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Identifying and finding the impact of Grade 8 learners' alternative conceptions of lightning

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CHAPTER 1

INTRODUCTION

1.1. Introduction

"If only we could understand how learners make sense of their natural world, we could design science curriculum so that science makes sense to all learners" (Aikenhead, 1996, p.3)

1.2. Statement of the problem

Most African children grow up with the belief that lightning is a result of witchcraft and it is man made. Even today most adults believe that certain people have the skills to generate and control the power of lightning. This belief is then passed on to children. Most children end up in a science class at school with this alternative explanation of the lightning, which is different from that of conventional science. The challenge for educators is to help learners also accommodate the explanation of conventional science. According to Wilson (1981) cited by Aikenhead (1996, p. 2):

> To be effective, teaching must take full account of the multi-dimensional cultural world of the learner, but to apply this principle in a particular situation, and to express it in terms of the curriculum materials and classroom methods, is a formidable task.

The reality is that learners listen to the explanation of the educator on the origins of lightning and accommodate it for examination purposes. The fact of the matter is that these learners live in two worlds. Jegede (1995) developed this behaviour into a theory now commonly known as collateral learning theory. Learners accept the scientific truth as a fact when at school, but revert to their original beliefs when at home. This might impact on their performance in the assessment of science. As argued by Jegede (1995, p. 97)

> The hostile manner in which science curriculum and instruction is implemented in African classrooms tends to give the impression that the Western view of nature is the only legitimate way of learning about the natural world, thereby denigrating the learners' indigenous knowledge as inferior and non scientific. This creates difficulties for the thought processes of African learners.

The question is how is their performance impacted, and what can be done to assist them. This document reports on a research study I undertook to answer these questions.

1.3. Purpose

The purpose of my study is multi-faceted. First, I attempted to identify learners' African conceptions of lightning. Secondly, I attempted to elicit, describe and assess these learners' process of learning Western conception of lightning. And finally, I attempted to

develop a model of teaching that can be used to help African learners accommodate the two conceptions without contradiction and hindrance.

1.4. Questions

I conceptualized the above purpose into the following three research questions:

1. What are the learners' African conceptions of lightning?
2. What are the learners' perceptions about the way their African conceptions promote or hinder their learning of Western conceptions of science?
3. What teaching model can be used to enhance both learners' conceptions?

To answer these questions, I chose the following allowing context.

1.5. Context

I conducted this study within the context of a Physical Science subject in a former model C school. I did this within the context of an electrostatic section prescribed by the National Curriculum Statements (NCS) on Physical Science Curriculum (Department of Education, 2005).

The NCS explains Physical Science as the subject that deals with society's desire to understand how the physical environment works, how to benefit from it and how to care for it responsibly. It also states that our country has a legacy in which the poor quality and/or lack of education in certain sectors resulted in the limited access to scientific knowledge and the devaluing of indigenous scientific knowledge. Therefore, the

curriculum of Physical Science must ensure increased access to scientific knowledge and scientific literacy (Department of Education, 2005).

The following are some of the aims of NCS that are relevant to my study:

1. Developing insights and respect for different scientific perspectives and a sensitivity to cultural beliefs, prejudices and practice in society (this aspect should also include mobilizing of African indigenous scientific knowledge and practices, particularly as these relate to solving social and environmental challenges in Africa)
2. Enhancing understanding that the technological applications of the physical sciences should be used responsibly towards social, human, environmental and economic developments both in South Africa and globally (Department of Education, 2005, p. 24).

The NCS prescribes the following three learning outcomes:

1. Practical scientific inquiry and problem solving skills:

   The learner is able to use process skills, critical thinking, scientific reasoning and strategies to investigate and solve any problems in a variety of scientific, technological, environmental and everyday contexts
2. Constructing and applying scientific knowledge:

   The learner is able to state, explain, interpret and evaluate scientific and

technological knowledge and can apply it in everyday contexts

3. The nature of science and its relationships to technology, society and the environment:

   This will help the learners to be able to identify and critically evaluate scientific knowledge claims and the impact of this knowledge on the quality of socio-economic, environmental and human development (Department of Education, 2005, p. 24).

I conducted this study at a middle class school. Amongst other things, it has the resources like sports grounds, libraries and a reasonable computer centre. Also, it has state of the art laboratories and employs a full-time laboratory assistant. These laboratories are well equipped. The chemistry laboratories have enough chemicals and the physics one has enough equipment such as circuit boards, Van der Graff generators and Boyle's law apparatus.

It has an enrolment of 1100 learners. The majority of learners are African and make about 75% of the school population. The other 25% is made up of Whites, Coloureds and Indians. African learners come from different ethnical groups such as Basotho, Amazulu, Amaxhosa and Amandebele, and their mother tongues are Sesotho, Isizulu and Isixhosa. Even though the medium of instruction is English, most learners still use their African languages to communicate amongst themselves and at home. They conform and practice African cultural beliefs in their homes. For example Basotho practice "Phabadimo" which is a ritual to honour ancestors for several achievements in that family, while the

Amandebele group together with some of Basotho send boys to initiation schools known as 'Lebollo'. Most of their parents grew up in rural areas and migrated to the Townships to seek employment in nearby industries. There are 35 educators, 20 white, 11 black and 4 Indian and Coloureds. Science educators at this school have qualifications ranging from three-year college diploma to a higher education diploma and even honour's degrees. In the past three years the school produced an average pass of 42% higher grade and 58% standard grade in science. Thus, most learners only pass science on the Standard Grade.

For my research I focused on one grade 8 class of 33 learners. This class constituted the case for my study. Because a "case study can be viewed as an in-depth study of interactions of a single instance in an enclosed system," Opie (2004) this research qualified to be a case study. I took a closer look at the interaction of different conceptions of lightning within the context of learning and teaching situated in a closed system called a classroom.

1.6 Limitations

There were time limitations. Because the study is part of fulfilment of Masters' degree, it had to be completed within six months from the date of presentation of the proposal. This resulted in the shortening of observations and interviews as only 33 Grade 8 learners participated in this study and amongst those, only 16 were interviewed.

The findings of this study cannot be generalised to other schools in another provinces even though there might be similarities. According to Opie (2003) a criticism of case studies concerns the extent to which their findings can be generalised – features, which exert a strong influence in one context, may not be present in another. [But] case studies are normally judged by their 'relatability', rather than their 'generalizability', a good case study will be reported in such way that the members of a similar group will be able to

identify with the problems and issues being reported, and draw on these to see ways of solving similar problems in their own situation.

Access is another limitation. The school was far away from my place of work, and I could only access these learners after school.

Lastly, there might have been limitations in terms of human, financial, material and physical resources.

1.7 Definitions of key terms

Western Modern Science: "an intellectual activity whose truth –finding goal is not, in principle affected by national, class, racial or other differences" (Mathews, 1994, p.182)

Indigenous science: "relates to both the science knowledge of long –resident, usually oral culture peoples, as well as the science knowledge of all peoples who as participants in culture are affected by the worldview of relativist interests of the home communities." (Snively & Corsiglia, 2001, p6)

African Traditional Worldview: *for the purposes of this study* African Traditional Worldview *will have the same meaning as African worldview or Traditional worldview:* " Reality is seen and judged especially from is dynamic aspects closely related to life. The farther a being is from these elements, the more unreal and valueless it is conceived to be." (www,ancestor veneration.GHCC.htm)

1.8 Significances of the study

Despite the number of limitations identified above, this study has some major significances. First of all, it revealed the *struggle* (emphasis in italics) African learners go through in their attempt to first understand the language of instruction "English", and then a "foreign cultural conception of lightning" different from theirs.

Secondly, it will elicit, develop and use the previously rejected African conceptions of lightning by the schooling system. As much as there is a need for the documentation and development of Africans' cultural conceptions and beliefs, there is also a need to find their usage in the development of new technologies and appliances.

Thirdly, in terms of the school, it will help educators understand African learners' struggle. Also, it will provide them with some tools to help them accommodate both conceptions of lightning. The study will assist in the development of scientific concepts without ignoring the spontaneous concepts. The teaching of science should not ignore the social and contextual implications of what learners have already accepted as science.

Finally, it is also significant that learners were allowed to express themselves in their mother tongue during data collection. Learners were able to give me their beliefs and thoughts without worrying about the language as they were using their mother tongue or any language they were comfortable with.

However before the actual fieldwork, I reviewed some literature to check whether these questions were researched before. The following chapter provides an account of what I found.