners:

I want you to notice that ... you will not be able to answer that question [How does deoxygenated blood reach the body cells from the lungs?], if you don't know how the circulatory system works. So this question is part of the main question which we have here and most of the questions that are given in the examination or in the test, they are part of the big topic like the one we are dealing with now (see Appendix 6c).

Activity 2 was done individually. This enabled me to assess the progress of each learner.

4.5.4.2 Negative points about the lesson

First of all, the lesson could not be finished within the time planned. Activity 2, which was done individually, took longer than planned as it proved to be difficult for some learners. I recorded this in my research journal,

The second exercise seemed to be a bit difficult and it took them 10 minutes to complete. Some learners were not done until the period came to an end (see Appendix 5a).

One learner also stated in her journal, “We were give one activity but we did not finished” (see Appendix 5b).

Secondly, most of the learners could not get the correct order of the explanation in Activity 2. Some learners only got the first and the last sentence correct (see Appendix 3ha). Some learners ordered the sentences in a way that did not make sense at all (see Appendix 3ha). These errors are attributed to the fact that some vocabulary e.g. *thrombosis* and *arteriosclerosis*, was new to some learners.

4.5.4.3 Aspects to be improved in this lesson

Activity 1 could be given as an individual activity because it proved to be easy. Activity 2 required learners to share ideas through discussion; it should, therefore, have been given as a paired activity.

Furthermore, Activity 2 needed more scaffolding by the teacher than the first activity. The learners should be encouraged to find the meaning of difficult words from either the glossary at the end of their textbooks or from a dictionary.

4.5.5 Lesson 5

4.5.5.1 Positive points about the lesson

The lesson began by giving feedback on the second activity of the previous lesson. This gave me the chance to clarify the cause and effect type of explanation. In the feedback, I pointed out the common mistakes made by the learners as discussed as negative points in Lesson 4. I gave the definition of *arteriosclerosis* and *thrombosis*. One learner was asked to tell the whole class what *cholesterol* was; he replied, “High oil or too much fat” (see Appendix 6c); I clarified that it is a substance mostly found in animal fat. The meanings of these words were written on the chalk board so that the learners could take note of them.

I diverged from the lesson plan to use the flow diagram (discussed in Lesson 5) so that the learners could understand both the process of how the build up of cholesterol can lead to functional disorder and be able to write about it. I planned that the flow diagram (see Appendix 3k) would be used to simplify the explanation of the effects of cholesterol on the coronary artery, but instead I used it to give feedback, which was a success. The learners wrote in their journals about what had been done during the lesson and what they had achieved:

The teacher explain well how the build up of cholesterol the circulatory system can lead to functional disorder. She display the poster (flow diagram) at the wall so that we may understand well. We learned the process of heart attack, she explained for us everything and what happened during this process (see Appendix 5b).

Know I learn how I re-write the sentences in order, because I know now when we was given the activity to do and I was try and I was try but I was not happy because firstly I does understand and now I understand (see Appendix 5b).

On today lesson we re-write the class work about the circulatory system. In where we have learn how you can explain it in a good way and even in order (see Appendix 5b).

After the feedback was given, the learners were then given five minutes to correct their work. Their results showed improvement (see Appendix 3h). I used the feedback opportunity to also describe the cause and effect of an explanation. I asked questions such as, “What is the „cause“ and what is the „result“ or „effect“ in this explanation?” (see Appendix 6c), in order to scaffold their responses. These questions helped the learners to understand that the cause and the effect or the result can be identified in the questions needing cause-effect explanations. This would aid their explanation writing. I also referred to the flow diagram to explain the cause and effect in the explanation.

4.5.5.2 Negative points about the lesson

The lesson did not take 40 minutes as planned, because I arrived 10 minutes late. As a result, the main objective of the lesson as indicated in the lesson plan was not achieved. The lesson was

used instead to give feedback on the previous day's activity as discussed above. I noted this in my research journal:

The lesson was started late because of administration work... The period came to an end before the learners can write another explanation with the teachers help (see Appendix 5a).

Although the use of the flow diagram proved to be successful for some learners, to others it was confusing. The non-participant observer noted in her field notes, "The wall chart is a little bit confusing, it is so hard to follow the arrows they over-lap each other" (see Appendix 5c).

Some learners also indicated that the flow diagram was confusing and they did not understand it although they got the explanation in the correct order in the activity they had done. For example, one learner wrote in his journal:

This explanation was not understood by many of the learners because it was confused and difficult. I tried to understand but still no I am not (see Appendix 5b).

4.5.5.3 Aspects to be improved in this lesson

In future this lesson could be used as a feedback lesson on the activity given during Lesson 4. After the learners correct their work, they could read out their answers and provoke a class discussion based on their answers.

Learners could be encouraged to draw up their own flow diagrams based on the understanding developed during the discussion. Instead of using the flow diagrams to simplify the explanation, learners could use an explanatory text presented by the teacher to draw up the flow diagrams with the teacher's help. This would help them to read and follow the flow diagrams in relation to the explanation they are dealing with. The teacher could provide key words and key phrases in the flow diagrams where the learners could fill the gaps by using the information from the explanation.

The learners could be given another more difficult activity where they first interpreted the flow diagrams and matched it with the explanation text. The text could contain jumbled sentences; this would give learners a chance to figure out the correct sequence of an explanation.

4.5.6 Lesson 6

4.5.6.1 Positive points about the lesson

The lesson objectives were reached as learners successfully wrote an explanation on the role of the coronary artery during a heart attack.

I introduced the lesson by asking learners to express what was done in the previous lesson. The lesson was developed from the learners' response that the previous lesson was on how one could tackle an explanation question.

As a reminder of what had been discussed in the lesson, I explained to the learners that there are different types of explanations. There are those that explain the cause and the effect of a phenomenon. In the discussion the learners were asked to give examples of the questions that had been discussed in the previous lessons as types of explanation questions such as:

- Explain how the build up of cholesterol in the circulatory system can lead to functional disorder (sequential explanation)
- Explain the role of the coronary artery during a heart attack (sequential explanation)

This was done in order to show the learners how they can identify the type of question and hence the type of explanation required.

The learners were given a chance to explain the role of the coronary artery during a heart attack. During the writing exercise, I provided them with clues, for example, "You need to gather all the information about the circulatory system e.g. the function of the coronary artery, etc" (see Appendix 6c). I told the learners to use the word „first“ in their first sentence and „as a result“ in the last sentence of their explanations, which I wrote on the chalk board.

This is how some learners developed good explanations (see Appendix 3i):

First, the walls of coronary artery becomes small due to fat layer deposited in them, and then cause the blood to clot. As a result, the heart will stop pumping blood and the heart muscle will no more get oxygen and glucose causing then Heart attack.

First the coronary artery receive a fat layer and it reduces the diametre of the artery. The coronary artery will stop providing oxygen rich blood to the heart muscle. As a result the heart will stop pumping blood and lead to Heart attack.

First, when coronary artery muscle get blocked by fatty layer or blood clot then food and oxygen does not reach the heart muscle. as a result the heart will stop beating and the person now suffers from heart attack

These explanations showed the success of this lesson and also of the previous ones; more than half of the class were able to write a reasonably effective explanation.

4.5.6.2 Negative points about the lesson

Despite the success of the writing exercise, there were some errors that could affect the meaning of an explanation e.g. incorrect sequencing and the use of technical words such as in the example below (see Appendix 3i):

First colonary artery supple heart muscels with glucose and oxygen. As a result it muscel become to fatty the heart can not allowe the glucose and oxygen pass in and out and this is called heart attack.

Some of the vocabulary was quite new to a large number of learners. This hindered their ability to write meaningful and coherent explanations. Some of the words were directly translated from the mother tongue into English which caused some parts of learners' explanations to make no sense. For example, a number of learners wrote that the heart would stop breathing as in the sample below (see Appendix 3i):

First the coronary muscles become muscles become blocked by fatty deposits or blood clot. then food and oxygen can not reach the heart muscles. As a result the heart may stop breathing

The learners also failed to link concepts together. They treated each concept discretely. For example, it was clear that some learners did not notice that respiration, blood circulation, and

excretion are concepts that are linked. Perhaps I should have pointed this out to the learners to enhance their understanding, especially blood in circulation and respiration.

Although the objectives of the lesson were reached the lesson proved to be tedious for some learners because of the repetition of the lesson content. Below is how some learners expressed their feelings about the lesson in their journals:

The lesson was not good because it was all about repetition for what we did last day (see Appendix 5b).

Today we made revision of the things we did in the week (see Appendix 5b).

My attempt to clarify the difference among explanations failed as only one type of explanation was practiced in the lesson.

Another failure of this lesson was time management. The pace of the lesson was slow. The learners took a long time to answer my questions. It took three to four minutes for a single question to be answered by the learners and I had to repeat or rephrase the questions. This could be because the lesson was boring to them and I could not provide an interesting activity to increase their interest, or maybe they didn't understand the purpose clearly enough – that they were focusing on how to write explanations in an exam. The period came to an end before some learners could finish writing their exercises. As a result, the activity was completed during the afternoon study time under my supervision.

4.5.6.3 Aspects to be improved in this lesson

Firstly, more activities, similar to the one used in the lesson, could be given during the lesson or as homework, for the learners to practice writing this type of explanation. Secondly, after the class had completed the first explanation text with my help, I would give them feedback pertaining to the common errors in order for the learners to improve their performance in the second exercise. Furthermore, I would share with them what the examiners had commented on

with regard to similar questions. During the feedback, learners could make comments or ask questions rather than listen to me. If necessary the same would be done after the second exercise.

Thirdly, in order to increase the lesson pace, I would bring in stimulating visual aids, for example a flow diagram with illustrations as part of a pre-writing activity. In the event of questions in the pre-writing activity, these would be written on the chalkboard; the learners would answer them in groups of three to four, within a limited time. I would then ask for answers from selected groups rather than letting each group answer.

Lastly, in order to do all the activities suggested for this lesson, it should cover 80 minutes which is a double period. In future I would not aim to teach all types of explanations in one lesson. I would rather, at the beginning of the curriculum cycle, clarify to the learners the type of explanation that would be learned.

4.5.7 Lesson 7

4.5.7.1 Positive points about the lesson

Feedback was given to the learners. In the feedback I referred to some specific explanations. I asked the learners to copy one learner's explanation (below) as a good answer to the question (see Appendix 3i). I advised the learners to copy this into their note books as examples.

First cholesterol is deposited on the walls of the coronary artery. This reduces its diameter and less oxygen and glucose passes through to the heart muscles. As a result the heart will not pump blood due to the lack of energy in the heart muscles, a heart attack then occurs.

I also referred to some learners' explanations (without revealing the learners' identity) to highlight the incorrect sequence and the incorrect use of technical words such as the ones referred to above in Lesson 6.

To introduce the topic I asked the following leading questions to gather the necessary information and build the learners' background knowledge about the excretory system.

- How do you define the word excretion?

- What are the organs or parts involved in the excretory system/urinary system?
- What do the lungs excrete?
- What does the skin excrete?
- What do the kidneys excrete?

These questions were used to gather the information on the excretory system and urinary system. I explained that the focus of this lesson was the kidneys; therefore at the end of the lesson they would be able to explain how the kidneys clean the blood.

I explained the difference between the excretory system and the urinary system. I did this by stating that these are two different systems. The learners listed the organs involved in the excretory system as the lungs, the skin and the kidneys. They also listed the organs involved in the urinary system as the kidneys, urethra, ureter and bladder, referring to the cross-section diagrams such as the one below in their summary books and the textbooks.

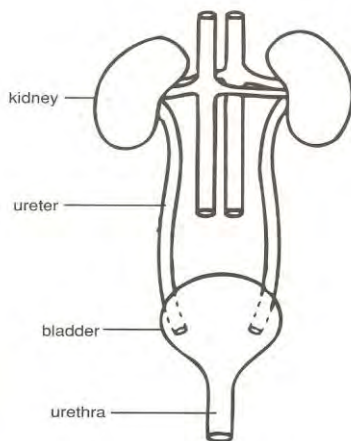


Figure 8: The urinary system

I instructed the learners to use different sources with different illustrations of the urinary system in order to get the labels of different parts of the urinary system. They used at least three different sources that were available in the class.

After the learners identified the parts involved in the urinary system, I asked them to find the function of the ureter, urethra, bladder, renal vein and renal artery from the sources they had. They could not locate the functions of the renal artery and the renal vein, because they were not written in the sources that had been provided. I therefore wrote the function of the renal artery and renal vein on the chalkboard for the learners to copy into their summary books.

Through our class discussion one learner asked, “Does it mean people that urinate at night their sphincter muscles are not tight?” (see Appendix 6c). This question showed that the learners were trying to relate the real situation to the classroom discussion.

I displayed a poster with a cross-section diagram (internal structure) of the kidney (see *Figure 5* on page 63). I described each part and gave its functions. I also put up a poster of a flow diagram illustrating how the blood is filtered in the kidneys (see *Figure 10* on page 90). I used the cross section diagram to explain to the learners how the kidneys clean the blood. I did this in order to prepare the learners for writing their explanations of how urea is removed from the blood.

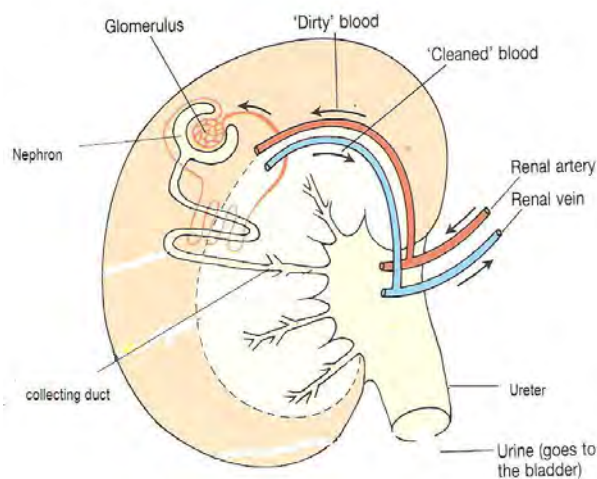


Figure 9: The internal structure of the kidney

4.5.7.2 Negative points about the lesson

As it was planned, learners could not write their explanation during the period, because there was not enough time. I told them to write their explanations during the afternoon study time.

There were not enough textbooks for all the learners. They shared one textbook among four to five. This caused distraction in the class when learners gathered around one textbook.

Some learners were busy copying the notes from the chalkboard when I was describing and giving the functions of the structure of the kidneys. This could have been the result of not having enough reference materials as they wanted to keep the summary. Copying the notes while the teacher talks however distract the learners' attention from what the teacher is saying.

I did not provide a detailed answer to the question of why people wet their bed at night. This is because there were no materials in class that contained information to answer such a question.

I came to realise after the lesson, that in my explanation of the flow diagram, there was some wrong information. I said, "Blood goes to the nephron from the renal artery to be filtered" (see Appendix 6c), instead of blood goes to the glomerulus from the renal artery to be filtered. The flow diagram was not clear. This mistake led to some learners writing the same error as when they were asked to write an explanation on their own.

4.5.7.3 Aspects to be improved in this lesson

Even though this lesson was a success, there were some aspects that could be improved upon.

Lack of resources – in future, I would photocopy the pages to be worked on with the learners. This would save time and also avoid disturbing the lesson proceedings.

To deal with the problem of learners copying the notes from the chalkboard when the teacher is explaining, I could prepare the notes in handouts and distribute them to each learner.

In order to deal with learners' unanswered questions in a similar lesson; I would try to research, read and get detailed knowledge on the topic. I would use the internet to search for articles similar to the one in the appendices (see Appendix 4b) about incontinence – the inability to control the passage of urine.

In order to give a correct explanation, I would re-arrange the flow diagram as follows (Figure 10 below):

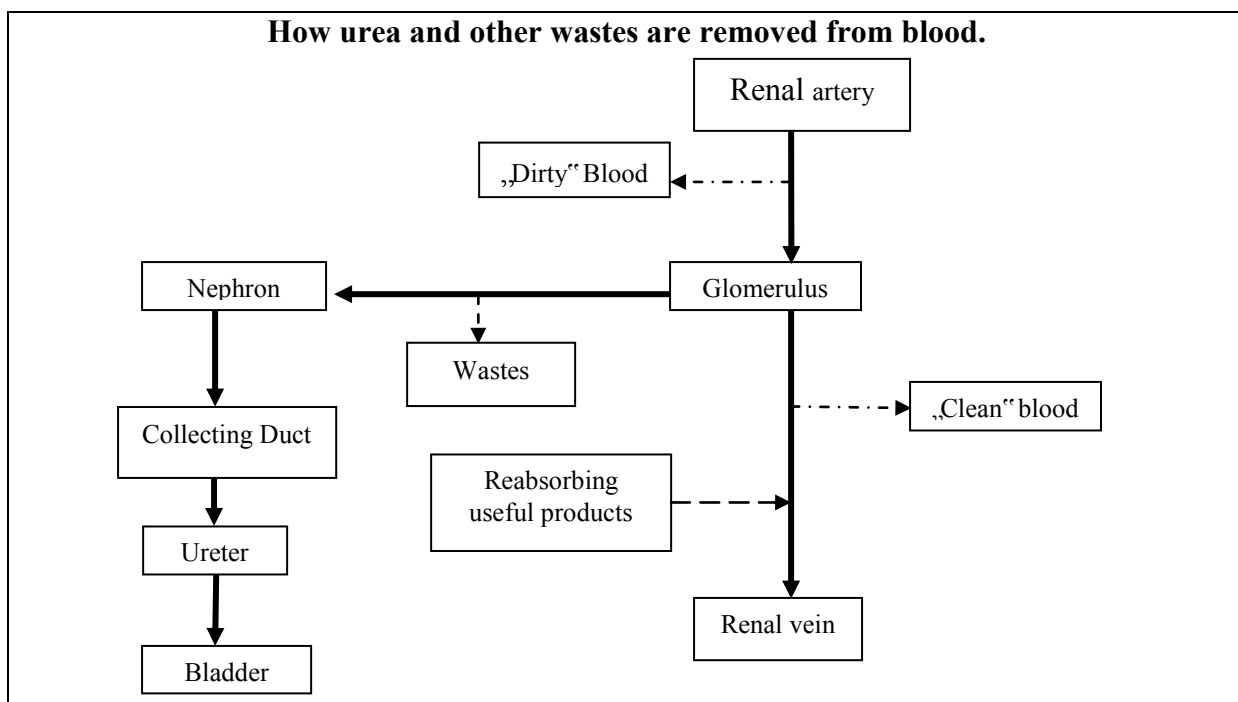


Figure 10: Flow diagram

4.6 Post-test results

The aim of the post-test was to measure the effectiveness of my teaching interventions on explanation writing skill. As discussed earlier in this chapter, the post-test was based on a different topic from the one used during the teaching intervention. It was based on the excretory system. Although the topics are different, they both require learners to know the function of a system in the human body.

The question that was used was: Explain how urea is removed from the blood. The table below shows the rating of the answers from all learners in the class.

Table 7

Rating of the answer	Number of learners
Good	4
Average	22
Bad	10

The following are samples of learners' explanations after my teaching interventions:

A good explanation (see Appendix 3j):

First, the dirty blood from the body enters the kidneys by renal artery, from the renal artery it moves through the blood capillaries which transport it to the glomerulus, while it is in the glomerulus it is filtered and waste substances move to the nephron and the clean blood moves continuously in the glomerulus. The waste substances that are in the nephron are filtered and then some are reabsorbed by the glomerulus, then they go to the renal vein which takes them out of the kidney. Urine from the nephron is collected by the collecting duct which carries them to the ureter then to the bladder. Finally, urine enters the urethra which takes them out of the body.

An average explanation (see Appendix 3j):

Firstly, the renal artery carries dirty blood into the capillaries, where by it will be transferred into the nephron. In the nephron the dirty blood will be cleaned and also the excrete materials like urea and salts will be separated from the blood. After that the clean blood it will go into the glomerulus, where it will go back to the capillaries and then to the renal vein and then it will be transferred to the body cells and where it is needed. While the excrete materials like urea it will be collected by the collecting duct to the ureter and finally the urea will be stored in the bladder.

A bad explanation (see Appendix 3j):

Firstly the kidney produce urine consist mainly of urea water and mineral salts. The collecting duct send urea into the ureter where the urea will be in urine form than ureter will send it to the bladder the urine stored in the bladder until it can be excreted through the urethra. when the muscle relax, urine leaves the body through the urethra finally urethra lets urine out of the body.

Comparing the learners' performance with regard to answering explanation questions in the pre-test and in the post-test, there is a slight improvement. There is a drop in the number of „bad“ explanations and an increase in the number of „good“ and „average“ explanations. The explanations in the post-test reveal that after the intervention, the learners went beyond what they could already do. There is evidence that the learners are aware of the language features in the explanation genre, even though in some explanations these features were not used properly. The learners have reached a new level of understanding; they developed knowledge of new Life Sciences concepts, although these concepts were often discrete rather than integrated into a systematic understanding of bodily processes.

4.7 The interviews

I interviewed the learners after my teaching interventions. I compiled their performance profile before, during and after my interventions. As discussed in Chapter 3, the learners were interviewed in pairs, according to their similar performances, also justified in Chapter 3. Learners A and B were interviewed together, as well as Learners C and D.

Learner A was rated „average“ in the pre-test activity his explanation was coherent, with some evidence in the use of language specific to explanation genre, but a lot of content details were missing. He was rated „good“ in the other two observed activities. He claimed that the learners had not been taught how to write explanations as such (see Appendix 6a). He felt that my teaching was of value to him, “because like in the exams we didn’t know how to answer the questions asking explanations, but now we can”, he said. He was confident that he would be able to identify questions that needed explanations since they might contain words such as, „explain“, „how“. He also said one of the words could be „suggest“. I am not convinced that he understood the word „suggest“, which he could have picked up from one of the questions that was used during the lessons. He was also confident that he would be able to write a good explanation, provided he knew all the parts and functions of the process to be explained.

Learner B had a similar performance to learner A, but he was rated „average“ in the post-test activity. He found the lessons to be interesting in terms of their content. This type of explanation (sequential explanation) helped him to understand the subject content better; he also claimed that he had not been taught how to write an explanation. He claimed that the types of explanation they were taught in other subjects were not those that outline a process but mere justification. He was able to identify questions needing explanations. He might identify a „how“ type of explanation by figuring out that the question has a cause and an effect. When writing an explanation he favoured the use of a flow diagram because the arrows helped him to organise his ideas. He was not confident enough to write explanatory answers without any guides.

Learner C was rated „average“ in the pre-test, „good“ in the second activity and „average“ in the post-test activity. She was aware of the language features, e.g. time connectives suitable for explanations, but used them incorrectly. During the interview she expressed the view that, it is best to know both the language and the facts relating to the topic to be written about. She liked the use of arrows in the flow diagrams, because when she wrote she could easily get the sequence of the explanation and they also supported understanding of what she was writing.

Learner D was rated „bad“ in her pre-test activity, „good“ in the second activity and „average“ in the post-test activity. She was not taught how to write explanations before my interventions. She complained, “they just say explain, but we are not given this, how we can really do it” (see Appendix 6b). She was aware of the language features of explanations and she understood my motive for using flow diagrams, but she felt that she would only write confidently if she knew all the parts that were involved in the process she was to explain.

4.8 Discussion of findings

In this section I will give an overall reflection and discussion of the aspects that occurred in the research cycle with reference to my teaching intervention in order to address the problem of writing explanations as answers to open-ended questions.

My initial assumption about the problem was that the learners could not express themselves in English, their second language. However, during the research process, new assumptions developed. Through the literature study and my teaching intervention, I came to realise that in addition to English language problems, lack of knowledge of different genres in writing and lack of Science curriculum content are also potential contributors to this problem. During my teaching intervention I focused on the last two problems while acknowledging the language problems.

As I explained in Section 4.4, my interventions were broadly based on Gibbons' (2002) approach to teaching different genres of writing by integrating language and curriculum content knowledge in Life Sciences. I chose this approach because it addressed the two significant problems that I wanted to tackle. The curriculum cycle moved from simple to complex lesson content, with the aim of developing the learners' explanation writing skills.

Gibbons' (2002) approach was helpful because it allowed the incorporation of language teaching into subject content which is addressed by stage one and stage two of the curriculum cycle. She suggests that the first stage should gather all the information about the topic to be written. The first two lessons of my intervention aimed to do this. I used two ways to help the learners gather the information about the topic and explore the subject content by making them recall their existing knowledge about the topic, and learn new facts. In stage two of the curriculum cycle, "the aim is for students to become familiar with the purpose, overall structure, and linguistic features of the type of text they are going to write" (Gibbons, 2002, p. 61). Lesson 3, 4 and 5 aimed to give learners examples of the explanatory texts.

This approach also has helped me to gain new insights into the learners' problems in writing explanations in response to examination questions. I have realised, in going through the process of writing with them, that learners find difficulty in structuring sentences; they also have difficulty in spelling some English words. The lack of these skills prevented learners from writing clear, well organised explanations. I was not able to address these issues due to time constraints.

This is where the responsibility of the English teacher begins – helping learners to construct sentences and correcting spelling mistakes. Teaching language across the curriculum entails learners to be taught, on one hand, the technical and specialist vocabulary of subjects, and on the other, the construction of sentences, paragraphs and texts that are often used in any subject (The National Curriculum for England (1999) cited in Osborne & Wellington, 2001, p. 5; Namibia. MOE, 2006). There should be a common understanding of learners’ language development by both the Science teacher and the English teacher. Perhaps these teachers could collaborate to contribute to learners’ ability to communicate in Science. The English teacher could use practical examples from the Science curriculum to teach sentence construction, grammar and spelling and also incorporate other basic domains of language in which writing is included. At the same time the Science teacher could concentrate on the detailed subject content, the specific register and terminology of science. This would have to be done in a way that did not disadvantage other subjects that are not related to Science.

One of the drawbacks of Gibbons’ approach is that it is time-consuming. Due to time constraints, there was not enough practice given. Lack of practice might have prevented the learners from mastering the skill of writing explanations and as a result they might not be able to implement what they have learned in the classroom situation during a confined situation such as the examination. This relates to Gibbons’ (2002, p. 61) advice that the curriculum cycle of teaching explanations might take time and it is not to be done in a single lesson but to be implemented for a lesson unit. There was not enough time to be able to differentiate between sequential and causal explanations, and perhaps it was too ambitious to include both types of explanation. In conclusion, in my experience, it is not entirely realistic to use Gibbons’ approach in the regular teaching of the Life Sciences curriculum to Junior Secondary learners.

Although time was a problem, the incorporation of language teaching in Science proved to be worthwhile. It provided an opportunity for the learners to explore the text structure and type of language feature of explanations, the genre which is often needed as responses to open-ended questions in examinations. This shows the advantages and disadvantages of the Gibbons approach to teaching writing during Science lessons.

There are some things that I did not anticipate to be important in teaching writing in Science. This research has highlighted for me the importance of the use of visual texts, scaffolding and continuous feedback as teaching strategies that could help my learners in learning to write explanations in Science.

Masters (2008) supports the use of visual aids by claiming that “simple images can conjure an entire script”. The inclusion of visual aids such as cross-section diagrams and flow diagrams in my teaching of explanation writing skills was a success. Flow diagrams help the learner to visually process how one point leads to another such as in the causal explanations. During my teaching intervention, my first attempt to use the flow diagrams, I wanted the learners to use the diagrams to re-construct a jumbled-up explanatory text into a coherent explanation. This seemed to have worked, as most learners gave the correct order of the sentences after their first attempt without the flow diagram which was not successful.

Despite my reservations regarding time, one can see the relevance of Gibbons’ approach to the teaching of explanation writing in Science. Perhaps in future trials, learners could be introduced to the four stages in the context of one or two Science topics. Throughout the remainder of the syllabus, learners could practice writing explanations without repeating the modelling and joint construction stages. In this case, visual texts could be used to build the content field so that the learners could write independently. National Literacy Strategy (n.d.), suggested that during language lessons, the learners will study the language features of different genres (discussed above), and use the Science lessons for content purposes only. This arrangement could provide enough time for the Science syllabi to be covered within the planned time-frame, despite the possible disadvantages stated above.

Because my lesson interventions constitute teaching language across the curriculum, it was also accompanied by some of the challenges that Stephen (1998) identified. These include the lack of learning materials such as textbooks and workbooks that contain suitable activities to teach writing. The preparation of these activities took time. I was also uncertain that these activities would help me in reaching my research goal. Some learners seemed not to be motivated in

learning language aspects in Science lessons. This is something that I anticipated as this was their first encounter with learning aspects of language in a Science lesson.

I have always been confident about teaching Life Sciences to Grade 10 learners. I am familiar with the syllabus requirements and I could plan my lessons considering the learning objectives. However, during this intervention I have noted that teaching the skill of writing explanations requires knowledge beyond the basic competencies outlined in the syllabus, the knowledge that I lacked during my intervention. As I reflected in my lesson evaluation, at times learners asked questions that I could not readily answer. This was a challenge to me as a teacher and it motivated me to look further for the solution of the problem. It was not however easy to find the solution because of the limited resources such as different textbooks or access to the internet. Although some solutions were found I did not have time to make them known by the research group, but they will be used in similar lessons.

4.9 Conclusion

In this chapter I have reflected on each lesson of my intervention and made an analysis of the positive and negative points of each lesson. I have presented the pre-test and post-test results to evaluate the effectiveness of my intervention. In the final chapter I discuss key aspect of my findings.

Chapter 5

Conclusion

5.1 Introduction

As the purpose of this research was to improve my practice of teaching learners how to write explanations in Grade 10 Life Sciences, in this chapter I conclude the thesis by reflecting on what I have learned from the research process, including the literature that I have read. I then outline what might be useful for other teachers in the field of Science teaching drawing from my experience in this research. I conclude by discussing the research limitations and I make some suggestions to remedy these limiting factors in the next cycle. Lastly I suggest future avenues for research in the field of language and Science teaching.

As an outcome of this research, I am now aware of the strategies that one can employ in order to teach learners to write meaningful explanations in the Junior Secondary Life Sciences curriculum. Gibbons' curriculum cycle approach is an appropriate strategy because it gives room to integrate language teaching in Science lessons. It does have the disadvantage of being time-consuming. The approach might not be realistic in terms of completing the curriculum within the prescribed academic year.

5.2 Lessons learnt

In the process of doing this research, I have learnt a great deal through reflection on my actions during my interventions and also from the literature underpinning my research topic.

Through reviewing the literature as discussed in Chapter 2, I have come to realise that explanations and information reports are the genres most commonly used in Science writing and that there are two types of explanations which are commonly used in Science for assessment purposes such as in written examinations. These explanations are distinguished by their purposes, structures and language features.

The research carried out elsewhere in the world has revealed to me the significance of integrating language (e.g. writing skills) and curriculum content in Sciences lessons. When teaching subject content in a second language, language issues need to be considered to enhance understanding.

The literature has also informed me of suitable teaching strategies that can be used to integrate the teaching of writing skills with curriculum content. These strategies include the use of graphic organisers such as flow diagrams and their significance in organising the learners' ideas when writing explanations. Paivio's (1971, 1986) cited in Burton and Miller (1994), work on dual coding inspired me to use pictures and models such as cross-sections to teach the human body organs in the Grade 10 Life Sciences syllabus.

In addition to the theories that I gained from the literature, I also had the opportunity to put them into practice. For example, the stages of the curriculum cycle in teaching writing (Gibbons, 2002), is something I learned through the theory and tried to implement practically. Before carrying out my intervention, I was aware that learners are required to write explanations during their examinations; thus in preparation for the examinations and tests, I used to give learners questions that needed explanations even though they were not taught the skill of writing explanations. Their failure to provide satisfactory explanations as responses to these questions led to this research and the recognition of a strategy – the stages of the curriculum cycle – to improve their approach to answering these questions.

I have learnt to design activities that address both English second language needs and the curriculum content (see Appendix 3). Prior to this research I used to focus on the curriculum content and overlook the language issues. In this research, I was forced to design activities to suit each stage of the curriculum cycle in order to address the language problem of my learners.

I have also learnt that this approach takes time for one to reach one's objectives. Therefore proper planning for either individual Science teachers or in collaboration with language teachers is needed.

5.3 Lessons for other teachers

Although the goal of this research project was to improve my own practice of teaching explanation writing skills, there are some points that might be useful to other teachers teaching Science subjects through the medium of English as a second language. I consider Gibbons' (2002) four stages of the curriculum cycle to be useful to any teacher teaching in the field of Science where the genre of explanations, instructions, and information reports play a major role. In addition to this, teachers may use their expertise to incorporate graphic organisers and images in the texts to enhance understanding of the subject they teach.

5.4 Limitations

Limitations are factors which might affect the validity of the research. During the research process, I experienced a number of limitations that would affect the validity of my research.

Being a half thesis research project, there was insufficient time to continue with the second cycle of my action research; thus it is difficult at this stage to draw conclusions from the results of my interventions.

Another limiting factor was the role of my non-participant observer, who had other demands on her time and at times, sometimes did not turn up for lesson observation. During her observations, she did not always focus on issues I had asked her to concentrate on, but focused on classroom management. Her inputs on the research focus could have broadened my reflections on the lessons and hence provided a spectrum for improvement. Most of the lessons were not discussed with my non-participant observer. This has limited me in critically reflecting on my interventions and poses a threat to the validity of the research.

Another limitation was the lack of consent from the learners' parents. The school management felt they had the authority to give me consent on behalf of the parent as I am a teacher at the school and the research was done in my designated subject. On reflection, however, I have come

to the conclusion that in future I would proceed to get the parents' consent despite the advice I received from the school authorities.

5.5 Further research

As my focus in this project was to improve the learners' explanation writing skills through action research, there were some aspects regarding the teaching of writing skills that I did not address in my study. I realised that there was a need to teach my learners how to write explanations as responses to some questions in Life Sciences. But my experience in this project has raised questions for possible further research. For instance:

- There seems to be a problem in teaching writing genres in the Namibian education curriculum; it would be a matter of interest to find out what these problems are, their causes and how they could be eliminated.
- What strategies do other teachers use to teach their learners to express themselves better when writing different genres in Science in Namibian secondary education?
- How does the English second language curriculum in Namibia address the language needs of other subject areas?
- Is the writing of different genres being addressed in the Senior Primary Phase (Grade 5 to 7)?

5.6 Conclusion

In this chapter I outlined the lessons that I have learned from my interventions to teach explanation writing skills. These lessons have had a marked influence on my practice as a Science teacher. I concluded by suggesting what aspects of my research might be useful to other teachers and outlining some areas for further research.

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Appendices

Appendix 1 -Permission letters and responses

Appendix 1a-Permission letter to Permanent Secretary in the Ministry of Education

Date: 28 March 2003

To: The Permanent Secretary
Ministry of Education

Dear Sir

Re: Request for permission to do research.

I am a registered student at Rhodes University-South Africa and a Head of Mathematics and Science Department (Name of school)

I am currently doing the Masters Degree of Education (General Education Theories and Practice) with the stated University on a part-time basis. I am intending to carry out a research in the field of Science Education focusing on the practice of writing scientific explanations. The research will help me in the approach of teaching to write scientific explanations.

I therefore hereby request your permission to allow me to carry out an action research at (Name of School). I intend to interview 2 teachers and some learners in Grade 10 at the stated school. I will carry the action on a Grade 10 class consisting of 35 learners by teaching a series of lessons on the subject of the research in Life Science. The research ethics will be followed and adhered to as the names of the learners and the school will not be revealed in the final report.

Thank you for your consideration.

Yours faithfully,

Helena M. N. Josua

Appendix 1b -Permission letter to Principal

Date: 7 April 2003

To: The Principal
(Name of school)

Dear Mr. (Name of the principal)

Re: Request for permission to do research.

I, **Helena M.N. Josua** (Student Number: 607J 3505) is a registered student at Rhodes University-South Africa. I am currently doing the Masters Degree of Education (General Education Theories and Practice) with the stated University on a part-time basis. I am intending to carry out a research in the field of Science Education focusing on the practice of writing scientific explanations. The research will help me in the approach of teaching to write scientific explanations.

I therefore hereby request your permission to allow me to carry out an action research at (Name of school). I intend to interview 2 teachers and some learners in Grade 10 at this school. I will carry the action on a Grade 10 class consisting of 36 learners by teaching a series of lessons on the subject of the research in Life Science. The research ethics will be followed and adhered to as the names of the learners and the school will not be revealed in the final report.

Thank you for your consideration.

Yours Sincerely,

Helena M. N. Josua

Appendix 1c-Response from the Permanent Secretary in the Ministry of Education

9 April 2008

Dear Madam

SUBJECT: PERMISSION TO DO EDUCATIONAL REASERCH

Your letter requesting permission to do research as part of the post-graduate studies fro a Masters of Education Degree, through the Rhodes University, Grahamstown, South Africa, has reference.

Kindly be informed that the Ministry of Education recognizes your effort and the possible contribution your research initiative can make towards successful curriculum implementation fro education in a broader sense.

This letter grants you permission to do the required work in terms of consultations, interviews and other related interactions at both school and regional office levels.

Kindly note that the Ministry of Education would expect from you to deposit copies of your published work in the respective liberalities and resource centres. Also ensure that your research activities do not interfere with normal school programmes.

Best wishes for success in your academic endeavour.

Yours faithfully

.....
PERMANENT SECRETARY

Appendix 1d -Response from the school Principal

14 April 2008

To: Ms Josua HMN

Re: Permission to do research at school

Your request to conduct an action research at (Name of school) has been positively considered. However be advised that your official duties at this school remains the number one priority. Any contradiction could lead to the immediate termination of the agreement.

The school wishes you all the best.

Yours sincerely

.....
PRINCIPAL

Appendix 2 -Theme lesson plans

Appendix 2a -Lesson 1

<u>Subject:</u> Life Science <u>Topic:</u> Blood Circulation- The heart	<u>Grade:</u> 10 <u>Date:</u> 21 May 2008 <u>Duration:</u> 40 minutes
<u>Lesson Objectives:</u> At the end of the lesson the learners will be able to: <ul style="list-style-type: none"> • Identify and name the structure of the circulatory system • Identify and name the structures of the heart and outline its functions 	
<u>Teaching Aids:</u> <ul style="list-style-type: none"> • Handouts with the internal and external structure of the heart. • Worksheets (Functions of the parts of the heart) 	
<u>Lesson Proceedings:</u>	<u>Time (min)</u>
1. Learners will recall and list the organs involved in the circulatory system. They will be noted on the chalkboard. They also recall the main function of the circulatory system. The teacher will explain the importance of studying these parts that it is to learn how the circulatory system works.	7
2. Learners are given the handouts to label the internal and external structure of the heart individually. They report their answers back to the class. The teacher will help the learners to outline the most important parts such as the septum, the valves, and veins and arteries.	10
3. In pairs the learners will complete the worksheets. They study the functions with the parts. They use the cross sections diagrams. Feedback will be given by some pairs. Discussion of the functions.	10
4. Class discusses the structure of the ventricles: Why is the wall of the right ventricles thicker than the left ventricle?	10
<u>Homework:</u> Read the handout about the blood vessel, compare the structure of the veins arteries and capillaries and map out the visible differences.	3

Appendix 2b -Lesson 2

<u>Subject</u> : Life Science <u>Topic</u> : Blood Circulation- The heart	<u>Grade</u> : 10 <u>Date</u> : 22 May 2008 <u>Duration</u> : 40 minutes
<u>Lesson Objectives</u> : At the end of the lesson the learners will be able to: <ul style="list-style-type: none"> Outline the functions of the arteries veins capillaries and component of blood. 	
<u>Teaching Aids</u> : <ul style="list-style-type: none"> Handouts reading articles (Veins, arteries, capillaries and blood components) 	
<u>Lesson Proceedings</u> :	<u>Time (min)</u>
1. Reminder: How does the circulatory system work? Learners give the feedback on the home work. Why is the left ventricle thicker than the right ventricle?	5
2. Learners will recall the three types of blood vessels in the human body. They receive the handout from the teacher for the next activity	5
3. In pairs, learners will read the article in the handout and answer the comprehension questions, listed on the chalkboard.	15
4. Each pair will give their responses. Teacher facilitates and consolidates the feedback given by the learners in response to the questions.	13
<u>Homework</u> : Write a short paragraph to explain how the circulatory system works.	3

Appendix 2c -Lesson 3

<u>Subject</u> : Life Science <u>Topic</u> : Blood Circulation- The heart	<u>Grade</u> : 10 <u>Date</u> : 27 May 2008 Duration : 40 minutes
<u>Lesson Objectives</u> : At the end of the lesson the learners will be able to: <ul style="list-style-type: none"> • Identify the features(language and structure) of an explanation text • Write a short explanation of how the circulatory system works 	
<u>Teaching Aids</u> : <ul style="list-style-type: none"> • Handouts: Explanation text (How the circulatory system works) • Worksheets (Explain steps of the flow diagram) 	
<u>Lesson Proceedings</u> :	Time (min)
1. The teacher will find out what the learners know in the parts of the heart. The teacher will ask the leading questions: Which vessel carries deoxygenated blood to the lungs? Which vessels carry oxygenated and deoxygenated blood to all parts of the body? What are the functions of the valves	7
2. (Pre reading activity) The teacher distributes copies of the worksheet. In groups of three, learners look at the diagrams in the worksheet and describe in their own words what is in each diagram. They discuss with their partners and give the feedback to the whole class.	15
3. Learners will receive the handout with an explanation text. The teacher will explain to the learners that the aim is to write an explanation of how the circulatory system works. With reference to the text, the teacher outline what the purpose of the text is, what the text structure is and the language features of the explanation text.	10
4. The teacher will explain to the learners that this type of an explanation is not suitable to be a response to an examination question, because it is a lengthy one.	5
<u>Homework</u> : Summarise the explanation (given in handouts) to make short.	3

Appendix 2d -Lesson 4

<u>Subject:</u> Life Science <u>Topic:</u> Blood Circulation - The heart	<u>Grade:</u> 10 <u>Date:</u> 28 May 2008 <u>Duration :</u> 40 minutes
<u>Lesson Objectives:</u> At the end of the lesson the learners will be able to: <ul style="list-style-type: none"> • Identify the features (language and structure) of an explanation text • Differentiate between the short explanation (examination question) and long ones (text) 	
<u>Teaching Aids:</u> <ul style="list-style-type: none"> • Handouts: Explanation text (How the circulatory system works) • Poster: How the circulatory system work 	
<u>Lesson Proceedings:</u>	<u>Time (min)</u>
1. Connects yesterday's lesson to today's lesson by asking questions in order to remind learners of what they did. Ask one learner to read the text in the handout (aloud). Ask learners to rate the explanation in the handout (by awarding marks).	7
2. Exercise the examination questions, How does oxygenated blood reach the body cells from the lungs? (see appendix 3e)Learners (in pairs) will study an explanation which can be a possible examination response to an open-ended question. The teacher will mark and scaffolds were necessary.	10
3. The learners will do activity 2 individually. They will rewrite the sentences that are jumbled-up, in a correct order. The teacher will help individual learners were necessary.	15
4. The learners will give their feedback by reading out their answers to the rest of the class.	10
<u>Homework:</u> Read to get information about the heart attack and how it occurs. Page 100, Discovering Life Science - Chikarango.	3

Appendix 2e - Lesson 5

<u>Subject</u> : Life Science <u>Topic</u> : Blood Circulation - The heart	<u>Grade</u> : 10 <u>Date</u> : 29 May 2008 Duration : 40 minutes
<u>Lesson Objectives</u> : At the end of the lesson the learners will be able to: <ul style="list-style-type: none"> To use flow diagrams to write their own explanation with the teachers help. Explain the effects of cholesterol in the human body 	
<u>Teaching Aids</u> : <ul style="list-style-type: none"> Poster and handout: Flowchart- Coronary heart attack 	
<u>Lesson Proceedings</u> :	Time (min)
1. The teacher will give feedback on how the learners have preformed in their previous day's exercise. The teacher will define the word that proved to be difficult to some learners: <i>arteriosclerosis, thrombosis and cholesterol.</i>	6
2. The learners will now correct their answers and let one learner read the answer.	7
3. The teacher will write the question on the chalkboard the learners are going to answer: With the help of the flow diagram, explain the role of the coronary artery during a heart attack. (Pre-writing activity) learners will answer these questions for brain storming. <ul style="list-style-type: none"> What is the function of the coronary artery? What causes the heart attack? The teacher will explain the flow diagram.	10
4. The teacher will give a hint to the learners on how to start with the explanation. The learners will start to write their explanations.	15
<u>Homework</u> : Finish off to write your explanation and to bring it to the class tomorrow.	2

Appendix 2f -Lesson 6

<u>Subject:</u> Life Science <u>Topic:</u> Blood Circulation- The heart	<u>Grade:</u> 10 <u>Date:</u> 2 June 2008 <u>Duration :</u> 40 minutes
<u>Lesson Objectives:</u> At the end of the lesson the learners will be able to: <ul style="list-style-type: none"> To use flow diagrams to write their own explanation with the teachers help. 	
<u>Teaching Aids:</u> <ul style="list-style-type: none"> Poster and handout: Flowchart- Coronary heart attack 	
<u>Lesson Proceedings:</u>	<u>Time (min)</u>
1. The Poster of the flow diagram used in the previous lesson will be displayed again for the learners to recall the information related to the functional disorder of the heart. One or two learners will explain the flow diagram verbally.	10
2. The teacher will write the question on the chalkboard: With the help of the flow diagram, explain the role of coronary artery during a heart attack. The teacher will ask learners“ view about the type of explanation they need to provide. Is it the cause-effect type?	5
3. The teacher will provide a clue to the learners that it is the cause and effect and explain why it is so by comparing the questions used in previous lessons. The teacher will give a hint to the learners: <ul style="list-style-type: none"> - Write 2-3 sentences if possible - Start yours sentences with these words to frame your explanation: First..... As a result..... 	10
4. The learners will then be given a chance to write.	15
<u>Homework:</u>	

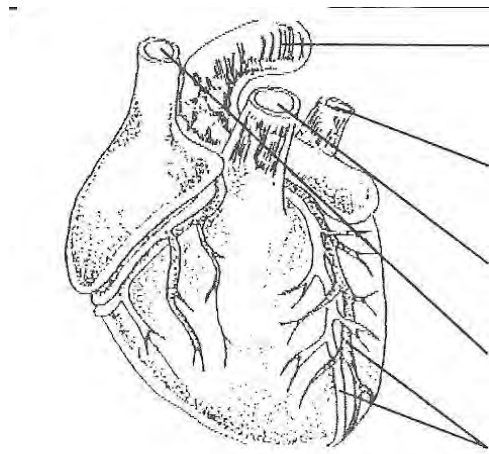
Appendix 2g -Lesson 7

<u>Subject:</u> Life Science <u>Topic:</u> Excretory System	<u>Grade:</u> 10 <u>Date:</u> 5 June 2008 <u>Duration :</u> 40 minutes
<u>Lesson Objective:</u> At the end of the lesson the learners will be able to: <ul style="list-style-type: none"> • Explain the function of the urinary system in excretion • Write an explanation without the teachers' help 	
<u>Teaching Aids:</u> <ul style="list-style-type: none"> • Poster: Internal structure of the kidney, How the kidneys clean the blood (flow diagram) • Handout: Flow diagram and internal structure of the kidney • Handout with notes on the excretory system 	
<u>Lesson Proceedings:</u>	<u>Time (min)</u>
1. The teacher will define excretion. She will ask the following questions: What are the wastes that are removed during excretion? What are the organs that are involved in the excretory system?	10
2. From their text books the learners will study the structure of the excretory system (urinary system) and state its function. The learners will state the function of the kidneys (prepared notes).	10
3. By referring the learners to the internal structure of the kidney, the teacher will orally explain how blood is filtered in the kidneys.	5
4. In pairs, the learners will study the flow diagrams and discuss it orally to prepare for the writing activity. They report to the whole class and have a class discussion.	10
<u>Homework:</u> Use the flow diagram and the internal structure of the kidney to explain how urea is removed from blood. <ul style="list-style-type: none"> • In your explanation use the following key features if necessary: (first, secondly, when, after, then, during, because, while, finally) • Make your explanation short and clear. 	

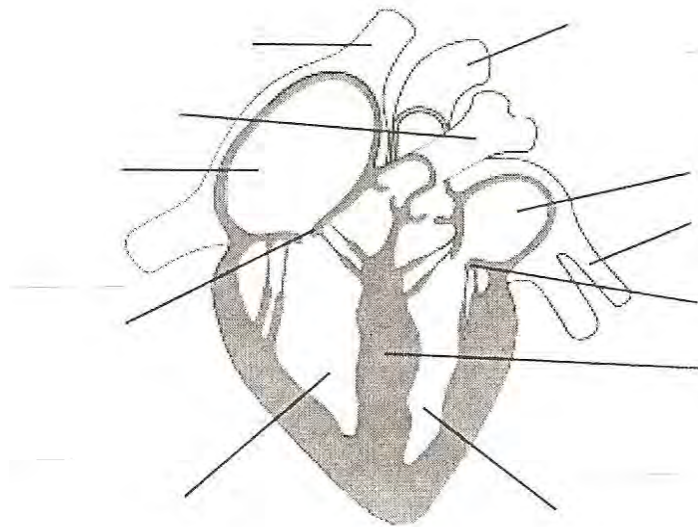
Appendix 3 - Activities

Appendix 3a – Internal and external parts of the heart

The external structure of the heart



The internal structure of the heart



Appendix 3b -The functions for the parts of the heart

Match the parts with their functions (Pair work)

Aorta	Carry blood from the heart to the lungs.
Vena Cava	They prevent the back flow of the blood.
Pulmonary artery	Carry blood from the heart to all parts of the body.
Pulmonary Vein	It has thick muscle walls to pump blood to all parts of the body.
Coronary artery	They have thin walls and they pump blood into the ventricles
Left and Right atrium	Supplies the heart muscles with oxygen and nutrient rich blood.
Left ventricle	Carry blood from all parts of the body to the heart.
Right Ventricle	Carry blood from the lungs to the heart.
Valves	It has thinner walls then the left ventricle to send blood to the lungs.

Appendix 3c - Comprehension questions (Lesson 2)

1. Compare the structure of the vein and artery
 - Lumen
 - Muscle walls

2. What are the functions of the
 - (a) Arteries
 - (b) Veins
 - (c) Capillaries

3. Why do arteries have thick walls?

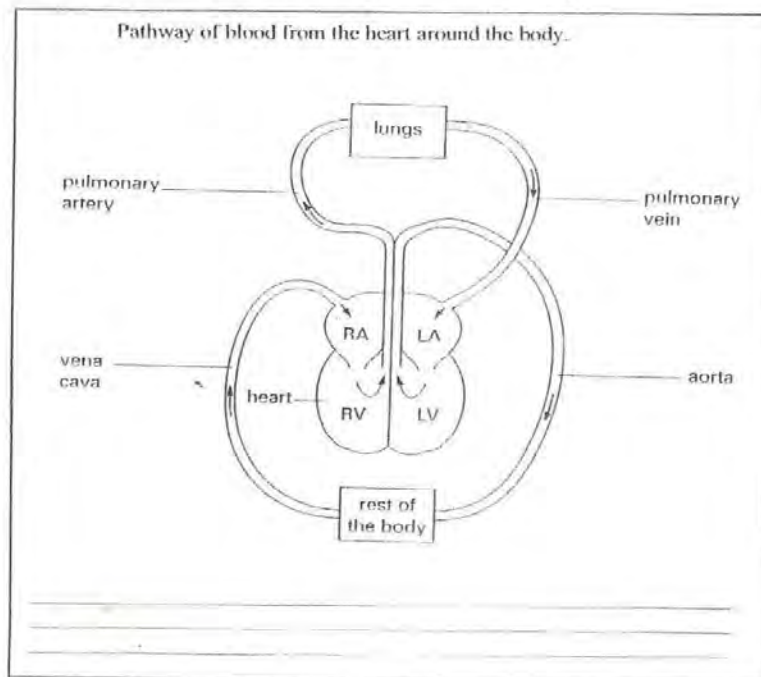
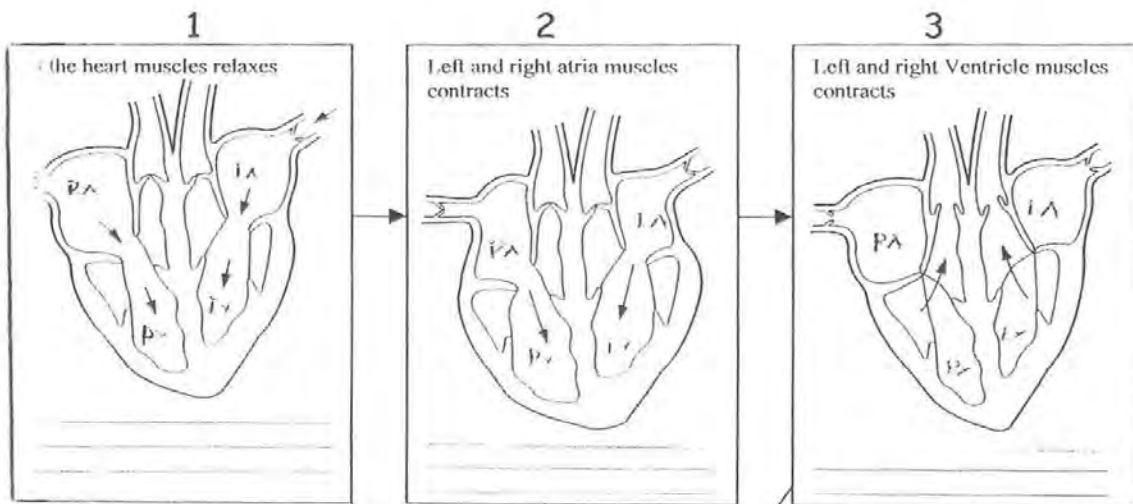
4. Name the component four components of blood?

5. State the function of each component of blood

Appendix 3d - Pre-writing activity

The circulatory system: An Explanation

1. These diagrams show how the circulatory system works.
2. Look at the diagrams and describe in short what is happening in each.
3. You may write down Key words to help you describe the diagram.



Appendix 3e - Exam type Question (Short Explanation)

How does oxygenated blood reach the body cells from the lungs? (3)

Fill in the words on the right to complete an explanation

<p>How does oxygenated blood reach the body cells from the lungs?</p>	<p>Heading</p>
<p>_____, during the _____ of the right ventricle, deoxygenated blood flows into the lungs from the heart through the _____. _____ in _____ it _____ away the carbon dioxide and _____ up the oxygen. From the lungs, the oxygenated blood goes in the _____, which carries blood from to the left atrium, then to the left ventricles. _____, the left ventricles sends oxygen rich blood to all parts of the body to different body cells.</p>	<p>Explanation Language features</p> <ul style="list-style-type: none"> - first - while - finally - gives - picks - the lungs - pulmonary veins - pulmonary artery - contraction

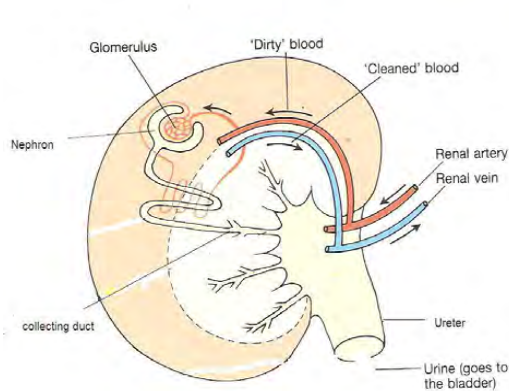
Appendix 3g – Writing activity (flow diagram)

Explain how urea is removed from the blood?

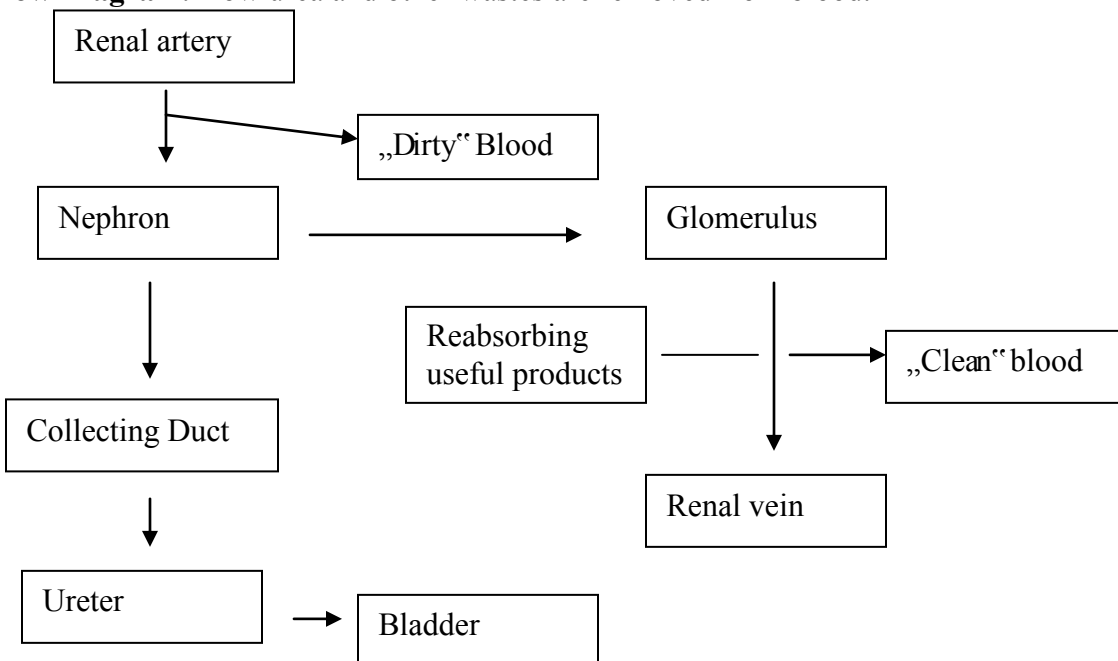
Use the structure of the internal **structure of the kidney** below and the **Flow diagram** to write a short and clear explanation.

You may use the following key words if necessary: (First, Secondly, when, after, then, during, because, while, finally etc)

The internal structure of the kidney



Flow Diagram: How urea and other wastes are removed from blood.



Appendix 3h -Samples of the learners' work activity 2, Lesson 4

First attempt

<p><u>Re-write the explanation in a correct order.</u></p> <p>First fat layer is deposited on the walls of the arteries. This is called a heart attack. As a result, the heart will stop pumping blood due a lack of energy. This will prevent the supply of enough oxygen and glucose to the heart muscles. Secondly, the cholesterol in blood may lead to clumping of blood platelets in the coronary artery resulting in thrombosis. This reduces the diameter of the artery resulting in arteriosclerosis. Both arteries arteriosclerosis and thrombosis may block the flow of blood in the coronary artery.</p>	<p><u>Re-write the explanation in a correct order.</u></p> <p>First fat layer is deposited on the wall of the arteries. Secondly, the cholesterol in blood may lead to clumping of blood. Both arteriosclerosis and thrombosis may block the flow of blood in the coronary artery. This reduces the diameter of the artery resulting in thrombosis arteriosclerosis. *Platelets in the coronary artery resulting in thrombosis. This will prevent the supply of enough oxygen and glucose to the heart muscle. This is called heart attack.</p>
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Second attempt

<p>First fat layer deposited on the walls of the arteries. Platelets in the coronary artery resulting in thrombosis. This reduces the diameter of the artery result in arteriosclerosis. Both arteriosclerosis and thrombosis may block the flow of blood in the coronary artery. This will prevent the supply of enough oxygen and glucose to the heart muscles. As a result the heart will stop pumping blood due a lack of energy. This is called the heart attack.</p>	<p>Firstly fat layer is deposited on the wall of the arteries. This reduces the diameter of the arteries resulting in arteriosclerosis. Secondly cholesterol in blood may lead to clumping of blood. Platelets in the coronary artery resulting in thrombosis. Both arteriosclerosis and thrombosis may block the flow of blood in the coronary artery. As a result the heart will stop pumping the blood due to lack of energy. This will prevent the supply of enough oxygen and glucose to the heart muscles. This is called heart attack.</p>
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Appendix 3i - Samples of the learners' explanations

<p>First, the walls of coronary arteries becomes small due to fat layer deposits in them, and then cause the blood to clot. As a result, the heart will stop pumping blood and the heart muscles will no more get oxygen and glucose, causing then Heart attack.</p> <p style="text-align: right;">3/3</p>
<p>First the coronary artery receive a fat layer and it reduces the diameter of the artery. The coronary artery will stop providing oxygen rich blood to the heart muscle. As a result the heart will stop pumping blood and lead to Heart attack.</p>
<p>Explain the role of Coronary artery during a heart attack?</p> <ul style="list-style-type: none"> - First the blood pushed into Coronary artery - First, when the Coronary artery <u>muscle</u> get blocked by fatty layer or blood clot then food and oxygen does not reach the heart muscle. as a result the heart will stop beating and the person now suffer from heart attack.
<p>Explain the role of coronary artery during a heart attack?</p> <p>First coronary artery supply heart muscles with glucose and oxygen. As a result it muscle become to fatty the heart can not allow the glucose and oxygen pass in and out and this is called heart attack.</p>
<p>Explain the role of coronary artery during a heart attack?</p> <ul style="list-style-type: none"> * First the coronary muscles become blocked by fatty deposits or a blood clot. then - then food and oxygen can not reach the heart muscles and then - as the result the heart may stop breathing
<p>First cholesterol is deposited on the walls of the ^{coronary} artery. this reduces its diameter and less oxygen and glucose passes through to the heart muscles. As a result the heart will not pump blood due to the lack of energy in the heart muscles, a heart attack then happens.</p>

Appendix 3j - Samples of the learners' explanations

first, the dirty blood from the body enters the kidneys by renal artery, ~~the it moves th~~ from the renal artery it moves through the blood capillaries which transport it to the glomerulus ~~white~~ while it is in the ~~grome~~ glomerulus it is filtered and waste substances ~~a~~ moves to the nephron ~~where~~ ~~the~~ and the clean blood moves continuously ~~th~~ through the glomerulus. The waste substances that are in the nephron are filtered and then ~~reabs~~ ^{some are} reabsorbed by the glomerulus, then they go to the renal vein which takes them out of the kidney. Urine from the ~~nephron~~ ^{carries} nephron are collected by the collecting duct which ~~passes~~ ^{carries} them to the ureter then to the ~~blab~~ bladder. finally, ~~the~~ urines ~~will~~ enter the urethra which take them out of the body.

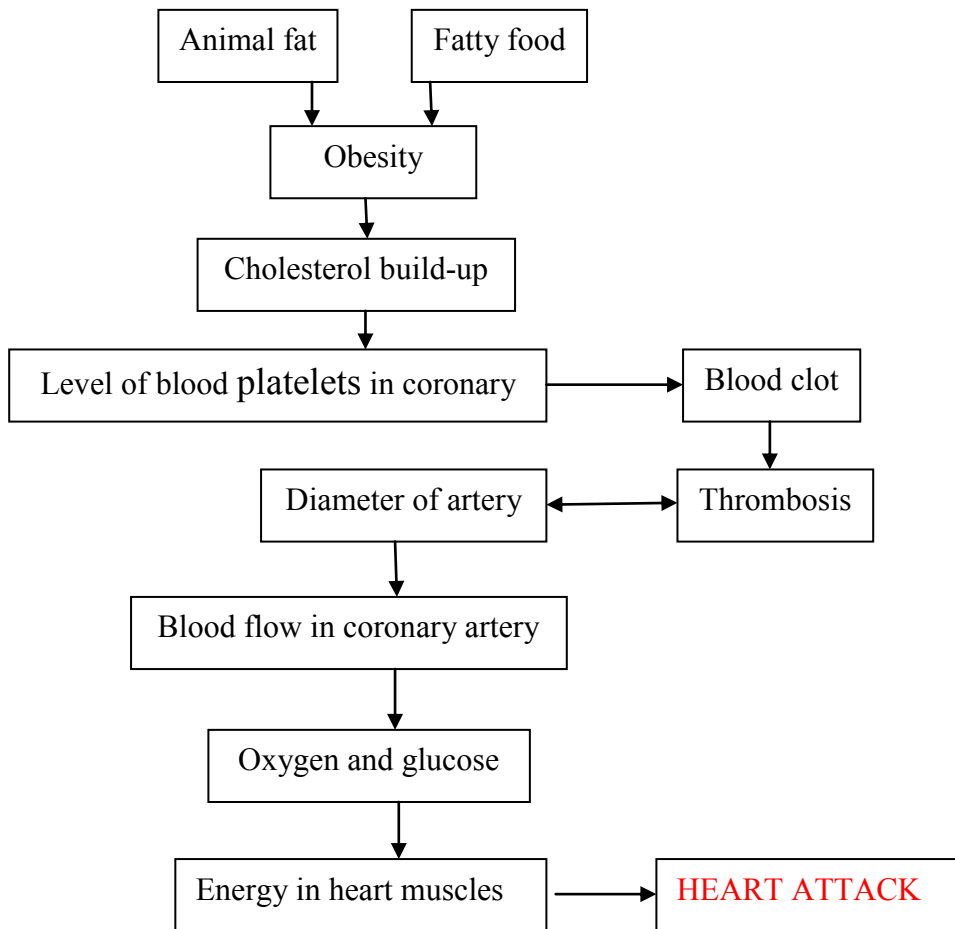
How is urea removed from the blood ^{Beth}

Firstly, the renal artery ~~will~~ carries dirty blood into the capillaries, where by it will be transferred into the nephron. In the nephron the dirty blood will be cleaned and also the excrete materials like, ~~urea~~ urea and salts will be separated from the blood. After that the clean blood it will go into the glomerulus, where it ~~it~~ will go back to the capillaries and then to the ~~to~~ renal vein and then it will be transferred to the body cells and where it is needed. While the excrete materials like urea it will be collected by the collecting duct to the ureter and finally the urea will be stored in the bladder.

how urea is removed from the blood?

Firstly the kidney produce urine consist mainly of urea water and mineral salt. the collecting duct ^{d?} send the urea into the ureter where the urea will be in urine form then ureter will send it to the bladder and the urine stored in the bladder until it can be time and excreted through the urethra. when the muscle ^{is} blood release, urine leaves the body through the urethra ^{the ureters} ^{released} ^{the} finally urethra lets urine out of the body

Appendix 3k - Flow diagram (heart attack)



Appendix 4 – Reading Articles

Appendix 4a – Blood components

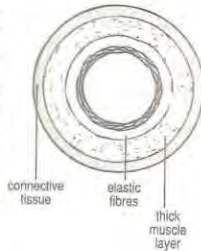
Structure of Arteries:

The pressure of the blood in the arteries is high.

1 Arteries have thick walls with three layers of tissue.
2 The middle layer has muscle and elastic fibres to allow the artery to expand under pressure.

3 The lumen (the space through the middle) of the artery is small.

4 Arteries divide into smaller branches called arterioles. Inside the body tissues the arterioles form a network of tiny channels called capillaries.



Functions of Arteries

Arteries carry blood away from the heart. They carry deoxygenated blood to the lungs and oxygenated blood to all the body tissues.



Structure of Veins

The pressure of blood in the veins is lower than the pressure in the arteries.

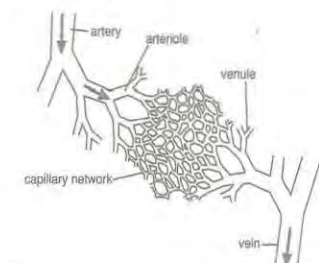
1 Veins have thin walls with three layers of tissue.
2 Veins have valves to prevent the backward flow of blood.
3 The lumen of a vein is larger than that in an artery.

Very small veins called venules collect blood from the capillaries. The venules join together to form veins.

Functions of veins

Veins carry blood towards the heart. The pulmonary vein carries oxygenated blood from the lungs to the left atrium. The vena cava carries deoxygenated blood from all the tissues to the right atrium.

Structure of Capillaries



The capillaries are a network of tiny blood vessels in every tissue. The capillary walls are one cell thick.

Functions of capillaries

Capillaries allow blood to pass close to every body cell. Nutrients and oxygen diffuse through the walls of the capillary and into the cells. At the same time carbon dioxide and other waste diffuses from the cells into the capillaries.

Blood plasma passes through the capillary walls to surround the tissue cells with fluid.

White blood cells are able to squeeze out through the capillary wall to attack germs in the tissues.

Structure and functions of blood components

An adult contains about 5 litres of blood. It consists of plasma and blood cells.

1 **Plasma** is the liquid part of the blood. It is 92% water. The remaining 8% consists of dissolved materials such as:

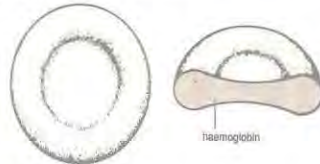
- ions of minerals e.g. sodium, calcium, chloride
- nutrients e.g. glucose, amino acids, vitamins
- waste e.g. carbon dioxide, urea
- blood proteins e.g. fibrinogen, antibodies
- hormones e.g. insulin, adrenaline

Functions of plasma

The blood plasma:

- a) transports all the blood cells.
- b) transports nutrients to cells that need them.
- c) transports dissolved waste to the kidneys and lungs.
- d) dissolves mineral ions to control blood pH
- e) helps in clotting when fibrinogen changes to fibrin.
- f) disperses heat around the body from the liver.
- g) delivers hormones from where they are produced to where they become active.

2 **Red blood cells** are very small biconcave discs. They have no nuclei. They contain haemoglobin, a protein that contains iron. The iron gives the red colour to the blood.



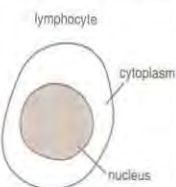
Functions of red cells

The red cells transport oxygen and, to a lesser extent, carbon dioxide as described in the section on respiration.

3 **White blood cells** are larger than red cells but they are far fewer in number. They have nuclei but do not have haemoglobin. There are several different types of white cell. Two examples are shown below.

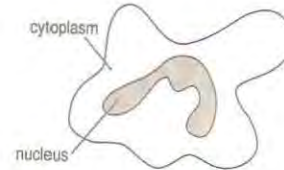
Functions of white blood cells

a) **Lymphocytes** produce antibodies which destroy germs and the toxins produced by germs. This is part of the body's immune system which protects the body against disease. Special lymphocytes called T-cells



are destroyed by the human immunodeficiency virus (HIV) which causes AIDS. This prevents the body from fighting other diseases such as TB, cancer, pneumonia.

phagocyte



b) **Phagocytes** engulf and digest bacteria. They are able to squeeze out of the capillaries to follow bacteria between the body cells.

4 **Platelets** are tiny cell fragments.



Function of platelets:

Blood platelets help to heal wounds. The platelets convert the soluble protein fibrinogen to insoluble fibrin. This makes a network of fibres across the wound forming a clot which stops the bleeding.

Appendix 4b -Incontinence

Incontinence

Incontinence is the inability to control the passage of urine. This can range from an occasional leakage of urine, to a complete inability to hold any urine.

The three main types of urinary incontinence are:

- Stress incontinence -- occurs during certain activities like coughing, sneezing, laughing, or exercise.
- Urge incontinence -- involves a strong, sudden need to urinate followed by instant bladder contraction and involuntary loss of urine. You don't have enough time between when you recognize the need to urinate and when you actually do urinate.
- Mixed incontinence -- contains components of both stress and urge incontinence.

Bowel incontinence, a separate topic, is the inability to control the passage of stool.

Alternative Names

Loss of bladder control; Uncontrollable urination; Urination - uncontrollable; Incontinence - urinary

Considerations

Incontinence is most common among the elderly. Women are more likely than men to have urinary incontinence.

Infants and children are not considered incontinent, but merely untrained, up to the time of toilet training. Occasional accidents are not unusual in children up to age 6 years. Young (and sometimes teenage) girls may have slight leakage of urine when laughing.

Night time urination in children is normal until the age of 5 or 6.

NORMAL URINATION

The ability to hold urine is dependent on having normal anatomy and a normally functioning urinary tract and nervous system. You must also possess the physical and psychological ability to recognize and appropriately respond to the urge to urinate.

The process of urination involves two phases:

1. The filling and storage phase

2. The emptying phase

Normally, during the filling and storage phase, the bladder begins to fill with urine from the kidneys. The bladder stretches to accommodate the increasing amounts of urine.

The first sensation of the urge to urinate occurs when approximately 200 ml (just under 1 cup) of urine is stored. A healthy nervous system will respond to this stretching sensation by alerting you to the urge to urinate, while also allowing the bladder to continue to fill.

The average person can hold approximately 350 to 550 ml (over 2 cups) of urine. The ability to fill and store urine properly requires a functional sphincter (the circular muscles around the opening of the bladder) and a stable, expandable bladder wall muscle (detrusor).

The emptying phase requires the ability of the detrusor muscle to appropriately contract to force urine out of the bladder. At the same time, your body must be able to relax the sphincter to allow the urine to pass out of the body.

Common Causes

Incontinence may be sudden and temporary, or ongoing and long-term. Causes of sudden or temporary incontinence include:

- Bedrest -- for example, when recovering from surgery
- Certain medications (such as diuretics, antidepressants, tranquilizers, some cough and cold remedies, and antihistamines for allergies)
- Increased urine amounts, like with poorly controlled diabetes
- Mental confusion
- Pregnancy
- Prostate infection or inflammation
- Stool impaction from severe constipation, causing pressure on the bladder
- Urinary tract infection or inflammation
- Weight gain

Causes that may be more long-term:

- Alzheimer's disease
- Bladder cancer
- Bladder spasms
- Depression
- Large prostate in men
- Neurological conditions such as multiple sclerosis or stroke
- Nerve or muscle damage after pelvic radiation
- Pelvic prolapse in women -- falling or sliding of the bladder, urethra, or rectum into the vaginal space, often related to having had multiple pregnancies and deliveries
- Problems with the structure of the urinary tract

- Spinal injuries
- Weakness of the sphincter, the circular muscles of the bladder responsible for opening and closing it; this can happen following prostate surgery in men, or vaginal surgery in women

Home Care

See your doctor for an initial evaluation and to come up with a treatment plan. Treatment options vary, depending on the cause and type of incontinence you have. Fortunately, there are many things you can do to help manage incontinence.

The following methods are used to strengthen the muscles of your pelvic floor:

- **Bladder retraining** -- this involves urinating on a schedule, whether you feel a need to go or not. In between those times, you try to wait to the next scheduled time. At first, you may need to schedule 1 hour intervals. Gradually, you can increase by 1/2 hour intervals until you are only urinating every 3 - 4 hours without leakage.
- **Kegel exercises** -- contract the pelvic floor muscles for 10 seconds, then relax them for 10 seconds. Repeat 10 times. Do these exercises three times per day. You can do Kegel exercises any time, any place.

To find the pelvic muscles when you first start Kegel exercises, stop your urine flow midstream. The muscles needed to do this are your pelvic floor muscles. **DO NOT** contract your abdominal, thigh, or buttocks muscles. And **DO NOT** overdo the exercises. This may tire the muscles out and actually worsen incontinence.

Two methods called biofeedback and electrical stimulation can help you learn how to perform Kegel exercises. Biofeedback uses electrodes placed on the pelvic floor muscles, giving you feedback about when they are contracted and when they are not. Electrical stimulation uses low-voltage electric current to stimulate the pelvic floor muscles. It can be done at home or at a clinic for 20 minutes every 1 - 4 days.

Biofeedback and electrical stimulation will no longer be necessary once you have identified the pelvic floor muscles and mastered the exercises on your own.

Vaginal cones enhance the performance of Kegel exercises for women. Other devices for incontinence are also available.

For leakage, wear absorbent pads or undergarments. There are many well-designed products that go completely unnoticed by anyone but you.

Other measures include:

- Regulate your bowels to avoid constipation. Try increasing fiber in your diet.

- Quit smoking to reduce coughing and bladder irritation. Smoking also increases your risk of bladder cancer.
- Avoid alcohol and caffeinated beverages, particularly coffee, which can overstimulate your bladder.
- Lose weight if you need to.
- Avoid foods and drinks that may irritate your bladder, like spicy foods, carbonated beverages, and citrus fruits and juices.
- Keep blood sugar under good control if you have diabetes.

Your doctor may recommend medication or surgery, especially if home care measures are not helping or if your symptoms are getting worse.

Medications that may be prescribed include drugs that relax the bladder, increase bladder muscle tone, or strengthen the sphincter.

Surgery may be required to relieve an obstruction or deformity of the bladder neck and urethra. Uterine or pelvic suspension operations are sometimes needed in women. Men may require prostatectomy (removal of the prostate gland). Incontinence can sometimes be managed by artificial sphincters. These are synthetic cuffs that are surgically placed around the urethra to help retain urine.

If you have overflow incontinence or cannot empty your bladder completely, a catheter may be recommended. But using a catheter exposes you to potential infection.

PREVENTION

Performing Kegel exercises while you are pregnant and soon after delivery may help prevent incontinence related to childbirth.

Appendix 5 - Journal entries

Appendix 5a -My Journal

Date	Entry
20 May 2008	<p>Discuss with non-participant observer what to observe. Give her some handouts for her to read what I expect from her. She agreed to take field notes instead of filling observation form. Arrange with the photographer-give time table.</p> <p>I gave the questions to the learners as discussed that they will be involved in the research. Questions based on the respiratory system. Serve as pre- test. Questions:</p> <ul style="list-style-type: none"> • Explain how different levels of activity influence the breathing rate. • Explain the effects of air pollution on the respiratory system. <p>Read through answers, realised problems with spelling, lack of understanding the questions.</p>
21 May 2008	<p>Lesson 1 The lesson was introduced with prior knowledge of what the learners have learned in the previous lessons of the systems of the human body.</p> <p>Told learners the target of the lesson: How the circulatory system works? This question will collectively address the learning objective that learners will “know the structures of the circulatory system and understand the functions of the heart, capillaries arteries veins and the components of blood”. The understanding of the learners will be measured if learners will be able to answer that question.</p> <p>This lesson’s purpose is to introduce the lesson schemes towards this objective.</p> <p>Homework is given to the learners to go and compare the left and right ventricle of the heart and suggest reasons why they differ in thickness. Question is given in order for learners to go and think of the role of the parts during the pumping of blood from the heart.</p> <p>Homework in the lesson plan is not given.</p>

22 May 2008	<p>Lesson 2 All learners present. This lesson is a low level lesson. Only knowledge and or facts were stressed on, but with the aim of going to answer an explanation question of how the circulatory system works.</p> <p>Only some information: the functions and structures of the veins arteries and capillaries.</p> <p>Some notes (Video cut to save space in memory card): Learner asked, Do nails and hair have blood, how do they grow? What gives Blood the red colour? Referred learners to the hand out to find answer to the second question? No answer to the first one? No resources for learners to explore.</p>
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27 May 2008	<p>Lesson 3 A good lesson. Have started with a god introduction. We jotted the chunks of the circulatory system on the chalkboard.</p> <p>As I talked to some groups while they were doing the pre-writing activity, I asked them if they will be able to write explanations on their own, provided they are given the pre-writing activity.</p> <p>Group 1 responded: “yes I think we will”. Looking at the response they have given as part of the preparation to the question. This group also said if they are given diagrams then they will be able to follow. In their answers, one learner showed the time connectives such as then, after, from and therefore.</p> <p>Group 2: they seem not to be sure of what exactly is happening they cannot put the connection between the information gathered on the board, the diagrams and the explanation. This is the case with most of the learners because they could not state the words involved. To this my observer has also noticed that they forgot about the words on the chalkboard.</p> <p>My observer commented that in this lesson she could see the direction of the teaching that also took some ideas that she could emphasise during her teaching of Life Science and Agriculture.</p> <p>She advised that however the explanation given as an example was long to be provided in the examination, she suggested we give another example but short.</p> <p>I asked her, How do you think of the strategy to teach explanations? “I think this is good and it will work with our learners,” the non-participant commented.</p> <p>What if slow learners are taught repeatedly, and other genres, to differentiate? I think it will work, but i also think our learners need a variety of discuss, define, describe, questions in order for them to put up differences.</p>
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28 May 2008

Lesson 4

The lesson started with the activity to clarify what was done yesterday. The idea I got from the observer after the previous lesson. Some learners took the point clearly of how to write explanations while some others could not. The ones who could give good explanations said they did not know that it could be done like that.

The first activity seemed to be too easy, but some learners referred to the notes they were given the previous day. I took the 3 minutes to complete the task.

The second exercise seemed to be a bit difficult and it took them around 10 minutes to complete. Some learners were not done until the period came to an end after 5 minutes or so.

Most of the learners got the first and the last sentence correct. Most gave the order which could make sense but it was not well thought of. Some few gave the order that does not make sense at all.

I think this came because some learners did not know the meaning of the word *thrombosis* and *arteriosclerosis*. I think the first sentence was right to many learners because it stated „first“ and the last one was „as a result...“

As the aim of the activity was to see if learners could sequence an explanation guided by the words. I think the previous lesson have achieved this. The words were the time connectives.

The second aim was to expose the learners to another example of a short explanatory text following a question that is exemplary to the examination question.

The first activity was also to expose learners to a possible examination question that needed an explanation (short).

This lesson was part of the second phase as the first example of the explanation was long to be asked as an open-ended question in the examination or in a test as the case with the Namibian context.

The second activity was to introduce learners to cause-effects kind of explanations.

29 May 2008	<p>Why use the flow diagram? When the explanation is that short but in the flow diagram there is more details.....</p> <p>The aim is to provide the details in the flow diagrams. Not for all information to be used (read Moline here to see what she says). My Idea is to create general understanding of the cause and effect of the explanation.</p> <p>The lesson was started late because of administration work. The camera went off because of the battery.</p> <p>I think I made a good start by giving back the papers to the learners. I have explained the flow diagram to the learners and also some terms before they started to answer the question again.</p> <p>The period came to an end before the learners can write another explanation with the help of the teacher. This is carried to tomorrow's lesson so that learners can write their pieces.</p>
2 June 2008	<p>The lesson was tape recorded because the cameraman wasn't around. The non-participant observer was not present; therefore this lesson will be partially transcribed.</p> <p>The lesson was a continuation to the lesson on Thursday last week because what was carried out could not be finished.</p> <p>Learners' mood has changed to the non-conducive environment in the classroom but it calmed down when they started to write. I think it was caused by the repeating of the poster which they used the previous Thursday.</p> <p>Comments to give in next lesson</p> <ul style="list-style-type: none"> • Coronary muscle becomes blocked - wrong, the blocked part is artery. • First, supply oxygen and glucose. • The heart stops breathing. • Word use and order. <p>Helped learner to learner with their difficulties in the afternoon.</p>
4 June 2008	<p>The lesson did not take place because of administration work.</p> <p>After reading from several journals of the learners I found out that the unit started to bore them.</p> <p>Because of this, I will change the content of the explanation. The next lesson will be on the excretory system.</p>

5 June 2008	<p>I did not have a period in this class but I made an arrangement with the learners and the principal to meet in the afternoon during the compulsory study time.</p> <p>How does the kidney clean the blood was the target of the day.</p> <p>Learners showed interest in the lesson (improvement from yesterday's observation).</p> <p>Used the flow diagram to explain how urea is removed from the blood.</p> <p>Learners are given to write their explanation as homework.</p>
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Appendix 5b -Learners' Journals

Date	Journal entries (different learners)	
21 May 2008	<p>Quiet lesson. The class was way too quiet. Miss gave us some handouts on the heart. The topic of the day was the circulatory system. I learned the organs involved in this system then we talked about the heart. I learnt that the circulatory system was mainly just about the blood. We learnt about the different parts of the heart and their functions. Ms wanted us to mostly know from which part to which part the blood is moving. I have difficulties in identifying some parts of the heart using the internal structure. I guess the only way to know them is by studying the structure clearly and know where each part is situated ^{situated}.</p>	<p>In today lesson our life-science teacher wanted us to learn more about the circulatory system and we learn the three organ which are involved in the circulatory system and how they work. But in those three organs we only take one which we do in the class and our teacher gave us pamphlet which have the heart and we discuss about its part and their function. and she also gave us class work pairs work to do them and she also see if we are correct and these topic to me was excellent and I think I want for get th what we have done today.</p>
	<p>Today we learn about circulatory system and how the heart circulatory system work and the function of the circulatory.</p> <p>I learn more information about the heart and part of the heart and their function of them so I need to know more about external structure of the heart and external structure of the heart to know the different between two.</p>	<p>Today was a good day because our teacher teaches us the function of the part of the heart, he put us in pairs to match right function.</p> <p>I think I learned a very thing I need to know nothing else I would like to know, but would like to see the part really one from goat. just with I also learned that the heart is a muscular organ. the heart is made of cardiac muscles. the main function of the circulatory system is to pump blood around the body.</p>

22 May 2008

Today has been one of the best day in my life. We learn about circulatory system which is very important. I learn more that the heart is divided into many parts and each part has its own functions. I need to learn more on external and internal structure of the heart.

I plan to study hard on their functions as they are so confused. I plan to do all my homework timely and with a full work rate just as I use to do on minutes.

Lordy: Hail Mary, full of grace, the Lord is with you. Blessed art thou among women and blessed is the fruit of your womb Jesus. Holy Mary, mother of God, pray for us sinners now and at the hour of our death. AMEN!!

The teacher want us to learn about circulatory system. This system have some organs and they are blood, blood vessels and the heart. She ~~teach~~ ^{teach} us only one organ which is, the heart.

I learned the external and internal structure of the heart and their function also. One external part of the heart is aorta, which carries the blood away from the heart to the ~~veins~~ other parts of the body. Others are pulmonary vein, pulmonary artery, vena cavae and coronary artery and vein. And I know their function very well also. The internal parts of the ~~body~~ ^{heart} they are many. ~~There~~ ^{the} teacher says, the important part is septum.

What I need to know is the functions ~~and~~ of the parts of the heart. I need to know also that why left ventricle ~~is~~ thinner than right ventricle. This one I don't know the answer, the teacher gave

This period was also good. Our teacher come in with the cameraman and miss Fiene again. We studied about the blood vessels. which is very easy, ~~I~~ we were divided in 2 groups and given some questions to answer. ~~I~~ I can't wait for tuesday lesson to answer a question the teacher left us. listening in the class is the only way I can study well.

We went into more details on some of the parts of the heart today. Class was just cool. We focused on the blood vessels of the circulatory system. The veins, arteries and capillaries. I learnt why they have different special features between each other. Miss wanted us to learn each of their functions and why some parts of the vessels have thicker walls than the others. The sides that pump more blood have much thicker ~~at~~ muscles than others. These things are quite easy but confusing and I need to make sure that I know each of them and can differentiate them throughly.

The teacher taught us about the ~~circulatory~~ ^{circulatory} system (continuing). We have learn about the blood ~~est~~ vessel today. The blood vessel contain of vein, artery and capillary. The vein function is to carry blood toward the heart. The function of the artery is to carry blood away from the heart. for the capillaries is to allow blood to pass close to every body cell. We also learn about blood and it consist of plasma (a liquid part of the ~~blood~~ ^{blood}), Red blood cell and White blood cell ^{and platelets}. Miss also told us to ~~be~~ find or study the functions of plasma, Red blood cells and White blood cells and for the platelets. The lesson was great and I can understand everything. I don't have any problem.

Today the lesson was enjoyable, interesting because there was a camera and there we learned about the blood from what ~~it~~ ^{the blood} is made from and the functions of blood components. we also learnt about the white blood cells, red blood cells and the platelets and their functions. ~~at~~ now my questions are as follows
(1) why ~~do~~ white blood cells have bigger than red blood cells?
(2) why is the formation of clots important?
(3) what role of Fibrin is in the formation of clots?

The lesson is always cool when there is a camera. I hope the next day is gone be the same.

Today it was a very excellent lesson. We learnt about the functions of the arteries and veins in general. I learnt that arteries have thicker walls than veins because of great pressure to pump blood to all body parts. But I still insist "if blood doesn't go to the nails and hair, then how do they grow if energy doesn't go there?" We are given a homework to find the functions of the 4 blood components.

In today's lesson we have learnt more about the heart but we were only focusing on some parts which are Artery, vein and Capillaries. We have also learnt the structure and functions of blood components which are plasma, Red blood cells, white blood cells and platelets. Our teacher also gave us a class work to do in the groups of three people and after we have finished we discussed it with the whole class and the lesson for today was very good, but if one part is not working or damaged what will happen?

about blood which is one of the Circulatory System. Blood has ~~is~~ divided into ~~two~~ ^{three} parts, arteries, veins, capillaries. It has also four components: the plasma, Red blood cell, White blood cell and the platelets. We also learnt about the functions of the veins, arteries and capillaries.

1. The teacher wants us to learn about the blood vessels, and its ~~two~~ ^{four} components and its functions.

2. I learned that the blood plasma, white blood cells and red blood cells are components of the blood. I learned that the plasma transports all the blood cells. White blood cells, I learned that white lymphocytes. I learned that the function of the arteries is to carry blood away from the heart. I learned that arteries have thick walls with three layers of tissues. I learned that veins carry blood towards the heart. I learned that veins have thin walls with layers of tissues.

I want to do more on how the colour of the blood is formed especially the red colour.

3. I want to know the answer of the question that says how does the circulatory system work and what's the definition of the circulatory system. I will conduct all life & science textbook.

Thursday is a good day when it came to the lesson because I learn more about blood vessels and how many blood vessels consist of veins, artery and capillaries and their function and also the components of the blood. I learn the difference between veins, artery and capillaries and why the artery has thick wall and vein has thin wall and the difference between the vein lumen and artery lumen. I know all about blood vessel and blood themselves that I learn today, and I want to understand in on what we did today.

Today was good to every one. We learnt about blood which is one of the Circulatory System. Blood has ~~is~~ divided into ~~two~~ ^{three} parts, arteries, veins, capillaries. It has also four components: the plasma, Red blood cell, White blood cell and the platelets. We also learnt about the functions of the veins, arteries and capillaries.

I want to do more on how the colour of the blood is formed especially the red colour.

27 May 2008

The day was marvellous and I ended up saying, 'upz what a day.' When Ms Helena came in the class today everyone was active. We were not concentrating on the camera and today. We learned about the the blood vessels and the functions of the arteries, the veins and the capillaries. We learned that the arteries got thick muscle layers while the veins have thin muscle layers. The arteries have thick muscle layers because they ^{need} a lot of pressure to pump blood to all parts of the body. So it has a thick muscle than the veins. We also learned about different blood components - They are plasma, red blood cells, white blood cells and the platelets. We were asked to find out what makes the blood red. It's because of the ~~haemoglobin~~ ^{haemoglobin}, a protein that contain iron. The iron gives the red colour to the blood. Every thing was good and clear. Ms was also happy.

were as before. In life science we learned about artery, veins and capillaries. I learned that arteries carries blood away from the heart and the veins carries the blood to heart while capillaries allow blood to pass close to every body cell. There are four blood components and they are Plasma, red blood cells, white blood cell and platelets. They has different functions.

We have given home works about how the circulatory system work and the other is to ^{write} function of the components of the blood.

The period was good because we were in group doing together and share our ~~experience~~. I will try all my best to do it more and nicely next time.

The lesson today was not good because I just don't understand what the teacher was teaching. The teacher taught us about how the ~~respiratory~~ circulatory system work and I don't really get the point so I need the teachers explanation. We did the activity in the class, but it was taught because I just Don't understand. The teacher must try to help us to understand more so that we can make it in the examinations. ~~About the camera I~~

Today we have studied about the Structure of the arteries, the structure of veins, the function of the arteries, the function of the veins, the structure of the capillaries and the function of the blood capillaries. ~~The~~ The teacher wants us to know about how the blood move in the body from one part to another. I have learned about the capillaries and blood cells. I need to learn more about the phagocytes and platelets. I plan to learn to learn by reading my books that ~~date~~ inform about capillaries, Plasma and phagocytes, and anything that I don't understand. ~~The~~ Period of today was very good as we do the exercise that help us to understand better.

Today's lesson was complete fantastic. Yesterday people only concentrated on the camera. We've learned about blood vessels and the function of the blood vessels.

The examples of blood vessels are red blood vessels, ~~veins, artery and capillaries~~ ^{veins, artery and capillaries}, ~~white blood vessels, plasma~~ ^{we have} also learned about the blood components.

I want to know what colour does the blood go if you are HIV Positive, does it remain the same or what does it really look like. And the difference between blood of humans and the one of animals. Now that I know more about my blood vessels I will have a look in the library to see if what really happens to the blood.

Today the lesson was somehow because I just don't understand what we were taught in the lesson. All ~~we~~ ^{now} understand is the ~~why~~ ^{how} to explain when ever you are ask to explain but I don't understand the activity of the circulatory system. I really want the teacher to explain more about this topic because even if this kind of questions come in examination I will just fail because I don't ~~know~~ understand. I don't even have questions about this topic because I don't understand I need more explanation.

The lesson was great It's only that I don't understand the topic I ^{hope} will understand soon.

28 May 2008	<p>Great day I can say! The lesson was great and we revised a bit about the circulatory system. Miss Hill explained more on how we can shorten our explanations for them to be short and clear. We did a little activity on how oxygenated blood reaches the body cells from the lungs. We got to know how to use the language features like first, while, finally and other related words. It was easy to understand. We also got some handouts that we needed to complete by the next day.</p>	<p>The lesson was so good and the time was so running quickly like water go down we learn about how does oxygenated blood reach the body cells from the lungs and how to fill the short work word in the position. We were given class activity but we did not finished the teacher told us to finished tomorrow. I learn more about circulatory system.</p>
	<p>Today the lesson was enjoyable because I understand what the teacher taught us in class. We were given activities to do in class and I also learned about how oxygenated blood reach the body cells from the lungs. I like the Chapter a lot best because it teach me a lot.</p>	
29 May 2008	<p>The teacher asked us question about what we did last time and it was from misunderstood to many of us. The teacher explain well how the build up of cholesterol in the circulatory system can lead to functional disorder. She display the post at the wall so that we may understand well. We learned the process of the a heart attack, she explained for us every thing and what happed during this process and the cause of this heart attack. This explanation was very not understood by many of the learn because it was confuse confused and difficult. I try tried to understand but still now I am not.</p>	<p>Today we learn about how the build up of cholesterol in the circulatory system can lead to the heart ^{functional disorder} by using the words in order and we make the correction for the activity that we did on Wednesday.</p> <p>know I learn how can I re-write the sentences in order because I know now when we was given the activity to do and I was try but I was not happy because firstly I does understand and now I know understand.</p> <p>I want my life-science teacher to give ^{me} more information and give us more activity to re-write and more sentences on how the building up of cholesterol in the circulatory system can lead and I learn more the difference between cholesterol ^{and} arteriosclerosis.</p>

2 June 2008

The lesson was not good because it was all about repetition for what we did last day. The teacher asked us to per move attention for what she told us about how to explain and give clear and correct answers to the question given asking to explain. We were talk about the question we did last days and she gave us one question says that ~~What~~ what is the role of the coronary ~~artery~~ during heart attack? I want to take this as serious ~~issue~~ ^{issue} and need to learn how to explain questions that asking to explained. There was no video taken.

Today we made revision of the things we did in the week ^{The teacher} she wanted us to learn about the role of the coronary artery during a heart attack. We have learned about explaining different explanations of different topics. I want to learn different ^{heart} functions on different parts of the ^{heart} during a heart attack. I am gonna make use of the library books. The lesson was boring.

Appendix 5c - Non-participant observer's field notes

Day 1, 21 May 2008

Circulatory system

Learners mention the organs : heart, blood vessels, blood, components

1 answer is Body cells

Q. What should be in the blood v?

Good. Letting learners to think more.

Q. How does the circulatory system work?

For them to answer they must know the heart structures and all the things- not really clear.

1. The Heart

1. Where can we find the heart in our body?

A- in the chest hidden under the ribs.

2. in what material the heart is made of? - Of muscles,

3. What do we call those Mus?

A- Cardiac muscles

4. What is the main function of the circulatory system? → to protect the heart. Then a chance to another. A- to pump blood and keep us alive.

Good: emphasising learners if they start to keep quite.

She also give some answers to questions Eg. to transport CO₂ and O₂.

2. Giving handouts

Consisting of External & internal structures of the heart.

Negt- Reading at the middle. Suppose in front cos every learner have the handout.

Q. What is a septum?

A- the muscle divide the heart into two parts.

Q. why do we have that muscle there?

3. Sitting in pairs.

It seems like it took some time cos learners opt for themselves, if she could opt for them it will be fast (it can consume a time).

The second handout written in pairs.

Q. Imagine what do you think is the functions for each part mentioned?

No use of resources, what they need is to match the function with the parts.

Good. Corrections of errors were made and observing how learners are discussing.

Nega.- No comparison to really life mentioned. Eg. Where do we find the heart? Everybody

feel your hear/beatng of it?

Nega.- Standing for long suppose to find whether all have finished. Stop learners without finishing.

Nega.- suppose to mention learners by name instead of ee and pointing.

Good- emphasising the lesson objection.

What blood is in aorta?

Going back to the definition of pulmonary artery- refers to lungs.

Suppose to explain the parts first before function.

e.g. arteries carries blood out a7 veins in.

→ Praise learners when they give right answer.

Which have the thick walls there is it the right/ left ventricle?

Confusion due to lack of concentration.

If you could move around concentration can come.

Lack of concentration at the end.

H.W.

Left → thin & right → thick v. walls

Why is the left ve Having a thicker wall than the other?

Day 2, 22 May 2008

Intro; Relates lesson to previous lesson.

Asking about the homework on the left and right ventricle → why?

Left is thick wall it pump blood to all parts of the body.

Right is thin wall it send blood to the lungs.

How does the circulatory system work?

Topic: Blood vessels. She defined it.

Blood vessels consist of

- veins
- arteries
- capillaries

How are they made & what are their functions?

Learner: Does nails have blood, how do they grow?

Nega: Challenging question. Answer it later.

Groups of 3

Learners discuss

Questions

1. What is the function of these?

- arteries
- Veins
- capillaries

2. Compare the structure of the vein and artery

- lumen
- walls

Note in a piece of paper.

Where is the deoxygenated blood?

Oxygenated blood is carried from where?

Capillaries

Q. 2

Lumen → hole artery - narrow
vein - large

Walls artery- thick
vein- thin

Why do artery have thick walls and why the vein have thin walls?

Another Q.

Blood components. What is the blood made of?

- red
- thick liquid
- made up of cells

Find 4 components of blood using the handout. Learners well using other additional materials.

What are the plasmas?

H.W.- Read more & find what gives the blood the red colour.

Find out the functions of the blood components → tomorrow.

Time was not enough.

Day 3, 27 May 2008

Intro- conjunction to the previous topic & reminding them this- How does the circulatory system work?

What information

- circulation of blood
- where the blood passes
- Parts involved e.g. blood vessels, the heart, parts of the body
- Which blood vessel carry blood from heart to lungs- pulmonary artery, from lungs to heart- pulmonary vein
- What are other blood vessels

Aorta- heart → body
Vena cava - body → heart

Objective: to be able to write explanation (a clear explanation)

You need to know

- what is explanation
- language appropriate
- where it end & starts

now sit in groups of 3 - she gives a hand out.

U need to understand the details

Learners must give what is happening to each diagram or the blood (1-4) using the hand out (copy)

10 minutes for learners to...

Nega. Time was not enough

A hand out was given again → on how to explain

No answer given from groups

She suppose to hear learners explanations, so that she can give hers/the clear one.

NB: the one I gives u is long, u need to shorten it, but how? Give this to learners to find whether they know how to shorten it.

Stand in front of the class to see all groups.

Taking 10 min from the other lesson.

Explaining about

- Explanation
- Language features & time connectives
- Details and technical terms

H.W. Shorten this explanation.

Day 4, 28 May 2008

I found the lesson started

Comment on the one who said 5/10 is too long.

Learners get the 1st and fill in the missing words, they then get the second one whereby they are given explanation about coronary artery, but sentences were not in order.

They have to put them in order.
It was a practical activity → done in class.

Lastly, given handouts of information to share.
Some minutes taken from next lesson → poor time management.

Day 5, 29 May 2008

Cholesterol → sub present in the animal fat what kind of a substance?
Writing an explanation about how Cholesterol cause heart attack.

The explanation have to start with
Causes ----- → effects/results
First last

A wall chart is displayed.

Explain how the build up of cholesterol in the circulatory system leads to functional disorder?

She repeat the build of cholesterol.

N.B. the wall chart is a little bit confusing; it is so hard to follow the arrows. They overlap each other

Appendix 6 - Interview transcriptions

Appendix 6a - Learners A and B

Interview 1 Date: 11 June 2008 Venue: (Name of school) Time: 11h00
Me: Let us now start MMhh. Ok. Last week I have taught you on the circulatory system and then secondly went to the excretory system. Were you ever taught those two topics before?
A: Yaa, the circulatory system, we were taught about the circulatory system last year.
Me: In grade 9?
A: Yaa.
Me: Ok. What about the circulatory system?
A: No, This was the first time.
Me: Ok. When you were taught about the circulatory system, were you taught in more details or you were just taught the basic information on the parts of the heart?
B: We were given the basic information and also a little bit advanced.. ,but not now in Grade 10 we are given more .. now advanced then last year.
Me: Now comparing the lessons for this year and the ones for last year, but I don't want you to concentrate on the one for last year, Did you like the lessons?
A: Yaah (smiling), very much.
B: Yaah oh! It was very interesting.
Me: What exactly did you like in the lessons, especially on the circulatory system?
A: Like explanations, because like in the exams we didn't know how to answer the questions asking the explanations, but now we can... its fine, we can answer them.
Me: You can answer them very well?
A: Yaaa.
Me: And you (name of learner B)?
B: Me I thought..... I found it very interesting especially on the ... about the heart attack parts. How it occurs and what causes them, because I never knew that may be a very skinny person can also die of heart attack, because I thought only abnormally fat people can die of heart attack. (learner A laughs).
Me: Ok. Ok. Now with these lessons of the circulatory system, what do you think was my aim, for me to teach you...?
A: The aim, I think was.. ah.. you have to teach us how to write explanations.
Me: ooh.
A: That's what I think.
Me: Do you agree? (looking at learner B)
B: Yaa. I think it was the aim because when we wrote the exam, may be you found that many

<p>questions that are asking explanations, when we answer, we did not answer what is asked maybe we explain leaving the main words, the main points.</p>
<p>Me: Exactly!</p> <p>Ok, that was really my aim teaching... , like (learner B) said I have realized that in some of the questions you leave out the most important parts of the answer concentrating in a loong, sentence but there is no information. That was my aim. But now looking at what I taught you and what you knew before is there a difference, were you taught how to write explanations before?</p>
<p>A: No. We were not taught how to write explanations before?</p>
<p>Me: You were not taught?</p>
<p>B: only in History but we were taught to write in point form in Grade 8.. 9... but until now we are using the same explanations.</p>
<p>Me: Only in point form?</p>
<p>A: yaa.</p>
<p>Me: Like?</p>
<p>B: Like.. Maybe , first... How did the presence of the South African people in Namibia affect the life of the Namibians and then explain your answer.</p> <p>Now first, you have to answer, was it important.. was it important or was it not important. Then you answer that question and then you motivate that answer in point form.</p>
<p>A: We use to look at the marks it is five marks then you make 5 points.</p>
<p>Me: You give five points? But how do you write them? In a sentence form or how?</p>
<p>A: Yaa. In a sentence form.</p>
<p>Me: Can you give an example</p>
<p>A: Like, the presence of the South Africans. You can write... it was not important to the Namibians because point one... Mhm.... The Namibians were treated cruelly.</p>
<p>Me: Ok.</p>
<p>A: Yaaa, and then point two, some of them were made to work without their will.</p>
<p>Me: Ok but how is that now different from the one I taught you?</p>
<p>A: The ones you taught us, you put everything in just .. in one paragraph and it's easy.</p>
<p>Me: It's easy....</p>
<p>A: Its now easier</p>
<p>Me: You have said that you were taught that one in History, not in Life Science. What about in Agriculture?</p>
<p>B: They are almost the same, but Agriculture ask the questions more concentrating on points example...Give \$ points.... Like they ask you... how to harvest (<i>Nando</i>)</p>
<p>Me: Mhmmm</p>
<p>B: Like to harvest maize, but then you write in point form.</p>
<p>Me: Ok. Not in paragraph form?</p>
<p>B: You write for example from the first step to the last step.</p>
<p>Me: Ok.</p> <p>Given the Questions....</p> <p>If I give you a question that I know.... me as a teacher I want you to write an explanation will you be able to identify that may be this question will need to give a short explanation or a long one. Not necessarily in the examination even just as a homework.</p>
<p>A: Yaa. Ok!</p>
<p>B: Yaa, cos the length of the explanation will depend on the question if you are asked to</p>

explain for example the whole circulatory system, then you may include many, many things, but if you are asked only the excretory system ...is a small system you may only write a short paragraph.
Me: Ok. But are you able to identify a certain question that this question here is not asking me my name it is not asking something's name, it is needing an explanation.
B: Yaah
A: yaah
Me: Can you give an example of such questions.
A: Some questions can have „explain“ in it or suggest some of the questions may have suggest,.. like that.
B: And they may have a cause and effect.
Me: Ok. In the whole life science lessons that we have ... not only in the circulatory system... can you formulate for me..... or will you be able to recall a question which needs an explanation. Just in Life Science.
A: Yaa, Mhhmm.. It's Like there is a question about thee..... saying that.... explain how the waste is... the kidney filter the blood. That need an explanation.
Me: And you (learner B)?
B: Yaa, there was a question of explain how the build up of cholesterol may lead to functional a disorder. That will also need an explanation.
Me: OK! Lets's say for example in the sentence there is no explain, does it mean that , that question does not need you to explain .
B: No.
A: No.
B: Some questions may say ... may ask you like.... describe or suggest.
A: Or just How.
Me: Now use those words to formulate a question which s going to explain.
B: Describe for example..... how the build up of cholesterol in your body may lead to functional disorder or suggest how the build up of cholesterol may affect the circulatory system.
A:Or it you can.....
Me: mhmm.
A: It can also have a how in it like how does a heart attack occur.
Me: Mhm, because even what that (learner B) have given there is a how, how, how. Ok. That is good. Mhmm... given these questions do you like them?
A: Yaa.
Me: You enjoy answering them even in a test or as a homework?
Both: Yaa
Me: They don't give you a headache?
A: No. (Laughing)
Me: Do you think you can have any problems when you answer these questions which are needing explanations.
A: Iyaa
B: Some questions that may for example the question is asking how does the circulatory

system work, but is only given 3 marks, but then, if you imagine how you are going to write the explanation, it may even take 5 lines but the marks are only 3 then its not fair (laughs).
Me: You think it is not fair.
B: Yaa.
Me: Ok. Now you remember from the explanations I taught you I planned that first of all I must teach the parts of the heart which fortunately you knew from grade 9, but you didn't know about the blood vessels and blood components.....
A: Yes
Me:which contributed to you understanding how the circulatory system works. I have used mmmm, I have tried to use the posters and the flow diagram. Do you remember those?
A: Yaah.
Me: Ok .How do you think..... Did they help you?
B: Especially the flow diagrams. They helped because the floe diagrams shows you... like the arrow points where the blood is going and the parts of the heart are shown there. Therefore, when you look at the flow diagram you know ...ooo, the blood is coming from the heart, from the heart then it goes to the body cells, from the body cells, come back to the heart and then it goes to the lungs, like that...The arrows are there exactly showing where the blood is going.
Me: Do you think....Because I taught... gave you two flow diagrams, the one on the circulatory system and the.... That was the second one, the other one from the circulatory system. Say for example with this new topic which you doing now, the nervous system, if I give you the question go and explain how the nervous system work without any support materials, no pictures, no flow diagrams, is it going to be easy for you?
A: Yah. It will be easy as long as we know the parts and their functions.
Me: As long as you know the parts and their functions.
DISTRUCTION INTO THE ROOM FROM OUTSIDE
Me: Ok Mhmm, what is the other thing that I wanted to ask you (softly)? It's on the activities that you have written. How do you think the activities were, easy, difficult?
B: Thee... somehow, cos we did not know how to answer some of the questions but since the activities we tried our best to answer what is asked.
Me: Ok! Is there anything that you want to tell me?
A: Yaah. Keep up the good job.
Me: Ok , thank you. I think we have come to the end of our interview. Have a nice day. Ok! Thank you.
Both: Same to you!

Appendix 6b - Learners C and D

Interview 2 Date: 11 June 2008	Time: 11h20 Venue: Name of school
Me: Did you like the lessons?	
D: We did like physically or something like that	
C: Yaa, we learned a lot because we even shared ideas doing things in groups by that we shared ideas and learned from each other. It was nice.	
D: it was nice	
Me: Ok, you think it was nice because you were working in groups?	
Both: yes laughs	
Me: What about the content?	
D: The main content?... of Circulatory System?	
Me: Yaah	
D: It's about how the heart works about the gases. ... Which gases was released... which gases was come going from one part to the other and the blood itself.	
C: And just about the chambers of the heart the one which pumps the blood and the one which receives the blood.	
Me: Did you know those things before ?	
D : No	
C: No, not at all we only.... there in grade 9 We only learned about the chambers but then we did not go into more details	
D: Like the functions we just learned(not clear)	
Me: Ok! That's why you said you enjoyed the most in those lesson nee?	
Both: yes!	
Me: Looking at those lessons that I was giving you, did you... Have realized something? May be what was my aim?	
D: Yaa! Ok you just wanted us to like know about it, how to explainshortening explanations in short to get to the main points of the system, the real main points and just to make it short and just understand it simply.	
Me : And you (Learner C) what do you think?	
C: Yaa, its just the ... like what she said, we learned a lot in shortening, not just knowing a long process, but then you shorten it and when the question is asked, you make it very clear and easy answer.	
Me: Do you think I have reached now my objective did I reach my aim?	
Both: Yes (giggle)	
Me: Or maybe you know it before? You just think I am wasting my time. You already know those. Did you know how to write explanations before.....	
D: No.	
Me:you make them clear so that the Reader will follow?	
D: No! We didn't know. Cos we just taught us how to use the language features, the words that we have to use in order to make it like a... what... you... a continuously, without using these other words from ...aa. .Like .. they are like in order. Like you have to make everything clear.	

Me: Which words are those ones?
D: They are like ... like...
C: Firstly, Secondly, and then, in order.
Me: Which is showing you the order of the explanation?
C: yaa!
Me: Ok, I like that. Did you know how to write clear explanations before? Or let me say, were you taught how to write explanations before? In English, History, geography, other subjects, did they teach you these?
Both: No, not really!
C: They just say....
D: They just say..... explain but then we are not given this... thee... the how we can really do it...the good way of doing it. They just say explain and they have to say like... explain how you understand it by yourself. Then you are not given the main features that you can use in order ... order to make clear and stright to the point.
Me: Mhmm.. Do you think you would be able to use the features that I have given you in any other explanations whether it is in Geography or you are just going to use it for Life Science?
C: No, no. I am sure many of us are going to use it in other subjects, „cos it’s really good. You getting more marks then,... rather than just explaining what you feel, but not using the main points. So we are gonna use it in other subjects.
Me: Ok! Given any questions will you be able identify any question which is needing you to give an explanation?
D: Iyaa! Just by looking at the words.
Me: Which ones exactly?
D: Mhm... ok., Like How does something take place or explain how does this and that... or maybe how does a certain thing play a role in something. And yaa.. by that you can know that this question need explanations.
Me: Ok! And aa... We also have this question which say discuss... Do you think that one is the kind of explanation question?
C: Iyaa! Those kinds of questions are they are kinds of explanations because; you have to discuss to explain ..in more details..... about that specific question.
D: It does”nt mean you have to discuss it with somebody. It means you have to discuss it by explaining saying what you think about that certain thing.
Me: Ok. Mhmmm... You have said that you will be able to identify questions, will you be able to recall ... any.. or if not be able to recall you can formulate your own question in life Science that is needing an explanation.
C: yaa, if you cannot recall you can just take from you head but make sure that everything is clear and understandable to the teacher.
Me: Can you give any example of the question that are needing you to explain. The ones which you can remember.
D: How the circulatory system work.
C: How the coronary thrombosis.....
D :cause the blood.... Mhmmm....

<p>And how the gases.... How oxygen reaches the body cells, how it reaches to all cells and... thee...thee..iyaaa... How the kidneys clean the blood and</p>
<p>C: And how blood is..... I mean How urea is removed from the blood.</p>
<p>Me: There is one thing which is repeating itself there. Which one is that, can you identify it?</p>
<p>D: Yaa...Are the kidneys cleans the blood and urea.</p>
<p>Me: The word which is unique in those questions</p>
<p>D: In the two questions?</p>
<p>Me: In the ... all the questions that you have given me there?</p>
<p>D: Ok...How!</p>
<p>C: The word how.</p>
<p>D: Iyaa!</p>
<p>Me: I agree, so would you say that any question which is having a „How“ , it will need an explanation?</p>
<p>C: Yaaa, cos you are asking how did you do it. How can.... something is happening?</p>
<p>D: How something is happening.</p>
<p>Me: Ok.Mhm. Now before I came to you with this explanation thing were you able to write? Did you ever ... Do you have any problems?</p>
<p>Both: Mhhh....</p>
<p>Me: Ok Ypu told from the beginning that you were not clear, you could write but not really clear.</p>
<p>Both: Mhhh.</p>
<p>Me: But now.... Because I gave you some exercises, do you think now after all these exercises you would have problems?</p>
<p>Both: Nooo!</p>
<p>C: Not very much.</p>
<p>D: I don't think so.</p>
<p>Me: You would not have any problems nee?</p>
<p>Both: Mh.. Mh.. (no, no)</p>
<p>Me: Ok, lets say ... because now we have started now with the nervous system.....</p>
<p>Both: Mhmmmm!</p>
<p>Me: If I give a question which is saying explain how the nervous system works...</p>
<p>D: Yaa. We can do it just by knowing the things that are involved in it. I think we can do it.</p>
<p>Me: Ok! Do you know those things right now?</p>
<p>D: Thee... Mhmmmm</p>
<p>C: I think so.</p>
<p>Me: Yeee? (What did you say?)</p>
<p>D: Iyaa</p>
<p>Me: Are you sure? (We laugh) Ok, but you have told me that its only when you know the different parts, the different functions that you will be able to write a clear explanation. Once you don't know them then you'll not know the direction.</p>

Mhm? Is that what you are saying?
D: Iyaa
C: Also the language that you are using you should also consider the language
Me: Ok.Mhmm So now if I am to ask you that question it means you must..... What are you going to do first?
D: First, you must know the parts involved.
Me: Mhmmm
D: And then the functions of each part and then the order , where the system starts and where it ends
Me: Mhmm.
D: Then you will be able to explain clearly.
Me: Now. You also realised that, when I was teaching you, I was using those pictures, first of all I have used the diagrams themselves, for example for the heart and for the kidney, I did the same. The diagrams for the external features of the heart and also for the kidney. And secondly, I gave you the flow diagrams. What do you think was my aim for me to give you those diagrams?
C: Aaa ...I guess there it was just showing us that from ... from this from this step it goes like.... It goes to another step which follows the first step and just showing us the flow how.....
D:from which part to which part.
C: From the beginning to the end, so that we may understand what happens next and then what happens next and then what happen next.
D: And then the results.
Me: Do you think it helped you in writing your explanations?
Both: Yes.
D: It helped a lot, cos we got how we can put them in order so that we can like explain clearly from where it starts to where it ends. Step by step to each part to the other parts, without mixing the parts.
Me: Would you like the same thing to be done with all the explanations that would be done?
Both: Iyaa
Me: Is there anything that you want to tell me?
C: We want to tell you, especially me. I just want to say that you are such a good teacher. You helped us like in those things. We only use to like write long explanations but now we know how to shorten everything and using the language clearly and understandable.
D: I just wanna say keep up the good work we really like learned a lot from you, and it was just so grate, by that we experience a lot . You are grate. I just want to thank you a lot.
Me: Ok. Thank you! I would like to thank you, because it's for nothing that I have selected you. Its because at least I knew that I would get something from you. Something really productive. Ok. Let's stop here.
Both: Ok
Me: Alright

Appendix 6c - Extracts of video transcription

Lesson 1

...

Me: Where can we find the heart in your body? Find it in your legs, head, where? Learner A?

A: We find it in our chest.

Me: In the chest. That's right. You find it in your chest, under the ribs. Let me say in what material is the heart made from? Is it a bone, is it a muscle what is it? Is it a plastic? Yes, learner B.

B: Muscle!

C: It is a cartilage!

Me: It is a ball of a muscle, hard strong muscle, not a cartilage what do we call that muscle? learner D

D: It's called a cardiac muscle...

Lesson 3

...

Me: in our papers, we have got an explanation of how the circulatory system, but it is not complete. That activity is going to help you to know what is happening. For you to be able to do an explanation you need to understand the details.

Like you jotted some of the information here some, of the information we put on the chalk board you'll be able to fix in those papers.

We have picture 1, 2, 3, 4. I want you to think what is happening to the heart and then you try to write a short sentence there in the space provided.

Like in picture one, they said all the muscles of the heart relax, when the muscles in the heart relax what is happening to the blood in the heart? Where does it go? Some of the arrows are there to help you.

Do you understand?

Class: Yes Miss!...

Me: ok!

...

Lesson 4

...

Me: Do you think you can e given that question in the examination?

Some Learners: Yes!

Me: Ok Yes, and if you look at the paragraph which is there, it's likely be one of the correct answers which is maybe going to give three marks, but that paragraph is not a complete one. There are two aims that I want you to do that exercise. I want you to exercise the words that we were dealing with yesterday to see whether you know the language features, the type of a language that you need when writing these types of explanations. And secondly I want you to notice that ... you will not be able to answer that question [How does deoxygenated blood reach the body cells from the lungs?], if you don't know how the circulatory system works. So this question is part of the main question which we have here and most of the questions that are given in the examination or in the test, they are part of the big topic like the one we are dealing with now.

...

Lesson 5

...

Me: I don't know whether everybody knows what is the meaning of the word cholesterol. Do you know what is it?

Learners: Yes/ No!

Me: How many people know what cholesterol is? Ah, Learner E, and F and G. Learner E, can you please tell the every body in the class what cholesterol is?

E: High oil or too much fat.

Me: Good, cholesterol is a substance which is mostly found in animal fat. Wherever you have fat layers cholesterol is also present. And it is not healthy thing in a human body.

...

Me: Now secondly, there were some of the words that could have made your explanation not to be clear. I think we all have a picture of what we want to see will happen to the heart. It's all about a certain problem that is going to happen to the heart, that explanation. Now, what is the effect, the effect of cholesterol? That's what the question is asking us?

...

Me: That kind of explanation, if you look at it, it is that kind where you start with the cause and end with the effect or the result. Now, what is the cause and what is the result or effect in this explanation?

K: the cause is cholesterol and the result is heart attack

Me: Good

...

Lesson 6

...

Me: For you to be able to write that one, and I said we will write together... what facts must you know?

Pause:

Me: Aah?

Learners: (silent)

Me: You need to gather all the information about the circulatory system e.g. the function of the coronary artery, etc". If you know the function of the coronary artery then I think I will be easier for you to capture that one. Ok. What other details must you know, so that you can compile an explanation on that

F: Ms?

Me: Eeh!

F: Are we going to write the function of the coronary artery during the heart attack?

Me: It's not to write functions, here you will write an explanation, but for you to write that explanation you must know function of the coronary artery as an example.

...

Lesson 7

...

Me: Another part which I want you to know there is the sphincter muscle. Can you see the sphincter muscle? That muscle if it becomes loose you will be pouring urine all over. It can contract and it can relax. When you urinate it relaxes and it contracts after you finish urinating.

G: Does it mean people that urinate at night their sphincter muscles are not tight?

Me: There are many possibilities, sickness, laziness etc. small kids urinate, but sometimes they need to be trained.

...