An investigation into how participation in science expo projects influences grade 9 learners' dispositions towards science learning: A case study

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By

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DECLARATION OF ORIGINALITY

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and has not previously in its entirety or in part been submitted at any university for a degree.

Signature: B. Musekiwa Date: 21 March 2016

ABSTRACT

There has been increasing participation of learners from disadvantaged backgrounds in competitive events like the Eskom Science Expo over the past few years. It is against this backdrop that this study sought to find out how some grade 9 learners' participation in science expo projects influences their disposition towards science. In the context of this study, disposition refers to how learners view themselves in relation to science learning as a result of participating in science expos.

The study is underpinned by an interpretative paradigm and I made use of a qualitative case study. My research participants were five grade 9 learners from two secondary schools in Grahamstown in the Eastern Cape Province of South Africa. I used observations, semi-structured interviews and learners' journals for my data collection. To analyse the data I used the inductive approach where I made use of themes emerging from the data. The social learning theory described by Vygotsky (1978) is the guiding theory in the research with a focus on mediation of learning and the zone of proximal development (ZPD).

The main findings from my study were that indeed participation in science expos does influence the disposition of learners towards science among the grade 9 learners. I also found an improved understanding of scientific concepts as the learners interacted with science in everyday and familiar contexts. Lastly, doing projects that are close to learners' interests resulted in them enjoying doing science more.

The learners' science expo projects contribution to the Grahamstown community is of no small value, as has already been seen by the achievement of previous participants. The current group is already showing their impact and influence of the science–expo project involvement in terms of their performance in their classrooms and in their awareness of their role as young 'scientists'.

I therefore recommend that more learners be encouraged to take part in such projects as the science-expo projects not only improve learners' understanding of the subject matter but also encourages a positive shift in their attitude towards science learning. It also enhances their understanding by allowing the young learners to interact with their environment to find solutions to problems that the community might be faced with, for example, water shortages

and sustainable development initiations like gardening and the proper use of naturally acquired water resources.

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DEDICATION

This work is dedicated to the heroes of my life the late Ndhleleni Spiwe Msipha my mother and the late Martin Chipo Vembo for being the parents who never thought anything was too good for me and thus exposed me to the best that life can give. Today I'm proud to be called an academic because you instilled the value of education when I was but a small girl. Some girls of my age were never afforded an opportunity to get education but you made sure I was not one of them.

I also dedicate this to all the educators in Africa the future of our learners is in our hands. Step-by-step, little-by-little, learner-by-learner, let us proudly afford these little ones an opportunity to explore this world and be the best they can be.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASEPs: Afterschool Science Enrichment Programmes

CAPS: Curriculum and Policy Statements

DBE: Department of Basic Education

L1: Learner 1

L2: Learner 2

L3: Learner 3

L4: Learner 4

L5: Learner 5

LCE: Learner centred education

PSL1: Pilot study learner 1

PSL2: Pilot study learner 2

PSL3: Pilot study learner 3

TIMSS: Trends in International Mathematics and Science Study

SAEON: South African Environmental Observation Network

ZPD: Zone of Proximal Development

CHAPTER 1: POSITIONING THE STUDY

> *Projects are designed to extend student learning experiences beyond the classroom by posing driving questions that situate the science with issues that are likely to be of interest to scientists, community based organisations and families (Singer, Marx, Krajcik & Chambers, 2000, p . 168).*

1.1 Introduction

This research study is a qualitative case study which aimed at investigating how the dispositions of five grade 9 learners towards science learning were influenced by their participation in the ESKOM Science Expo. The first chapter outlines the background and context in which the study is situated. This is followed by the statement of the problem which motivated me to carry out this study. The problem statement, rationale for the study, explanation of the key concepts and a brief description of the theoretical framework follow. A sketch of the key concepts in the theoretical framework is provided but is explained in greater depth in Chapters 3 and 4. Lastly, I provide an outline of the whole thesis.

1.2 Background/Context of the study

The Trends in International Mathematics and Science Study (TIMSS) is a body that publishes reports on performance in Science and Mathematics by learners in different parts of the world (Reddy, 2006; 2015). The reports reveal over several years that the performance among learners in these two subjects is generally poor internationally. Caygill, Kirkham and Marshall (2013) noted that for countries such as New Zealand and Singapore the results showed that there was a decline in performance in science among the primary school learners in recent years. South Africa has fared poorly in the TIMSS reports and this is the reason why Reddy (2006; 2015) concluded that there is no doubt that there is a need to be concerned about the dire performance in mathematics and science in South Africa. These reports are relevant to my study because my research is based on participation in the ESKOM Expo which involves carrying out scientific projects using scientific knowledge. It is however important to note the view that, "Each international achievement study has its own historical roots, its own framework for assessment and its own sponsors" as cautioned by Reddy (2006, p. 65). Thus, the results from South Africa may not be necessarily be an accurate reflection of the

performance of all learners across the country. What follows is a description of the performance in science in the South African context.

1.2.2 South African context

The education system in South Africa has experienced ongoing transformation since the country became a democratic state in 1994. Several education policies have been created in response to the expectations and needs of the country (South Africa. Department of Basic Education [DBE], 2011). One of the key areas of concern is Science and Mathematics education which is important for the development of the skills required to grow the country industrially (ibid). Currently, the Curriculum and Assessment Policy Statement (CAPS) is a document that guides the procedure and implementation of the government education policy. The document has a clause which indicates that learners should be able to use science and technology effectively and critically showing responsibility towards the environment and the health of others (DBE), 2011). Furthermore, the Natural Sciences Curriculum promotes scientific investigations as a way of addressing the much needed skills shortage in the country (ibid). CAPS also encourages a learner centred approach to learning where learners are placed at the centre of learning as opposed to the traditional approach to learning which is teacher centred. Making the learners a central focus ensures they get maximum benefit from the learning process.

In the South African schooling system, the subject Natural Sciences is compulsory from grade 7 to grade 9. The subject aims to ensure that learners acquire and apply scientific knowledge and skills in ways that are meaningful to their own lives. The curriculum further stipulates that in grade 9 each learner must submit a science project for assessment (DBE, 2011). It could be argued that the preparation for projects for the science expo is an extended opportunity for scientific investigations to take place in schools. If the learners do their projects thoroughly they can then present them at the ESKOM Expo. The South African Department of Basic Education (DBE) teamed up with ESKOM, the electricity power supplier of South Africa, to fund and promote the investigative minds of young learners through the Eskom Science Expo. This was done in order to promote an interest and aptitude in science thinking amongst learners. In preparing the projects to showcase at the expo, the idea is that learners will develop various scientific skills like the ability to do research, observation and inference (Eskom, 2012). Alant (2010) shows the importance of the participation in the expo by stating that it is a means of

opening up learners' horizons of science and technology. In the next sub-heading I describe the situation in Grahamstown where my study is situated.

1.2.3 Grahamstown context

Grahamstown is one of the cities where the ESKOM Expo was launched and it has been ongoing since 1980 (Alant, 2010; Kahenge, 2013). The city is located in the Eastern Cape Province of South Africa and has many learners who come from both rural and urban communities. There are about thirty primary and secondary schools in Grahamstown and the learners range from middle class urban settings to rural backgrounds from formerly disadvantaged communities.

The performance of the learners in science related subjects in Grahamstown has been generally poor with only a few progressing to pursue science related courses and careers. Since the inception of the ESKOM Science Expo in Grahamstown, the participation of learners in science expo has risen quite significantly despite the differences in learners' backgrounds (Kahenge, 2013). Every year there are a considerable number of learners who take part in the ESKOM Expo. Kahenge's (2013) study focused on learners' and teachers' experiences with Science expos. My study builds on Kahenge's study by analysing how the participation of learners enhances their disposition towards science learning. Both my study and Kahenge's were situated in Grahamstown involving learners from the same type of schools. The learners were assisted in doing their projects by their schools and also by external stakeholders.

My research participants are drawn from schools in Grahamstown and they represent a part of the Grahamstown community at large which was previously disadvantaged. To provide support for learners undertaking science projects towards the expo, the Rhodes University Education Department in collaboration with the South African Environmental Observation Network (SAEON) initiated a community engagement project in 2012. The aim was to encourage participation in science related activities by young learners, in particular learners from historically disadvantaged background from Grahamstown East. Through the assistance of Rhodes University and SAEON the learners prepare for the ESKOM Expo.

1.3 Problem statement

Scientific investigations are an integral part of CAPS but the opportunity for learners to effectively engage with scientific skills is scarce and inadequate. This results in learners not being inclined or lacking the necessary motivation to learn science at school. The direct result is a lack of skilled people that are required to fulfil the demands of South Africa realising its potential as one of the most industrialised countries in Africa. To this end, Alant (2010) observed that despite the government's efforts to improve science and mathematics education in South Africa, little has been achieved.

For instance, the curriculum which includes science is prescribed by the Department of Education and is supposed to be implemented in all schools in the country. The situation on the ground, however, shows that this is only possible in theory and not in practice. The constraints in the education system that were inherited from the apartheid regime still operate in most under-resourced schools in particular. Science education in most of these schools is done through formal classroom learning without an opportunity to undertake scientific investigations as offered by ESKOM Expo. The problems of a high teacher-learner ratio in the classroom, a lack of a well-stocked library or laboratory in the schools makes it even more challenging to meet the desires of the intended outcomes of the curriculum.

The ESKOM Expo is a worthy initiative which is supposed to complement the work that is done by the schools in fulfilling the requirements of the curriculum. My study thus examined how participation by learners in the expo influences their dispositions towards science learning. By participation in the expo I refer to the preparation for the expo and also what happens on the actual day of the ESKOM Expo exhibition.

1.4 Rationale for the study

By analysing how participation in the ESKOM Expo affects the participating learners, I hope to improve their practice and ensure that learners have an opportunity to carry out scientific investigations in after-school science enrichment programmes. This in turn could result in creating a positive attitude towards science learning. Osborne, Simon and Collins (2003) talk of the need to educate as many young learners as possible to counter the decline in interest in science. Although Osborne et al.'s study was conducted in the United Kingdom, the same could be said for the South African context.

Furthermore, this study could be useful in finding ways of developing positive learning dispositions towards science among learners. Additionally, the study could be useful in informing science teachers and curriculum designers on how they can effectively incorporate more scientific investigations in the curriculum.

1.5 Theoretical framework

A theoretical framework is the guiding structure on which a research study is based (Gay, Mills & Airasian, 2006) and for my study social constructivism proved to be the most appropriate framework.

Social constructivism

The theoretical framework used for the study is social constructivism whose main proponent was Lev Vygotsky (1978). Vygotsky posits that learners construct knowledge on their own as they interact with a learning environment (Kim, 2001). Within social constructivism, I focused on the following concepts, namely, the mediation of learning, the Zone of Proximal Development (ZPD), self-regulation and a learner centred approach which I briefly discuss below.

Zone of proximal development

Mediation of learning within the ZPD occurs through various channels. In the context of my study, learners worked with limited supervision from their science teachers and other facilitators who could offer assistance where required. According to the theory, learning takes place when learners communicate with each other as peers in a language that they are comfortable with. The learners also worked on their projects to be presented at the ESKOM Expo with the help of family members who, although they may not necessarily possess classroom scientific knowledge, but rich everyday science knowledge which can be incorporated into their broad knowledge of science. The theory behind the ZPD is that learners learn with the help of significant or more knowledgeable others, so within the ZPD learning is done through peer-to-peer interaction and dialogue as a way of mediating learning.Vygotsky (1978) argues that the mediation of someone more knowledgeable is vital in learning and is

one of the main components of social constructivism which forms the framework for the research.

Self-regulation

Self- regulation is another aspect of social constructivism whose main proponent was also Lev Vygotsky. Vygotsky (1978) says that self–regulation is achieved through social interaction and involves children using their inner potential to imitate adult behaviour (Harrison & Muthivhi, 2013). Self–regulation is the ability of learners to be adaptable, Diaz, Neal and Amaya-Williams (1990) describe it as self-regulation is the capacity to guide behaviour and the capacity to meet the demands and different tasks or situations (p. 128). In my study the learners worked with scientific projects where they were required to work on effectively and complete within a given time-frame. Most of the time the learners worked independently which required a high level of self-regulation.

Learner centred approach

The learner centred approach is a method of learning that also finds expression in social constructivism. It is an approach that emphasizes the centrality of the learner in any learning situation. In the learner centred approach, learning relies on the learner making links between existing knowledge and the content of instruction (O'Sullivan, 2004). This is also supported by the notion in social constructivism that learning only takes place when a learner constructs new knowledge to add on to their existing knowledge. It is a break away from the traditional method of teaching where learners were seen as mere recipients of knowledge from the teacher whose role was to impart this knowledge.

1.6 Research goal and questions

The main goal of this study was to find out how participation in science-expo projects influenced learners' dispositions towards science learning. I therefore tracked the learners' involvement starting from the process of preparation for the expos until they entered for the ESKOM Science Expo competitions.

To achieve this goal, the following main question was asked:

Main question:

How does participation in science expos influence grade 9 learners' dispositions towards science learning?

To help answer the main question the following sub-questions were asked.

Sub-questions:

1. What motivates learners to take part in the Eskom Expo?

   To answer this question I used interviews and learners' journals.

2. What activities manifest in the development of scientific skills as the learners prepare for Science Expo?

   To answer this question, I conducted observations and analysed learners' journals.

3. What were the learners' attitudes towards science before and after the expo?

   To answer this question I used observations, interviews and analysed learners' journals.

4. What causes the shifts/changes in the dispositions towards science learning?

   To answer this question I used interviews and observations.

5. What are the dispositions to learning science after the expo?

   To answer this question I conducted semi-structured interviews.

1.7 Data gathering techniques

The data gathering techniques of my study comprised:

- Semi-structured-interviews;
- Observations; and
- Learners' journals.

These methods were used because they are most suitable for my study which is a case study and hence qualitative in nature.

1.8 Key concepts

There are several key concepts that are part of this study and I outline them in the following paragraphs.

1.8.1 Learning dispositions

There is no clear agreement about what learning dispositions might be (Carr & Claxton, 2002), however literature shows that there are various attributes of dispositions towards learning (ibid). For my study I chose to look at disposition in terms of the attitudes, motivation and resilience as the attributes of dispositions. I selected these attributes because they best reveal the link with how learning science is influenced by participation in expos.

1.8.2 After-School Science Enrichment Programmes

Learners prepare their projects for the ESKOM Expo by working in environments in the form of after-school science enrichment programmes (ASEPs) where they interact with peers and facilitators from SAEON and some lecturers from the Education Department at Rhodes University. Singer, Marx, Krajcik and Chambers (2000) highlighted in the epigraph that, "projects are designed to extend student learning experiences beyond the classroom by posing driving questions that situate the science with issues that are likely to be of interest to scientists, community based organisations and families (p.168).In the ASEPs the learners work on issues related to their projects. Most of the work is done by readjusting and making various changes to the projects as learners strive to produce their best. Herein lies the importance of self-regulation as espoused by Vygotsky (1978). Various skills such as research, writing and presentation are firstly developed in the learners so that they can use them throughout their journey until the day they present their findings. Learners are also coached and supported on how to choose appropriate topics for their projects in the after-school enrichment projects.

1.8.3 Expos and dispositions

My research sought to get clarity on whether participation in science expos influences learners' dispositions towards science learning. What is important to note is that I focused not only on the expo but on the events leading up to the expo. This began with the way learners were

selected and how they were guided in choosing their topics for their projects. This was followed by the whole process of meeting, working on projects and then the process recycled again and again until the final day of the expo. This process contributed to what I consider to be the important factors that influence learners' dispositions. These factors are discussed in detail in Chapter 2 and are recorded through the use of different methods of data collection explained in Chapter 3 of this write up.

1.9 Thesis outline

This thesis consists of six chapters. The outline of each chapter is as follows:

Chapter 1- This chapter laid the foundation for my study by describing the context in which my study is situated geographically and positioning it internationally. I also briefly touched on the problems associated with science learning internationally and locally. The importance of my study was justified and I provided a clear idea of how the main concepts in my study will work to bring about the ideas I want to share. The problem statement and rationale for the study were highlighted as well as the key concepts and methodology used in the study.

Chapter 2- Chapter 2 outlines the literature I consulted for the study and the theoretical framework used for the study is explained in detail. The literature is on learning dispositions and their attributes. The importance of the hybrid space in which learners work on their projects is also highlighted including the relevant literature.

Chapter 3-The explanation of the research paradigm, the nature of the study and the data collection techniques used in the study are to be found in this chapter. The main methods of data collection used which are semi-structured interviews with an analysis of the learners' journals and workshop observations are explained. I also describe the ethical issues that arose in carrying out the study and how I ensured validity and trustworthiness of the data.

Chapter 4- Data presentation and analysis is presented in this chapter, where information is displayed through the most suitable tools and analysed in line with the literature review.

Chapter 5- In Chapter 5 the data is interpreted and discussed in detail. Themes emerging from the data are coded to make sense of the data. The use of analytical statements made it easy to critically interpret and discuss the data in light of the research questions.

Chapter 6- Findings from the study and recommendations are recorded in the fifth and last chapter. Limitations of the study will also be outlined for consideration by whoever might want to engage in a similar study.

1.10 Concluding remarks

In this chapter I provided an outline of the background and context of my study. This is necessary for the accurate understanding of the research and its uniqueness. In the next chapter I outline the literature dealing with the main concepts of the research and also expand on the theoretical framework on which the research is based.

CHAPTER 2: LITERATURE REVIEW

> *Disposition is the ability to retain one's own beliefs and values while at the same time critically examining them in light of another's understanding. Lessons that involve the student in decision-making processes may help the student develop this disposition (Borda, 2007, p.1037).*

2.1 Introduction

The main goal of this study was to investigate how participation in science expos grade 9 learners' dispositions towards science learning. In this chapter I review the literature relevant to my study. Essentially, this study is informed by three bodies of literature. The first is an exploration of the literature that concerns science expos or fairs and their impact on the disposition of learners towards learning of science, followed by an analysis of literature on learners' dispositions towards learning science as a result of participation in science expos. Discussion on attributes of dispositions (attitudes, motivation and resilience) used in the study is also be reviewed in this section.

The chapter ends by looking at the literature on the theoretical framework used in understanding the learning process of learners where I discuss various aspects of the social constructivist learning theory. The Zone of Proximal Development and its elements like dialogue, peer to peer interaction and self-regulation are also discussed in this chapter.

2.2 Scientific investigations and the curriculum

To address the issues highlighted in the problem statement it is important to examine the curriculum policy of South Africa to assess how it attempts to curb the problem. The Curriculum and Assessment Policy Statement (CAPS) of South Africa is the policy document that currently guides the South African education system. It aims at ensuring that learners acquire and apply knowledge and skills in ways that are meaningful to their own lives (DBE , 2011). The subject Natural Sciences is compulsory from grade 7 to grade 9 and scientific investigations are encouraged at these stages of learning.

The curriculum also aims at promoting active and critical learning rather than rote learning. The intention is that learners will leave the school system having mastered fundamental

principles of science which will enable them to participate usefully in the workplace. Science education would also produce learners who can take care of their environment and come up with problem solving ways to improve their communities. The policy also aims at producing citizens who are able to give back to their communities through knowledge and use of indigenous knowledge systems (DBE, 2011). This is relevant to my study as the participants in this study are learners who are unfamiliar with the context in which the study was done yet have decided to take part in the ESKOM Expo.

While the CAPS policy is sound it nevertheless has some problems associated with it. One of the problems has to do with its implementation. To this end, Ramnarain and De Beer (2013) talk about the tightly structured learning environment of the school which may not allow students to engage in open investigations. This makes it difficult to operationalise the policy. The curriculum is also prescriptive and demands that a large amount of work be covered for assessment purposes leaving no space for carrying out scientific investigations (ibid).

It is against this backdrop that Science expos are held in different parts of South Africa. They provide an opportunity for learners to carry out scientific investigations in line with the aforementioned policy statement. The term scientific investigation is used synonymously with scientific inquiry, which refers to the activities through which students develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world (Roth, 2011). Scientific investigations are considered to have "strong educational value by engaging a student deeply in both the content and process of science and by providing a practical perspective and cognitive connection to the theoretical materials presented in a classroom setting" (Jona & Adsit, 2008, p. 5). The role of scientific investigations is critical for achievement in science learning.

In order for learners to carry out scientific investigations as they work on their science projects for the ESKOM Expo they work in spaces outside of the usual classroom set up in the form of After-School Science Enrichment Programes (ASEPs).

2.3 After-School Science Enrichment Programmes

The learners in my study engage in ASEPs as they prepare projects to showcase at the ESKOM Expo. The ASEPs serve as a platform that learners use to prepare for the ESKOM Expo.

Meetings take place on some Saturdays and even Sundays where learners meet to discuss their projects and also to get assistance from other stakeholders involved in their programmes. The meetings take the form of after-school science enrichment programmes (ASEPs). After-school science enrichment programmes are defined as a unique out of school educational experience that engage and challenge students (Miller, 2010). These after-school science programmes are said to have many benefits for the learners.

In a report on some primary schools learners in the Grahamstown area, Kahenge (2013) concluded that ASEPs are done in several communities as a way of reinforcing learning. Johnson (2011) for instance points out that ASEPs can help show students how academics are relevant to their personal interests. In after-school enrichment programmes learners have an opportunity to link academic endeavours to their personal lives. This is made possible by the fact that they are not in a classroom setting. In preparation for the ESKOM Expo, learners work in familiar contexts and there is an opportunity to work in areas that are of interest to them. Miller (2010) supports the idea of the programmes by saying that the programmes provide various social and academic benefits for learners.

An important aspect of after-school enrichment projects is the learning environment of the programmes. Unlike in classroom settings there are more flexible learning styles such as peer-to-peer conversations and the freedom to communicate in the learners' first language. According to Kahenge (2013), few studies have been conducted on peer-to-peer conversations that take place when learners are on their own. Peers are defined as an individual of roughly equal status such as a neighbour, classmate, or sibling (Rogoff, 1998). The peer-to-peer conversations are an important aspect of social constructivism which is my theoretical lens (see Section 2.9) in this study whereby learners learn form more capable peers as they move within the ZPD.

Ramnarain and De Beer (2011) posit that engaging learners in scientific projects which is what happens in ASEPs results in more authentic learning. This is explained by what they perceive ASEPs achieve and is recorded as follows:

- Improved development and integration of concepts;
- Extended and authentic practical work;
- Access to rare material and to 'big' science;

- Attitudes to school science: stimulating further learning; and
- Social outcomes: collaborative work and responsibility for learning. (p.101)

The role played by ASEPs in the preparation for the ESKOM Expo is invaluable and is a major consideration to enable learners to participate in the expo effectively.

2.4 Learning dispositions

The term disposition itself has been defined differently by many scholars and there seems to be no agreement on what the term really means. Jung and Rhodes (2008) affirm this by concluding that dispositions are hard to define and measure after doing a study on disposition assessment in teacher education in the USA. They allege that dispositions are undeniably a murky concept. Some scholars have defined disposition as habits of the mind, learning repertoires, inclinations and many other definitions (Claxton & Carr, 2002). Katz (1993) defines dispositions as a tendency to exhibit frequently, conscious and voluntarily a pattern of behaviour that is directed to a broad goal.

In the epigraph Borda (2007) state that disposition is the ability to retain one's own beliefs and values while at the same time critically examining them in light of another's understanding. He went on to say that lessons that involve the student in decision-making processes may help the student develop this disposition (Borda, 2007). Blaicklock (2008) pointed out that any learning should be able to show a change in individual children's learning over time. Gresalfi (2009) concurred by saying that dispositions take shape dynamically over a period of time. The change is therefore not an overnight event but happens over a period of time.

Research on learning dispositions draw from social theorists such as Vygotsky (1978). Crick and Goldspink (2014) highlight the issue of learning power dimensions associated with learning dispositions. Long and Graven (2016) emphasize the importance of learning dispositions by saying that they are a central aspect of learning. The power dimensions are categorised into what is known as learning power scales comprising of: 1. Changing and learning; 2. Critical curiosity; 3. Meaning making; 4. Creativity; 5. Learning relationships; 6. Strategic awareness and 7. Resilience (Deakin Crick & Goldspink, 2014 p.4). Changing and learning is defined as a way a learner looks at him/herself as someone who learns and changes over time. The seven aspects relate to my study which is on three attributes of learning attitudes, motivation and resilience.

Making connections and realising that learning matters is defined as meaning making. The fourth scale which is creativity is defined as risk-taking, playfulness, imagination and intuition. Learning relationships also leads to development of learning dispositions as learners in this case learn with and from others. The ability to manage the learner's thoughts, feelings and actions and to manage the learning processes is referred to as strategic awareness. Lastly, on the learning power scales is resilience which implies perseverance in the face of challenges. Resilience has also been highlighted in Carr and Claxton (2004) who refer to it as the inclination to take on learning challenges where the outcome is certain. Critical curiosity refers to the desire to want to know more.

2.5 Attributes of dispositions

Attitude is one of the attributes that define dispositional characteristics as observed by Jung and Rhodes (2008). Motivation is another key attribute that I used to illuminate learning dispositions. Crick and Yu (2007) posit that disposition arises from the desire or motivation which provides energy for necessary action. Attallah, Bryant and Dada (2010) weigh in by saying that dispositions include motivational roles that emotions play.

Lastly, I considered resilience as another attribute of dispositions. Blaicklock (2008) asserts that an act of taking interest in, being involved and persisting with difficulty are elements that show resilience. The choice of attributes I made was therefore based on their perceived relationship with learners' dispositions as a result of participation in the ESKOM Expo. In my study, I looked at dispositions of learning being influenced by the learning that takes place when learners participate in the ESKOM Expo. The attributes of dispositions that I discuss in my study are interwoven and they play a complementary role. I now discuss these in detail below.

2.5.1 Learners' attitudes

Learners' attitudes are an important attribute of dispositions towards science learning. Osborne, et al. (2003) posits that attitudes towards science are "feelings, beliefs and values held about an object that may be the enterprise of science, school science, and the impact of science on society or scientists themselves". Simpson and Oliver (1990) define attitude as a person's positive or negative response to the enterprise of science or whether a person likes or dislikes science.

There are several factors that might cause learners to have either negative or positive attitudes towards science learning. It is important to note that measuring learners' attitude towards science is a complex process because there is no single explanation for what attitudes are (Osborne et al., 2003). Osborne et al. (2003) go further to explain that attitudes towards science learning can be related to gender. Temelli and Kurt (2013) claim that there are studies that showed that gender is the most important factor in determining students' attitudes towards science education. Chikunda (2010) alludes to the fact that many women are unfamiliar with science because the logic of science dominated and developed by men can never be totally compatible with women's standpoints.

Cherian and Shumba (2011) found that male learners had a more positive attitude towards science education than female learners. This was after a study conducted in Limpopo (South Africa) on sex differences and attitudes towards science. This concurs with the view that more studies have shown that the issue of gender has an impact on school subject preferences with science being resisted by the female gender (Mwetulundila, 2011). Studies in Botswana show that girls do not perform well in science because they fear science (Duncan, 1989). This is supported by Mwetulundila (2011) who comments that boys are more likely to have repaired bicycles or handled tools commonly found in science laboratories than are girls, boys have familiarity as a basis for science learning.

One of the chief influences of how well males and females regard science learning is their attitude towards science. In their study conducted in Kenya, and Chetcuti Kioko and (2012) found that the attitude towards science is a common problem in science education mainly for girls. They listed several factors that affect girls' attitude towards science (ibid).

- The relevance of science to daily life;
- Self-concept and performance in science;
- The perceived difficulty of science;
- The social applications of science and the context in which science is taught; and
- Their experience of school science and curriculum which sometimes leaves girls with the impression that science is a dry subject and only for the brilliant involving mainly the recall of factual knowledge rather than skills (p.1579).

Notwithstanding, the issue of gender is by no means the only factor influencing the attitude of learners towards science learning but it does play a significant role in influencing learners' dispositions. Most of the challenges related to gender and science education are found in African countries and South Africa is no exception.

Bilgin (2006) talking about teaching styles points out that the way learners are taught has a great influence on their attitude towards science learning. For instance, interaction, dialogue, discussion and cooperation in activities can boost a positive attitude towards science education. Osborne, et al. (2003) in research conducted in America concluded that the quality of teaching of school science is a significant determinant of attitude towards school science.

Kaya and Ebenezer (2007) describe perceptions of science as referring to the degree of a person's understanding of the value of science in everyday life and to society as well as the relationships in nature, everyday life, and science. Learners' perceptions of science can also be determined by the information they have about the subject. This information has the potential to intimidate them or encourage them to learn and have a positive attitude towards science.

Osborne et al. (2003) highlight the view that science is a difficult subject and only for those considered to be very intelligent as it involves mainly the recall of factual knowledge rather than skills. This perception of science is the reason some learners do not even want to attempt to learn science and herein lies the importance of motivation in science classrooms which I discuss below.

2.5.2 Motivation

Motivation is the second attribute of dispositions that I chose to look at in order to address the issue of how participation in science expos influences learners' dispositions. Motivation is an important factor in prompting anyone to take part in a certain activity even it may be for the particular individual's benefit. In this study, I looked at motivation as simply one's direction to behaviour or what causes a person to repeat a certain behaviour and vice versa. Gresalfi (2009) notes that motivation is a key factor which is central to a learning process. Czerniak (1996) after carrying out a study on science fairs concluded that motivation can be stimulated by the social aspects of participating in science fairs. Dionne, Reis, Trudel, Guillet, Klein and Hancianu (2011) undertook an exploratory study on sources of motivation for participating in science fairs in Canada. They concluded that:

> Scientific knowledge, along with learning strategies acquired by the student, is an important element of motivation, which can be examined in a science fair participation. (p. 670)

Czerniak (1996) added another dimension by stating that gratification, which can come in the form of personal satisfaction or winning a prize is another source of motivation for learners to take part in science fairs. Van der Meij, Van der Meij and Harmsen (2012) state that learning environments affect student motivation but students have to be resilient and not give up easily.

2. 5. 3 Resilience

Another attribute of disposition used in this study is resilience. Resilience refers to accepting challenges even where outcomes are uncertain (Claxton & Carr, 2004). Blaicklock (2008) posits that a resilient disposition refers to being involved persistently even in the face of challenges without giving up. Learners work mostly by pushing themselves and they do not give up on their scientific projects even if they struggle in the process. This is linked to an important aspect of social constructivism which is self-regulation (see Section 2.9).

Coffield (2002) talks of dispositions as being able to think, to persist in tasks and to give opinions and contribute ideas and to work collaboratively. Resilience as an aspect of dispositions is seen by how well and how long learners endure in the face of difficulty (Claxton & Carr, 2004). Ben-Chaim Ron and Zoller (2000) posit that courage is an important pre-requisite of persistence because it usually takes courage to persevere in challenging situations. Having looked at the three attributes of dispositions, I now move on to look at factors that influence the learners' dispositions towards learning of science.

2. 6 ESKOM Expo

The EKOM Expo for Young Scientists is an exposition or science fair where students showcase their projects about their own scientific investigations (ESKOM Expo, 2015). The mission for the ESKOM Expo is to develop young scientists who are able to find scientific solutions to problems they may have identified. In this study I use the term 'expo' and 'fair' interchangeably because they have similar meanings (Kahenge, 2013). Bencze and Bowen (2009) posit that science fairs are events at which learners' projects are evaluated and celebrated (p. 2462). These may be done for various reasons including to develop scientific skills, to motivate learners and even for prizes.

Research on the impact on science learning that science fairs have has been conducted in various parts of the world. Claxton and Carr (2004), having studied learners' involvement in Australia, observed that interesting projects invited children's engagement and expectations encouraged the children to sustain an interest over long periods. Yasar and Dale (2003) state that science fairs challenge learners to do their best. Science fairs promote learner led projects `and the presentation of projects can help learners to gain a more informed scientific understanding which underlies the importance of Vygotsky's (1978) concept of self-regulation (see Section 1.5). In preparation for the ESKOM Expo learners are also forced to collaborate within a community and before they showcase their projects according to Singer, et al. (2000). Students need to communicate with each other, teachers, scientists and community members to find information and solutions to their questions.

Learners from various schools across the country showcase their scientific investigations projects that are done according to curriculum requirements. In Cape Town an article entitled, "Why am I doing research for expo 2005" Taylor (2011) highlights some important findings about the learners who presented their projects at the ESKOM Expo. Although the Expo is a kind of competition, all learners who participate get a certificate of attendance (Taylor, 2011). The studies done by Ndlovu (2013) and Taylor (2011) looked at the difficulties faced by the learners because of what they consider their disadvantaged backgrounds. The studies also revealed some important dispositional attributes of the learners as a result of their participation in the expo. Some of the findings revealed that the experiences of learners at the expo were disheartening for those who did not win merit awards (Taylor, 2011).

There are other studies which have been done on learners' involvement in Science Expos in other parts of South Africa, for example, in Kwa-Zulu Natal and the findings are quite similar to those from the Western Cape. Alant (2010) in her study on some reflections of the ESKOM Science Expo as a means for accommodating disadvantaged learners highlighted some fundamental observations. Of particular interest to me was the fact that the Expo acts as a conduit through which learners express their interest in science and technology (Alant, 2010). The observation serves to endorse the importance of Expos as a means through which learners develop their scientific inclinations. Reporting on a study of grade 9 learners in South Africa who were doing scientific investigations, Ramnarain and De Beer (2011) concluded that learners were well motivated in science learning and readily assumed the responsibility for their projects. Students who participate in science fairs could develop an interest in science that goes well beyond a motivation gratified only by prizes or rewards (Dionne, et al., 2011).

There are, however, some criticisms that have been levelled against science expos. Yasar and Dale (2003) are of the view that the competitive nature of science fairs can lead to anxiety and pressure on the part of the learners. Bencze and Bowen (2009) echo these sentiments by saying that learners become discouraged by the judging which tends to praise winners and this might be daunting to other learners. Alant (2010) also critiques the science expo because of the way learners are put in different categories hence disadvantaging learners especially from disadvantaged backgrounds. It appears there is no real competition if the competition is segmented according to learners' background. Despite these challenges science teachers need to encourage their learners to take part in the science expo as the advantages outweigh the disadvantages.

2.7 How participation in science expos influences learners' dispositions towards science learning

There is a possibility that participation in science expos has the potential to influence the learners' dispositions towards science learning. Borda (2007) claims that the ability to retain one's own beliefs and values while at the same time critically examining them in light of another's understanding is achieved through participation in science expos.

The dispositions of the learners towards science learning are also influenced by their interaction with new knowledge and by engaging with peers. In the preparation for the expo learners work in the hybrid space where they link the school and the home environment (Ramnarain & De Beer, 2013). Learners interact with the ideas and work of others which gives them the space to make their own judgements on their projects. In her study conducted in South Africa, Kahenge (2013) asserts that Science Expos help to develop learners' interest in science outside the traditional classroom setting, build self-confidence and increase motivation to take up science as a subject.

A study of high school students' disposition towards science was conducted in Detroit in the USA by Kaya and Ebenezer (2007, p.9). This was in response to declining science enrolments, interest, and achievement among students moving from middle school to senior secondary over the last two decades. The major finding from their study was that positive dispositions were cultivated in students partaking in science fairs because they were fully involved in long term projects.

Talking about science expo projects preparations in North Carolina USA, Zimmerman, Muntele and Ila (2012) maintain that the preparation seminars which were done weekly gave learners opportunity to develop their ability to communicate verbally and graphically with their peers. In preparing their projects learners worked in groups which is an advantage in itself. Graven (2011) whose study on maths clubs observed that developing learner sense-making and shifting learner dispositions from passive learners to more engaging, confident and actively participating learners should be a core focus in clubs. This indicates that as a result of participation there may be a shift in dispositions towards learning not only in mathematics as is the case in Graven's study, but also in science.

Kaya and Ebenezer (2007) on the observation of the US IT projects with high school learners commented that the learning style was learner-centred with partners or small groups completing the work while expert facilitators remained accessible for guidance and help. Jiang, Jiang, Yu, Liu, Li, and Zuo (2014, p.4) claim that young people with high dispositional optimism are confident about eventual success by attempting despite the challenges. For instance, in science expos learners may receive negative feedback on their projects but this might not necessarily discourage them from continuing or taking part in future events and this could be evidence of resilience (see Section 2.5.3). Herein lies the importance of knowing learners' views on their participation in the science expo which I discuss below.

2.8 Learners' views on involvement in science expos

Research done on some of the students who have taken part in projects similar to science expos by Kaya and Ebenezer (2007) revealed that learners' dispositions vary from learner to learner. In their study some learners indicated that their dispositions towards science learning had changed whilst others said nothing had changed. The expos can either discourage or encourage learners, whilst other learners feel indifferent. Some of the responses of the learners in the TITiC project in the US were as follows:

> "*My attitude towards science has changed during this TITiC Project in a positive way. Previously I thought it was a bit boring and I had little interest in it. Now I enjoy it and feel that it is very important to be knowledgeable about. In using the technology to test our water during our project I learned that it involves a lot of hard work and trial and error procedures. I realize how much work is involved to accomplish these tasks".* (Kaya & Ebenezer, 2007, p. 10)

The view of the participant above gives an indication of learners' feelings as a result of involvement in science expos. Similarly, Taylor (2011) writing about the ESKOM Science

projects done by some Cape Town learners noted that the responses of learners varied from learner to learner.

2.9 Theoretical framework

A theoretical framework is the structure on which the research is based. In the context of my study the way the research participants carried out their projects was done through working in a social constructivist environment. That is, they worked in a hybrid space where they married what they learn at school with what they do at home. The theoretical framework for my study is the social constructivist theory whose main proponent was Lev Vygotsky.

Social constructivism

Central to the theory of social constructivism is Vygotsky's (1978) notion that learning should be centred on the child. McRobbie and Tobin (1997) allege that in social constructivism meaning is constructed by individuals as new information interacts with their extant knowledge (p.194).This is supported by Kim (2001)who says social constructivism entails learners constructing meaning through social interaction with their environment. Within Vygotsky's social constructivism, I used the concepts of mediation of learning and the zone of proximal development (ZPD). Self-regulation is also an important concept in social constructivism. I now discuss each of these below.

Mediation of learning

Mediation of learning in my study took the form of collaborative learning during the workshops where learners met with facilitators and lecturers from the science education department. In the context of this study, mediation of learning is regarded as important for the development of some learning dispositions (Carr & Claxton, 2002, p.10). Coffield (2002) talks of dispositions in relation to performing tasks, contributing ideas and working collaboratively. Since these learners' projects are in the form of scientific investigations they can get assistance from peers and significant others.

Dispositions of learning can thus be influenced by learning opportunities and circumstances (Claxton & Carr, 2004). Such learning environments as prescribed in social constructivism may ultimately influence learners' dispositions. Gresalfi (2009) accentuates that:

> learning is a process of developing dispositions; that is, ways of being in the world that evolve around ideas about, perspectives on, and engagement with information that can be seen both in moments of interaction and in more enduring patterns over time. (p. 329)

Graven, Hewana and Stott (2013) assert that research on learner dispositions explicitly locates itself within a socio-cultural frame and connects dispositions to identities. In her study conducted in South Africa, Graven (2011) looked at learners' sense-making and shifting learners' attitudes from passive learners to more engaging, confident and actively participating learners. Carr and Claxton (2002) who conducted their research in New Zealand link dispositions to mediation of learning by pointing out that "some dispositions can be tied very closely to particular kinds of tasks, contexts and materials" (p.11). It should be recognised, however, that learning takes place at different levels and herein lies the importance of Vygotsky's (1978) concept of the zone of proximal development (ZPD) which I discuss below.

Zone of Proximal Development

Embedded in the social constructivist theory is the zone of proximal development (ZPD). The ZPD is defined as the distance between actual development and the level of potential development of learning (Vygotsky, 1978). This according to Thompson (2013, p.247), is the instance when the most powerful forms of learning take place for learners. Zhang (2008) defined ZPD as:

> The distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving adult guidance or in collaboration with more capable peers. (p. 80)

Simply put, the ZPD is the difference between what a learner can do without help and what he or she can do with some assistance. Moll (2002, p.17) says that, "the child is capable of constructing new knowledge with the help of more knowledgeable others". Zhang (2008, p.80) supports the concept of the ZPD by saying that mediation takes place through adult guidance or in collaboration with more capable peers. Collaboration with others in working exposes the social constructivist idea of learning as a social activity. In the context of this study, mediation of learning in the ZPD ensures that scientific skills are developed.

Harland (2003) posits that some of these scientific skills are research, observation, inference, measurement, prediction and communication. The elements of mediation in the ZPD used to develop the skills are mediated activity, social interaction and dialogue (Thompson, 2013). The three elements work together well through face-to-face interactions mediated by speech as observed by Zhang (2008). Learners engage in activities that allow for social interaction and dialogue amongst the learners also occurs in the ZPD (Thompson, 2013).

It is in the ZPD that social interaction, dialogue, and mediated activity between learners and others take place (Thompson, 2013). Newman and Holzman (2002) believe that the practical significance of the ZPD is that it is the only measure of development. Duffy and Jonassen (1992) claim that the more knowledgeable others should provide just enough guidance in the ZPD but not too much. The ZPD elements will feature in the research design section of the study. In the context of this study the knowledgeable other does not only refer to educators but to other learners as well as siblings and SAEON facilitators who helped the learners with their projects. They also received assistance from lecturers from the Education Department at Rhodes.

Self-regulation

According to Harrison and Muthivhi (2013), self-regulation is a deep internal mechanism that underlies mindful, internal and thoughtful behaviour of children. It is also viewed as a way in which mediated activity becomes internalised and resilience takes place. This refers to a situation where learners are proactive and exert control on their learning processes and environments (Schunk, 2001). Harrison and Muthivhi (2013, p.81) further explain that self-regulation is achieved through social interaction as Vygotsky (1978) proposed. The value of self-regulation is that:

> Self-regulated children can delay gratification and suppress their impulses long enough to think ahead to the possible consequences of their action, or to consider alternative actions that would be more appropriate. (Harrison & Muthivhi, 2013, p.81)

For self-regulation to take place there is need for a conducive environment to be established. Van der Meij, van der Meij and Harmsen (2012) posit that self–regulated opportunities are offered in inquiry based learning environments. In my study self-regulation was manifested through learners working on their projects independently only presenting their final projects to the facilitators on workshop days. There was also an indication of self-regulation as learners showed evidence of reworking some aspects of their projects.

2.10 Concluding remarks

In this chapter I looked at how social constructivism is used to enhance learning among learners in after-school enrichment programmes which are used to prepare learners to present projects at science expos. From the literature on dispositions to learning, after-school enrichment programmes and science expos, it is evident that the three work together to enhance the learning of science and to an improvement in the general inclination towards science as a discipline. In the next chapter I discuss the data collection methods for my study as well as the pilot study which I conducted.

CHAPTER 3: METHODOLOGY

> *A case study is a study of a case in a context and it is important to set the case within its context (i.e. rich descriptions and descriptions are often a feature of a case study (Cohen, Manion & Morrison, 2011, p.289).*

3.1 Introduction

The main goal of my study was to investigate how the disposition towards science learning for five grade 9 learners from selected under-resourced schools in Grahamstown East in the Eastern Cape was influenced by their participation in the Eskom Science Expo. The research process is outlined in this chapter where I elaborate on the methods used to do the research and provide insight into how the data was analysed. I also discuss the issues of validity and ethics that I took into account when conducting the study.

Before embarking on the main research I conducted a pilot study with learners who had taken part in a previous ESKOM Expo. Findings from the pilot study are discussed and tabled in this chapter.

3.2 Research design

My research design was a qualitative case study employing the interpretative paradigm. An interpretative paradigm does not have to produce generalizable results. It focuses on understanding the subjective world of human experience (Cohen, Manion & Morrison 2011). The idea of choosing this paradigm came about as a result of the need to address the problem in the particular context in which the case is located. The epistemological implications of this paradigm were that the community from where the research participants were drawn ultimately benefit from the study and that they become part or take ownership of the research process.

The main features of a case study are that it is unique and context specific (Cohen, et al. 2011) A case study, according to Cohen, et al. (2011) is rich in description and contextually embedded. This means that my findings should not necessarily be expected in a study involving a different context. So for this reason as stated in the epigraph “a case study is a study of a case in a context and it is important to set the case within its context” (ibid p. 289).

Qualitative research means any type of research that produces findings not arrived at by statistical procedures or other means of quantification (Corbin & Strauss, 1996). Creswell (2007) defines a case study as a comprehensive investigation of a confined system centred on extensive collection of data. Cohen et al. (2011) underscore this by saying that the depth in gathering information is important in a case study for. They go on to say that a case study is descriptive one where extremely rich, detailed and in-depth information will be acquired through several data collection instruments (ibid).

The primary purpose of a case study is to determine the factors and relationships that have resulted in the current behaviour or status of the subject of the study (Gay, 1987, p.225). The case study was appropriate for my intended study because I focused on a single case of learners from one group of learners. My unit of analysis was how their participation influenced their dispositions towards science learning.

I anticipated that in my research I needed to collect a lot of data from various sources which would help to answer the main question of my study: How does participation in science expos influence grade 9 learners' dispositions towards science learning?

It is recognised, however, that the findings from my study cannot be generalised because in a case study the reality is a social construct and can only be understood by those who take part in it (Urqhart, 2013). Since my study looked at how learning dispositions are influenced by taking part in science expos for grade 9 learners, the study involved looking at feelings, attitudes, thought processes, emotions and other phenomena which are difficult to obtain through conventional research methods, so the nature of the problem under study was best served by a case study (Corbin & Strauss, 1996).

3.3 Research site and participants

There were initially thirty learners from three under-resourced schools from Grahamstown East taking part in the ESKOM Science project. For my research I worked with five learners who were involved with the expo in 2014. The 5 research participants were chosen based on their consistent attendance at the workshops held to prepare them for the ESKOM Expo. They were four boys and one girl. The learners are referred to as Science-Expo Stars, a name first used by learners who took part in the expo in 2013. The learners met on a regular basis to discuss their

projects with the facilitators from the South African Environmental Observation Network (SAEON), some of whom are lecturers from the Education Department, Rhodes University.

3.4 Research goal and questions

The goal of this study was to find out how participation in science expos influence grade 9 learners' dispositions towards science learning. I traced the learners' involvement starting from the process of preparation for the expos until they presented their projects at the ESKOM Science Expo competitions. To achieve this goal the following questions were asked:

Main question:

How does participation in a science expo influence grade 9 learners' dispositions towards science learning?

To help answer the main question the following sub-questions were asked.

Sub-questions:

1. What motivates learners to take part in the Eskom Expo?

   To answer this question I used interview questions and the learners' journals.

2. What activities manifest in the development of scientific skills as the learners prepare for Science Expo?

   To answer this question, I conducted observation and analysed learners' journals.

3. What were the learners' attitudes towards science before and after expo?

   To answer this question I conducted observations, interviews and analysed journals of the learners.

4. What causes the shifts/changes in the dispositions towards science learning?

   To answer this question I used interviews and observation

5. What are the dispositions to learning science after the expo?

   To answer this question I conducted semi-structured interviews.

3.5 Data gathering techniques

The data gathering techniques used for my study were those considered most suitable for a qualitative case study as Cohen, et al. (2011) state that the use of various sources in research can provide concurrent and convergent validity on the case. I used observation, semi-structured-interviews and analysis of learners' journals. A sample of five grade 9 learners was selected for the study based on their continued attendance at workshop sessions in preparing for the ESKOM Science Expo from start to finish. The group comprised four boys and one girl, as the learners who best fitted my selection criteria. The criteria used for sampling was not gender biased but was based on working with learners who exhibited commitment to the current ESKOM Expo preparations. In the thesis I did not use the learners' names rather I used numbers to identify each learner. They are referred to as learners 1 to 5 consistently throughout the thesis.

Three observation sessions were attended the first being in the early stages of the preparation, the second one was done about a month later and the last one was a few days before the Expo. The different sessions attended were planned as such as they were expected to show the learners progress at the different stages of preparation. Semi-structured interviews were carried out the day after the Expo event and for some learners a few days later. The timing of the interviews was in order to get information on the dispositions of the learners immediately after the expo to capture the exact feelings of the learners.

Stake (1995) is of the view that, triangulation, which refers to using several data collection techniques, helps to ensure that data gathered is accurate and alternative explanations can be found. The use of many methods aid not only in collecting a lot of data but in validating it (see Section 3.9) and making it more authentic. Using several methods to compile data is very important because a case study requires different methods to collect information about a phenomenon in order to contribute to the credibility of the research (Urqhart, 2013). Berg (2000) proclaims that the case study is a methodological approach that incorporates a number of data-gathering techniques. To give an account of the methods I employed and how they were used I start with the observation of workshops in preparation for the ESKOM Expo.

3.5.1 Observation

Observation during the workshops where learners prepared for the Eskom Expo is one method I used for gathering data. In this method I was an observer as Cohen, et al. (2011) see observation as very important in carrying out research as it allows a first-hand supply of information. By attending the workshops for learners and their facilitators I gained insight into what they did and how they prepared for the expo. Bless and Higson-Smith (1995) posit that in observation the assumption is that the observer merely records facts without interaction with the observed. In my case I diverged from this notion slightly as I did interact with the learners in the process. Berg (2001, p.114) asserts that observation allows the researcher to observe the process that is often of profound importance to qualitative investigations, namely, interactions as emphasised by the social constructivist perspective which is the theoretical framework of this study (see Section 2.9). It also highlighted moments of self-regulation by the learners as they worked and reworked on some areas of their projects.

As an observer I noted moments of interaction as well as mediated activity between learners as stated by Vygotsky (1978). I also observed moments of interaction among the learners as they worked on their projects. When the ESKOM Expo took place, I also managed to observe the activities at the exhibitions. Judges went around assessing learners' projects and asked several questions of the learners on their exhibition posts. It was not easy to tell whether judges were impressed by the learners' projects or not. This could be a technique that is used to make all learners feel at ease. After the exhibition, judges convened to adjudicate whilst the learners waited in anticipation.

3.5.2 Semi-structured interviews

The second technique I used was semi-structured interviews. Berg (2001) describes interviews as encounters where face-to-face interactions take place. Semi-structured interviews make use of pre-determined questions; however they are allowed to digress, to probe far beyond their prepared and structured questions (Berg, 2001). Semi-structured interviews make it easier for the interviewer to probe and get unexpected. Semi-structured interviews allow for flexibility in questioning, because it is possible to ask questions which may not be in the original list of questions. Gay, Mills and Airasian (2006) posit that interviews are the most appropriate method

for asking questions that cannot effectively be structured into multiple choice questions. I carried out semi-structured interviews with the learners which were conducted after the ESKOM Expo of 2015. The interviews were held at the secondary school where some of the learners attend school. The duration of each interview was about fifteen minutes.

In the semi-structured interviews learners had already taken part in the ESKOM Expo and I was able to collect information on their dispositional attributes or shifts as a result of their participation. Questions posed to reveal resilience were asked such as, "would you take part in the expo again even though you did not win an award in this expo? I also collected data on whether there was a change in the attitude towards science as a result of the expo. Considering that one of the attributes of dispositions is motivation some of the interview questions were designed to extract information on this attribute of dispositions. Crick and Yu (2008) highlight the importance of interviews as the most feasible way to gather data about what learners say about themselves. Interviews proved to be one of the best ways to gather data from learners.

Questions to check resilience were also asked by asking the learners to state whether the challenges they faced made them want to give up or did they continue with the projects despite the challenges. The forms of mediation used to realise the desired goals of the learners were also discussed in the interviews. Learners would site new things they had learnt or acquired through mediation in the ZPD in the interviews. The interviews were tape recorded and transcribed for further analysis (see Appendix F). The mechanical recording of interviews served to give data that was not only objective but also efficient as observed in Gay, et al. (2006). The semi-structured interviews as expected opened up new questions as a result of the responses from the learners which resulted in unexpected new themes emerging. Most of the research questions were addressed by the semi-structured interviews.

3.5.3 Learners' journals

Journal analysis is the third technique that I used in gathering data. A lot of information about what learners went through as they worked on their projects, whether it really brought about a shift in their dispositions towards learning science or not was revealed in their journals. Berg (2001) believes that any document even of a personal nature, like a journal provides very important subjective views of the people who write them. To emphasize the importance of document analysis (Bowen, 2009, p.30) posits that, "documents provide background and context, additional questions to be asked, supplementary data, a means of tracking change and

development, and verification of findings". Analysing journals thus helped me in confirming what other data collection techniques revealed and even provided more information on research participants.

Notwithstanding, the learners' journals were informative in varying degrees with some being more informative than others. Learners 3 and 4's journals, for instance, gave a lot of insight into their experiences as they worked on their projects. They described their reasons for taking part in the expo and their sources of inspiration for the particular projects they were doing and the lived experience of doing the project. In the journals learners used English as the language of communication and being second language speakers some language errors were noted in the journals. The learners were given a criteria to follow when making the journal entries by the SAEON facilitators, however the quality of the entries did not always meet the required standard in the case of some learners. Ultimately I was able to collect relevant data from the journals.

3.6 Analysis of data

In my data analysis I critically assessed the data gathered from the different methods used to collect it. I checked for patterns, correlations, differences and similarities in the responses from various respondents as suggested by Cohen, et al. (2011). Stake (1995) says that, "the search for meaning often is a search for patterns, for consistency within certain conditions" (p.78). Similarities in the dispositional attributes of attitudes, motivation and resilience were likely to be revealed by the responses to interview questions. Responses by the learners to interview questions were transcribed and coded to categorise them and critically analyse the patterns that emerged.

The data from observations revealed how the preparation for the participation in the expo revealed the attributes of disposition that are the focus of my study. Observing and listening as the learners interacted with each other during the preparation stage of their projects allowed me to record instances where the attributes of dispositions were revealed. The language the learners used and the ways in which the learners were assisted in doing their projects were also noted. An analysis of learners' journals helped me understand the learners' experiences as they worked on their projects.

3.7 Validity

Validity in research is simply defined as an account which accurately represents features of the phenomena which it intends to describe, explain or theorise (Winter, 2000). There are ways of ensuring validity in research. Bloor and Wood (2006) assert that validation might be achieved by the collection of corroborating findings from the same respondents on the same topic. Cohen, et al. (2011) proposed that triangulation can be used to achieve this validation. Reliability points to the dependability of the research (Cohen, et al., 2011). Although the nature of my study was qualitative I was still able to ensure reliability through stability of reforms in the observations in both the pilot and main study. The methods of data collection I used were also suitable to ensure reliability in my study.

Triangulation is defined as a systematic comparison of findings from the same research topic generated by different research methods (Bloor & Wood, 2006). They went further to classify triangulation into four categories of triangulation. The one I used in my study is referred to as methodological triangulation. This method ensures or at least tries to ensure validity by using many methods although some may be inferior to the other methods as cautioned by Bloor and Wood (2006). These scholars also cautioned that the portrayal that triangulation is a procedure of validation can be misleading.

In my study I compared the data from semi-structured interviews with that from learners' journals as well as from observations. Some participants documented their experience and in the interviews they had an opportunity to make clarity on some issues which may not have been clear in their journal entries.

Cohen, et al. (2011, p.181) claim that "in qualitative data collection the intensive personal involvement and in-depth responses of individuals secure a sufficient level of validity and reliability". This is relevant to my study because I rely on the in-depth information that emerged from my research participants.

3.8 Ethics

Ethical considerations are vital to any research process. Pryke, Rosse and Whatmore (2003) are of the position that researchers must interact with the researched to get informed consent. Ethics have a strong bearing on whether one gets the most out of the whole research process, as they provide for a conducive environment in which to conduct research for the learners.

Before I embarked on the research I sent my research proposal to Rhodes University Higher Degrees Committee for approval. Having been given the go-ahead I embarked on the research. I sent out letters written in English and *isiXhosa* (see Appendix A) to obtain informed consent from the parents and where possible I met the parents of the participants. All the parents I managed to meet face to face readily agreed to allow their learners to take part. The parents viewed this as an opportunity which could create important educational opportunities for their children. The consent of the parents is a formal requirement which was necessary in allowing me the space and time to interact with the learners. The consent of the facilitators from SAEON and Rhodes University Education Department was also secured and they gave me permission to attend the workshops where the learners worked on their projects.

For confidentiality of participants' identities, I did not use the learners' real names but referred to them as Learners 1-5.In order to have a working relationship with my participants I ensured the participants that no harm of any nature would come to them as a result of taking part in my research and that they would most likely benefit from the research.

I established a relationship with the parents of the learners which proved to be mutually beneficial to both me and the learners. Parents believed that it was for their learners' benefit to take part in academically beneficial activities.

3.9 Limitations of the study

One major limitation of my study could be that I am currently not teaching the same grades as that of my research participants. If I had been, it would have afforded me more time to interact with the learners as well as greater depth in terms of data gathering. Another limitation was that of time constraints because I had limited time to interact with the learners as they needed to do the projects in the first half of the year. Also, it is difficult to generalise the findings from the research. Nonetheless, valuable insights emerged from the study. Before I move to the presentation and analysis of data for the main study, I discuss the pilot study that was done before the main study.

3.10 Pilot study

Before I began the main research I conducted a pilot study to help me decide whether I could launch full scale research on my chosen topic. Conducting the pilot study gave me some

insights into what I needed to do in order to carry out my research successfully. Areas of concentration in doing the main study were highlighted by the pilot study. The pilot also helped me to fine tune the interview questions for the main study. I used a thematic analysis as prescribed by Fereday and Muri-Cochrane (2008) where there is a search for themes that surface that are important to the description of phenomena. The main themes I was looking for in the study were those related to how the theoretical framework of my study helped in exposing the three attributes of learning dispositions I was working with.

I worked with learners who had taken part in the Eskom Science Expo before. I took part in a workshop that was conducted by the Science-Expo Stars project facilitators and all the learners from one school in Grahamstown who took part in the ESKOM Expo in 2014.I then conducted semi-structured interviews with three grade 9 learners who had just participated in the ESKOM Expo in 2014. The methods used to collect the data for the first phase are recorded in Table 1 below.

Table 1: The techniques, methods and the purpose for the gathering of data in each stage (Pilot study)

Stage	**Methods to be used to gather data**	**Data to be gathered**	**Purpose**
Stage 1	Participatory observation	How learners work on the projects for science expos, observation of moments of interaction and mediation of learning	To understand the lived experience and also to observe the process of participation in science expos from its early stages of preparing for the expos.
Stage 3	Interview of three grade 9 learners from the school who participated in the science expo. I will use semi-structured interviews.	To get learners' perspectives and experiences on their involvement in science expos. What motivated them and if there was any shift in their dispositions as a result of the participation	To understand the lived experience of the learners and whether there is a shift in their dispositions or not towards science learning.
Stage 4	Transcribing the audio recordings and notes from the observation of workshop.	To get information from interviews and observation the learners' journals	For data analysis

3.11.1 Presentation of data from the pilot study

Data collection for the pilot study was done through semi-structured interviews (see Appendix C) as well as observation of workshops as the learners worked on projects preparing for the expo.

3.11.2 Findings from the workshop

The two workshops I attended with the learners as they prepared for the expo provided some data and insights on the mediation of learning and process skills of the learners and even their attitudes towards science learning. Scaffolding by the facilitators is one form of mediation that was clearly observed. Additionally, learners also were encouraged to support each other (peer support). The informal questions I asked during the observation sessions also played a role in providing information about the learners' dispositions towards science.

In the workshops I attended learners and facilitators worked on the learners' projects together. The role of the facilitators was mainly to give advice on what the learners could do to improve their projects. In some cases learners would present more than one project and the workshop would assist in deciding which one a learner would work on for the expo. I witnessed various forms of interactions. There were interactions amongst learners and also between learners and facilitators throughout the sessions. The learning environment was different from the usual classroom environment. At one workshop the learners took breaks in between learning sessions and interacted with nature outside the building before re-engaging. The atmosphere was relaxed and stress-free.

From the analysis in Table 2 below it could be concluded that the workshops with learners did help them to get through to the expo but only to a limited extent. The sessions were theoretical in nature and most of what was shared were the ideas of the participants. This means that the practical investigations on the projects which were all practical in nature were done by the learners on their own.

Amongst the learners were some who were more knowledgeable than others and they were seen to help their peers. They conversed in their mother tongue which probably helped in fostering understanding. There was also evidence of self-regulation especially as the day of the expo approached, the learners' projects improved significantly. The other indicator of self-regulation were the charts which learners exhibited at the expo. The charts sketched a narration

of the work done on the projects by the learners. The actual projects were also on display accompanied by the charts, serving as evidence of the learners' work. To ensure validity and authenticity of the learners' projects at the expo, learners were required to give a detailed account of what their projects were about and how they designed them.

Table 2: Degree of interaction in the workshop

Themes	**Observable behaviour**	**Degree**
Mediation of learning	Interaction in workshops between learners and facilitators and amongst learners	Average
Movement in the ZPD	Learners use first language to discuss their projects with each other (dialogue). Help of facilitators given to learners as they worked on their projects (significant other)	Good
Self- regulation	Learners work and make adjustments on their work(self-regulation)	Good

3.11.2 Findings from the semi-structured interviews

I was granted permission to carry out the interviews in the school's library by the headmaster of the school. I tape recorded the learners as I interviewed them separately. The first interviewee would call the next interview after finishing his or her session. I did this to ensure that no one's response was influenced by what the other respondent said. The time taken for the interview differed from respondent to respondent. The interview with the first learner took much longer as she had so much information to share having won a gold medal and had proceeded to the finals in Pretoria. A lot of follow up questions arose in her case hence the time

spent doing the interview increased. After tape recording I transcribed the interviews and the time taken to transcribe each interviewee was not the same as the others (see Appendix C). The presentation of the findings is displayed in Chapter 4.

The interviews with the grade 9 learners revealed a lot of information concerning their dispositions towards science learning. They were conducted at the school that three learners who participated in the pilot study attended. The timing of the interview was to capture data on pre and post expo disposition of the learners. The important findings from the interviews were related to what motivated learners to take part in the expo, their attitude towards science before and after expo and lastly how resilience manifested as they participated in the expo.

3.11.3 Presentation, analysis and discussion of results for the pilot study

The semi-structured interviews were conducted with two girls and one boy. The workshop sessions however comprised more learners, about fourteen in total. One of the things that I observed in the workshops was the way learners were motivated and assisted by the facilitators to work on their projects. In some instances learners changed their projects over and over because of challenges highlighted in the workshop sessions. Attendance at the workshop was an indicator of resilience on the part of the learners (see Section 2.5.3). The interviews with learners revealed most of the data concerning shifts and causes of shifts in learners' dispositions towards science learning. The first theme I worked with was what motivated learners to take part in the Eskom Science Expo. This was important for the justification of the attribute of motivation as valuable to the development of a learning disposition towards science learning. It emerged from this study that factors that motivated learners varied from learner to learner. Responding to questions on what motivated the learners to take part in the expo, the learners responded as follows:

Responding to questions on motivation the learners gave the following responses:

> PSL1:"*Well to be honest ane Mrs Kuhlane introduced us to the expo and told us that if we win we gonna get bursaries to Rhodes so I thought let me give it a try", "maybe I could and to also solve the problem in my community"*
>
> PSL2: "*Discovering myself, investigative mind, to improve myself"*

PSL3: "*To solve problems in my community, to reach my career, ability to study further"*

The most common factor that the learners alluded to as a common motivational factor was the need to solve problems in their community. Kaya and Ebenezer (2007) concluded that learners enjoy working on projects that were relevant to their context. The response by the learners to the question of motivation thus confirms findings from other studies in that all 3 learners highlighted the need to get assistance with further education and to solve problems in their communities. The desire to win a prize was also a motivating factor. This is similar to what Dionne, et al. (2011) established having done a study on students' sources of motivation for participating in science fairs in Canada.

Rochford (2007) reported on learners in Cape Town who took part in the expo and mentioned reasons like needing to solve the problems of people living in shacks in the Joe Slovo informal housing settlements. Others mentioned reasons like needing to take part as a stepping stone to their careers, personal ambitions and challenges (Rochford, 2007). These findings are similar to some of the responses from my interviews.

In response to the question of what motivated them to choose their projects all the learners indicated that they wanted to work on projects that were relevant to their communities. Jiang et al. (2014 p.4) say that "contextualisation is supported by the creation of anchoring events that enable learners to visualise how the project's substance relates to their community, family, or themselves". This helped understand why the learners chose the topics they did. The semi-structured interviews also revealed some of the weaknesses of the questions asked, as they did not always give me the feedback I thought I would get.

Responding to questions on attitude towards science learning the learners had this to say:

PSL1: *"Well science is mxnm, first of all I thought that science was a hard subject and I can never do a career in science but now I have looked at many different careers in science"*

PSL2: "*Attitude has improved"*

PSL3: *"I love science because of the community, my teacher made me to take part in science that changed my attitude"*.

The responses of the majority of the learners to the question of attitude confirm what was observed by Osborne (2010) that the quality of science teaching can affect learners' attitudes

towards science. It would appear that after taking part in the Eskom Science Expo learners seemed to have developed a new appreciation of science. Some said they did not enjoy learning science before but now they love it and their attitude has improved.

Responding to questions on resilience the learners had this to say:

PSL1: "*I've learnt it in a book I've read it in a book and researched about it"*

PSL2: "*Discovering myself, investigative mind, to improve myself*"

PSL3: *"Self-taught, internet"*

The learners mentioned the ability to understand some things they had learnt in class better as one of the positive outcomes they acquired. Process skills, research and the ability to write well were some of the issues highlighted by the learners as having improved since participation in the expos started. Three learners mentioned the issue of confidence building as a result of their participation in science expos as well as the ability to speak in public. In response to one of the questions on how they saw themselves and their future in relation to science, the majority of them seemed to suggest that now they were more confident and able to take up science related courses in further education.

The idea of significant others helping the learners was indicated by all the learners in response to the question of who helped them with their projects. The responses of the learners were generally similar to those revealed by other research dealing with township schools for example the ZAMA group of scientists. The said group participated in the research done by Dale Taylor and was the first group to participate in the ESKOM Expo in 2006 (Taylor, 2011).

Jiang, et al. (2014) observed that young people with high dispositional optimism are confident about eventual success by attempt even despite the challenges. This was the finding from some of the learners I interviewed who indicated that they were still going to continue taking part in the expo despite encountering obstacles in the process. Evidence of resilience was seen in most of the learners' responses to the question of their experiences doing the projects and also by analysing their journals. Participation in the expo meant a lot of extra work for the learners. For the five of them to get through to the expo was an indication of resilience because others quit along the way due to the amount of work needed to get through to the expo.

Learners 1, 2 and 3 gave more information on resilience by sharing how they worked on their projects. Learner 1 in particular who won a gold medal at the expo and went through to Pretoria

for the next level of the competitions narrated how she had found it difficult to choose a project. Eventually she decided on a project of cleaning dirty toilets using easily accessible materials. This meant that she had the task of persuading members of a community near her own home to get permission to work with their toilets. The project showed extreme dedication on the part of the learner. The rest of the learners indicated varying degrees of resilience.

In addition to responses to questions around the three attributes of dispositions, learners also gave insight into the scientific skills they developed as they participated in the expo. This was noted by Dionne, et al. (2011) who observed that there were some scientific knowledge and learning strategies that came out as one of the components in the data.

Table 3: Presentation of attributes of dispositions in the pilot study.

Attributes	**Themes emerging**	**Source of data**
Attitude	Attitude towards science has changed as a result of taking part in expo	Observation and interviews
Motivation	Learners explain the factors that motivated them to take part in expo	Interviews and observation
Resilience	Learners demonstrate the ability to work on their projects and see them through despite challenges faced in the process	Interviews and observation

3.12 Concluding remarks

In this chapter I focused on methods of data collection that were used in my research. I also discussed how some of the methods helped in answering my research questions. The limitations and challenges faced in carrying out the process were highlighted. I also took care to highlight how I dealt with ethical issues as my study involved participants who were minors. Factors that dealt with validity and trustworthiness of the research were also discussed.

The pilot study done prior to the main study and its results was discussed in this chapter. In the next chapter I present my data from the study and analyse, discuss and give my interpretation of the results.

CHAPTER 4: DATA PRESENTATION AND ANALYSIS

> *The coding process involved recognizing (seeing) an important moment and encoding it (seeing it as something) prior to a process of interpretation (Fereday & Muir-Chocrane, 2006, p.3).*

4.1 Introduction

In this chapter I present the data collected through observations, journal analysis and semi-structured interviews. Through coding and categorising, themes, patterns contradictions, similarities were recorded. Fereday and Muir-Chocrane (2006, p.3) observed that "the coding process involved recognizing (seeing) an important moment and encoding it (seeing it as something) prior to a process of interpretation". This is the process I followed in this chapter where I recognised important moments or statements and coded them.

Table 4 below shows the profiles of my research participants.

Table 4: Learners' profiles- Main study

Learners code	**Gender**	**Age**	**Participation**
L1	Male	16	Second time
L2	Male	15	Second time attending and won a merit at the expo
L3	Male	15	First time
L4	Female	15	Second time
L5	Male	14	First time

The data for my study were collected from the learners in Table 2 above, but in the observation sessions there were other learners who were not part of my sample. However, their interaction was observed together with those in the sample.

4.2 Data from workshop observations

The purpose of the workshops was to support learners with their science expo projects and learner participation was encouraged. Herein lies the importance of Vygotsky's social constructivism which is the theoretical framework in this study.

Observation session 1

Day one was the first workshop day for the learners. Fourteen grade 9 learners (8 boys and 6 girls) from 3 township schools attended the session. The facilitator of the workshop from SAEON led the session. She started by welcoming everybody and inducted the learners on participation in the ESKOM Expo. Learners were given note books to write in during the sessions. They were also encouraged to keep journals of their work where they recorded all their experiences, challenges and triumphs as they worked on their project.

A list of requirements for the preparation for ESKOM Expo was given to the learners. The facilitator gave an overview of what expo entails and the general nature of the competition. An overhead projector was used showing slides on how to conduct a scientific project. Learners took notes as they listened to the facilitator as she explained the fundamentals of doing a scientific project. Looking at the learners in this first stage of the sessions I noted different expressions of anxiety, excitement and others which I could not actually read amongst the learners. Learners were told to communicate in the language they were most comfortable in by a co-facilitator but the main facilitator encouraged the use of English as it is the language of communication which would be used at the ESKOM Expo event. This could have contributed to what I consider quite a passive first session.

Observation session 2

The second session I attended was done at one of the secondary schools in the township on a Saturday. Twelve learners attended the session. The number of girls had decreased to five and that of boys to seven. This was not the second session for the learners and facilitators but for me as researcher. The facilitator welcomed everybody but immediately expressed her

disappointment at the drop in attendance as previously the session had registered 14 learners in attendance. The dropping out of some learners could indicate that not all learners were keen to continue with the projects, an indication of their disposition to science.

Some learners attempted to explain the absence of their peers, for example one pointed out that her friend had lost interest. The entire session focused on listening to learners presenting their topics and the facilitators giving guidance where necessary. Areas of guidance were:

- Choice of project;
- Scientific skills development and interpretation in the project; and
- Research methods used by learners in collecting data on their projects.

Observation session 3

The third and last session was done at the university's Science Education Department. As usual one of the facilitators welcomed us and the learners to the last and crucial session. In attendance were only eight boys and one girl. Also present were two former participants of the Eskom Expo who had been invited by one of the facilitators to attend the session. The main reason for the invitation was to encourage the learners and cast on eye on the current groups' projects as the final preparations were done. The facilitators were otherwise impressed by the standard of the projects of the seven learners whose projects were allowed to go through to the final competitions. There were however still areas for improvement which the session worked on. From these seven learners FIVE of them constituted my research participants.

Table 5: Level of interaction in the workshops

1= very low; 2= low; 3=average; 4=high; 5=very high

Type of interaction	**WORKSHOP 1**	**WORKSHOP 2**	**WORKSHOP 3**
Learner to learner	1	2	3
Learner to facilitator	1	4	5
Facilitator to learners	4	4	4

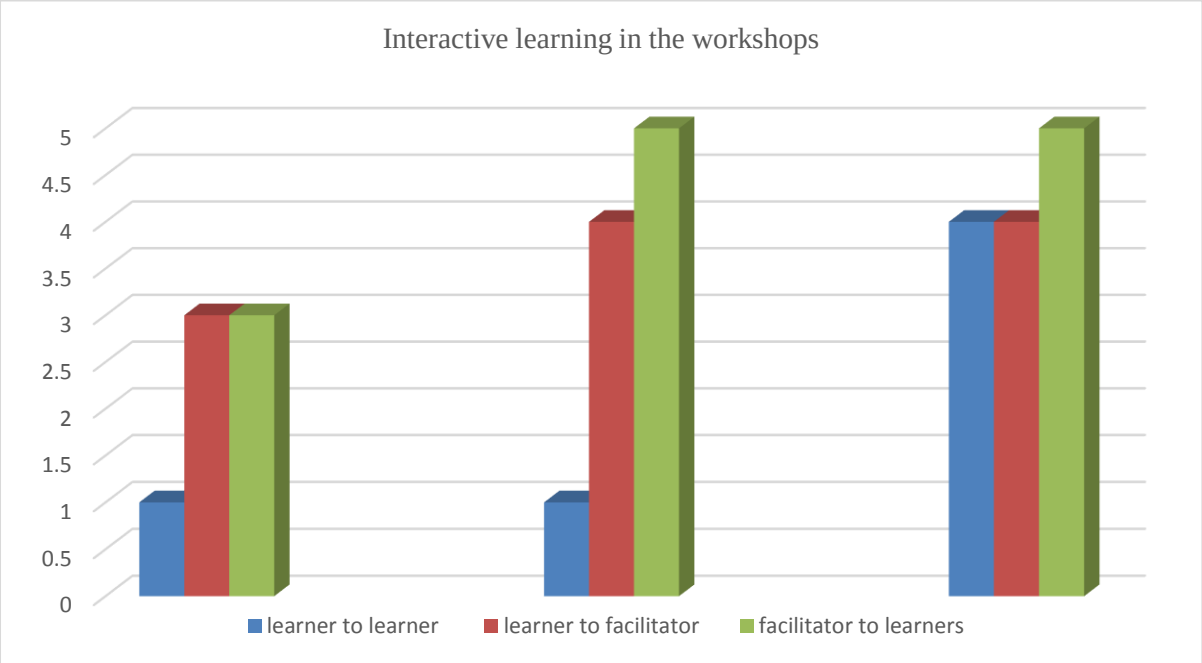
The level of interaction in the workshop sessions for the learners seemed to improve with each new session. In the first workshop the facilitator did most of the talking whilst learners responded passively. The last 2 sessions showed an improvement in interaction between both

learner to facilitator and amongst learners themselves. I ensured reliability of the data recording the different interactions and compared the findings.

Table 6: Analysis of interactions in the workshops

Themes	Observable behaviour	Degree
Mediation of learning	Degree of interaction in workshops between learners and facilitators and amongst learners	Average
Movement in the ZPD	Learners' use first language to discuss their projects with each other (dialogue). Help of facilitators given to learners as they worked on their projects (significant other)	Good
Self- regulation	Learners' work and making adjustments to their work (self-regulation)	Good

Graph: Interactive learning in the workshops



In the graph above levels of interaction in the workshops I attended with learners are displayed. In the first and second workshop sessions the level of interaction amongst learners was quite low only to pick up in the last workshop. This could suggest increased confidence on the part

of the learners. The interaction from learners to facilitators was on the rise from the first to the second workshop and got even higher in the third workshop. That of facilitators to learners was always on the up-side.

4.3 Interviews with learners

Learners were interviewed immediately after the expo. After the interviews I transcribed the interviews which I had recorded electronically with a tape recorder (see Appendix D). The data from the interviews was examined and analysed to highlight themes that related to the attributes of disposition and any emerging themes (see Appendix E). I summarised points that were made by each learner. Tables 6 and 7 below show the data from learners on attributes of dispositions and on how they learnt from the science expo.

Table 7: Analytic memo on attributes of dispositions-learners' excerpts

Theme	Excerpts from learners
Attitudes	L1: Science *ndiyayithanda* (I love science) *Ngokuba* (because) iscience it's changed I like science more L2: I want to experience the life of science Overjoyed by participation in expo L3: Now I have a love for science so in class I will do it as one of the subjects. My view of science has changed. journal records what motivated the learner to take part in the ESKOM Expo i.e. to find a way of to store water L4: I'm a genius I'll figure out a solution how I am going to do it.
Motivation	L1: *Bendifuna ukhu*,(I wanted to improve my project) L2: My career is on science, is to be a scientist one day record of why learner chose the project L3: For my own satisfaction and see my project to the end, for the prize L4: Universities will be pleased to have a student who has been in such challenging competition to be one of the top 15 just to make my mom and school proud L5: It was for the love of science I'm good at science also at school
Resilience	L1: It's about gaining experience, it's about commitment L2: I want to improve this project again because I can see this project going somewhere Learner doing same project for second time L3: The experience shows you where you went wrong and where you need to fix it L4: Science expos can be a lot of work but in the end its worth it L5: And I've learnt that you don't need to be scared of anything and anyone and you must keep going no matter what happens

Table 7 above shows the attributes of dispositions as evidenced by the learners' responses in the semi-structured interviews which were done in the main study. All the learners expressed their attitude towards science by using the word love or an expression that meant a better

appreciation of learning science as a result of participating in the ESKOM Expo. L1 and 3 in particular indicated that their attitude has actually positively towards science learning.

On motivation the learners showed its crucial role in shaping their disposition towards science learning. Though their reasons for taking part in the ESKOM Expo, all learners clearly justified the value of motivation in influencing their dispositions. L1 alluded to the fact that he was motivated by the need to improve his project. This was because he had participated in the previous expo and he now wanted to work on the recommendations given by the judges. His participation in the previous expo worked as an impetus for him to enter the expo and ultimately affecting his disposition positively.

For L2 the motivation came from his strategic awareness of what he wanted to do in future which is a science related career. This response was echoed by learners even in the pilot study and this shows that it is not motivation only but also the type of motivation that influences learners' disposition. As learners are going through the school stages they are already thinking about their futures and this has an impact on what activities they might want to part in to achieve their goals. L4 did not differ much from L2 as he also indicated the motivational factor related to what he wants to in future. He indicated that for him participating would help him improve his performance in science related fields at university level.

L3 and 5 seemed to suggest that their source of motivation was more of self-satisfaction. On further probing though L5 for instance revealed more sources of motivation including even the need to make her mom proud. Overall there is evidence to show that indeed motivation is key to learners being inclined towards science learning.

Table 8: Indicators of shifts in dispositions

Indicator	Themes emerging	Author with related literature
Change in attitude towards science	The learners attitude towards science has changed as a result of taking part in the expo	Bilgin (2006) Osborne et al. (2003) Ramnarain and De Beer (2011) Kaya and Ebenezer (2007)
Future career options	Learners indicate that they are now considering taking a science related career in the future as a result of taking part in expo	Kaya and Ebenezer (2007) Chetkuti and Kioko (2012)
Entering the expo again	Learners indicate that they will enter another expo competitions if given the opportunity	Carr and Claxton (2004) Kaya and Ebenezer (2007)
Increased confidence	Learners claim that they are more confident now when learning science and dealing with scientific concepts	Kaya and Ebenezer (2007)

Table 9: Analytic memo on causes of shifts in dispositions: Learners' excerpts

Theme	**Excerpts from learners**
Help of another	L2: Besides bana my brothers and my next door neighbour L1: they did a lot from, from my project. L3: For instance sis Nozi, if not for sis Nozi I think a lot of things I wouldn't be able to do or see. Like I would go to her and show her my project because at times its either I did less on a certain topic or certain equipment that I needed to use for experiment so I think without her effort I wouldn't have made it. I could not have achieved al that I did without the help of sis Nozi and Charles.
Learning environment and learning methods	L2: The classroom environment is not very nice I learn more in the club than I do in class L3: I thought science was not fun, that you had to do things like experiments and it was tiring, but you actually have fun whilst doing it L1:Leyi eye expo *siyanikwa ithuba ixhesha ukuba sicinge* about ideas *zethu* that's why *ingumehluko kuleyi yalapha* (in learning for expo we are given time to think about our ideas that is why it is different from school science) L4: Science *iya zameka ya*(it is possible to learn it)and *ya* ineed ieffort *yomuntu*
Change in learners' perception of science	L2: Expo has become a platform to improve my skills L3: I think learning science in the classroom now will be different I only used to look at science as just a hard subject that I just needed to pass, I will do science with more passion. L4: *Iscience iyazameka funeke* (it is possible to learn science it needs) practice each and every day in order to achieve high marks.

Data from the semi-structured interviews and even journal entries showed various factors that led to a shift in learners' dispositions towards science learning. The way learners interact with the learning material as well as the learning styles seems to have an impact on their disposition towards science learning. Learning with the help of other people on a one to one basis seems to cause of the shift in the learners' disposition. All learners in both the interviews and journal entries indicated having received some of help in the process of doing their projects for the expo. The help of a knowledgeable other was also noted in the observation sessions and the learners also made reference to these in the interviews.

In preparation for the ESKOM Expo, the learners learn in environments that are different form their classroom environments at school. This evidently also contributed to the shift as it were of their disposition towards learning science in a positive direction. Coupled with the learning environment was also the issue of activities that ASEPs seemed to provide which were not found in the formal classrooms. All learners indicated that the way they learnt science for the expo was different from the way they learnt in the classroom with the former seemingly a preferred way of learning. L3 in particular expressed excitement and surprise at the discovery that science was actually fun to do, suggesting that he never had this experience before.

Taking part in the ESKOM Expo also produced a change in the way in which learners perceived science. L3 and 4 especially commented by saying that as a result of learning for expo, they realised that science is not as difficult a subject as they thought before. Their way of seeing science had now changed as a result.

4.4 Data from learners' journals

All learner**s'** journal entries were according to the requirements of the expo preparations. However, the data from the journals varied in terms of the information it provided. Some had depth for analysis whilst others were not as informative. The data supplied in each journal were paraphrased and recorded as follows:

Learner 1

Journal outlines the to do list of the learner; project outlined form the beginning to the end; project is on water conservation; process recorded from choosing the topic to working on the selected topic; not much detail in terms of learners' lived experience doing the project. Findings

of the learner's research recorded in the journal. From advice given in the workshop sessions from the facilitators and from lecturers from the Rhodes Science Education Department, the learners came up with a better tool for water harvesting.

Learner 2

Learner 2's project was on changing attitudes towards illegal dumping. The journal made a detailed description of the problem of illegal dumping. It also recorded why the learner chose the project. His aim was to solve the problem of illegal dumping first in the learner's immediate environment and then in the larger community. The journal recorded the learner's lived experience and feelings towards the problem of illegal dumping. It records that a campaign would be undertaken to bring people on board and stop dumping illegally by putting bins on dumpsites so people could put litter in the bins. A process of bringing awareness was done by conducting a survey to assess people's awareness though the use of a questionnaire distributed by the learner.

Learner 3

The learner's project was on how to alleviate water shortages by making use of water from the sea. The journal recorded what motivated the learner to carry out the project which was to find a way of storing water. According to the learner the problem of water shortages is not only a local problem but a global one. The learner commented that the inspiration came an important question he asked himself which was, *"how can there be water shortages when there is so much water around?"*

According to the learner the challenge of doing such a project is expense and accessibility of the materials to use. The learner thought of a way to make ocean water drinkable. Journal concludes by stating that results did not agree with the hypothesis, but the learner is pleased with the results all the same. The display of results clearly shown in the journal.

Learner 4

L4 detailed her goals in the journal. Listed were the projects that she wanted to do and finally the one she chose was on eliminating the problem of smelly feet using cheap methods. Examples of the ways to do this are listed as using onion, powder, gravel soil, sand, lemon and soda. Experience of the first session's workshop was recorded. Indicated the tips given by one of the facilitators, a senior lecturer at the Rhodes University Science Education department.

Details of how the learner used the public library to look for what is considered an interesting topic. Some excerpts:

> *Science expos can be a lot of work but in the end it's worth it because like universities will be pleased to have a student who has been in such challenging competition, and being brave like me cause like I'm the only girl at my school who is doing science expo. I'm one brave girl, I'm very proud of myself.*
>
> *I know what I'm going to do, I'm going to do a project about smelly feet but the question is how am I going to do it , anyway I'm a genius I'll figure out a solution how am I going to do it. Actually today I will just think about how I will do this*.
>
> *Yes! Yes! Yes! I know I am going to do surveys asking people about how they feel about smelly feet and how they treat them for smelling.*
>
> *I'm enjoying writing in my journal but I'm mostly enjoying to be part of expo exhibition hope to be one of the top 15 just to make my mom and school proud, it's not easy being raised by a single parent it's not easy.*
>
> *My mom bought me a watch just to encourage me to continue with my science last time I didn't make it now she encourages me to work hard and try my best to make it through.*

The excerpts from L4 were the most informative as it gave a detailed record of her experiences throughout the process whilst preparing for the expo. In contrast, journals for other learners were quite scanty. Table 10 below summarises the findings from the learners on the attributes of dispositions.

Table 9: Attributes of dispositions-Main study

Attribute	Themes emerging from data	Data source
Attitudes	Learners mention that they love science, they love the life of science.	Journals, interviews
Motivation	Learners indicate that they were motivated to take part in the expo by the following: To solve problems in their communities For personal satisfaction The desire to win a prize The possibility of getting a bursary for university To make parents and their school proud	Journals and interviews
Resilience	Learners indicate that doing expo is about commitment, hard work, perseverance because it is worth it.	Observation, journal and interviews

4.5 Concluding remarks

In this chapter I presented the information on attributes of dispositions derived from the various data gathering techniques that were used. I used triangulation in two ways, from information given by different participants and by way of information from different methods of collecting data. In the next chapter I interpret and discuss the findings in the light of how theory interrogates the same data.

CHAPTER 5: INTERPRETATION AND DISCUSSION OF FINDINGS

> *Information alone cannot make decisions for us and responsible decision-making requires human judgement, both to fill the gaps left by incomplete information and to interpret information that is available (Gadamer, 1967 as cited in Borda, 2007, p. 1035).*

5.1 Introduction

The main goal of my study was to find out how participation in the Eskom Science Expo influences grade 9 learners' dispositions towards science learning. To answer this main question and the sub-questions, I made use of three data collection methods, namely, observation, semi-structured interviews and journal analysis. To interpret the results, I came up with five analytical statements which address the main question for my study and the five sub-questions for this study.

Having done the pilot study and using it as a guide I embarked on the main study. The discussion and interpretation of the findings from the data collected is given below.

5.2 An overview of my analytic statements addressing my research questions

Table 10: Analytic statements

Themes	Analytical statements	Data sources	Research question
Motivation	Factors that motivated learners to take part in ESKOM Expo	Journals, interviews	1
Attitudes towards science	Attitudes of learners towards science	Journal Observation Interviews	3
Resilience:	Commitment Seeing my project through	Interviews Observation	2
Causes of shifts in dispositions	Dialogue Peer to peer interaction Mediation in the ZPD Self- regulation Learning environment Increased engagement with scientific concepts	Observation Interviews	4
What are the dispositions of learners after expo	Change in attitude towards science Future career options in science field Increased confidence Happy I entered will keep on taking part Not happy my ideas were not respected	Interviews	5

5.2.1 Analytic Statement 1: What motivated learners to participate in the expo?

Motivation is one attribute of dispositions which learners indicated in their journals and during observations and interviews. The key issue was on addressing what encouraged learners to join the expo. My study not only focused on the day of the expo but on the whole process starting from when learners decided to join the competition up to the preparation stage and ending on

expo day. There was need for them to be motivated to take part in the rigorous process and to ensure that they stayed committed. In answer to what motivated the learners to join the expo their responses were unanimous in that participating might help to solve a problem in their community although that was not the only motivating factor. The factor of solving community problems is similar to what was observed by Rockford (2007) who reported on learners in Cape Town. The learners cited their main reason for entering the expo was to solve community problems. The problems were not necessarily the same as those of learners in my study but the motivation seemed to be similar.

Learner 4 indicated that her motivation for entering the expo was to make her mother who had raised her singlehandedly, proud. Learner 2 was motivated by the need to improve scientific skills for he stated that his future centred on the field of science. The view was echoed by L1 who said that he saw himself as an engineer in the future hence he decided to commit himself to taking part in the expo. Just like L2, L3 indicated that being involved in scientific projects was a lifetime commitment which he did not intend to stop. Learner 3 also claimed to have been motivated by the need for self-satisfaction, hence he conceded that it was not about winning a prize. This view is similar to what Dionne et al. (2011, p.674) mentioned as one motivational factor for taking part in science fairs by saying that "gratification can be mere personal satisfaction from learning". All the learners except for L1 did hint at being motivated by the need to win a prize. Dionne, et al. (2011) pointed out that learners often enter a competition for the purpose of winning a prize. In the interview after the expo with L1, he exclaimed that he was overjoyed by the merit that he got and L3 declared that he would enter expo again citing the following reasons:

L3: *For my own satisfaction and proud of myself that I went through with this thing and I see it to the end. It sinked in that I too wanted to shake one of those people's (judges) hands and hold something that say I went home with this. I'm very competitive person by nature like I'm very competitive everybody who knows.*

Just as concluded by Dionne et al. (2011) the main motivational factors for learners taking part in the expos were self -satisfaction, the achievement/rewarding factor and interest in science.

5.2.2 Analytic Statement 2: Attitudes of learners towards science

The question of learners' attitude towards science was answered mostly through information from the journals and the semi-structured interviews. Attitude is one of the three attributes of

dispositions that my study focused on. Questions on attitude are not answered using the word attitude *perse* but also through attributes such as interest, love, enjoyment and so on as explained by Kaya and Ebenezer (2007) see (Section 2.5.1). Gender has also been linked to attitude of the learners towards science learning. This was not an aspect under investigation in my study but having only one female going through to the expo could support the idea that science seems to be a subject that does not yet attract girls. In one of her reflections the girl who is L4 exclaimed "*like I'm the only girl at my school who is doing science expo, I'm one brave girl, I'm very proud of myself".* In her journal L4 states various factors that could be the reasons for her resilience (see Section 4.4). L4's statement indicates what has been said concerning the influence of gender on science learning by (Murat & Temelli, 2013; Chetcuti & Kioko, 2008). These scholars noted that studies reveal that a lot of girls are sceptical about learning science. It is good to note that in the case of L4 she embraced the challenge.

According to the interview responses of L1, I thought that he had a positive attitude towards science learning. Some of his responses in the interview questions indicated that he was committed to science learning and he would continue learning and participating in science expos. That was an indicator of a good attitude towards science learning. L1 went on to reveal an affective angle of disposition by saying that he loved science and had no problem learning it even in class.

> L1*:* *Science ndiyayithanda and nalapha esikolweni ndenza iscience neMaths (Freely translated: I love science and even here at school I'm doing science and maths)*

The last point of enjoying learning science in class is a contrast to what was said by L2 who conceded that he did not enjoy learning science in class.

> L2: *In class why I think because in these subjects I feel miserable I can't I don't know exactly these things that they teach me , some of them what is difficult to me is the teacher because when I don't understand I put my hand up but that teacher won't exactly to explain.*

This difference between classroom science and science in preparation for expo correlates well with Ramnarain and De Beer's (2013) assertion that there is an apparent disconnection between the science classroom and their home communities. Although all learners indicated a difference in how they learnt science in the different spaces, L2 and L3 are the ones who clearly

highlighted their dissatisfaction with classroom science, while L1 only indicated that it was different.

An important indicator of an attitude as an attribute of disposition was a response given by L3 having been asked about how participation in the expo changed the way he would learn science. The learner responded as follows:

> *L3: I will do this as one of the subjects that I love like I'll do this with more passion a let me say so, I'll do my subjects with more passion because I only did like for the past few years as a subject that I only needed to pass.*

Similar findings of a change in attitude were recorded by Dionne et al. (2011) concerning a shift in attitude after learners had taken part in science fairs.

5.2.3 Analytic Statement 3: Analysis and discussion of learners' resilience

Resilience in learners was evidenced by the ability to continue with their projects right up to the end. From a group of about twenty four learners only six remained in the club. Another indicator of resilience was the re-entry into the expo without having won a prize. When explaining why they kept on entering the expo even if they had not won prizes the first time, L1 and L2 indicated that entering the expo was about gaining experience whilst L3 alluded to the fact that he needed to finish what he had started and work on the recommendation of the judges.

L1 and L3 talked about entering the expo in order to gain experience and also as a matter of principle and commitment.

> L 1: *It's about gaining experience, it's about commitment*
>
> L 3: *For my own satisfaction and proud of myself that I went through with this thing and I see it to the end*

The element of self-regulation (Harrison & Muthivhi, 2013) was also evident as the learners did most of the work on the projects without supervision. L3 mentioned that, *"the experience shows you where you went wrong and where you need to fix*" (see Appendix D). L4 declared in her journal that, "*Science expos can be a lot of work but in the end it's worth it*" (see Appendix E). Given the extra time and effort entering a project in the expo involves, I find this dedication laudable.

The disadvantaged backgrounds that learners came from meant that they did not find it easy to work on their projects at home. The abject lack of resources made their work difficult but they did not give up. This is what was observed by Blaicklock (2008) who claimed that learners persisted even in the face of immense difficulty. Alant (2010) came to a similar conclusion on the learners from Hammarsdale who made use of local scrap yards for components for their projects. Despite their limitations the learners persisted to the day of the expo.

5.2.4 Analytical Statement 4: Causes of shits in dispositions towards science

Table 11: Factors which caused shifts in dispositions

Factors indicated	Themes emerging	Literature
Help of another	Learners indicated that they had help of either siblings or facilitators at SAEON or from their peers in doing the project	Jiang et al. (2014) Kahenge (2013) Rogoff (1998)
Learning environment and learning methods	The learning environment for expo which takes the form of an ASEP And learning methods used there were fun, different from school	Chetcuti and Kioko (2012) Claxton and Carr (2004) Dionne et al. (2012) Osborne et al. (2003) Ramnarain and De Beer (2011)
Ability to do projects that are close to their hearts	Learners indicated that they were happy to do projects of their choice without being too restricted.	Carla (2011) Miller (2010) Mwetulundila (2011)
Change in learners' perception of science	Learners indicated that they now found that science is not a complex subject after all and they were beginning to appreciate it	Kaya and Ebenezer (2007) Borda (2007)

Table 11 above shows a summary of factors that caused shifts in dispositions among learners as a result of taking part in the expo. The next few paragraphs discuss the factors in detail.

Help of other people

The guiding theoretical framework for my study was social constructivism which emphasises the importance of learners working in a social environment that allows the construction of knowledge to take place. In responding to the question of who assisted the learners in doing their projects for the expo, they all indicated that they had received help from a significant other who were mostly the facilitators from SAEON and the Education Department. This is in line with Vygotsky's theory of real learning taking place with the help of a more knowledgeable other in the ZPD.

Within the ZPD there is also the idea of peer to peer interaction where learners interact with fellow learners. This was seen in workshops where I observed how learners helping each other as a result of the social learning environment. Moll (2002) and Zhang (2008) highlighted this kind of interaction (see Section 2.8).

Learning environment and methods used in ASEP

Another key factor which might have caused a shift in the disposition of learners towards science learning is the learning environment. Graven (2011) observed that learners' dispositions shift from passive to more engaging and active as a result of the environment in which they learn. In the After-School Science Enrichment Programmes (ASEP) where learners work on their projects in preparation for the expo, the learners are free to communicate with each other in the language they understand. This view is also supported by Kaya and Ebenezer (2007) who talk of a learner–centred atmosphere with facilitators being available for guidance. This is different from the classroom restrictions that learners may encounter in formal traditional classroom practices like rote learning. This could also explain the problem that L2 highlighted when learning science in the classroom as compared to in the ASEP.

The learning methods used in the ASEP where learners carry out work on their projects are different form the way they learn at school. This is according to the responses given in the interviews by all the learners. The following excerpts from learners show how they view learning science in preparation for the expo and at school.

L1: *Ndingathi apha esikolweni iscience ayiko elihlobo ndifunda ngayo kwi expo (Freely translated: I can say here at school science is not taught the way I learn about it at the expo)*

L2: *In class why I think because in these subjects I feel miserable I can't I don't know exactly these things that they teach me , some of them what is difficult to me is the teacher because when I don't understand I put my hand up but that teacher won't exactly to explain*

L3: *I thought it was too much like uba it wasn't fun, you had to do things experiment and it was tiring , but you actually have fun whilst doing it and it's nice to like with science people ... things people solve things and it's nice to see all that stuff and it's nice to have your own thing.*

Kaya and Ebenezer (2007) observed that learners' enjoyment of science when they have fun learning the subject is an indicator of a positive attitude towards science which is acquired as a result of participation in a scientific project. Muntele and Ila (2012) add that opportunities to develop their ability to communicate verbally and graphically with their peers enhances learning. In the context of this study, that could be one of the learning styles that helped learners as they prepared for the expo which may presumably not always occur in the classroom situation. L3 for instance indicated the importance of fun in learning.

Projects of interest to the learners

When participating in the ESKOM Expo learners the type of projects they chose were not prescribed. They were allowed to be as creative as possible and to choose projects of their own choice. This flexibility allowed the learners some level of independence and control which they might not get in classroom settings which are often prescriptive and usually tend to be guided by certain time frames. Although there is not much literature on this I found it to be a key factor that increased learners' interest in their projects.

Using data from journals, observations during the workshops and also interviews with learners, I concluded that doing projects of interest to the learners caused a shift in disposition towards science learning. Mwetulundila (2011) who did a study on gender and science education concluded that girls are more inclined to topics that are related to biology as compared to their male counterparts. This could help explain why L4, the only female in this study, chose to do a topic on reducing the growth of bacteria that causes smelly feet. In the journal she detailed how she took a long time before deciding on a topic and also how she was disappointed that a fellow classmate who is also a girl had stolen her topic (see Appendix D). The topic in question was also linked to Life Sciences.

Furthermore, Kaya and Ebenezer (2007) concluded that students generally identified research questions that had a personal relevance when doing their projects. In the preparation for the ESKOM Expo learners this is encouraged. This is similar to what my research participants did when choosing their projects. In explaining why he chose to look at how to harness sea water for domestic consumption, L3 expressed his concern about the problem of water shortages that was associated with the province and yet there was a large sea nearby. It was this problem that motivated him to do a project on water conservation. This is similar to what was stated by L1 in the interview when responding to the question of why he was entering the expo again, he

had this to say "*Ndingathi iscience ithetha ngezinto eziinvolver idaily lives" (Freely translated: I can say science deals with things in our daily lives).* L1's project was on electricity and he concluded the interview by expressing his interest in and the relevance of the science project he did for the expo to his personal experience in his neighbourhood (see Appendix F). This concurs with what Kaya and Ebenezer (2007) discovered that after engaging in science projects, that learners had a better understanding of the value of science in their lives.

L2 did a project on environmental awareness with a particular focus on illegal dumping. It was the second time he entered the expo and he expressed a personal feeling of how he did not like seeing litter everywhere as was the present situation in his community (see Appendix D) hence through the project he hoped to provide a solution to the problem. Ramnarain and De Beer (2013) posit that in doing projects for the expo, learners allow themselves to deeply engage in science on their own terms.

Change in learners' perceptions of science

One of the most crucial problems that have been used to explain the lack of interest in science or the poor performance in the subject in most schools is the learners' perception of science. Science is generally perceived to be a difficult subject because of what is considered to be its complex nature. This problem was also highlighted by some of the learners who took part in my study. They mentioned how they overcame this perception as a result of taking part in the ESKOM Expo.

Osborne, et al. (2003) highlighted this problem by saying that science is viewed as a difficult subject a perception that was supported by the learners in this study. One of the reasons could be because of the way science is taught in class compared with the way it is done at the expo. Kaya and Ebenezer (2007) explained that the perception of science refers to the degree of a person's understanding of the value of science in everyday life. It could be that this new found value of science which learners only discovered as they took part in the expo helped change their opinion of science.

Talking about the challenge that girls have with learning science, Duncan (1989) concluded that girls were scared of science. This observation was supported by L4 who disclosed that she was so afraid of science that she had planned on avoiding it and pursuing arts related subjects instead. However, since her teacher persuaded her to enter the expo she has grown to enjoy it

and mentioned that it is possible to learn science and do well in the subject. L2 talked about the difference between school science and science done for expo. His view seemed to suggest that the perception of science changed as a result of the way it was taught.

Increased engagement with scientific concepts

Increased engagement with scientific concepts could also be attributed to the shift in disposition of learners towards science learning. The projects done in preparation for expo are not only intensive in terms of the scientific skills applied but they are also more thoroughly prepared as there are no strict time constraints.

Yasar and Dale (2003) argue that the presentation of projects can help learners to achieve a more informed scientific understanding. Ramnarain and De Beer (2013) concur by saying that working in the hybrid space allowed learners to engage more meaningfully with scientific concepts. This may not always be possible to achieve in a normal classroom discourse. Learners had this to say when explaining the difference in the way they learnt science for the expo and in the classroom:

> *L1:* *Apha esikolweni iscience ayiko elihlobo ndifunda ngayo kuexpo, leyi eye expo siyanikwa ithuba ixhesha ukuba sicinge about ideas zethu that's why ingumehluko kuleyi eyalapha.* (*Freely translated: Here at school science is not like the way I learn it at the expo, at expo we are given time to think about ideas that is why it's different from the one at school*).
>
> *L3:* *I thought science was not fun, that you had to do things like experiments and it was tiring, but you actually have fun whilst doing it* (see Appendix E).

Learners claimed to have spent less time in understanding science content; they enjoyed science lessons and developed a desire to continue studying Physical Sciences in the future. Thus, their attitudes formed a vital part of learning science and developed traits such as positive attitudes, motivation, and genuine interest in studying science (Kibirige & Hodi, 2013). Essentially, the above statements also show how learners engaged with scientific concepts in ways that made them view science through a different lens thereby influencing their disposition.

The magnitude of the attributes of disposition was not the same for all three of them. Each attribute had a different value which contributed towards the dispositions of learners towards science learning. Motivation and attitude seemed to have the same weight. The evidence of

resilience was understood by considering that the learners worked on projects until they were ready to be exhibited at the expo. Observation at workshops did not allow me to note whether learners were persevering despite challenges according to the way resilience has been defined. Taking part in the expo also answers the question of resilience.

A history of the expo has shown that learners from previously disadvantaged schools like the ones my participants come from do not fare well at the expos compared with learners from more privileged schools. This was the case with the latest expo they entered. Only one learner L2 managed to get a prize which was not so prestigious because it was a merit. However the learner was pleased probably because he had entered previously and had not won. L4 who was the only female participant to go through entered for the second time but she did not win any prize. She was visibly disappointed by the outcome as she had high hopes the second time around based on the effort she put in the preparation which was based on the feedback from the judges in the previous expo. The learners seemed to be fully aware of the fact that they might not win. This made me conclude that the most influential attribute of learners' disposition towards science is attitude.

Learners indicated in their responses that despite the challenges they faced they remained upbeat and maintained a positive attitude towards science learning. Issues of how learning differs in the classroom from the ASEP were raised but still the learners maintained a positive attitude. The only girl in the team went up to the expo was not daunted by her gender but through determination and what I call a positive attitude she took part in the competition. It would appear that motivation and a positive attitude work together to produce resilience in learners.

5.2.5 Analytic Statement 5: Dispositions of learners after expo

The main question of my study was how does participation in science expos influence grade 9 learners' dispositions towards science learning? It is therefore necessary for me to analyse the disposition of my participants after they attended the expo event. The semi-structured interviews that I conducted with the learners provided most of the answers to this question. Of the 5 learners that I interviewed, 3 seemed to have a positive disposition after the actual expo. Only L2 received an award which was a merit at the expo.L1 and L3 did not receive any awards

but that did not seem to dent their enthusiasm towards science learning. Their responses to how they felt about the way the expo was conducted were as follows:

L1: *Yes I did, the judges zisuke zandixelela ukuba ndilungisephi (Freely translated: the judges told me where I should improve on my project)*

L1: *I didn't win any award no, but next year I will enter the expo again*

L2: *I felt advantaged because when I got that merit like it was joy and akhaze (I've never), I couldn't do anything like hey.*

L2: *Yes, there were no, there were no, ukuqathwa, sasinga qatwa tinadhu, pa (Freely translated: We were fairly treated nobody treated us unjustly at all).*

L3*: I will enter again. A part of me feels that I just can't leave it hanging, because the judges said like this is future thing, like they shared a lot of good things about the project , a lot of pointers , me just leaving it hanging doesn't make sense*.

All three seemed to indicate that they got what they deserved in the expo. This was in contrast to the responses of L4 and L5 who expressed displeasure with the way they thought their projects were handled. Their disgruntlement did not necessarily produce a negative disposition towards science learning but they did exhibit some element of disappointment which could potentially lead to a refusal to take part in scientific projects in future. They had this to say about their experiences:

L4: *Judges shame they didn't tell me anything as in they didn't have comments as in your project needed that and that they said everything is cool, and they said construct is too bright but it's cool they didn't have comments ok like bad comments I must fix that and that, they did have icomment ngespellng setekkies they said here in Sa we spell takkies as in ta and then overseas they spell tekkies as in te so its fine so ya.*

The excerpt above shows how L4 felt about the judging process at the expo because she did not get satisfactory feedback to explain why she was not given an award. Poulos and Mahony (2008) explain that feedback is effective when it is credible and when it is influenced by learners' perception of the provider of feedback. In the case of L4 it was also a matter of not getting satisfactory feedback that led to his dissatisfaction. On being asked whether he would consider entering the Eskom competition again he replied as follows:

L5: *I wouldn't say I will enter again because uhm this past few weeks I've seen my project being advertised on TV so it was very hurting to me because they took it from me.*

The reason for L5's unhappiness was probably due to ignorance because later on he got clarity on what had really transpired and he realised he was mistaken. His case probably shows the importance of thorough feedback to learners who take part in the expo.

My interpretation of the dispositions of learners after the expo was that for L1, L2 and L3 the shift was positive. They came of the competitions even more determined to continue learning science and in the case of L3 there was an almost complete shift in a positive direction. The positive shifts were as a result of their participation and their experience with the expo. In contrast, for L4 and L5 there was an indication of a slightly negative disposition as a result of their experiences. Although she was referring to the issue of language, Alant (2010) warned that omission of some critical issues at expos have crucial implications.

Some of the key issues showing learners' dispositions after the expo are change in attitude towards science, future career options in science related fields and increased confidence when dealing with scientific concepts.

With regards to change in attitude learners 1 to 4 indicated that their attitude towards science learning had changed positively. L3 in particular highlighted that he had changed the way he viewed science as a result of the participation by saying:

> *But now I have a love for science so in class I will do it as one of the subjects that I love. I will do science with more passion*

Kaya and Ebenezer (2007), Bilgin (2006) and Osborne, et al. (2003) concluded that taking part in science fairs do result in a change in attitude towards science (See Section 2.5).

The future career options of the learners also served as evidence of their dispositions as a result of taking part in the expo. The learners had the following to say concerning their future career options:

L3: *Now I want to do medicine.*

L4: *Originally I wanted to do drama but now I can see myself doing a science related job.*

L1: *In future ndizibona ndingumye we (freely translated: I see myself as one of the engineers).*

Lastly learners claimed that they are more confident now when learning science and dealing with scientific concepts. This observation was also made by Kaya and Ebenezer (2007) after their study on US students taking part in an IT project. L1 alluded that he had become so confident with scientific concepts such that he is now fixing any problems to do with electrical faults at home (See Appendix

D). Other learners also expressed that they were more confident in dealing with scientific concepts than they were before taking part in the ESKOM Expo. I can safely conclude that the dispositions of learners after taking part in the ESKOM Expo changed positively for most of the learners in my research. However the whole process has its share of challenges and the next paragraph explains some of the challenges.

5.3 Challenges associated with the expo

In this study most of the learners who took part in the expo are from disadvantaged backgrounds and entering the expo competition had its challenges. Alant (2010), for instance, highlighted a number of pitfalls that learners have to negotiate when taking part in the expo competitions. In my research the learners shared the same platform with learners from better resourced schools. This seemed to give the learners from better resourced schools an advantage over those from less resourced schools.

The nature of the expo competitions proved problematic for L4 and L5. L5, who entered the expo for the first time thought that he was not fairly treated. He thought that his project was taken and used immediately after the expo but he was not given due recognition. With the help of other learners clarity was eventually given on the matter and the learner was made to understand that he had not been cheated as his project had been done before. This to me showed that there might a lack of information provided to learners who participate in the expo. They do not seem to have the necessary exposure which might help them to deal with the whole expo process. It also indicates probably a small gap in the provision of feedback to learners.

L4 raised some very crucial and sensitive issues regarding how she felt betrayed and done down by what she clearly thought to be an unfair way of analysing her project. This is indicated in the way she described the judges' remarks (see Appendix E). The only negative comment she received was on a spelling mistake and yet she did not win and this disheartened her to the point of refusing to enter the expo again. L4 also expressed some disappointment at the way in which her project was judged and this could be as a result of what I also felt that the expo did not give her the necessary feedback to avoid the confusion the learner had.

Alant (2010) observed that both the poster and interview have to be in English which is the working language of the ESKOM Expo. An opportunity to explain her project in *isiXhosa* and

respond to questions in her home language could have made a difference when explaining her ideas to the judges.

5.4 Concluding remarks

In this chapter I presented findings interpreted from the data I gathered from the observations, semi-structured interviews and learners' journals. Gadamer, 1967 as cited in (Borda, 2007, p.1035) concluded that "information alone cannot make decisions for us and responsible decision-making requires human judgement, both to fill the gaps left by incomplete information and to interpret information that is available". The methods used in data collection worked together in answering all the research questions asked in this study. An analysis, discussion and interpretation of the data followed. My recommendations of what I think can be done with my findings and the implications for the education system will be highlighted in the next chapter as well as a description of the limitations of my study.

CHAPTER 6: SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

Learning should involve developing dispositions that involve the ability to recognise when skills become useful tools for solving problems (Carr & Claxton, 2002, p.12)

6.1 Introduction

In this chapter I highlight some of the conclusions drawn from the research done on how participation in science expos influences grade 9 learners' disposition towards science learning. Recommendations are made as to how the research might be used to deal effectively with some of the challenges faced by learners in the learning of science. Areas for future research are also suggested.

6.2 Summary of my findings

My research focused on three attributes of disposition, namely, motivation, attitudes and resilience. In summary I can conclude that although these are probably not the only attributes necessary for influencing learners' dispositions they do play a significant role, as evidenced by the data from the research participants. The three attributes play a complementary role in respect of each other. An attitude towards science on its own cannot produce the right disposition. Motivation is also required, especially when the attitude is not positive. Both attitude and motivation work together to produce resilience in learners. Thus these attributes of disposition are seen as interwoven in this study, rather than as independent of each other.

Motivation is a key factor for learners to have the right disposition towards science learning. If one looks at L4, who happened to be the only girl in my study, and who attended the expo, one sees a significant shift in her disposition towards science learning. Originally she had wanted to become an actress, but after she took part in the ESKOM Expo, her focus shifted in terms of her strategic awareness. L2 explained that prior to taking part in the science expo he did not really see himself as a science-oriented person, but all that had changed and he was now willing to pursue other science-related fields in future.

The attitude of learners also plays an important role in determining whether or not they will be inclined towards learning science. This was seen in the case of all the research participants. In

the case of L3 and L4, to be precise, who did not seem to have an interest in science at the beginning, it appears that their positive attitude made it possible for them to take part in the expo, despite not winning. L2 also indicated that he would never stop doing science and would even attend more expos. This is despite the fact that he has entered the expo twice already and has never won a prize.

Resilience is a third important ingredient for learners, in addition to a positive attitude and motivation. From listening to the learners' experiences as they narrated them, reading their journals and watching them in workshops, it was clear to me that it took some serious determination on the part of those who made it to the end. The process was not without its frustrations and challenges, but they persevered regardless. L4 for example, described the frustration of losing all her work saved on a flash stick. She also told how she would travel to and from town to make use of the library. L3 described the challenges of finding the right equipment to use in testing the water in his project; these could have easily discouraged him, but he did not give up. Considering that entering the expo was a voluntary and not compulsory process, the resilience displayed by the learners is commendable.

Several shifts in disposition were recorded. These include a change in attitude towards science, opting for future careers that are based on the discipline of science, wanting to take part in expos again, and an increase in confidence when dealing with science-related projects. These shifts represented notable changes on the part of the learners in this study.

Shifts in disposition were found to be the result of taking part in the expo. The shifts were caused by several factors, including the learners' getting help from other people, finding learning environments that were conducive, and doing projects that were close to their hearts.

The central conclusion that I reach as a result of this study is that participation in science expos certainly does have an influence on learners' disposition towards science learning. This influence can either be negative or positive. My findings revealed that the influence was more positive than negative. From most of the learners that I interviewed I gathered that there had been a shift in their disposition. Even the disgruntled learners indicated that even though they might not take part in an expo again, they would continue learning science at school.

6.3 Extent to which my research questions were answered

Five sub-questions were asked in my research to unpack my main research question: How does participation in science expo influence grade 9 learners' disposition towards science learning?

The first sub-question asked what motivated learners to take part in the expo. This question was mainly answered through journals and in the semi-structured interviews with learners. These findings were reinforced by the fact that the learners went through to the expo, and by the explanations they displayed on their exhibition charts at the expo.

The question of what activities resulted in the development of scientific skills as learners worked on the projects was answered by semi-structured interviews and also observation. This question was not easily answered by the research methods used. This was because when learners actually worked on their projects they were on their own, and herein lies the importance of self-regulation, as proposed by Vygotsky (1978).

Sub-question three was about attitudes towards science before and after the expo. The question of attitude relied on consideration of factors such as interest and enjoyment. The interview responses adequately addressed this question. The causes of changes in the learners' disposition towards science learning were answered by observation at workshops and responses to interview questions, in which learners indicated the activities they took part in which enhanced learning. All the learners indicated that the way they were taught in preparation for the expo was different from what they were used to. L1, L3 and L5 in particular seemed to suggest that they learnt more effectively in preparation for the expo, and from that it could be concluded that the way learners prepare for the expo has an influence on their disposition.

Lastly, interviews gave data on the disposition of the learners after the expo. Two of them indicated that although they would not participate in the expo again, they would continue to learn science-related subjects.

6.4 Recommendations

Having considered the benefits of participation in science expos in influencing learning dispositions towards science learning, I have several recommendations to make. Grade 9 is a

strategic time in the school life of learners, and hence an appropriate time to give them an opportunity to engage with scientific projects. If learners are to improve their attitudes towards all the sciences, the time allocated in secondary schools for science lessons needs to be increased. This finding was also made by Kibirige and Hodi (2013) in their study conducted in South Africa. Schools should also promote scientific inquiry to a greater extent than is currently the case. Science teachers should be empowered to assist learners in carrying out scientific investigations.

Another recommendation is that individual activity and group participation work jointly to shape productive dispositions in learners, as was noted by Gresalfi (2009). If learners are to develop a useful disposition towards science learning, a positive attitude and motivation are necessary. This is similar to the conclusion reached by Borda (2007) after an analysis of a hermeneutic approach to science learning as proposed by Gadamer (Borda, 2007). Borda goes on to recommend allowing learners the freedom to work with projects of their choice. I would therefore recommend that group activities b made an integral part of any learning.

From my study it emerged clearly that when learners work with projects that are close to their hearts or that involve things familiar to them from their immediate environment, their interest is aroused and they apply themselves to the projects with more zeal. Kaya and Ebenezer (2007) made the same findings in a study of high school learners in America. It is therefore imperative that learners be afforded the opportunity to help choose their own projects.

Allowing learners to be part of the decision-making process, especially regarding their projects, helps them with learning to make judgements. It also gives them the power of ownership over their projects. Referring to science teaching, Pell and Manganye (2007) advised that science should be taught for positive attitudinal outcomes as well as positive cognitive gain, as the two are not exclusive. I would also recommend that there be more explicit encouragement for female learners to take part in such scientific projects as the Eskom Expo. The story of L4 is a clear example that one's gender should not be a deterrent for any learners who want to take part in scientific projects.

Kahenge's (2013) study focused on learners' and teachers' experiences with science expos, while focused on how participation in expos influences learners' dispositions towards science.

An area for future study could be how teachers can utilise the learners' experience in the expos to enhance their classroom practice.

Finally, and probably most importantly, I would like to make a recommendation in line with what was said by Carr and Claxton (2002, p.12), that "learning should involve developing dispositions that involve the ability to recognise when skills become useful tools for solving problems". This is probably the essence of learning science, to be able to solve problems. It is also in line with the main idea behind the conception of the Eskom Expo for young scientists.

6.5.1 Limitations

The major limitation of my study is that its findings cannot be generalised across the education sector because it was a case study focusing on Grade 9 learners from two schools and therefore very much context-related. Notwithstanding this, some insights into learners' participation emerged from this study. Another limitation that I noted was my inability to obtain as much information in the main study as I would have preferred. This was because of the departure of one of the science teachers who used to facilitate the workshops of the learners and mentored them until they reached the ESKOM finals. As a result, I did not get as much insight into the learners' journals as I would have had the teacher still been there.

The findings of my research may in part be influenced by my own perception of what might be the experience of learners from disadvantaged schools. Presently, I am not working with learners of the same grade as the ones in my study. This could have an effect on my understanding of what they go through and what is required of them at this stage of their learning. As a result, I did not get to fully appreciate the level of scientific engagement they went through in preparation for the science expo.

If I were to do this research again, I would spend more time with my research participants to gain greater insight into their lived experiences. I feel that I did not get enough of their real experiences as most of the work they did on their projects they did in their own homes.

6.6 Reflections

My research journey was an insightful one. The knowledge that I was going to be a Master of Education graduate gave me such joy in the beginning, but the events that followed almost got me thinking about quitting. The distance between Masters and Honours in terms of the

expectations of the supervisors was quite overwhelming at the beginning. Often I found I was not as good as I thought I was. My writing style was not academic enough as I preferred a more conversational idiom (writing for myself rather than for other people), and this was not acceptable. I suddenly found myself being chastised for making strong claims, some of which I had made before; but now they were not permitted without evidence and argument. There were a lot of adjustments to make and now I am grateful for the coaching I got from my supervisors. I felt fortunate to have the combination of supervisors who worked with me. Their support, patience and tolerance saw me through.

In the field of research itself, I got to relive some of the emotions that come with being an educator and from which I had been partly sheltered as a result of working with more mature learners over the past few years. Doing the research on a site which is not the same as my usual working space made it a taxing process, but fulfilling at the same time, because the learners fully applied themselves. My life was adjusted to suit the requirements of this project, especially on the social front.

Working with the young learners from different schools made me view the policies that are put in place by the policy makers in a critical light. Belonging to a generation that experienced the injustice of apartheid (or its various manifestations in other parts of southern Africa), I found unacceptable the lack of commitment that still exists in structures that determine matters of equality and equity in education.

At expos, learners who come from disadvantaged and under-resourced schools have an opportunity to share the stage with those from advantaged and resourced schools. While this may sound good, the downside to it is that the expectations of the adjudicators seem to intentionally ignore the differences that learners bring to the expo. The absence or inadequacy of resources seems to be ignored, and yet this makes a significant contribution to what the learners can bring to the expo. I am saying this because although it was not the core focus of my study, the feelings of betrayal and unfairness that some learners in my study developed had me getting involved emotionally. My only hope is that I will be able in whatever way I can to continue encouraging the affected learners to keep going and not give up their dreams.

An area of frustration for me was when I could not get hold of one participant who had what I considered to be probably some of the most valuable data. She was disappointed by the expo that she no longer wanted to discuss anything to do with the expo. I was however fortunate

because through perseverance I managed to get hold of her and also counselled her on the issue that was bothering her.

My whole experience doing this research has left what I think will be permanent marks on the map of my professional journey. The research encouraged me to look closely at my learners' background, and this gave me an in-depth understanding of how social inequalities impact on learners. As an educator it has showed me that there is potential in every child and that it is my responsibility to ensure that that potential is unleashed.

6.7 Conclusion

In the introduction I explained that my research would be on how participation in science expos influences five grade nine learners' dispositions towards science learning. I assessed and analysed their journals, conducted interviews and also observed as they worked during the workshops preparing for the ESKOM Expo. I have looked at the dispositions through attributes of attitude, motivation and resilience. I also analysed the issue of dispositions in terms of how they can be viewed through the theoretical framework of social constructivism used in this study.

In this chapter I have made some recommendations on what can be done to realise the goal of shifting learners' dispositions towards science learning in a positive direction. Areas for future research have been highlighted and I have also explained the limitations of the study. My journey throughout the research process was outlined in my reflections.

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Appendices

Appendix A: Letter of consent

Dear Parent,

My name is Beatrice Musekiwa and I am doing a master's degree in Science Education at the Education Department, Rhodes University. You are being requested to give permission for your child to take part in a research study on, "An investigation into how participation in science expo projects influences grade 9 learners' disposition towards science learning".

The focus of the study seeks in particular, to look at how learners' dispositions towards science learning are influenced by their participation in science expos. If you are agree that your child can be one of the participants in the study, she or he will be interviewed on dispositions towards science learning. There is no foreseeable risk involved in participating in this research.

Kindly be informed that participation in this study is voluntary. If you do not want your child to be in this study, he/she does not have to participate. Also, participants are free to withdraw at any time if they so wish. A decision not to participate in the study will not have any effect on participating in the Science expo club.

If you have any question about the research, please feel free to contact me at 078354 5809, beakundi@yahoo.comor Dr. K. Ngcoza at k.ngcoza@ru.ac.za, Mr K. Jawahar at k.jawahar@ru.ac.za and Mrs Z Kuhlane at 084 038 7368.

Thank you for taking time to read this letter.
If you agree for your child to participate in this research, please complete the consent form below.

Yours sincerely,
Beatrice Musekiwa

I …… (full name of parent), the father/mother/guardian of …… (full name of child) hereby confirm that I understand the content of this document and the nature of the research, and I consent to my child participating in the research study.
I also understand that my child is at liberty to withdraw from participating at any time without any disadvantage.

Parent's/Guardian's name……
Parent's/Guardian's signature……..
……..
Date…….

INCWADI MVUMELWANO

Mzali obekekileyo,

Igama lam ndingu Beatrice Musekiwa. Ndenza izifundo ze-masters kwihlelo lweNzulu lwazi kwe zeMfundo kwiSebelwe Mfundo eRhodes University. Ngembe ko nokuzithoba, ndicela imvume yakho ukuba umntwana wakho abe yinxalenye yabantwana abaya kuthi bathathe inxaxheba kwizifundo zam ezijolise ekuphandeni ukuba ingaba ukuthatha inxaxheba kwabo kwiScience Expo kunegalelo kusinina kwizifundo zaboze Nzululwazi.

Ukuba uyavuma ukuba umntwana wakho athathe inxaxheba koluphando, uyakuthi keubuzwe imibuzo malunga ne 'Expo Science Club', abhaleno vavanyo ekuqaleni kwizifundo nasekuyenikokuphelakonyakaukuzamaukuqondaukubaumahlukoukhonakusinina. Akukhontoke inobungozi ukuthatha inxaxheba koluphando. Iziphumo zovavanyo ziyakuba semfihlakalwe niyayeazi yikubanawo amagama abantwana.

Qondakananjaloukubaukuthathainxaxhebakoluphandokuxhomekekeemzaliniwomntwananasemntwaneni, ukuba ayiyo minqweno yakho ukuba umntwana wakho athathe inxaxheba, akunyanzelekenga ukuba athathe inxaxheba. Kananjalo, ukubaumntwanawakhouyafunaukuyekanangonaebeseqalileukuthathainxaxhebakoluphando, uvumelekile ukwenza oko. Okubalulekileyo kukuba ukungathathi nxaxheba koluphando, akuthethiukubaumntwanawakhoakavumelakangaukubaathatheinxaxhebakwi 'Expo Science Club'.

Ukuba unento ofuna ukuyiqonda malunga noluphando, unga qhagamishelan anam kulenombolo078354 5809, beakundi@yahoo.comokanye uDr. K. Ngcoza (k.ngcoza@ru.ac.za), uMr K. Jawahar (k.jawahar@ru.ac.za) no Mrs Z Kuhlane at 084 038 7368.

Ndenza ongazenzisiyo umbulelo ngokuthatha ithuba lokuba ufunde lembalelwano. Ukuba uyavuma ukuba umntwana wakho athathe inxaxheba koluphando, ndicela ukuba uzalise esi siqendu semvumelwano singasezantsi.

Ozithobileyo,
Musekiwa Beatrice

Mna …… (igama elizeleyo lomzali), utata/umama/umgcinika …… (igama elizeleyo lomntwana) ndiyaqiniseka saukuba ndiyawazi umongo nomxholo walencwadi mvumelwano kananja lonohlobo lophando. Ngokoke ndiyavuma ukuba umntwana wam angayinxalenye yoluphando. Ndiyaqondaka nanjalo ukuba umntwana awam unakho ukungaqhubekeki ukuthatha ainxaxheba koluphando nasekubeni ebeseqalile ukuyithatha, kodwa ndiyakuthembisa ukuba loo nto ayikumbe kamakhiwiniba.

Igamalomzali/umntuojongenenomntwana……
Ushicelelolomzali/umntuojongenenomntwana ……..……..
Umhla……

Appendix B: Presentation of data from learner journals

Learner 1	Journal outlines the to do list of the learner; project outlined form the beginning to the end; project is on water conservation; process recorded form choosing the topic to working on the selected topic; not much detail in terms of learners lived experience doing the project Findings of the research recorded From advice given in the workshop sessions with SAOEN facilitators, the learner came up with a better tool for water harvesting
Learner 2	On project on how to alleviate water shortage by making use of water from the sea Journal records what motivated the learner to carry out the project ie to find a way of to store water , according to the learner this problem of water shortage is not only a local problem but a global one Question asked by learner to self was " how can there be water shortages when there is so much water around Learner says inspiration came from that question to do this project According to learner the challenge of doing such a project is on expense and accessibility of materials to use Learner thought of a way to make ocean water drinkable Currently it is not being used because of too much salt in it an also some microscopic elements in it The learner aims to use leaves to reduce salinity of the water9this is done scientifically by using apparatus to catch vapour in order to reduce salinity , then neutralise the ph of the water with leaves (scientific process) Learner records the process when different experiments are done and observations recorded (scientific skills of observation use of scientific apparatus etc)

	Testing each 3 times to take the average was not easy but all was worth it as there was a positive result in the end Journal concludes by stating that results did not agree with hypothesis, but learner is pleased with the results all the same Another findings discovered a water purification process in a way (discovery learning) Leaves do not reduce saltiness of water, at least it was a lesson well learnt Display of results clearly done in the journal
Learner 3	Project on changing attitude towards illegal dumping Detailed description of illegal dumping record of why learner chose the project the aim was to solve a problem of illegal dumping first in the learner's immediate environment and then in the larger community the journal records the learner's lived experience and feelings towards the problem of illegal dumping a campaign to bring people on board and stop dumping illegally by putting bins on dumpsites so people can put litter in the bins process of bringing awareness done by conducting survey to assess people awareness (research skills) questionnaire distributed by learner (research skills)
Learner 4	Learner 4 details her goals in the journal. Listed are the projects that she wants to do and finally the one she chooses is on decreasing smelly feet using cheap ways. Examples of the ways to do this are listed as using onion, powder, grave soil, sand, lemon and soda. Experience of the first session's workshop was recorded. Indicated the tips given by one of the facilitators, a senior lecturer at the Rhodes University Science education department. Detail of how learner used the public library to look for what is considerably an interesting topic. Some excerpts:

	• Science expos can be a lot of work but in the end it's worth it because like universities will be pleased to have a student who has been in such challenging competition, and being brave like me cause like I'm the only girl at my school who is doing science expo. I'm one brave girl, I'm very proud of myself. • Weeks are passing by but still stuck on one step, finding a proper topic. Hopefully I will find a great one, a solution to make my community better in a way of doing a double project theta they can all afford -(language). • I know what I'm going to do, I'm going to do a project about smelly feet but the question is how am I going to do it , anyway I'm a genius I'll figure out a solution how am I going to do it. Actually today I will just think about how I will do this. • Yes! yes! yes! I know I am going to do surveys asking people about how they feel about smelly feet and how they treat them from smelling. • My mentors are just great they are helping a lot. I wish I could make it through I really pray to the Most High God to bless me with many blessing so that I make it through. Family support indicated by saying her mum gave her money to go to the library because it was for the expo. Doing work using library computers has one problem, only 45 minutes is allowed hence she will have to go back another day. • I'm enjoying writing in my journal but I'm mostly enjoying to be part of expo exhibition hope to be one of the top 15just to make my mom and school proud, it's not easy being raised by a single parent it's not easy. • My mom bought me a watch just to encourage me to continue with my science last time I didn't make it now she encourages me to work hard and try my best to make it through.

Appendix C: Transcripts of interviews with learners- Pilot Study

Learner 1

Interviewer: Thank you Eyethu for agreeing to do this interview

Interviewer: Uhm my first question is why, what has motivated you to take part in the science expo

Respondent: Waal to be honest ane Mrs Kuhlane introduced us to the expo and told us that if we win we gonna get bursaries to Rhodes so I thought let me give it a try,

Interviewer Okay

Respondent: maybe I could and to also solve the problem in my community

Interviewer: So it's basically those 2 things to solve the problems and the likelihood that it would help you in future

Respondent: Yes

Interviewer: Okay, so far what scientific skills have you acquired as a result of taking part

Respondent: Waal I learnt how to write scientifically first of all,

Interviewer: Great

Respondent: kkkkk (laughing)

Respondent: I learnt to use the hydrogen sulphide test I know how to test some germs aah bacteria in toilets because since my project was based on toilet cleaning.

Interviewer: Okay

Respondent: And I also learnt to be confident and gained power of public speaking

Interviewer: Is it?

Respondent: Yah

Interviewer: How did that happen?

Respondent: Because in the science expo there are many people so you have to learn to be confident about your project and to know your project properly and ya that gave me the power

Interviewer: Okay alright so how has that participation like changed your attitude towards science learning?

Respondent: Well science is mxnm, first of all I thought that science was a hard subject and I can never do a career in science but now I have looked at many different careers in science

Interviewer: Is it

Respondent: Yes and it motivated me so much and we met different people who are very famous for science for science aah

Interviewer: So now you are confident aah that you can even take up a career in science, a science based career like medicine maybe, what one, which one do you actually have in mind

Respondent: Eh

Interviewer: So which career do you have in mind?

Respondent: I'm interested in laser physics

Interviewer: Laser physics

Respondent: Yes

Interviewer: Wow hey you know where you are going,

Respondent: Kkkk

Interviewer: what's laser physics?

Respondent: It's based on invest aah in researching lasers like the lights and what, what kind of power it has and sometimes it's about producing different lasers ,like now they discovered that laser can cut hard substances

Interviewer: Okay

Respondent: And now they are still researching on some lasers that can burn staff without polluting the air

Interviewer: Woow, is that somehow related to what you have learnt in class or?

Respondent: No I've learnt it in a book, I've read it in a book and researched about it

Interviewer: Okay so basically now you, you are probably going to look at other things that are related to science as a result of this participation?

Respondent: Yes

Interviewer: but are there any new things that you have learnt since taking part like you say ok before I took part I didn't know about this /

Respondent: ya many things because I looked at other children's project and I learnt so much like recycling paper ,or using the dirty energy from garbage to generate electricity

Interviewer: ok

Respondent: I also learnt that titanium oxide can be used as a cleaning substance because many people think titanium is a dangerous substance but when it's mixed with certain can create a cleaning substance

Interviewer: ok,

Respondent: so many things

Interviewer: otherwise if you had not maybe taken part you wouldn't have known these things, from other learners, wow I really hope that you will be able to pursue your career in science

Interviewer: how do you see yourself in future as a result of taking part in science expo? What do you plan to do later in life, and how does your participation in the science expo influence your decision?

Respondent: I know that I want to be a scientist

Learner 2

Interviewer: what has motivated you to take part in science expo?

Respondent: discovering myself, investigative mind, to improve myself

Interviewer: what scientific skills have you learnt through taking part in the science expo?

Respondent: seeing others which were better than me, searching information, using computer, confidence

Interviewer: how has the participation changed your attitude towards science?

Respondent: attitude has improved

Interviewer: who's been assisting you in your project?

Respondent: science people at the monument, expo students, peers

Interviewer: what is your project about?

Respondent: growing plants using different animal waste

Learner 3

Interviewer: what has motivated you to take part in science expo?

Respondent: I love science because of the community, my teacher made me to take part in science that changed my attitude IT skills, motivated to do more, competitive spirit, prizes bursary

Interviewer: what scientific skills have you learnt through taking part in the science expo?

Respondent: I've learnt more about water

Interviewer: who's been assisting you in your project?

Respondent: friends, family, teacher, self-regulation, internet, input from community

Interviewer: what is your project on?

Respondent: project on recycling water

Appendix D: Audio transcriptions- Main study

Learner 1

Me: Was it your first time to take part in the expo

L1: bendifuna ukhu, I wanted to improve my project

Me: do you feel that that happened, did you improve your project?

L1: Yes I did, the judges zikhezandicelela ukhuba ndilungisephi

Me: what was the project about?

L1: I didn't win no

Me: will you enter again next year

L1: Yes yes I will enter

Me: To what end?

L1: It's about gaining experience, it's about commitment

Me: what is your view towards science?

L1: ndingathi iscience ithetha ngezinto ezievolver apha ngaphandle into eziyenzeka in daily lives iyaisinyukangokuabafundiabaninzibaayithandaisciencebayaythandaiscience and most students sithi gqi ne more ideas so iyapuhla nook

Me: What about you personally?

L1: into yokuba iscience it's changed I like science more

Me: do you like attending the expo?

L1: science ndiyayithanda and nalapha esikolweni ndienza iscience neMaths, ndingathi apha esikolweni iscience ayiko elihlobo ndifunda ngayo kuexpo.

Leyi eye expo siyanikwa ithuba ixhesha ukuba sicinge about ideas zethu that's why ingumehluko kuleyi eyalapha.

In future ndiyathanda into zombani even ekhaya kubizwa mna.

Ndizibona ndizoba ngumnye weengineers in future.

Learner 2

Me: I want to congratulate you on your merit, how do you feel? Thank you for agreeing to do this interview again

L2: I feel overjoyed

Me: You feel happy?

Me: Seeing that it was your second time entering the expo, what was the experience like for you?

L2: It was like my first day I felt like it wasn't the first time, I was not changed

L2: I felt like a scared again to be interviewed

Me: By the judges,

L2: Because my English is not.....

Me: So when this expo, how has it changed or how has it the way you see science even when you learn science in class

Me: what has expo done to you in terms of your response in class?

L2: I want to experience the life science. It makes me want to do more than working in classes of science

Me: The life of science

L2: My career is on science, is to be a scientist one day that's why I'm interested in this expo thing.

Me: So you can even enter next year again? Is it like it has become a platform to keep on improving your skills?

L2: yes I will enter

Me: how did the help from oSisNozi, o Mrs Kuhlane, how did they help in your project? Do you feel that their assistance helped you get this merit?

L2: Yes they do, did they participate in my project and my surveys either

Me: You can speak in isiXhosa vha?

L2: Besides bana my brothers and my next door neighbour they did a lot from, from my project.

Me: So you feel that this is your merit with them not just yours alone

L2: Yes

Me: Because all these people made a contribution

L2: Yes

Me: Ok

Me: How do you feel about the whole expo thing yesterday, did you feel disadvantaged or did you feel like if I was at that school maybe I would have done better?

L2: I felt advantaged because when I got that merit like it was joy and akhaze, I couldn't do anything like hey

Me: Ok so you no complaints whatsoever, you were fairly treated?

L2: Yes, there were no, there were no, ukukhathwa, sasinga qatwatinadhu, pa.

Me: Ok that's how you feel?

L2: Yes

Me: What do you want to improve maybe next?

L2: I want to improve this project again because I can see this project going somewhere

Me: Ok with more skills you can see it going somewhere, I like that, I like that

Me: What about in class now, how have you become different in class?

L2: In class why I think because in these subjects I feel miserable I can't I don't know exactly these things that they teach me , some of them what is difficult to me is the teacher because when I don't understand I put my hand up but that teacher won't exactly to explain

Me: Ok so in a way are you saying maybe there are things you are learning more outside the classroom than in the classroom?

L2: Yes

Me: Ok thank you so much for this interview, I wish you all the best in your endeavours

L2: I wish this is not the last

Learner 3

Me: Welcome, how do you feel about the expo yesterday?

L3: It was fun but scary at the same time because I was nervous and the experience was worthwhile

Me: Were you?

L3: I wasn't nervous when going there and setting up the project, I was nervous when judges were there, I was shaky and I was able to do all that I wanted to do.

Me: Would you enter again next year?

L3: I will enter. A part of me feels that I just can't leave it hanging, because the judges said like this is future thing, like they shared a lot of good things about the project , a lot of pointers , me just leaving it hanging doesn't make sense.

Me: Ok not just because of the judges said but for your own satisfaction?

L3: For my own satisfaction and proud of myself that I went through with this thing and I see it to the end

Me: Ok

L3: I want to win I don't even want merit I want to win this and I believe ukuba with all these pointers I'm in the right track.

Me: Ok now tell me has your view towards science changed as a result of taking part in the expo?

L3: Uhm well to be honest since I'm not a science person right coz I want to do medicine and other stuff I thought science was

Me: You want to do medicine?

L3: I want to do medicine

Me: So it's a science course isn't it?

L3: I know it's a science thing but I thought like medicine is a mixture of science body and then science is when you want to be a scientist I thought it was on, how may I put it it's not boring but I thought it was too much like uba it wasn't fun, you had to do things experiment and it was tiring , but you actually have fun whilst doing it and it's nice to like with science people ... things people solve things and it's nice to see all that stuff and it's nice to have your own thing

Me: I see you love things that have fun, fun is important hey?

L3: Ya, fun is important because I see fun as important because if you are bored with what you are doing, there's nothing good that's going to come out of it , you need to be happy with while doing it. It's like your project you need to have fun doing it but having fun doesn't only mean fun all the time it's fun with work so you need to know how to balance both

Me: I noticed that um I went to your stage, you didn't have a lot of documentation, why was that?

L3: Well due to, I don't know if it's I rush or whatever. uTheo came to my house and then I left the one with an empty file and then usis Nozi had my pledgerism form of declaration ad all that stuff but I left my life I was focused too much on the board and then I forgot all the other things.

Me: Maybe perhaps those are the things you need to look at next time,

L3: That's what I like because the experience shows you where you went wrong and where you need to fix it , part of me is mad at myself and disappointed but part of me is proud for the fact that I went and I know how to prepare next year because I went

Me: ok that's very rich information you have given me, you acknowledge that you could have done more that is good.

L3: Ya I couldn't do more ya since my mom's telling me I need to have a plan B.

Me: so future where to from now, are you going to pursue a career in science?

L3: I think my plan B is science

Me: What is your plan A?

L3: My plan A is medicine and my plan B is science.

Me: let me put it this way uhm, this is as a result of participation in the expo you are beginning to see other possibilities?

L3: Ya

Me: that is good, what was the most it moment for you at the expo the one thing you cannot forget?

L3: well one thing I cannot forget there's 2 things actually that I cannot forget, it's when I was presenting my project to the judges , I think somehow I knew it was a project I had to present it and I loved doing it but at a certain point I didn't think of it as a bigger thing, I didn't think of it as a bigger picture and that same thing when the judges were there and when they were calling out the names like the names of the merit the bronze and that stuff. It sinked in that I too wanted to shake one of those people's hands and hold something that say I went home with this coz I don't know what happened, I'm very competitive person by nature like I' very competitive everybody who knows me but with the expo I don't know I was more focused on doing my project more than beating everybody else or coming out on top I was more focused on the project

Me: was it your first time?

L3: It was my first time going to expo, because the first year the first time because of the complex nature, since my project needs more time, we came out late because of the printing and typing so we had a lot to do in a short space of time

Me: that last time

L3: So it means this time was really your first time?

Me: this time was really my first

L3: So perhaps you know exactly where to, how to hit your target to come out tops

L3: Ya to come out tops next year like seriously

Me: okay going back to class do you think the way you learn is going be different

L3: I think it will be different because I only looked at science as a hard subject that I just need to pass but now it's more on a scale of its since I did this and it included science so in class I will do this as one of the subjects that I love like I'll do this with more passion a let me say so , I'll do my subjects with more passion because I only did like for the past few years as a subject that I only needed to pass , like I need to read and all that stuff

Me: I get you

L3: thank you so much but do you feel that for your project to be what it was even though you didn't get a bronze or silver other people's effort also contributed

L3: ya they did they did contribute

Me: who are those people?

L3: for instance sis Nozi, if not for sis Nozi I think a lot of things I wouldn't be able to do or see. Like I would go to her and show her my project because at times its either I did less on a certain topic or certain equipment that I needed to use for experiment so I think without her effort I wouldn't have made it.

Me: so you really feel that you were helped or assisted?

L3: Ya I was assisted in the workshops I attended the pointers I got especially from u Charles the last time I had none of those before and those are the things that made my project better that's why I'm saying that I want to go back next year.

Learner 4

Me: thank you for agreeing to do this interview with me finally!

L4: pleasure

Me: I'm aware that you entered for the second time right?

Me: What motivated you to enter for the second time now?

L4: It's for the love of science

Me: you love science?

L4: yeah

Me: From the time you started to do science entering the expo, let me say from the last time what sort of changes have you observed in yourself with regards to science?

L4: I was more confident

Me: The second time?

L4: Ya

Me: Ok

L4: The first time I was scared because it was my first time then my second time I was more confident and bengi proud because I did a good but unfortunately ya

Me: Unfortunately what

L4: Unfortunately the judges didn't approve my good job

Me: What did you mean?

L4: What do I mean coz my project, I think mna there was it had everything they asked for but khe I wasn't through the final but its fine.

Me: What was your project on?

L4: It was about decreasing smelling tekkies

Me: Uh

L4: And my results were successful, and I got good results and ya but unfortunately

Me: Unfortunately you didn't win?

L4: Yeah

Me: You sound like you are disappointed

L4: I am

Me: Why are you disappointed because earlier on you said you entered for the love of science?

L4: Yeah

Me: You did not say to me, don't worry I'm not punishing you ne I'm trying to find something out.

L4: Ok

Me: you said you entered for the love of science?

L4: yes

Me: but now you are disappointed?

L4: yeah

Me: so what you are saying is that you were disappointed by not winning?

L4: yeah

Me: you were disappointed by that?

L4: yeah

Me: but that was not the reason you entered?

L4: yeah the reason was because I wanted to win and I love science

Me: you wanted to win and you love science?

L4: yeah

Me: now it's clear you see where I was coming from.

L4: ok

Me: so having said that what is your feeling now towards science how do you view science learning science I'm not just talking about entering the expo?

L4: science is so challenging and science iyazamekaya and yaya ineedi effort yomuntu lot of effort and funeke upractice each and every day in order to achieve high marks

Me: do you see it as a subject you can continue with

L4: ya

Me: even after school

L4: ya

Me: ok so aside from the fact that you were disappointed do you think that it was worthwhile learning science

L4: ya

Me: uhm thank you for that and what are what some of the challenges are you faced when you were preparing for the expo, what are the things you had to overcome mhlaumbe?

L4: ndikenda missisher ezinye izinto when I was typing

Me: uhm

L4:I forgot to type other things then my flash yaxima everything so I had to retype again redo the project again ya

Me: Oh in the process

L4: ya

Me: So it was difficult

L4: It was difficult

L4: yes but I managed to do it

Me: but you managed to do it

L4: my iflash yami ixime igraph zami so I had to draw some of the graphs and my work was was too what umsebenzi wami ube umninzi so kandikwazi ukufika kakuhle mhlambi ngezo those were some of the reasons I didn't win really.

Me: that was my next question ukhuthi what did the judges tell you because I'm sure even if you don't win judges do say something to you.

L4: judges shame they didn't tell me anything as in they didn't have comments as in your project needed that and that they said everything is cool, and they said construct is too bright but it's cool they didn't have comments ok like bad comments I must fix that and that, they did have icomment ngespellng setekkies they said here in Sa we spell takkies as in ta and then overseas they spell tekkies as in te so its fine so ya

Me: ok I wish you all the best but for me just to wrap up since you have expressed your disappointment for me is to say iESKOM is just a stepping stone there might be other expos you don't have to give up an Dim glad that it's not affecting the way you are going to keep on learning science at school. Thank you so much for sharing this information

Learner 5

Me: Thank you for agreeing to do this interview with me, I said thank you

L5: Ok

Me: Pleasure ne. You were entering expo for the first time how was it for you

L5: It was good and very challenging

Me: Very challenging

L5: Yes

Me: In what way?

Me: Take me through from the preparation stage because I remember a few days before the expo facilitators at SAEON tried to help you with your project

L5:Yes it needed so much work and a lot of thinking so ah it wasn't aha project that I was gonna just pull out of my mind I had to think.

Me: Uhm

L5: Hard to do my work and to see if it will work or not

Me: Uhm

L5: From the process then I saw that it can work and I believed in myself that I can do it

Me: What was the project about?

L5: It was about ITG intercontinental travelling visa card

Me: What motivated you to take part?

L5: It was for the love of science I'm good at science also at school so I thought I would try to do more and try to invent my own staff and come up with my ideas and see where that is gonna take me

Me: Ok you thought there is a space for that in science to come up with your own ideas?

L5: Yes

Me: So where do you see yourself in future?

L5: In future I see myself as an inventor

Me: What would you like invent?

L5: Like technology innovation

Me: You are interested in innovation in the field of technology

Me: So how is the preparation for the expo different from the science that you do at school?

L5: For expo it takes a lot of hard work it takes weeks and months do a lot of thinking so much work

Me: More than at school?

L5: More than at school you don't sleep you do a lot of work a lot of filing a lot of typing then there'll be days where you have to your own filing all by yourself do your own graphs by yourself do your graphs calculating and stuff

Me: By yourself?

L5: By yourself with no one helping you.

Me: Are you saying you didn't get any help?

L5: I didn't get any help but I got help here and there.

Me: Ok maybe you are saying for somethings you got help?

L5: Yes for a few things.

Me: Because I attended sessions where people were actually talking to you trying to help you.

L5: Sharing their ideas of how should I add on

Me: Ok so tell me about how entering the expo has changed the way you look at science, I'm not interested in what happens at school but entering expo participating and eventually entering the expo how has that changed you in as far as your feeling, your view perception of science is concerned?

Learner 5: Um I have been a hard worker

Me: Uhm

Learner: Yes

Me: And I've learnt that you don't to be scared of anything and anyone and you must keep going no matter what happens

Me: So do you think next year you will enter again

Learner 5:I wouldn't say I will enter again because uhm this past few weeks I've seen my project being advertised on TV so it was very hurting to me because they took it from me

Me: Do you think they took it from you

L5: Yes

Me: What are they advertising on TV?

L5: My project my visa card exactly the same

Me: Are you sure?

L5: Exactly the same

Me: Really?

L5: I've seen it several times

Me: When you thought about it, were you the first person ever you knew who had done something like that because that would mean really they are copying from you?

L5: I wouldn't know but to my understanding I was the first one to come up with that

Me: What was it about again remind me?

L5: It was about a visa card travelling card,

Me: I have heard of visa travelling cards already, I'm not downplaying your project but you see when you invent something and you see people using your idea you should get paid for it.

L5: Yes

Me: Some people even get paid for it you see.

L5: They should pay

L5: My project was about a visa card resembling a visa passport, I was changing the visa passport into a card that has a micro-chip, storing al your details into the micro-chip, instead a person getting more stamps

Me: Ok are you talking about a visa or a passport?

L5: It is I'd say it's both.

Me: Because the one that gets stamped on is a passport

L5: Yes

Me: So you are saying instead of them stamping on a passport you are having this chip?

L5: This chip instead of renewing your passport or getting more stamps you are having this chip for a long period

Me: So why does that make you to say you will not enter the expo again?

L5: Because they took my idea for themselves and they are advertising it on TV.

Me: Who is they?

L5: I don't know I just saw it on TV.

Me: The expo people maybe?

L5: I'd say that.

Me: What about going back to school would you be interested to continue learning science?

L5: Yes.

Me: thank you so much for doing this interview with me all the best.

Appendix E: Observation Notes
Observation session 1

Day one was the first workshop day for the learners. Fourteen learners attended the session and they are all grade 9 learners from 3 township schools. Eight of the learners were boys and 6 were girls. The facilitator of the workshop from SAOEN led the session. She started by welcoming everybody and inducted the learners on the participation in the ESKOM Expo. Learners were given note books to write in during the sessions. They were also encouraged to keep journals of their work, where they record all their experiences, challenges and so on as they worked on their project.

A list of requirements for the preparation for ESKOM Science Expo was given to the learners. The facilitator gave an overview of what Expo entails and the general nature of the competition. An overhead projector was used showing slides on how to conduct a scientific project. Learners Took notes as they listened to the facilitator as she explained the fundamentals of doing a scientific project. Looking at the learners in this first stage of the sessions I registered different expressions of anxiety, excitement and others which I could not actually read amongst the learners. Learners were told to communicate in the language they were most comfortable in by a co-facilitator but the main facilitator encouraged the use of English as it is the language of communication which would be used at the ESKOM Expo event. This could have contributed to what I consider quite a passive first session.

Observation session 2

The second session I attended was done at one of the secondary schools in the township on a Saturday. Sixteen learners attended the session. The number girls had increased to seven and that of boys increased to nine. This was not the second session for the learners and facilitators but for me as a researcher. The facilitator welcomed everybody but immediately expressed her disappointment at the drop in attendance as previously the session had registered 26 learners in attendance. This revelation got me thinking about the disposition of learners towards science learning. It was indeed an indicator that not all learners were keen to continue with the projects.

Some learners try to explain the absence of their peers with one in particular pointing out that her friend had lost interest already. The entire session focused on listening to learners presenting their topics and the facilitators giving guidance where necessary. Areas of guidance were:

- Choice of project:
- Scientific skills development and interpretation in the project
- Research methods used by learners in collecting data on their projects

Observation session 3

The third and last session was done at the university science department. As usual one of the facilitators welcomed us and the learners to the last and crucial session. In attendance were only eight boys and 1 girl. Also present were two former participants of the ESKOM Expo who had been invited by one of the facilitators to attend the session. The main reason for the invitation was to encourage and cast an eye on the current groups' projects as the final preparations were done. The facilitators were otherwise impressed by the standard of the projects of the seven learners whose projects were allowed to go through to the final competitions. There were however still areas of improvements which the session worked on. From the seven were the FIVE learners who were my research participants.

Introduction

My project is about changing [illegal] illegal dumping. Let me define the [illegal] illegal dumping for you maybe some of you do not know exactly the word illegal dumping it is the important think or [which] must be Removed.

Illegal dumping means:

- The disposal of waste in areas such as constructions site, Roads, Pavements, [parks] parking lots, Vacant plots, Sports fields, city, national park etc.
- The disposal of waste into, on top of next to someone's else waste that has been set out on their pick up [point]

I know what you think about my topic in your mind you are asking me why I chose dumping is because my community has problem but I know, not only my community same place have the problem that community has that is illegal dumping in my Community has the dumping [hasn't] hasn't been Removed for decades

I can usually see children playing [dumpsites] dumpsites and they are surrounded

Not enjoying writting on my journal, but I am enjoying mostly to be part of the Science expo exhibition Hope to be one of the top 15 just aye to be in the top is just to make my mom & School proud, its not easy being raised by a single parent its not easy.

Today I am going to go to the library to gather information about interesting topics cause I don't think my last year project will be "okay" for me to continue with. I just don't feel very proud about it I feel like people won't be intrested in it. I should seriously find a new intresting project not later than today

Hypothesis

People in South Africa have been throwing stuffs every day lately, but to me in my community people have been throwing things and clearing the dumpsites every month. So what am sayin is that people in Gezhaams town have limited knowledge on the effects of illegal dumping on the environment and on their health. People will not throw their waste in the Recycling bins provided especially ~~so~~ where there is no notice Requesting them to do so.

The idea was that if I can put Recycling bins at these dumpsites ~~will~~ people will get to Recycle and less dumb Rubbish.

In my hypothesis what I think will happen to these dumpsites people will finally do things that I expected them to do like following the warning sign for example by picking up papers and throwing them to the bins that is been provided.

The only improvement that is made durin project is that my Community has cleaned th

Rhodes Education Dept

9:00 End @ 14:30 25 March 20..

9:00 - we started our workshop by welcoming every learner who came and took part. Our organisers Mrs Rakiya and Mrs Bester showed us a video which will help us with our Science projects - we took notes and - ~~[illegible]~~ there are different schools who took part, Mr Ngcezu gave me tips and he said there is nothing wrong by doing two projects. So I am continuing with both of them.

Regional Expo 2015: Judges Scoring Sheet

Eskom EXPO FOR YOUNG SCIENTISTS	**NAME(S) OF LEARNER(S) :**	Primary	6	7		Project Number :
		Junior	8	9		
		Senior	10	11	12	
	PROJECT TITLE :					
	AMOUNT OF TESTING:					

MARKS ALLOCATED				
SECTION I VALUE OF PROJECT / 50	**SECTION II** WRITTEN COMMUNICATION POSTER, REPORT, FILE / 30	**SECTION III** ORAL COMMUNICATION / 20	INITIAL TOTAL / 100	FINAL TOTAL AFTER PANEL DISCUSSION / 100

NAME OF JUDGE (PRINT PLEASE):	JUDGE'S SIGNATURE:	CONVENOR'S NAME & SIGNATURE:

POSITIVE COMMENTS AND SUGGESTIONS FOR IMPROVEMENT :please complete this section in detail.

Do you think this project is of International Science Fair (ISF) standard? Yes/no Motivation.
What improvements would you recommend for this project? Please specify.
Who could mentor this finalist if selected for the International Science Fair? Please give the name and email address of this person.
Any other comments for the comment card? Poster Journal/Project data book/rough work Project report Interview General

Semi-structured interview schedule for the pilot study

Qn 1: What motivated you to take part in the ESKOM science expo project?

Qn 2: what scientific skills have you developed working on the project?

Qn 3: how has participation in the expo changed your attitude towards science?

Qn 4: do you see yourself pursuing science in future after school maybe?

Qn 5: who assisted you in doing the project and what can you say about the help you got?

Semi-structured Interview questions for the main research

Qn 1: Was it your first time to take part in the expo?

Qn 2: What motivated you to take part in the ESKOM science expo project?

Qn 3: How do you feel about the expo yesterday?

Qn 4: Would you enter the expo again given an opportunity?

Qn 5: How has participation in the expo changed your attitude towards science?

Qn 6: Do you see yourself pursuing science in future after school maybe?

Qn 7: Who assisted you in doing the project and what can you say about the help you got?