

CHAPTER 3

RESEARCH DESIGN

3.1. Introduction

In this chapter I describe the research design I used in this study. I describe how I chose the participants; developed, administered and evaluated the instruments I used; and collected data and analysed it. I conclude by assessing the design itself and recommending future corrections if this study is to be replicated somewhere.

3.2. Design

I used a case study research design, whereby a case was a grade 8 class of about 40 learners. 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 qualifies as a case study because I looked at a real situation where learners had different conceptions of lighting. I interviewed learners who were exposed to this situation and because the research was carried out at a school I was comfortable as this is a familiar environment, I had an idea of the environment and the influences the learners are subjected to. All the above statements qualify this study as a case study because Opie (2004) states that “ the focus of a case study is on a real situation, with real people in an environment often familiar to the researcher.”

3.3. Participants

My participants were 33 (i.e. 15 boys and 18 girls) grade 8 learners of average age of 16 years from around suburbs and townships of Brakpan, Benoni, Springs and Nigel. (See Table 1 for demographics)

Table 1 Participants Demographics

Ethnicity	Boys	Girls
Basotho	5	6
Amazulu	2	3
Amaxhosa	2	4
Amandebele	5	5
Xitsonga	1	—

3.4. Method and Instruments

I used three different instruments to collect data. First of all, I used a documents review guide to review and analyze the following documents:

1. Learners' writing
2. Learners' test and exam papers
3. Any learners, writing about lightning.

I then used the information I acquired from the above documents to develop a questionnaire (see Appendix B). 33 learners completed the questionnaire in an hour's time on the 10th of November 2005 at about 12h00.

A questionnaire was administered to elicit a range of learner's cultural conceptions. To achieve this care was taken to adhere to Floyed Fowlers points as cited by Frank and Wallen (1990):

- Is this a question that can be asked exactly the way it is written?
- Is this the question that will mean the same thing to every one?
- Is this the question that people can answer?

The survey questions in the questionnaire were designed in a manner that made it easier for learners to supply the researcher with privileged information about their lifestyle and beliefs.

When a questionnaire is compared with other research procedures, it was found that “there is no other more reliable and valid method which could be used” (Opie, 2004. p. 95). The use of a questionnaire was not problem free as there was a lot of work that went into its design. According to (Opie, 2004) there are five main issues in the questionnaire design:

- Layout
- Question ordering
- Sampling
- Pilot study
- Distribution and return

After analysis of the data from the questionnaires, I purposefully selected 16 learners for one-to-one face-to-face interviews (see Appendix C for the interview guide).

The interviews were used to respond to the reason ‘why’ the learners responded the way they did in the initial instrument. According to Opie (2004) open-ended questions can be set to try to achieve such exploration but fail to do so. In my own context I will be dealing with learners that are second language speakers and who may not be comfortable expressing their views, thoughts or feelings on paper. It is for this reason that I believe we needed to include interviews in this study because “interviews encourage respondents to develop their own ideas, feelings, insights, expectations or attitudes and in so doing

allowing the respondents to say what they think and to do so with great spontaneity and richness” (Oppenheimer, 1992. p. 81).

3.5. Data Collection

I started collecting data from the 15th of August 2005. From the 15th of August I collected 50 learners’ assignments and test papers. It took me 11 days to review and analyze them. I administered the questionnaire on the 10th November 2005 this is the time when electrostatics, which is where lightning is covered, is taught. It took an average of 60 minutes to complete the questionnaire in the presence of their educator.

33 learners completed the questionnaire in an hour’s time on the 10th of November 2005 at about 12h00. After analysis of the data from the questionnaires, I purposefully selected 16 learners for one-to-one face-to-face interviews (see Appendix C for the interview guide). These are the learners who displayed strong views on a particular lightning conception. I also used “ethnicity” as criteria to diversify the purposeful sample. All the interviews were conducted in learners’ mother tongue, tape-recorded, transcribed and translated into English.

3.6. Data analysis

Data from the questionnaire and interviews is both quantitative and qualitative. In analysing this data I used an induction method. I read the notes, transcripts and data several times to create themes or categories for common responses. (See Tables 2-6 for the analysis of data from the questionnaire and interviews)

3.6.1 Analysis of Data from Questionnaire

Table 2: Responses to question A of the questionnaire

Question A	Major Themes	Categories	Questionnaire	Interview
According to your parents/elders/community people/etc what is lightning and how it is formed?	Religious conceptions	God	11	7
	African conceptions	Witchdoctors	11	7
		Flying broom	1	-
		Snake	-	1
		Ancestors	4	4
		Rain queen	4	1
		African kings	1	2
		Bad spirits		
	Conventional			4
	Other	Gunshot	-	1
		Heat	-	1

Table 3: Responses to question B of the questionnaire

Question		Questionnaire	Interview	Average %
<i>According to your teachers/educator what is lightning and how it is formed?</i>	Correct*	15	9	51
	Incorrect*	13	5	45
	No idea*	5	2	4

* The words correct/incorrect and no idea are referenced in relation to the scientific worldview.

Table 4: Responses to question C of the questionnaire

Question C		Questionnaire	Interview	Percentage (%)
<i>Is the definition of lightning from your parents/community different with the one from your teacher? How do the two differ?</i>	Different	24	13	77
	Not different	6	1	12
	Don't know	3	2	11

Table 5: Responses to question D of the questionnaire

Question D		Questionnaire	Interview	Percentage (%)
Does the definition of lightning from your teacher disturb you from understanding the definition from your parents? How does it do that?	<i>Yes</i>	20	11	69
	<i>No</i>	10	3	19
	<i>Not sure</i>	3	2	12

Table 6: Responses to question E of the questionnaire

Question E		Questionnaire	Interview	Percentage (%)
Does the definition of lightning from your parents/community disturb you from understanding the definition from the teacher? How does it do that?	<i>Yes</i>	18	11	62
	<i>No</i>	13	3	29
	<i>Not sure</i>	2	2	9

3.6.2 Analysis of Data from Interview

For the interviews I analysed some learners' transcripts. (See illustrations of learners 4, 9, 11, 12, 13, and 14 below).

3.6.2.1. Learner 4

This learner had a unique conception of lightning. He stated both on the questionnaire and the interview that he sees lightning as a bird that is being sent to bewitch someone.

(See the discussion below)

A: Um Sir, they say it has something to do with the sangomas, the sangomas maybe like they want to kill someone sir ; they send lightning in a form of a bird, if it does not strike or misses you it will leave eggs under the ground. So Sir when it comes t that back again it will strike again in order for it not to come back you must dig up the eggs and throw them awayand they say.....”

The learner has strong African conceptions and states that he does not believe in the conventional definition of lightning. The evidence here is when the researcher asked about the conventional definition he continued to indicate that he has more explanations of the African conception. In the discussion below you will realize that he has different ways of explaining his African conception and he talks about it with passion and confidence. When he talks about the conventional definition he refers to it as a European something.

“Q: So do you find this definition of lightning from school and the one from your community different?”

A: Yeah. The people from the community tells you about something from what happened like in the Africans. It's tradition Sir: like from ancestors Sir: the Ndebeles sir when they come from the mountains (initiation school) their chief strikes the cane on the ground and lightning strikes to show that that they are back. And the teachers tell us about European something..."

This learner claims he understands both the conventional definition and the African conception, but he further claims that the fact that he knows both does not prohibit him from learning the concept. The learner also states that he does not believe in the conventional definition, but he believes in the African conception as explained by his community and parents. The learner has strong views and is very confident and outspoken in nature, he does not hesitate to mention that he uses the conventional definition of lightning because that is what the teacher would like to hear, but he does not believe it. The statement below gives evidence to this.

"Q: So then at school..... Then you've got this definition from the community and from school, which one should you say it's European and which one it's African and how do cope with that when you are at school?"

A: Sir I understand both of them.

Q: So do you think both of them exist, they exist side by side or do you think one of them does not really exist?"

A: Umm.... I believe the one of the African. It is better.

Q: You don't believe the other one..."

A: yes the European one?"

Q: Emm....when you write examinations and everything, when you are taught at school, then how do you cope?"

A: Sir I just.... they give us notes and study through them.

Q: So in exams which one do you write then, when you are asked at school to write?

A: The European one Sir, the one that says about clouds.

Q: Why not the African one?

A: Because they'll mark me wrong, maybe they don't know that one."

Like all other participants this learner had views on how teachers should teach him. He is convinced that his teacher does not know enough about this concept and that the teacher is biased. He believes the teacher and the people who write textbooks must research more on the African conception and then combine the European definition and the African conception. This participant believes that textbooks authors are biased towards the African conception as a form of science. He believes it would be better if they could mention both forms in their writings.

"A : she doesn't want to talk about African, whenever I talk about African she suppresses me and when ever I ask questions sometimes she doesn't answer them. I think people who write textbooks must research. A: They should teach us both African and European so that we can understand meanings not to know about the European one only. For us we want to know what the elder people say.

Q: So but how should teachers do, do you have suggestion of how should teachers do it?

A: They should teach us the African so that we know what happened, how it happens you know....

Q. which one does your teacher teach or believe

Q: So do you think the textbook don't have the African?

A: No, they don't. it's only the European one 'cause it talks about the negative and positive charges they don't mention the African way like we know it sir.

Q: So do you think maybe you could do better in science if you have your teachers teaching you both ways?

A: yes! sir."

3.6.2.2. Learner 9

This learner has strong African conception and she stays with her grandmother who grew up in rural areas and still practices most of the African cultural beliefs.

"A: Basically according to my grandmother she tells me that lightning is formed ka li sangomas haba loantshana or something (through sangomas fighting against each other or something) and sometimes she says if sangomas ba e rometse go wena (a sangoma is snet to bewitch you) or something you should have eggs and candles in your house so that e se kene ka mo gare and strikes (it does not get into the house and strike you). So this eggs and candles are something to prevent lightning from striking."

She has strong African views on lightning and believes there is no truth in the definition taught at school. She believes that the African conception is real and that the conventional definition should be used at school. She states that by learning the conventional definition and getting good marks in tests, she is put in a situation where she has to compromise her believes just to belong with the others in class.

“A: No it doesn’t disturb me. It’s just that I do understand both of them, but then I believe most in the one from my grandmother.

Q: Then how do you deal with both, now when you are in a classroom situation, maybe you are writing exams, how do you deal with both? Which one do you use?

A: I use the one from school ‘cause they teach about it, so I can’t say the sangoma’s stuff when the teacher asks how lightning is formed.

Q: Why not?

A: Because they didn’t teach me in that way, they taught me in another way and I have to use the one I’m taught.

Q: She is gonna say this is wrong but what are you saying?

A: I’m saying that I do compromise, sir.”

The above statements reveal the frustration of this learner because she has to deal with a school system that does not allow her to express her prior knowledge so that it could be addressed. She shows her frustration by using words like “compromise”. This means that to her, learning the conventional definition is a compromise because no effort is being made by the teacher to amalgamate her prior knowledge with the content in class.

Having strong African conceptions is not helping this learner to understand the conventional definition. This is evident because she states that her performance in assessment tasks at school is not excellent because she does not believe in the conventional definition, she further believes that the conventional definition is imposed on her at the expense of African science:

“A: In a way yes because you can’t umm... write something that don’t believe and you won’t basically understand. For instance that I believe in this then I’m doing this ‘cause we want this.

Q: So you’re saying once you don’t believe in something you won’t perform the best and how would it affect you at school, would it affect other people also knowing that they understand this but they have to write the different one?

A: It does affect because like umm... I would compromise but then if I were to be taught in that way obviously maybe I would perform better than I do now.

Q: Better in terms of?

A: Like marks and stuff like results.”

In an attempt to answer the third research question learner no 9 was asked the following question:

“Q: Right. Let me say you are a teacher, I give a class to teach and in your class there are people who believe what your grandmother taught you and there are those who believe in the school one and you want to teach them so that in the end they understand the two, how will you teach them?

A: I would first ask them which one do they believe in, the Western or the African one then if half of the class understand this one and the other half understand the other then I will try to find the easiest way to teach both of them so that they can understand.

Q: Here you say “ I think both should be used in books so that we know about African science and the Western culture.” What did you mean?

A: I meant like Sir... the one that my grandmother taught me, we should also learn about it and the stuff inside books so that we know that sangomasare they for real or

what then le di friction tse(friction and stuff), how do they connect to one another.”

Again this learner believes learners are supposed to be recognized as people who come to class with some form knowledge. This learner basically explains that she will use a ‘constructivist approach’. That is it will be an approach that recognizes that the prior knowledge that the learner brings into class must be used in conjunction with new content. This participant has realized that most of the textbooks used at the school only mention the European definition of lightning; she therefore suggests that an effort should be made by teachers and scientists to recognize what her grandmother taught her.

3.6.2.3. Learner 11

Learner no 11 has strong African conception: he believes that lightning is divided into categories. He is quite a strong in character and does not hesitate to speak his mind. He gets good marks in science but he is quick to state that he does not believe the conventional definition is fact. He says it is unreal.

“A: To me lightning is eish.... there are two types of lightning. The first one is from God, the natural one which only strikes to trees and everything but the other one is from people it kills....it hits people with something like personal stuff and yeah....

“Q: What would be those personal issues if I were to ask you?

A: Emm...maybe somebody wronged that person and then the person goes to where people get muti, where they use it to do the lightning and whatever, that’s what I believe.”

This learner does not believe in the conventional definition of lightning and has strong views on this matter.

“Q: Right then at school what do your teachers say lightning is?”

A: At school they talk about negative and positive charges and clouds, which rub against each other, which to me sounds artificial. It’s not real.

Q: So, I’m looking at, you know.... you told me about the one from community and the one from school, are they different and if they are what’s their difference?

A: The different is the one from the community sounds real and the one from the school is not real to me. I only use the one from school at school and the one from the community in the community.

Q: Yeah I know I’ve got to come to that question that when you have to learn science at school, how does that impact on you, the fact that you’ve got two definitions and you feel the one from school is not real and the one from the community is real, which one do you use at school then?

A: The one I use at school is the one I learnt at school.

Q: Even though you do not believe it?

A: Yes.

Q: Why do you use it?

A: To get the marks.”

This particular learner has problems believing in the existence of conventional science, but still cannot comprehend the idea of African science written on textbooks. He holds a conception that he believes belongs to the community in which he comes from and he admits that he is used to reading about conventional science on textbooks.

I believe the problem here is the manner in which science has been taught to this participant has made him to stop believing in science as a real phenomenon that exists even in African communities. This particular participant every thing that happens around him cannot be classified as science, and furthermore believes that science in his context cannot be explained in terms of conventional definitions and concepts.

“A: I think I would just ask them what they believe and yeah teach them in what they believe ‘cause it can be sometimes confusing learning about two different things.

Q: But do you think they are two different things?

A: Yeah I think so because scientists believe that man were not created by God and people believe that a man was created by God and again scientists believe that a man it was some generation from baboons, men were made and so we can believe that there is science and things in the community.

Q: So there will always be different?

A: Yeah and they will never say men....umm.....when you speak you will never say you came from baboons, you know that you were made by God.”

3.6.2.4. Learner 12

This learner has a view that lightning will strike when a person that has super powers as a result witchcraft dies.

“Q :I am going to ask questions based on your responses on the survey. You wrote here that lightning is something that you heard from the elders and what is it that you heard?”

A: I heard that when lightning strikes is like someone is dying o thwele (reinforced in muti) or they are bewitching someone.

Q: So when someone like that dies lightning strikes?

A: Yeah sir.”

This learner has strong views about the African conception of lightning, and according to him this view is based on a personal experience. According to him lightning that was created by witchdoctors killed a close family member. This learner has a dilemma because he strongly believes the lightning conception according to his parents and has a difficult time accepting that lightning can be caused by anything accept what his parents told him.

“Q: So which one do you really believe from what you’ve told me?”

A: I believe the one from my parents, because my brother died from manmade lightning, he was bewitched..

Q: Don’t you find that disturbing because in a test you have to write what you don’t believe in?”

A: No sir because when I write a test, I write what I have been taught at school. Even if I don't believe but I will write what I have been taught by my teacher.

Q: Do you think it's a good idea to write what you don't believe?

A: No sir because you are writing something you don't believe."

Clearly here the learner admits that his African conception of lightning prevents him from learning the conventional concept. The participant further states that it is confusing to learn be told one thing at home and then come to school to find another conception.

3.6.2.5. Learner 13

This learner has an African conception, but she mentions this in passing.

"A: The difference is that my parents and community tell us that it is caused by God and is bewitched and then the school tell us about the friction of clouds."

This participant is quick to mention that is very confusing to come to school and be told about chares in the clouds and the stay in the community that tells you about religious beliefs and witchcraft.

"Q: So then if you are in a school situation and learning about light and static electricity do you feel disturbed that you get different definitions?

A: Yes. Because it is confusing and you don't know which one to believe.

Q: So which one do you actually believe in given the definitions?

A: The one from the community.”

Considering the above information, this participant is in a difficult situation of having to transit from one school of thought to another.

3.6.2.6. Learner 14.

This learner comes from a background of the Ndebele nation and lives in the same community and has an African conception of lightning.

“A: According to my parents and community lightning is caused by when ancestors are fighting.

Q: I see here you said when ancestors are angry.....

A: Yes because they are fighting sir.”

When asked about the implications of being in a situation where a person has two conceptions. The learner stated that it is confusing because he does not know which one to believe and which one to discard. He is quick to mention that he because there are more explanations for the same concept then the scientists must research further.

3.7 Conclusion

In retrospect I can claim that my design worked to a large extent. I managed to get the data I wanted (i.e. valid data) in an unbiased way (objective). However, I am not sure if I go back I will get the same responses (reliability). Thus I suggest that in future, anyone who wants to do this kind of work should collect data from more than one school and use more learners (I used only 33 learners). In the next and final chapter I report my findings.