

Chapter 1

Introduction

1.1 Statement of Purpose

The purpose of this study is to investigate the effect of the South African Environmental Observation Network (SAEON) science education camps initiative aimed at encouraging science careers selection among the Grade 11 Phalaborwa learners. The study followed mixed methods of qualitative and quantitative research methods to identify and quantify careers former SAEON science participants are following or have followed at universities, and to explore science camps contributions to learners' scientific skills, knowledge and values.

1.2 Background to the Study

The shortage of scientists in South Africa (<http://www.news24.com>, April 04 2003 12:26:49:937PM; NRF Media Statement, 23 January 2009) and elsewhere in the world evoked debate on how best the situation could be redressed (Osborne, Simon & Collins 2003 and Teitelbaum, 2004, Nordling 2009, Onwu & Kyle, 2011). As the debate rages, the South African government took stopgap measures that include recruitment of manpower (science and mathematics teachers) from abroad to fill the gap. This can best be seen as a temporary solution. On the other hand efforts and resources were being directed toward creating a sufficient number of scientists in the country by increasing the number of learners studying science.

Science education programmes were initiated at schools from previously disadvantaged learning background to complement school activities in order to attract young people to careers in science, engineering and technology (DST, 2006; NRF, 2008).

In addition, Life Orientation (LO) has been drafted in both General Education & Training Band (GET Band) and Further Education & Training Band (FET Band) to orientate learners to the world of work, careers and career choices, and to play a crucial role in linking the economic needs of the country with the aspirations, abilities and skills of learners (Orsmond, 2002). However, schools and even institutions of higher education are unable to attract youth into science careers (Van Esbroeck, 2002).

Many steps can be taken to redress the shortage of scientists in the country. Subsequently, the South African Environmental Observation Network (www.saeon.ac.za) has initiated science education programme that serves as the platform of interaction of high school teachers, learners and scientists/researchers. The science education programme has been designed to recruit, encourage and prepare learners from the previously disadvantaged communities for careers in science related fields.

SAEON is an NRF scientific research facility and an initiative funded by the Department of Science and Technology (DST) mandated to establish and maintain environmental observatories (hereafter called nodes) linked by an information management network to serve as research and education platforms for long-term studies of ecosystems. The nodes are distributed at six different South African biomes (see figure 1.1) and are coordinated by the national office located in Pretoria. These nodes are:

- Lowveld Savannah at the Limpopo Province,
- Coastal-inshore at the Eastern Cape,
- Marine-Offshore at the Western Cape,
- Fynbos at the Western Cape,
- Arid lands at Northern Cape and
- Grasslands, Forests & Wetlands at KwaZulu-Natal.

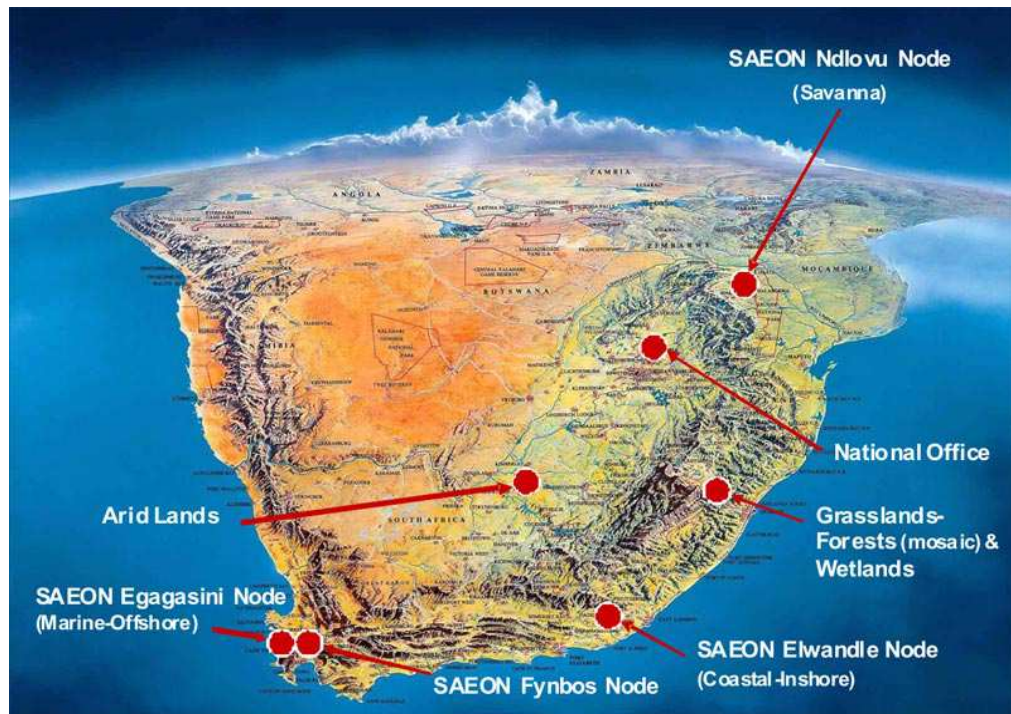


Figure 1:1 Map of Distribution of SAEON Nodes and the National Office

The Lowveld Savannah node (herein known as Ndlovu node, where the research has been conducted) has offices at the Phalaborwa gate of the Kruger National Park (KNP) in the Limpopo Province. According to SAEON's mandate, its responsibilities rest on three pillars:

- Observation science,
- Information management and
- Science education.

The Ndlovu node focuses through observation science on changes occurring in protected and rural areas, river degradation, and loss of ecosystem productivity and biodiversity resulting from land use and global climate change. The node archives environmental data (information management) to maintain a long-term record of change and to prevent data loss through software redundancy or damage. Science education focuses on both teacher support and exposure of secondary school learners to environmental issues, and promoting careers in science disciplines.

The SAEON science education programme is coordinated by the science education officer who collaborates with the node-based scientists and partner organizations to design/develop and implement curriculum linked science education programmes. The science education programme uses science teacher-support programme and science learner-support programme as the strategy to demonstrate the relationship between science teaching and learning, and research for researched-based science education.

The science teacher-support programme includes formal meetings (workshops) and informal meetings (forums) to expose teachers to scientists who introduce them to scientific methods, enquiry teaching and learning activities. The learners programme targets grades 9, 10 and 11 learners and aims to attract them into careers in science by providing them with exposure to hands-on activities and with opportunities to interact with scientists and researchers. The learners programme is comprised of monitoring projects (school yard based), science awareness projects and holiday science camps held at various centres in the Limpopo Province.

Learners conduct scientific monitoring projects such as tree monitoring projects and weather monitoring projects on, or near, school grounds under the supervision of educators and SAEON node staff. The data collected are added to SAEON's archive of long-term data and made available to scientists and the general public. Through partnerships, SAEON hosts awareness events such as Biodiversity day, National Science Week and National Women in Science to expose learners from local schools to the working world of scientists and conservationists.

SAEON Environmental Science Education Programme initiated science education camps as strategy of recruiting learners into careers in science and anticipates that at least 5 learners who have gone through its science education camps nationally would enrol for science related careers at universities per annum.

The annual five-day science camps programme is held at a venue where learners have exposure to environmental science workplaces, and direct contact with scientists and researchers. The SAEON science camps are aimed at influencing, recruiting, encouraging, preparing and supporting grades 9, 10 and 11 learners from the

historically disadvantaged backgrounds of learning into science careers through partnerships among learners and scientists (SAEON Business Plan 2004-2005). However, this study focuses on grade 11 science education camps programme.

Between 2006 and 2008 twelve Grade 11 learners; one from each of the twelve local public high schools in Phalaborwa were selected to attend a week long science camp. In 2009 and 2010 learners were selected from nine high schools. SAEON targets grade 11 learners who have chosen science as specialization subject at the end of Grade 9 but whom are yet to select careers in science. SAEON target grade 11 learners because it believes that many grade 11 learners are at the stage of seriously considering different career options (Park, 2006). The main recruitment strategy to the science camps includes essay writing on career aspirations in science and best performances in Life Sciences, Geography, Mathematics or Physical Science. The Ndlovu node is currently working closely with nine public schools within close proximity to Phalaborwa.

The science education camps expose learners to scientists and engage them in intensive structured small scale scientific research projects aimed at stimulating their scientific knowledge and skills and promoting teamwork. In addition learners are introduced to diverse careers in environmental sciences. In this manner learners are afforded opportunity to complete career portfolios with the objective of guiding them set career goals; identify their abilities and their career interests.

Furthermore, during science camps learners are engaged in sporting and social activities such as soccer games, swimming, volley ball, amazing race, video watching and free time interspersed within the academic week. As a result learners engaged socially with each other and with scientists. Each year the programme is reviewed and adjusted; these adjustments are based on the observations made on the engagement of learners on the science camp activities and the recommendations made by the scientists, the programme coordinator and learners (camp participants).

SAEON believes that the interaction between scientists and learners during science camps expose learners to science that ultimately strengthens learners' scientific skills and yield more realistic perception of science career related fields (Wang & Staver, 2001, Bachman, Bischoff, Gallagher, Labroo, & Schaumloffel, 2008).

Thus, SAEON assumes that learners can learn science best if they learn science on terms of scientists because scientists are better equipped to teach scientific methods (Barton & Yang, 2000). However, the following criticisms have been levelled against SAEON science education camps by:

- The selection of camp participants that is driven by best academic grades. This is rather seen promoting competitive education than learning (Krumboltz, 2009);
- The programme expectation for learners to make future career predictions is unrealistic whilst the future is so uncertain (Krumboltz, 2009). Careers selected at developmental years are often discarded at later years as learners' values are shaped and reshaped (Hruska, 1974),
- The programme lacks the ability to provide continued interaction among participants and scientists. For example, there is no further interaction between the camp participants and the scientists after the camps.
- There is poor representation of black scientists role models especially of South African origin; and
- Very few learners are enrolled for science education camps whilst there is a substantial need for scientists. This means that a number of potential scientists are ignored.

Some of these comments are fair such as the programme's lack of ability to provide continued interaction among participants and scientists, but others such as poor representation of black scientists role models especially of South African origin are not fair since this is what the programme aims to address. With time, more black role models are expected to emerge.

1.3 Rationale

1.3.1 The Past

As we celebrate the nineteen years of democratic order in our country we cannot refute the legacy of inequality caused by apartheid regime and incapacity of officials to translate policy or vision into contextual reality (Jensen, 2001). As a result greed and power hunger is still continuing to tear the social fabric and deep inequalities persist (Mail & Guardian, 2011). The strides made into democracy and education policy change made do not in any way suggest that all is rosy especially in education. It suffices to mention that ‘---the making of education policy in South Africa is best described as a struggle for the achievement of a broad political symbolism to mark the shift from apartheid to post-apartheid society --- but not connected to any serious intention to change the practice of education on the ground’ (Jansen 2001, P. 273). This implies that when policy and curriculum change are undertaken local realities are often disregarded in making certain that changes are relevant or possible (Chisholm, 2005).

Up to a short time ago in South Africa the focus of scientific education was mostly on the white minority as its area of relevance for future careers (Nordvelle, 1990). On the other hand the black majority was excluded as a matter of policy in terms of financing and management of science during the apartheid era in South Africa (Nordvelle, 1990, Onwu *et al*, 2011). As a result many black students were not exposed to or aware of careers in science.

The above situation resulted in many of black students not following science disciplines or following scientific careers. (Nordling, 2009; Philander, 2009; News24, 2003). Environmental science discipline is one of the worst affected in this regard (Rosenburg, Raven, Nsubuga, Mosidi, Ramsarup & Burt, 2009). This is subsequent to a perception that exists that many black South Africans are not interested in environmental science careers because these careers are not part of black families’ cultural context (Rosenburg *et al*, 2009, Onwu, *et al*, 2011).

In fact, the cultural and economic context of many black families is / was a struggle to subsist on inadequate land allocated by the apartheid structures. In this way, black people became alienated from the land under the apartheid regime (Rosenburg *et al*, 2009). Furthermore, the wider environment, as we understand the term today, did not feature in their world view. It seems then that science has in the past been focussing on implementing the repressive policies of those in power to sift those who should follow science disciplines and those who should not (Melon, 1943).

Comparatively South Africa has fewer scientists (including astronomer, chemist, and ecologist) than many countries. Only 3 out of every 1000 people in South Africa were scientists, whereas Japan had 71 scientists and the USA 22 scientists per 1000 of the population (Dzvimbo and Moloi, 2008; Onwu *et al*, 2011). Dzvimbo *et al* (2008) further stated that South Africa also compared poorly with other developing countries. In Brazil the figure was 11 scientists per 1000 people.

It is worth noting that nearly two decades into democracy the distribution of the scientific workforce has changed but little. In 2011 thirteen (87%) of SAEON scientists/researchers were whites and two (13%) were blacks, but they are not South African citizens. Only one of the two black scientists is at a managerial level. This might have a negative influence on how South African black learners perceive science disciplines.

1.3.2 Attracting Learners into Science Disciplines

The situation above shows that South African schools have difficulty in developing students' interest, knowledge skills and attitudes required for careers in science (Van Esbroeck, 2002; Winberg, 2006). This may be attributed to; firstly; the under-preparation of science teachers especially those from the previously disadvantaged teaching and learning backgrounds (Cosser, 2010). These teachers may be an effective factor in driving students away from STEM disciplines than attracting them (ISCU, 2010). Majority of science teachers have difficulty teaching science concepts like the chemistry of depletion of ozone layer, solid waste, endangered species or natural

resources which requires of teachers to have knowledge of several disciplines (Sanera, 1998).

Phalaborwa is in the rural setting surrounded mostly by rural villages where most of the schools in the SAEON programme are situated. The schools in this region are characterised by number of poorly prepared maths and science teachers. Therefore, a number of foreign nationals but not enough was recruited to teach mathematics and science as indicated earlier in this study. Recently Phalaborwa science teachers during the SAEON science teachers' workshop with the scientists commented that they were not confident with scientific method since they were not well trained using the method. As a result they are reluctant conducting science practical activities with learners.

The Online Independent (2011) reiterates that such poor communities suffer shortage of qualified teachers, due to inadequate salaries, a lack of support and incentives. Consequently, classes in these communities seat 50-60 learners (Independent Online, 2011). Such conditions as these are common at schools in the Phalaborwa region and make teaching and learning of science education poor. This shows that disparities in school system are still widespread (Independent Online, 2011).

Secondly, a spontaneous curriculum changes since 1994 has created instability in education. The curriculum has since then changed at least four times; Curriculum 2005, Revised National Curriculum Statement, National Curriculum Statement and Curriculum Assessment Policy Statement. Such changes serve as a note of a reminder of the compounding uncertainties in our education fraternity.

Another negative contributory factor is that few people are employed in natural science disciplines and the career has increasingly become unattractive prospects for new graduates (Osborne *et al*, 2004). One obvious example of the negative contributory factors is the financial remuneration for scientists. In the current unstable socio-economic climate youth would rather choose the occupation that would yield the highest expected monetary returns than science (Xie & Achen, 2009; Teitelbaum, 2003).

1.3.3 The Role of Science in society

Several educationists believe that a shortage of scientific skills has a negative impact on the economic productivity capacity and quality of life of any society (Wang *et al*, 2001; Winberg 2006; Bischoff *et al*, 2008). Scientific skills contribute to the national economies, social well-being, and quality of life through discoveries in the natural, social, and physical sciences that get transformed into new consumer products, improved medical treatment, and more efficient social services (Johnson, 2004).

Furthermore, scientists provide understanding of how fundamental physical, chemical, geological, biological, and social processes interact (Edelson, 2007). This understanding according to Hansmann, Scholz, Crott and Mieg (2003) connects knowledge of general natural sciences to that of specialists to the analysis of diverse environmental systems. The understanding of environmental science informs scientist of how ‘to halt or reduce global declines in biodiversity and their effects on human beings’ (Reyers and McGeoch, 2007, P.295). Therefore, science is crucial in the production of knowledge for an effective economy of any country (Stern, 2004; Bischoff *et al*, 2008).

1.3.4 The difficulty of incorporating scientists into science education

In the United States of America (USA) and elsewhere, there is a gap that exists in the ways in which the practice of science is viewed / implemented (Strauss, Shope III & Terebey, 2005). This gap has created a significant degree of conflict and tension between those in the academic and research communities (Pushkin, Duit, Gilbert, Psillos, Ostman & Dahncke, 2001). The disagreements, among others, centre on pedagogical practice. Firstly,

Secondly, many scientists’ communication skills may not be adequately developed to communicate their scientific findings in science education (ICSU, 2010). Thirdly, scientists are not fully aware of certain current educational issues. For these reasons scientists become less than optimally effective in their role in education (ICSU, 2010).

Thus, over and above what has been explained above, there is a general shortage of scientific skills in South Africa especially of black scientists (Winberg, 2006; Patterson, 2009; NRF, 2009). As a result the South African scientific workforce is largely dominated by the aging white males (Nordling, 2009). Nordling (2009) revealed that 50% of the country's scientists who published peer-reviewed articles were aged over 50 years in 2004.

Despite the dilemma in science education as indicated above it is apparent that scientists may play a pivotal role in science education by supporting and equipping teachers with scientific knowledge and skills in their key roles of inspiring and mentoring future scientists. Thus SAEON has initiated and implemented the science education programme which embraces involvement of scientists to equip science teachers and learners with such required scientific knowledge and skills. Therefore, this study was undertaken to find out if the involvement of scientists in SAEON science education programme motivates learners to pursue careers in science.

1.4 The Intervention

From what has been outlined above, the SAEON camps can be seen as an intervention and the research question enquires into the effectiveness of the intervention. At this point, aspects of the intervention will be explained. An outline of one of the camp programmes (Table 1.1, i.e. 2007) appears on the following page. Programmes for other camps are enclosed in appendix 5. It can be seen that the camps are fairly similar in that outdoor activities, conservation and environmental education and 'hands-on activities' all feature.

Time	Monday	Tuesday	Wednesday	Thursday	Friday	
07:00 08:00		Breakfast/Group report	Breakfast	Breakfast/ <i>Group Report</i>	Breakfast/ <i>Group Report</i>	
08:00 09:45		Presentation 4 'Environment and water' Dr Thomas Gyedu-Ababio	Trip to Skukuza Presentation 7 Game capture / Bomas visit. Wildlife disease in KNP Dr Lin-Mari De Klerk-Lorist Lunch Drive Back to SAWC We will need lunch packs	Presentation 9 'Field Activity, importance of savannahs' Obeid Katumba	Drive to Phalaborwa	
09:45 10:00	Tea break with biscuits					
10:00 11:30	Drive to SAWC	Presentation 5 'Catchment system and river health' (field/practical activity at Klaserie river) Jenny Newenham				
11:30 11:40					Tea break with biscuits	
11:40 13:00					Presentation 10 'What is Ecology' Amy Pollard	
13:00 14:00	Lunch	Lunch		Lunch	Lunch	
14:00 14:30	Introductions SAEON	Presentation 6 'The century of science and technology; be a scientist now' Edward Kohi		Drive Back to SAWC	Presentation 11 'Game on Ecology' Amy Pollard	
14:30 15:30	Presentation 1 'History & Development in SA' Meinring Prinsloo					
15:30 15:45	Tea break without biscuits		Tea break without biscuits			
15:45 17:15	Presentation 2 'Environment Management' Kathleen Hay	Presentation 6 continues Edward Kohi		Presentation 12 'Introduction to termites in savannahs' Nikki Stevens		
17:15 18:15	<i>Sporting activity</i>					
18:30 19:00	Presentation 3 Documentary 'Running Dry' SAEON	<i>Sporting activity</i>		<i>Sporting activity</i>		
19:00 20:00	Dinner	Dinner	Dinner Presentation 8Document. 'Inconvenient Truth' SAEON	Dinner/Braai		

1.5 Significance of the Study

The results of this study will be useful to the SAEON board of administrators responsible for adjusting and improving the activities of the SAEON science education programmes. It offers the board of administrators a way to increase the rationality of policy making (Weiss, 1972). Furthermore, this will inform the local Department of Basic Education (DBE), as well as the Department of Science Technology (DST) and NRF of the influence SAEON science education camps have on students' career selection.

The evaluation about the working of the programme has a potential of increasing the positive influence of the programme being repeated and the less successful being improved or being abandoned (Stame, 2004 and Weiss, 1972). This has a direct bearing in funding of the programmes. Subsequently, if the SAEON science education camps model is successful could be used by other organisations elsewhere in South Africa particularly with the disadvantaged rural communities. It is also envisaged that the study will help to close the gap in literature on how science education camps could be utilized to encourage students to select science careers.

1.6 Research Question

What is the influence of the South African Environmental Observation Network science education camps on science career choice among the selected grade 11 Phalaborwa learners?

1.7 Research Sub Questions

1. What are the career choices of Grade 11 learners before participating in the SAEON science camp?
2. What careers do the former SAEON camp participants follow at tertiary institutions?
3. Do other factors influence SAEON science camp participants to follow science careers or not?
4. How do the SAEON science camps stimulate camp participants' scientific knowledge, skills and values?

1.8 Scope, Limitations and Assumptions

The study was conducted in Phalaborwa, Mopani district in Limpopo Province. The study was limited to 15 students that have participated in the SAEON science education camps since 2006 to 2009. The students came from various learning institutions with the main focus on students from historically disadvantaged backgrounds of learning. Tracking of the post camp participants was dependent upon the SAEON database contact details. This has been problematic since some students have their contact details changed and some have relocated without trace which limited the number of participants. The assumption of the study is that students consider career selection as the most important fact determining the quality of life. The validity of the study has relied on that the students have given genuine (honest) answers and thoughtful responses.

Chapter 2

Literature Review and Theoretical Framework

Overview

This chapter accounts for the theories that inform the study. It reviews the literature that explains the importance of career choice process in the life of individuals. It also attempts to explain on how factors such role models, parents/guardians, income/salary, social cognitive factors and career awareness/information also influence career selection among high school learners.

2.1 Introduction

To certain theorists, a choice of a career is a most important task but it is also a complex process regarded as the defining moment and the major source of identity in the life of young people (Hruska, 1974; Stoss & Parris, 1999; Gushue, Scanlan, Pantzer & Clarke, 2006). I would certainly agree that as far as identity is concerned, what one does is certainly a part of who one is.

In the middle high school years, young people go through the rigorous exercise of choosing a career from a variety of disciplines for further study. These decisions affect their later choice of career. Before venturing into the world of work these young people must make a crucial career decision which is influenced by several factors including the environment (economic and political) of a country (Wang *et al*, 2001; Winberg 2006; Gushe *et al*, 2006). In addition the process of career decision making is made further complicated by the lack of reliable information on what learners are to expect both in terms of their education and practice of their careers (Lewis, 1985). This situation is prevalent at the rural remote areas of which Phalaborwa is an example. In areas such as these, youth have little or no access to career information centres or career guidance counsellors.

As mentioned earlier on, the conflict that exists between the scientists and science academics regarding the practice of science and who should follow and who should not follow a science disciplines and poor remunerations for scientists make careers in science unattractive (Pushkin *et al*, 2001; ICSU, 2010). Such disagreements in academia and scientific research fraternity may discourage students from selecting a career in science. Furthermore, because of the instability of economies of countries, careers go in and out of fashion. An occupation that seems attractive and permanent in 2012 might be non-existent in 2020 (Elder, 1963). This may raise questions among the youth of what better career pays well, offers job security and high social prestige. As appealing as a career choice may be, remuneration leading to financial stability or otherwise is a reality and people may well give up job satisfaction for such stability.

It is apparent from the above account that many factors affect the choice of career individuals make. This study follows the Social Learning Theory of Career Selection by Krumboltz, Mitchell and Jones (1976) and Happenstance Learning Theory by Krumboltz (2009) which is a modification of the previous one. The Social Learning Theory of Career Selection suggests that a choice of career is a process that is influenced by:

- interactions of genetic endowment (e.g. race and sex) and other learned abilities,
- environmental conditions and events (e.g., social and economic forces),
- learning experiences and
- task approach skills (e.g., associative and instrumental) (Krumboltz, 1976).

The Happenstance Learning Theory ‘posits that human behaviour is the product of countless numbers of learning experiences made available by both planned and unplanned situations in which individuals find themselves’ (Krumboltz 2009, p.135).

The theories suggest that the above factors interact in such a way at different stages in the life of an individual as to influence the career decision-making path (Bernes, 2000: Krumboltz *et al*, 1976). This decision-making path could be facilitated by engaging and exposing an individual to new and exciting events and environments which have the potential to open career doors which were previously closed.

Therefore, a child should be educated in all social practices that embrace formal and non-formal education aimed at preparing a child for better destiny (Niewenhuis, Beckmann and Prinsloo, 2007). This suggests that both formal education (school) and informal education (family) have influential roles in the development and shaping of a career decision by students.

Krumboltz (2009) indicates that human behaviour which may include career decision making is influenced by a number of learning experiences encountered as both planned and unplanned situations in which individuals find themselves.

The above mentioned author Krumboltz (2009) goes on to suggest that individuals find themselves in and function in situations over which they have partly control (e.g. social, cultural, political or economic events) and over partly have no control (e.g. location of natural resources and natural disasters). For example, environmental science education relies on governmental funding. But, it is disregarded or even dismissed in politics and industries, and also within academia (Jeffery, 2006). As a result, the corporations find financing careers in such fields too risky, too unpredictable and slow to yield returns because it is dependent on political decisions and world events (Jeffrey, 2006 and Teitelbaum, 2003).

The above mention influencing factors have a bearing on the career preferences, skills, plans and activities of the individual (Krumboltz, *et al*, 1976). An example may be drawn from Phalaborwa learners where the study has been conducted. The economy of Phalaborwa is driven by the surrounding mines; therefore Phalaborwa learners are exposed to jobs in the mines. As a result they are likely to follow careers in mining related fields.

The Social Learning Theory of Career Selection by Krumboltz *et al* (1976) and Happenstance Learning Theory Krumboltz (2009) embrace role models, parents/guardians (family), income/salary (remuneration), social cognitive factors and career awareness/information as other factors influencing career selection among individuals as they will be explored below.

2.2 Factors Influencing Career Choice

2.2.1 Role Models

In a traditional context (environment) a young child is initiated into the routine of the family through series of observations and imitations of the performance of an adult (role model such as mother, father or sibling) seen on many successive occasions (Meadows, 1998; Krumboltz, 2009). In some instances parents play role models by reading books to their children at an early age to instil language proficiency skills (Krumboltz, 2009). By the same token the positive influences of good role models and learning experiences have the potential to persuade some students to study for a degree and / or to pursue a career (Silverthorne, Price, Hanning, Scanlan, & Cantrill, 2003; Doucet, Shah, Cummings & Khan, 1999 and Curtis, Main, Main & Pitts, 2008).

Scientists serve as role models who have scientific knowledge and skills that enable them to motivate and encourage (mentor) learners to persist in learning science and to think productively about their career possibilities (Meadows, 1998 and Moore & Holmes, 2003). Therefore, invitations of high profile and other scientific speakers to schools have the potential to encourage students to enter into science related careers (Lindner *et al*, 2004). A topical example would be the South African palaeontological team involved in the discovery and identification of *Australopithecus sediba*. Of particular interest in the Phalaborwa region is the work conducted on conservation of biodiversity in the nearby Kruger National Park. However, it is acknowledged that time is a real constraint.

The involvement of scientists in education is very limited; they leave career choices in science to students, parents and teachers (Stoss *et al*, 1999). The situation is even bleaker mostly among black youth in the rural remote areas such some parts of the Limpopo Province (Phalaborwa) where the study was conducted. For example, SAEON scientists and the twelve grade 11 Phalaborwa learners (small scale) as in the case of this study only meet once during the annual one week long science education camps. Therefore, not all the schools (learners) in the region have an opportunity to participate in the science camps. Consequently, most learners in the region are likely to have misconceptions of what a scientist really look like and what he does.

2.2.2 Parents/guardians

Authors such as Taylor, Harris & Taylor (2004), Feller, Honaker & Zagzebski (2001) argue that parents and guardians are the main influence on the career development and career choice of their children. Subsequently, parental approval or support for students is significant to enable the students to pursue or explore diverse career possibilities. Parents make judgements about the status of the occupations to which their children should aspire (Creed, Conlon and Zimmer-Gembeck, 2007).

Students from families with high social status are more likely to be exposed to jobs during their high school lives and have earlier and greater exposure to the world of work (Lindner *et al*, 2004). High social status families are characterised with smaller family size. The size of the family determines the maximum support for each child and the type of school should go to (Elder, 1963). Thus children from high social status families are exposed to various career options and socialised to a career that would yield high reputation and / or income (Creed *et al*, 2007; Lindner *et al*, 2004).

On the other hand families with low social status are associated with low income and have more siblings which put strain on the family financial resources. Therefore, it is very unlikely for illiterate and poor parents in rural areas to have such an influence on their children to choose a science career (Onwu *et al*, 2011). Such parents are usually unaware of career possibilities having had limited exposure themselves. This may result in children of low social status settle for careers yielding low income. Another factor associated with parental influence is that of students' economic background of which is influenced by parents' financial security. This also has an influence on the choice of a career (Ladany, Melincoff and Constantine, 1997).

In fact, *career* in the sense of *vocation* may not be an issue at all, but what is usually at stake is the need to find employment and a source of income. In other words, students who may not have financial security may not be keen to commit to a preferred career choice (Ladany *et al*, 1997). As a result a lack of financial resources becomes a barrier for students to pursue a career of their choice (Nathan and Hill, 1992; McWhirter, 1997; Elder, 1963).

According to Larkin *et al* (2007) of USA Centre for Education Statistics, students who earn high school diplomas or degrees and enrol full time immediately after finishing high school depend on parents' financial security for support. This support means more than fees alone but incidentals such as food, clothing and transport fall to the parents. Subsequently, in the lack of such support much of the talent in rural and economically underprivileged communities remain unexposed and uninitiated into science related fields.

It is evident that economic resources and or social status of a family play a crucial role in determining the kind of education the youth will receive and eventually influence the career the youth will follow.

2.2.3 Income/salary

Education has always been seen as a form of an investment because it has an upfront cost one bears, and gives an individual an opportunity to earn an income from the career chosen in the future (Saks & Shore, 2003; Teitelbaum, 2003).

Therefore, lack of financial resources can be a limiting factor on student's opportunity to enrol for a degree at university and eventually affects the income one will earn. It raises the reasons for the youth to make their career choices based on monetary rewards, duration of training and prestige attached to the career and social status (Dick and Rallis, 1991; Doucet *et al*, 1999; Curtis *et al*, 2008; Falaye & Adams, 2008). These ultimately affect their future as at what age time they will start families, the size of the family and kind of education their children will receive.

The salaries of scientific occupations are relatively low compared to other same high-skilled occupations like accountancy (Xie *et al*, 2009). In addition the research by Stern (2004) shows that despite fact that science is the production of economic knowledge with potential testable and empirical tests, scientists' salaries are associated with lower wages and a lower ranking in terms of monetary compensation. Subsequently, it is most likely for young people to choose careers such as accounting that would yield high expected monetary returns to keep up high reputation and job satisfaction (Xie *et al*, 2009).

Most youth when asked of what career path they would like to follow, they often express the view that they would like to follow a career which has high wage returns that would give them high prestige of which careers in science related fields falls short. It seems that science related fields do not portray the kind of vigorous employment and earnings prospects that would be expected to draw numbers of bright and informed young people (Teitelbaum, 2003). It is apparent that choosing a career or level of education and financial returns (wages) are generally inseparable.

2.2.4 Social Cognitive Factors

Each person is born into a preexisting social and cultural setting, family, community, social class, and language (milieu/environment). These all have an impact on how a child will develop social connections which inevitably result in the kinds of educational and social opportunities they may or may not receive (Barton & Yang, 2000). In fact, such factors play an important role in the construction of one's identity which includes science identity (Thorne 2012 *pers.comm.*) As a result social cognitive factors such as academic preparation (students' aptitudes) and socializers (mother, father, teacher, and friends) affect career choices among students (Dick *et al*, 1991; Quimbly, Seyala and Wolfson, 2007). Such cognitive factors are linked to the experience of primary basic education which exerts a significant influence on other educational experiences which occur in the life of an individual (Halverson, 1974 and Ebsin, 2002).

Jensen and McMullen (1994) in Lindner *et al* (2004), and Subotnik, Tai, Rickoff & Almarode (2010) reveal that many students' interest in science careers is developed between the fifth and eighth grade. This implies that science is a cumulative discipline; it is therefore necessary that educators at the level of basic education be academically prepared because they play the pivotal role to effect positive life changing learning experiences of the young ones (Ebsin, 2002; Ekman, 2007).

However, underprivileged students are likely not to choose science related careers because of factors such as poor academic preparation and lack of career planning, social-psychological factors such as poor or no role models, and perceptions of careers

in science (Fouad and Romo in Lindner *et al*, 2004). In addition, as indicated earlier on, students from middle classes are more likely to be exposed to a variety of employment types during their high school lives. For this reason, they could be more knowledgeable about the world of work (Lindner *et al*, 2004). In addition Onwu *et al*, 2011 suggests that many learners do not perceive science as being relevant to their lives. Onwu *et al* comment reminds us of the abstract nature of science.

Therefore, it is important for institutions of learning to make connections between science, science education and science processes and the students' everyday lives. Educated citizens should be aware of the ways in which science (and technology) influence our environment and the ways in which we live. This awareness should ultimately affect students' career choice in science related fields (Barton & Yang, 2000; Lemke, 2001). Therefore, exposure to work experiences and learning environments has a positive influence for individual educational aspirations (Tang *et al*, 2008).

2.2.5 Career Awareness/Information

Life Orientation, Learning Outcome 4 (Career and Career Choices) has been introduced into the school curriculum to create awareness of career and career choices among learners (Scales & Taccogna, 2000). However, a lack of knowledge of career possibilities among students especially at rural communities still persists. It is unclear why rural learners have not benefitted from the inclusion but it is possible that rural teachers are also not fully aware of the range of careers in urban areas.

Findings from a study conducted by Mbetse (*ibid*) in 2002 in Bushbuckridge (formally Limpopo rural area, now Mpumalanga) support the previous supposition about rural teachers (Ebersöhn and Mbetse, 2003). Mbetse's (*ibid*) findings reveal that educators and schools find it difficult to teach career education. Educators feel they lack expertise in presenting career education content. The limited number of trained educators and the consequent allocation of Life Orientation lessons to any educators with time slots to be filled further compromise career education. Stakeholders mentioned that their community schools are understaffed and available staff overstretched in providing career education:

"We are experiencing problems at the moment because we are too few staffed with few teachers and we cannot give career guidance to all grades any longer because we are too full" (Ebersöhn *et al*, 2003, P.324).

Mbetse's (*ibid*) also found out that educators in the community he studied felt that the training and support they received from the Department of Education provided them with information, but not skills to utilise these in providing career education:

'We have lots of talks and there is material, but I do not believe I am the one to say that this is your personality, these are your interests and this is your aptitude, I do not have the qualifications for that' (Ebersöhn *et al*, 2003, P.324).

Subsequently, many students have limited knowledge of careers and positions they are interested in; many of them make career decision based on academic performance (Laker, 2002 and Visser *et al*, 2004). For example a learner who may have obtained better grade mark in science in grade 12 may be persuaded to follow a career in science related fields irrespective of not being passionate about the career and /or not having sufficient knowledge about what the career is really like. As a result, a lack of awareness of full range of choices may often lead to making use of limited range of career alternatives or opportunities (Ozbilgin, Kusu and Erdogmus, 2004). Such a situation is common with secondary school learners in rural and remote areas who are poorly informed about career opportunities (Buikstra, Eley and Hindmarsh, 2007).

However, some learners may have opportunities to attend career exhibitions, but teacher follow up on career choices at schools is non-existent due to poor teacher training in career guidance (Ebersöhn *et al*, 2003). Therefore teachers should be adequately informed on how to better assist students achieve their educational and career goals in today's social, economic and cultural context (Tang *et al*, 2008).

2.2.6 Summary

It is apparent that combination of factors influence career an individual selects. This study upholds the Social Learning Theory of Career Selection of Krumboltz *et al* (1976) that genetic endowment and special abilities, environmental conditions and events, learning experiences, and task approach skills influence career choice at different stages in the life of an individual.

The study embrace the Happenstance Learning Theory by Krumboltz (2009) that 'human behaviour is the product of countless numbers of learning experiences made available by both planned and unplanned situations in which individuals find themselves' (Krumboltz, 2009, p.135). Thus many interventions and interactions in the life of youth have greater influence in a career an individual ultimately follow. The study also acknowledges that the above factors as identified by Krumboltz *et al* (1976) and Krumboltz (2009) are interconnected to various factors such as income and reputation, role models, parents or students' economic backgrounds, access to career information and cognitive factors to influence a career choice among individuals.

Chapter 3

Methodology

3.1 Introduction

This chapter outlines the study design, methods and procedures. This includes the research methods, setting, participants and research instrument explaining how data was collected.

3.2 Research Methods

This study lends itself to a mixed methods approach of data collection. For this reason, both quantitative and qualitative methods have been employed. Leedy & Ormrod (2002), Henning, Van Rensburg & Smit (2004) and Tuli (2010) make distinctions between quantitative methodology and qualitative methodology as follows:

- Quantitative methodology is concerned with attempts to quantify social phenomena and collect and analyse numerical data, and focus on the links among a smaller number of attributes across many cases. The meaning of the findings of the study is presented statistically and has positivist character.
- Qualitative methodology, on the other hand, is more concerned with understanding the meaning of social phenomena and focus on links among a larger number of attributes across relatively few cases. The meaning of the findings of the study is largely presented and constructed from the language that present the data. It upholds the constructivist/interpretivist view.

Both qualitative and quantitative methods have flaws. Quantitative methodology is often criticized in the knowledge produced that may be too abstract and general for direct application to specific local situations, contexts, and individuals. On the other hand the knowledge that is produced by qualitative method may not be generalized to other people or other settings (Johnson and Onwuegbuzie, 2004). For example, the findings of this study may be unique to the relatively few people included in the research study.

The quantitative aspect of the study was addressed by tracking several students who have participated in the SAEON science camps over four years (2006-2009) to determine the careers they are following or have followed. The study also investigated whether or not the students studied at institutions of higher learning. The data illustrate the number of students following or who have followed careers in science related fields. These data also illustrate, by way of contrast, those who have followed or who are following career fields other than science.

The qualitative study aspect has been used to enquire and seek direct inputs from the 15 camp participants over the years (Kitzinger; 1995 in Calderon, Baker and Wolf, 2000). Formal interview focusing on how the camp has stimulated the camp participants' knowledge and skills and the positive role and weaknesses of the science education camp during the five-day learning experience was conducted with five participants.

3.3 Procedures of Data Generation

3.3.1 Preamble

From previous camp evaluations it was clear that, at the time, the participants found the camps extremely valuable and enjoyable (See appendices 6, 7&8). Students' comments were in the main very positive. For example, students made the following remarks:

'I admire SAEON for being the source of exposure to the world of science. It gives learners an opportunity to explore nature and gain a greater understating of how things work in nature and also how you as an individual can make a difference. It also serves as an eye opener when it comes to careers in science. One finds out that there are plenty of careers out there in science'.

'Surely you (SAEON) had our minds twisted and most of us are now interested in a career which involves nature. We as the 2008 ADVENVIRO kids will carry on making a difference out there with the skills and knowledge we obtained'

Of course, it is acknowledged, that the responses may represent what the students thought we wanted to hear, but the overwhelming positive responses suggest otherwise. In addition the science camp report by Karen Vickers (science camp lecturer) and letter of congratulations on the 2009 camp (see appendix 8) support the participants' positive remarks about the camp's positive experiences. It is further noted that in this, as in other types of qualitative research some aspect of trust is required.

3.3.2 Research Setting

As previously mentioned the actual camps (the Intervention) took place between 2006 and 2009. However, the questionnaire and interviews were completed at a later date. The place and time allocated for the interview was determined by participants' availability and interest in the study. Some participants were based at universities (University of Cape Town, University of Johannesburg) which are far from the Phalaborwa region where the study was conducted and were thus unable to meet me face to face. The questionnaire was posted to study participants and the responses analysed. The face to face interviews were conducted at participants' respective homes, institutions of learning or places of work.

3.3.3 Participants

The study gathered data from 15 former SAEON science camp participants. These are former grade 11 Phalaborwa learners selected from the local public high schools in Phalaborwa to participate in the SAEON science education camps between 2006 and 2009. The participation in the study was voluntary.

3.3.4 Research Instruments

Information sheets (Appendix 3) were provided and students' consent was sought for participation in the study. Likert Scale type of questionnaires was used to gather data (appendix 4). Questionnaires were emailed and hand delivered to 20 former SAEON

science camp participants who participated in the programme between 2006 and 2009 to determine careers they are following at tertiary institutions. Fifteen questionnaires were returned. It should be noted that to guarantee anonymity, the questionnaires were not tracked, and hence there was no attempt at tracing non-responders. Pseudonyms and codes instead of participants' names were used for each questionnaire and upheld throughout the study. Five students were randomly selected on availability and interest to participate in formal face to face interviews to establish their career paths and to get an informed sense of the effect of the SAEON science education camps.

The following questions were included in the interview sessions regarding the ways the camp have stimulated students' interest in careers in science, scientific knowledge, skills and values:

- What are you doing now?
- What field of study are you following?
- Did anything stop you from following the career of your choice/furthering your studies?
- Has the SAEON science camp experience in any way influenced your choice of career?
- What other factors has influenced your career choice?
- Has SAEON in any way stimulated your interest in science (scientific knowledge, skills and values)?

Other questions were posed if the opportunity arose. Responses to all interview questions were recorded on tape and later transcribed.

Documents from SAEON archives about science camp activities conducted since 2006 to 2009 were used to gather data that highlight the trajectories of the study or students career patterns (Leedy and Ormrod, 2005, Maree, 2010). The documents include various types of correspondence, SAEON policy documents and business plan, archive files, photographs, video discs, newspaper articles, learners' camp reports (Leedy *et al*, 2005). Some of the information from the archives is confidential and has not included in this report.

Presenters report/s' feedback were used to gain understanding of the organizational functioning of the science camps (appendix 8). Participants were requested to give their impressions on SAEON's science camps positive role, and the areas of weaknesses to improve on and to give any other valuable experience/s that the SAEON science camps had provided them with other than the career choices and scientific knowledge and skills.

3.5 Data Analysis

3.5.1 Quantitative Data

The questionnaire in appendix 4 should be consulted when this sections is read. Responses were anonymous and aimed at evaluating career aspirations/selections, in particular towards science related fields, and the influence of other factors including role models, parents, teachers, remunerations and grade 12 results. Responses were organized in a Likert-style 5-point format, with responses graded from 1-strongly disagree to 5-strongly agree. The questionnaire was also designed to gather information regarding the camp experiences of students, including hands-on experience, learning, positive and negative influences, and the subsequent effect these experiences may have on career choice. All responses were counted, recorded and tabulated. The tables were converted to graphical format which provides a rapid view of the findings.

3.5.2 Qualitative Data

Open ended answers from the paper and pencil questionnaire were recorded and scrutinized for common factors. Responses to interview questions were similarly analyzed.

3.6 Validity and Reliability of Instruments

Validity of an instrument refers to the extent to which it measures what it is supposed to measure (Maree, 2010, p.216). In this study the effect of SAEON science camps were measured to find out if they influenced participants' career choices and have stimulated

participants' scientific knowledge, skills and values. Reliability is the extent to which a measuring instrument is repeatable and consistent (Maree, 2010, p.216). In order to ensure validity and reliability of results data for this research was collected through the use of triangulation sources using questionnaires and semi-structured interviews (Jick, 1979). 'Triangulation refers to the use of more than one approach to the investigation of a research question in order to enhance confidence in the ensuing findings' (Bryman, P.1142). Both quantitative and qualitative approaches were employed to inform this study. Also a sample of two people (SAEON staff member and the teacher who were involved with the science camps since the inception) was used to test the questionnaires and prepared questions for the interviews. Some of the concepts were modified when it was found that were difficult in order to suit the language level of the learners.

Chapter 4

RESULTS

4.1 Introduction

The subsequent chapter presents the findings of the study based on the quantitative and qualitative data that focused on the effect of the South African Environmental Observation Network science education camps initiative aimed at encouraging science careers selection among the Grade 11 Phalaborwa learners. It is acknowledged that the findings cannot be generalized to a wider context. Such generalization is inappropriate in a limited study like this one. However certain trends may be noted. The chapter opens with biographic information and career selection made prior to the science camps and the careers enrolled for at various institutions of higher learning. These data provide some information about the study participants. Then a presentation of themes extracted by using the questions from both the questionnaires and interviews which informed by the research questions follows. These extracted themes will be supported by quotes from the raw data to qualify and validate them.

4.2 Personal information

4.2.1 Participants Biographic Information

Table 4.1 below illustrates biographic information of the study participants. The study participants are the former grade 11 learners selected from the high schools located at the rural townships and villages within Phalaborwa proximity to participate in the SAEON science camps between 2006 and 2009.

Table 4.1: Participants Biographic Information

Year of participation	Camp participants	Study participants	Gender		Age range	
			Females	Males	17-21	22-26
2006	12	1	1	-	-	1
2007	12	6	3	3	3	3
2008	12	4	2	2	2	2
2009	12	4	3	1	4	-
Totals	48	15	9	6	9	6

From the above table it can be seen that forty eight (n=48) grade 11 learners (science camp participants) attended the SAEON science camps between 2006 and 2009. Fifteen of the 48 science camp participants aged between 17-21, and 22-26 volunteered to participate in the study. Nine (n=9, 60%) of the fifteen science camp participants were aged 17-21 and six (n=6; 40%) were aged 22-26 when the data was collected. The table illustrates that nine (n=9; 60 %) females and six (n=6; 40%) males participated in the study. Six (n=6; 40%) of the study participants were the 2007 science camp participants whilst the 2008 and 2009 have equal number of four (n=4; 26.7%) participants respectively. The 2006 science camp is the least represented in the study with one (n=1; 6.6%) participant.

4.2 Study Participants' Career Choice Distribution

Question 1: *What are the career choices of grade 11 learners before participating in the SAEON science camp?*

Question 2: *What careers do the former SAEON camp participants follow at tertiary institution?*

Section 4.2.2 addresses the study sub questions 1 and 2. Question 1 focused on the careers the study participants have selected before participating in the SAEON science camp.

Question 2 focused on the careers the study participants are following or have followed at high institutions of learning. Table 4.2 below illustrates the career choices of the study participants selected prior their participation in the SAEON science camps and the careers kind of qualification they enrolled for at various high institutions of learning.

Table 4.2: Participants Career Choices

Participants	Gender	Year	Career choice prior the science camp	Career enrolled for at Tertiary institutions	Nature of qualification	Year of study
Ntsako	F	2008	Medicine	Medicine	Degree	3
Thoko	F	2009	Mine Engineering	Mine Engineering	Degree	2
Siphiwe	F	2008	Biotechnology	Biotechnology	Diploma	2
Themba	M	2009	Horticulture	Accounting Sciences	Degree	2
Matome	M	2007	Mine Engineering	Mine Engineering	Diploma	3
Lerato	F	2007	Electrical Engineering	Electrical Engineering	Diploma	Experiential
Lebo	M	2008	Environmental Sciences	Mine Engineering	Degree	Completed
Nyeleti	F	2009	Psychology	Civil Law	Degree	1
Makgari	F	2007	Mine Engineering	Tourism	Diploma	Completed
Tlangi	F	2006	Environmental Sciences	Marketing & Mechanical Engineering	Dip & Cert	Completed
Rixongile	F	2009	Mine Engineering	Did not enrol	Grade 12	-
Ntlhari	M	2007	Environmental Law	Communications/Journalism	Degree	4
Hlayisani	M	2007	Mine Engineering	Tourism	Diploma	4
Tintswalo	F	2007	Geology	Logistics	Diploma	3
Vukosi	M	2008	Geology	Electrical Engineering	Diploma	3

The table shows that five (n=5; 33.3%) of the fifteen (n=15) study participants were consistent with their career choice made at high school, nine (n=9; 60%) enrolled for different careers from the choice made at high school and one (n=1; 6.7% did not enrol at any institution. Some of the participants had already completed their careers in Marketing, Electrical Engineering, Mining Engineering, Tourism and, Communications and Journalism at the time of data collection. These participants were awaiting internship and or employment opportunities. Some study participants were in their second, third or fourth years of their studies at higher institutions of learning.

Only six (n=6; 42.9%) of the fourteen (n=14) enrolled participants were registered for the degree qualifications at the university and eight (n=8; 57.1%) enrolled for diploma qualifications at various high institutions of learning. One (n=1) after obtained a diploma in Marketing of further registered for qualification certificate in mechanical engineering

The table further illustrates that Engineering has been selected by most study participants. Five (n=5; 33.3%) of the fifteen (n=15) participants followed a career in engineering at institutions of higher learning. Out of the five (n=5) enrolled for engineering, three (n=3; 60%) enrolled for mining engineering and two (n=2; 40%) enrolled for electrical engineering. Three (n=3; 60%) of the five that enrolled for engineering are males and two (n=2; 40%) are females. Two (n=2; 13.3%) participants followed a career in Tourism. Medicine, Biotechnology, Accounting Sciences, Civil Law, Marketing, Communications and Logistics received one response each. These findings suggest further that career choice may not be entirely free. Only one participant did not enrol for tertiary education. The overall majority of participants; nine (n=9; 64.3%) of the fourteen (n=14) followed science related careers although not environmental in nature, compared to five (n=5; 35.7%) who chose other.

Table 4.2 shows that five of the fifteen participants followed a career in engineering. The participants might have been encouraged to follow in a career in engineering because the local mines (Foskor and Rio Tinto) offer students study bursaries and scholarships to follow careers in engineering. Little can be said of the environmental science related careers that depend on the government funding which is thinly stretched. Phalaborwa learners are exposed to mining related jobs. As a consequence, the participants may have been persuaded to follow careers in mining related fields because of opportunities such as bursaries or scholarships, internship programmes and employment openings the mines offer.

Table 4.2 illustrates further that out of the fifteen study participants, five enrolled for their first career choices whilst the others enrolled for different career choices. It shows that there are various factors that might have influenced study participants choice of career at tertiary institutions.

4.3 Factors Influencing Participants Science Career Choice

Section 4.3 - 4.5 explore both the positive and negative factors and individuals that could have influenced participants' career choice. The section answers sub researches question three which reads thus:

Question 3: *Do other factors influence SAEON science camp participants to follow science careers or not?*

4.3.1 Factors Positively Influencing Science Career Choice

Participants were requested to respond to the questionnaires and interviews by indicating how the grade 12 results, study bursaries, career opportunities, lack of career information, personal interest, salary, fringe benefits and job security have influenced their career choices. The following section explores the students' comments. A Likert-style 5-point format, with responses graded from 1 (strongly disagree) to 5 (strongly agree) has been used to rank participants responses. Figure 4.1 illustrates study participants' responses.

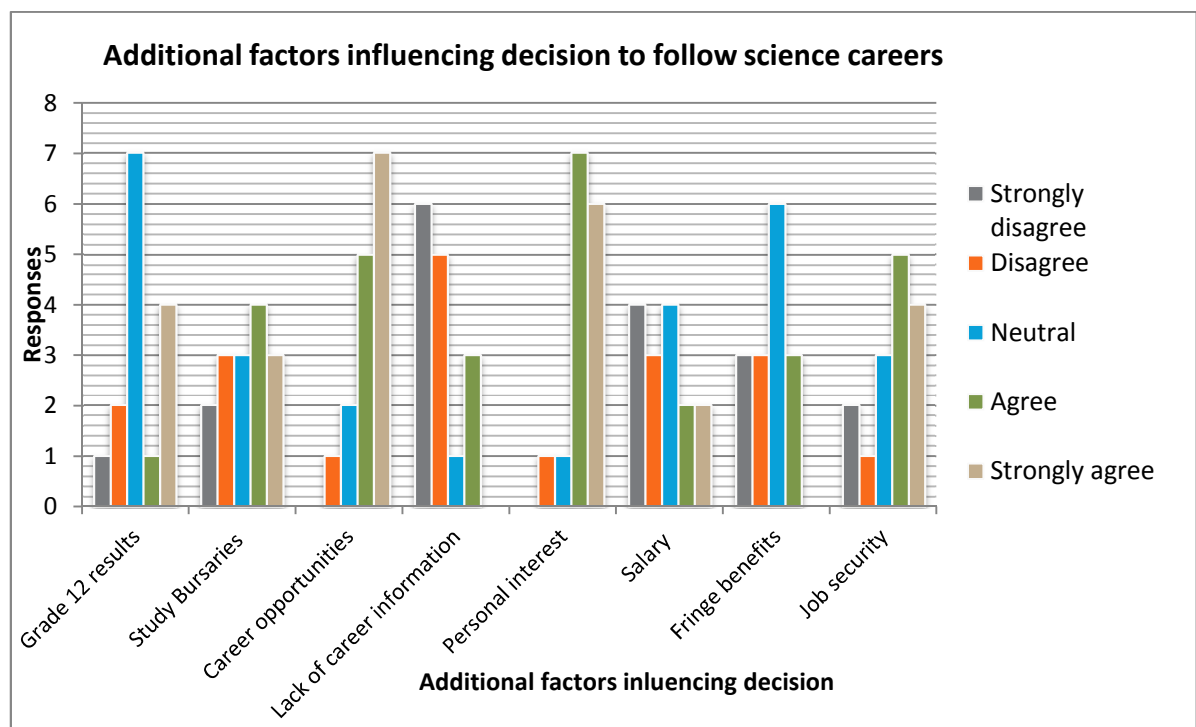


Figure 4.1: Factors Influencing Decision to Follow Science Careers

Figure 4.1 shows that the above career influencing factors had a different degree of influence upon participants to select a field of study. Of the fifteen participants seven strongly agreed that career opportunities influenced their career selections. Five participants strongly disagreed that lack of information on careers had influenced their career choice. Ten participants agreed that their career selection was driven by personal interest. Six participants remained neutral that fringe benefits influenced their career choice. The study bursaries, salary, fringe benefits and job security have almost similar degree of career selection influence.

The subsequent paragraphs synthesize some of the reasons the study participants took up certain careers and not the others. For the synthesis, during discussions and interviews have been used and i.e. referred to.

The majority of participants indicated career opportunities influenced their career selection. As indicated earlier on the economy and the life style in Phalaborwa region is driven and dictated by what happens at the mines. For this reason, it is very likely that the study participants were inspired to select a career in engineering because of the mine job opportunities. This is summed up by Lebo who said *'SAEON exposed us to different careers from engineering; but, I made my decision to follow a career in engineering because of the opportunities like bursaries or scholarships that go with the career'*.

Ntlhari came to the science camp in 2007 having already made up his mind to follow a career in Civil Law. However, after a series of engagements with the activities of the week and interactions with scientists he considered a career in environmental law. In an informal discussion I asked Ntlhari why he followed a degree in Communications (Media and Journalism) and not follow the career of his dreams. Ntlhari said; *'my scores were low to break into a degree in law, but, Media and Journalism gives me an opportunity to explore different avenues in society, it is a window to my degree in law. I am doing my honours degree in communications now and hope to complete this year, 2013'*.

Ntlhari could not break into a career in law because his matriculation scores were lower than the scores required to enrol for a degree in law. Themba was very keen to follow a degree in Horticulture. His involvement in school's eco-club and his active participation in the South African National Parks Junior Honorary Rangers in the Kruger National Park inspired him to follow in a career in Horticulture. However, after receiving his good matriculation results he did not follow the career of his first choice. He was offered a bursary to study Accounting Sciences at the University of Pretoria. Despite pursuing a career in Accounting Sciences, Themba is still actively involved with his Junior Honorary Rangers' duties. This suggests that his love for natural sciences and environment remained constant, but financial issues became a barrier against a career in Horticulture.

The SAEON science education programme coordinator (researcher) asked Ntsako before participating in the SAEON science camp what career she would like to follow. Ntsako tells her story differently; *'with the abilities and talents I have, I'm planning to study medicine. I will also be involved in the business world'*.

These were big ideas from a young girl demonstrating positive attitude towards life and showing exuberant confidence in her academic abilities. Ntsako stuck with her words to the end of her high school years. After receiving her grade 12 results with excitement she exclaimed:

'With these results the doors are open - it is my dream to be a medical doctor.'
'Through hard work, dedication and determination to succeed in my studies throughout the year, I managed to get four distinctions which were:

Accounting 82%

English (FAL) 83%

Life Orientation 89%

Mathematics 94%

'As for my other subjects, I got Bs for them. My average was a distinction (81%)'. 'I'll be furthering my studies at the University of Cape Town.'

I'll be doing a Bachelor's Degree in Medicine and Surgery (MB.ChB.) which has study duration of six years' (Appendix 7).

Ntsako was dedicated to her school work and remained optimistic that her abilities will usher her toward a degree in medicine. Tlangi has a qualification in Marketing but she believed she would be more employable if she could complement her qualification with a career in engineering. For this reason, Tlangi also pursued a qualification in engineering. This further suggests that job opportunities had a greater influence on study participants' career selection.

In a contrasting way, Ntlhari, Ntsako and Themba depended on their matric results to pursue their careers at institutions of high learning. Ntlhari could not follow a career in law because he did not meet entrance requirements for a degree in law. His matric scores were a hindered him against enrolling for his first career choice but settled for a degree in Communications. On the other hand Ntsako's matric results were excellent and opened the doors for her to pursue a degree in medicine (*appendix 7*).

Themba was persuaded to follow a degree in Accounting Sciences because his grade 12 results attracted financial assistance towards degree. The matriculation Matric results determined or influenced the degrees Ntlhari, Ntsako and Themba followed. The matric results were a barrier for Ntlhari's aspirations to follow a degree in law and positively steered Ntsako towards realisation of her dream career in medicine. For Themba, his too good matric result made him sacrifice his first choice career.

The above synopsis affirms that financial support, good matric results, job opportunities and surrounding environment influenced career choice of the study participants.

4.4.2 Factors Influencing against Following a Science Career

In the subsequent section 4.4.2 of this study, the participants were requested to respond to the questionnaires and interviews by indicating the influence of poor grade 12 results, lack of career information, lack of career opportunities, personal interest in other

careers, financial cost of science careers, poor science salaries, lack of fringe benefits and poor work conditions had on their career choices. A Likert-style 5-point format, with responses graded from 1 (strongly disagree) to 5 (strongly agree) has been used to rank participants responses. Figure 4.2 illustrates study participants' responses.

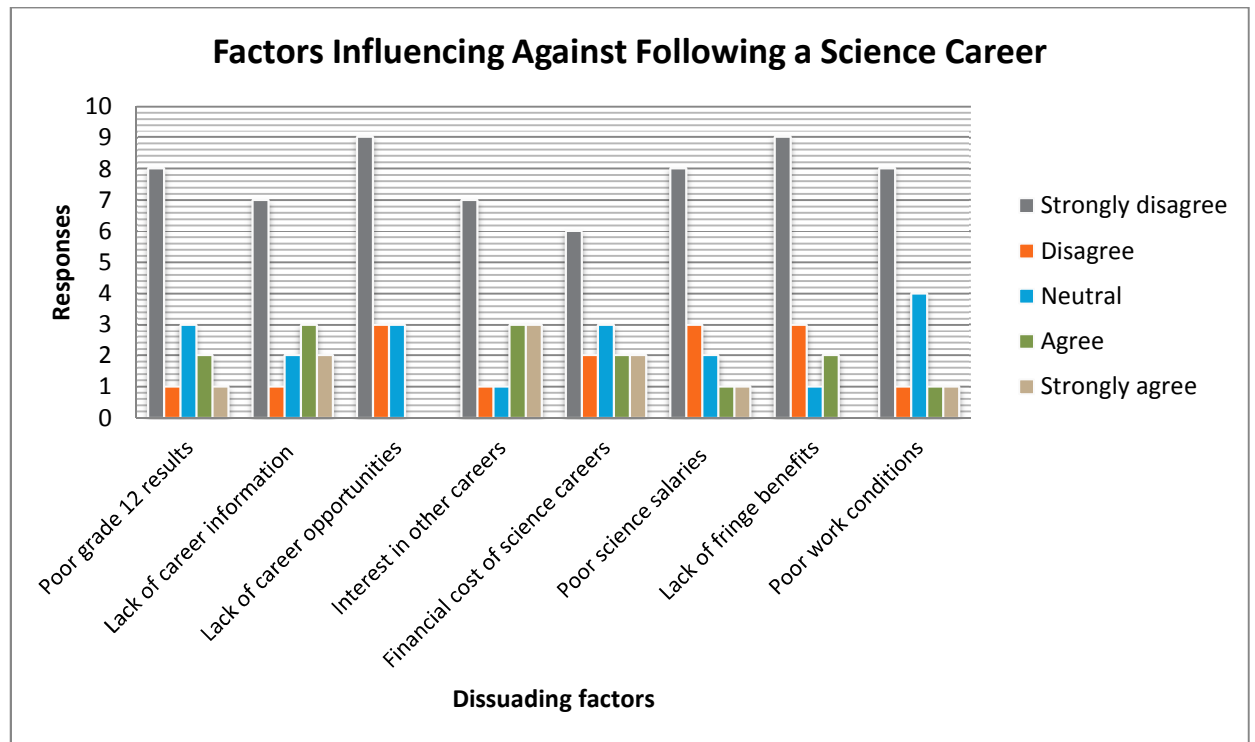


Figure 4.2: Factors Influencing Against a Science Career

Figure 4.2 illustrates that a large number of participants claimed these factors did not influence the choices in a negative way. In other words, the majority of the participant strongly disagreed that a lack of career opportunities, poor salaries and lack of fringe benefits in science related fields had an influence in their career choice. However; a few of the participants remained neutral. Fewer participants strongly agreed that the above factors dissuaded them from following their dream careers.

In an informal interview Tlangi, the 2006 science camp participant, explained that she did not follow Environmental Sciences related field career although it was her first career choice. She said; *'I really wanted to follow a career in Environmental Sciences with all my heart, but I did not have money to enrol for it. An opportunity fell on my*

doorsteps, I was offered a bursary to study Marketing, and I could not waste a year staying at home and do nothing whilst waiting for the good Samaritan to give me some money to follow a career in environmental science'. 'I took the offer'. 'I have a qualification in Marketing and I am now doing N4 Mechanical Engineering'.

Tlangi could not follow her first career choice because of a lack of financial support. Her parents were unemployed but depended on her married sister for financial assistance during her high school years. Therefore, there was no source of financial support other than her married sister. On the other hand the government could not offer her a scholarship or bursary to enrol for a career in Environmental Sciences.

Lebo acknowledges that the SAEON science camp exposed him to other science careers other than engineering; however, he decided to follow a career in engineering because he was exposed to it in his lower grades. This suggests, firstly, Lebo lacked exposure to other careers at an early age except engineering. His choice of the career in engineering might have been influenced by his surrounding environment. This affirms the assumption made earlier on that Phalaborwa is dominated by mine workers who may be Lebo's role models. Secondly, the other careers may not be offering better opportunities than engineering. As such, other careers might have not been appealing to Lebo as much as engineering.

Table 4.2 illustrates that Rixongile could not enrol with any institution of learning to further her studies due to a lack of financial support. Financial resources like bursaries or scholarship had negatively influenced Rixongile from following her career in mine engineering. Her single and unemployed mother could not afford university fees. A lack of financial resources became a barrier for Rixongile to pursue a career of their choice (Nathan and Hill, 1992; McWhirter, 1997; Elder, 1963). It is evident that Rixongile could not enrol full time immediately after finishing her high school because she depended on her mother for financial support (Larkin *et al*, 2007).

4.5 Individuals/persons Influencing Career Choice

Section 4.5 of this study explores the participants' responses to the questions on the extent to which parents/guardians; other family members, school principal, life orientation teacher, other educators or educators, peers/friends, role models and others influenced their career selections.

A Likert-style 3-point format (greatest, partially, least), with responses grading of greatest, partially and least has been used to rank participants responses. Figure 4.3 illustrates study participants' responses.

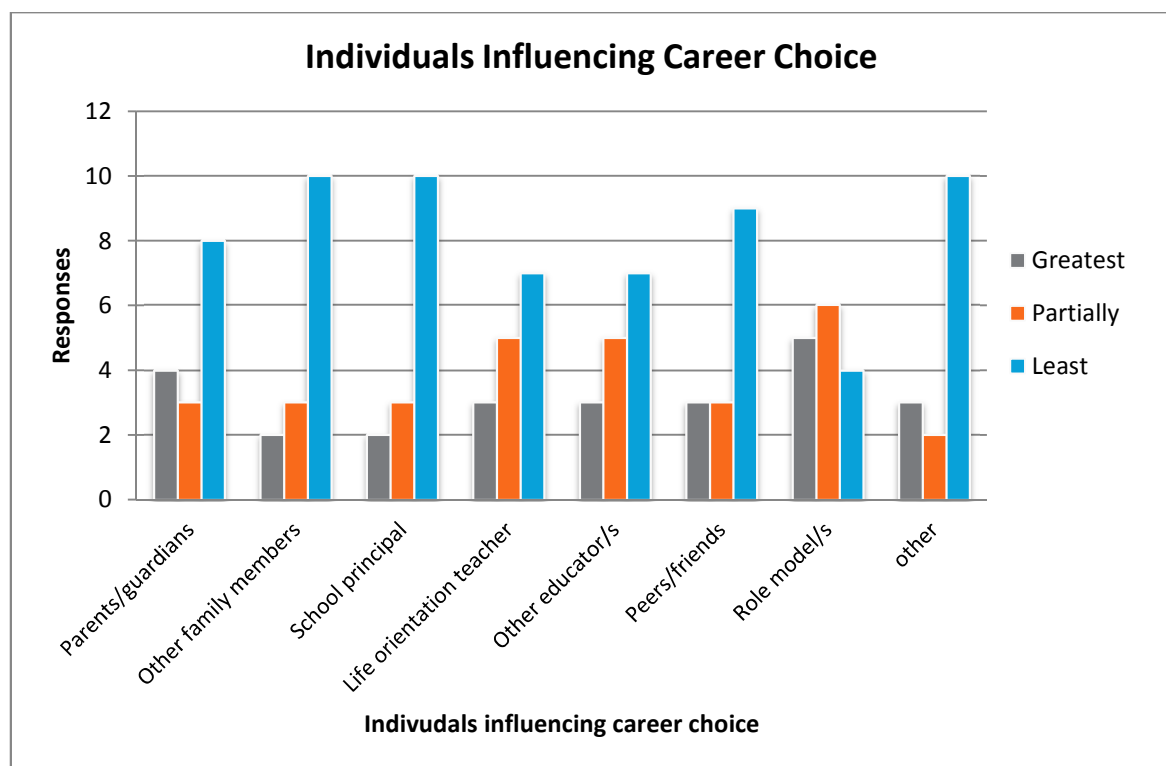


Figure 4.3: Individuals Influencing Career Choice

The figure above shows that a large number of the study participants was least influenced by the listed individuals. Nonetheless, the graph shows that role models and parents appear to have had greatest influence on the career choice to some of the study participants. In addition, the graph illustrates that Life Orientation educators, other educators and role models partially influenced study participants to select careers they are following or have followed. Other individuals also influenced participants' career choices. For example, Siphwe during the interviews indicated that she was encouraged

to follow a career of her dream; Biotechnology, by Joe Sibiya, SAEON science camp coordinator. She mentioned that Joe told them that they should follow the careers they are passionate about as much as he was doing what he likes best.

In a formal interview I asked Ntsako if she was following a career in medicine because of her mother who is a nurse. Ntsako confidently answered; *‘I am an asthma patient, and seeing how this doctor helps me through my condition, I thought to myself, I can be a medical doctor too and can help many sick people out there’*. Ntsako’s personal interest and passion to be a medical doctor, and the family doctor had a greatest influence in her following a career in medicine.

The figure further shows that other educators have influenced participants’ career choices. The 2009 science camp participants acknowledged that their science educators had encouraged them to follow science related careers. They did not know what the science camp would offer until their participation. In acknowledgement they wrote; *...we were overwhelmed by great expectations, beliefs and courage from our science teachers not knowing at all that it was an eye opener to the real science world’*.

The figure illustrates that various individuals and circumstances influenced the study participants to follow various career fields. For example, Ntsako followed a career in medicine because of her personal interest in a career and inspiration received from the family medical doctor who helped her with medical condition.

4.6 The SAEON Influence on Participants’ choices

Section 4.6.1 explores the extent the science camps, as well as other factors, influenced participants’ tertiary educational and career choices. Section 4.6.2 addresses sub research question 4 which enquires how the science camps stimulated scientific knowledge, skills & values.

4.6.1 Influence on career choice

During the science camps the participants were exposed to science career choices, interaction with scientists, interaction with other learners, engaging with projects and field trips to science centres. In this study, the study participants were requested to respond to the questionnaires by indicating how the exposure to aspects of SAEON science camp influenced their career choices. Responses to questions 8 to 12 (i.e. five questions have been analysed in detail as shown below. the composite graph has been used to capture the findings. A Likert-style 5-point format, with responses graded from 1 (strongly disagree) to 5 (strongly agree) has been used to rank participants' responses. Figure 4.4 illustrates study participants' responses.

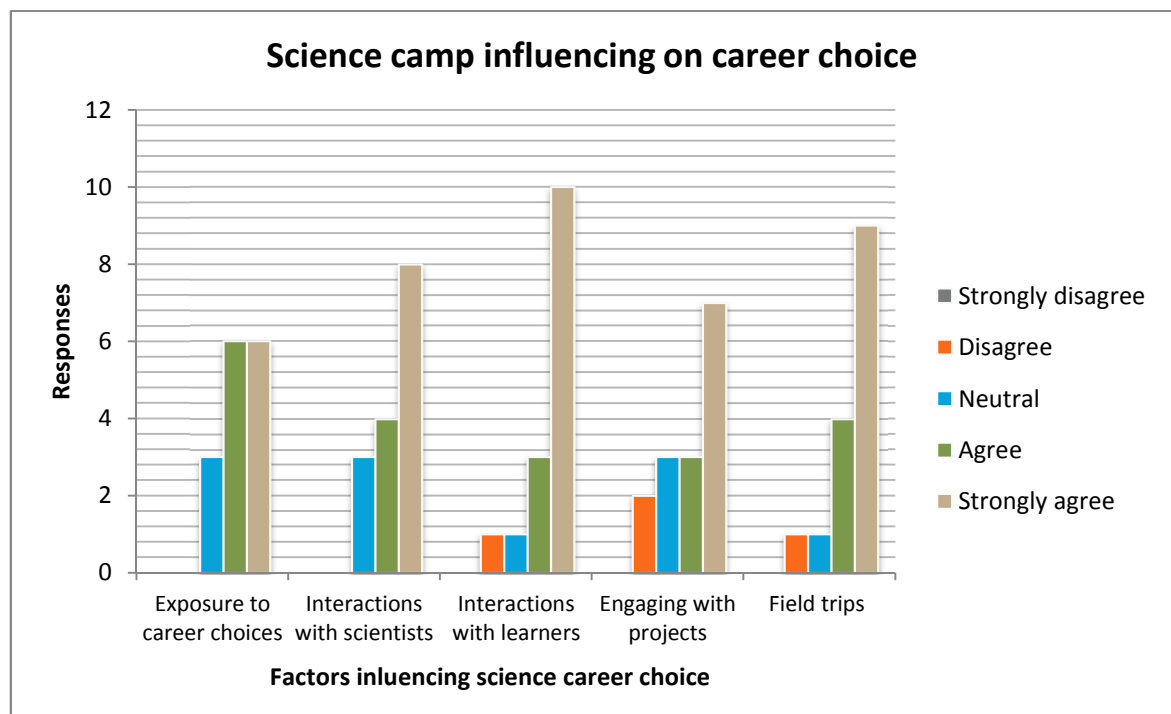


Figure 4.4: SAEON Influence on Participants' Career Choices

The graph illustrates that the science camp had a positive influence on the study participants. A large proportion of the study participants strongly agreed that the camp influenced their career choice. Few participants remained neutral, even fewer disagreed and none strongly disagreed that the science camp had an influence their career choices. The graph further shows that interactions with other learners had a great influence on the participants. The following remarks by the in participants' science reports indicate

the extent of influence the science camp had: *‘Even though we did not know each other, we bonded strongly like a hydrogen bond. We left behind our normal schedules, heading to a new road to success ...’* (appendix 6).

In addition, Professor Lara Allen, the Executive Member of The Board of Tshulu Trust after observing the science camp programme of the week unfolds wrote to Joe Sibiya (SAEON science camp coordinator) to congratulate and commend him on the successes of the 2009 science camp. Professor Allen wrote that the coordinator of the science camps as follows about the students as follows: *‘They made substantial progress over the course of the week, and it was particularly rewarding to watch friendships develop between ... learners’* (Appendix 8).

Certainly, the science camp succeeded in developing team spirit among the study participants; however, it is not clear how the interactions among the learners have influenced their career choices. The graph also illustrates that field trips or visit to science centres as the second career influencing factor.

The 2006 science camp participants were overwhelmed by the experience of observing the tranquilized cheetah (Figure 4.5) at the Hoedspruit Endangered Species Centre (Cheetah Breeding Project). The excited students wrote on their science camp report: *‘A cheetah was tranquilized for us to observe its adaptations at a closer distance. It felt great to touch the animal and examine it’* (Figure 4.5).



Figure 4.5: Tranquilized Cheetah Observed at Close Range

This was the highlight of the science camp as it appears that the experience of observing and the examining the cheetah for disease and other presentations had immensely inspired their interest in conservation (Appendix 6). However, none of the participants chose careers in conservation.

The telling experience for the 2007 camp was the visit to Moholoholo Wildlife Rehabilitation Centre, Kamai Reptiles Centre and the boat trip at Blyde Dam in Hoedspruit. The experience of the visit is best explained by Siphwe in a formal interview when she was asked the positive role SAEON science had in her life; she said; *‘SAEON gave me an opportunity to see one of the world's heritage site and opened my eyes to see how we as individuals put certain organisms such as animals and plants to extinct’*. The participants valued the visit to the natural heritage site and subsequently encouraged participants to preserve and conserve the immediate environment (Appendix 6).

Figure 4.5 also shows the value that the study participants attached to interactions with scientists, engagement with science research projects and exposure to different science career fields (Appendices 5 & 6). The following responses to the questionnaire items and the interview remarks show the scope of the influence of the science camp upon study participants: *‘...broadens the scientific knowledge of participants. The science camp equips learners with necessary knowledge to choose a career and apply theory behind the information’*.

Tlangi's view of the role of SAEON science camps is that they encourage science career selection: *‘the science camp helps in decision making of career choices in the science field and play a big role in the provision of information, knowledge or education concerning the careers. As a result of this pool of information available to students this enables us to make better informed decisions’*.

The 2009 science camp group report indicates the intensity of their engagement with the science research project. *‘Within five days we had investigated Hamakuya's biodiversity status through fieldwork, surveys, and interviews with the community members’* (Appendix 6).

The above account suggests that the SAEON science camps positively encouraged study participants to consider careers in science related fields. It is, of course, acknowledged that other factors have influenced participants' career decision making. The following Section 4.4 - 4.6 is an attempt to explore other factors that might have influenced participants' career choices.

4.6.2 How the Science Camps Stimulated Scientific Knowledge, Skills & Values

Question 4: *How do the SAEON science camps stimulate camp participants' scientific knowledge, skills and values?*

One of the objectives of the science camp is to arm learners with tools related to the scientific method, including problem solving, measuring and identification of birds, rodents, and vegetation, data analysis and the use of Microsoft excel (computer), and conducting questionnaires with community members to investigate how they use resources. Section 4.6.2 of the study addresses the ways in which the science camps have stimulated participants' scientific knowledge, skills and values.

The study focussed on the following factors to get a sense of the degree of stimuli, improved scientific inquiry, conducting scientific investigation, collecting and presenting data, handling of equipment, data analysis, field methods skills, conceptual understanding, outdoor skills and social skills. A Likert-style 5-point format, with responses graded from 1 (strongly disagree) to 5 (strongly agree) has been used to rank participants responses. Figure 4.6 illustrates study participants' responses.

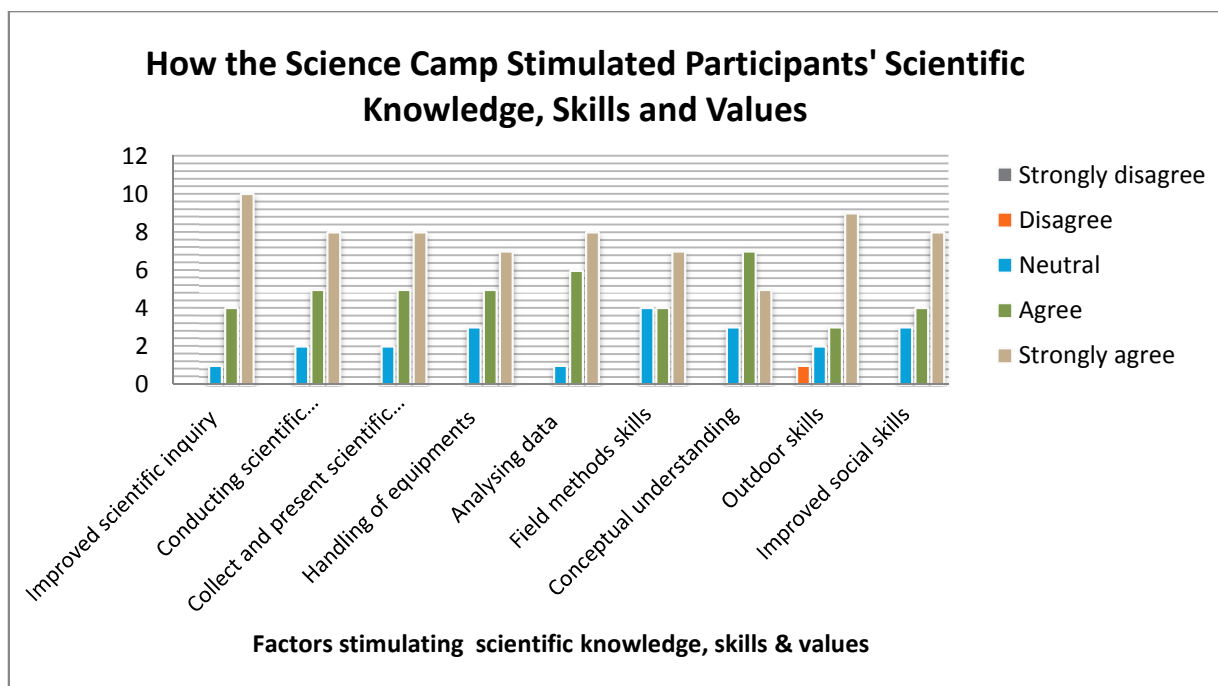


Figure 4.6: How the Science Camps Stimulated Participants' Scientific Knowledge, Skills and Values

Figure 4.6 illustrates that the camps have positively stimulated participants' scientific knowledge, skills and values. A Large number of participants strongly agreed that the science camps improved their scientific inquiry, outdoor skills. Conducting scientific investigations, collecting and presenting scientific data, and analysing data have equally stimulated participants' scientific knowledge, skills and values. One participant disagreed that science camp stimulated his outdoor skills.

The following remarks made by the participants at the closing presentations of the science camps suggest that the participants' scientific knowledge, skills and values were positively stimulated. In acknowledging the experience and time spent with the scientists and quality of knowledge gained by engaging with the science camp activities the participants, in a group report, remarked: *'...accompanied by a great group combination of experienced scientists, both locally and internationally, educating us about the sustainability of our environment. We gained knowledge in scientific investigations, in data analysis and presentations'*. The participants thought that with the skills and knowledge achieved at the science camp could make a difference in their surrounding environments (Appendix 6).

Professor Allen in her letter of appreciation on the achievements of the science camp indicates that the staff and volunteers of the Tshulu Trust were impressed by the enthusiasm and knowledge of the science camp participating learners over the week. Figure 4.6 illustrates that the science camp has positively stimulated participants' handling of equipment and field method skills. In her letter on the programme of the science camp, Professor Allen emphasized that the camp was a great success; *'...teams of learners used GPS units and scientific knowledge to solve clues, instructors and students worked together to understand how principles of conservation could be applied to local contexts'*. Professor Allen went to mention that *'... and in their enthusiastic final presentations, the learners synthesized this new knowledge, exhibiting high standards for themselves and for each other'* (Appendices 6&8).

The participants were engaged in different sporting activities and various games like amazing race to encourage interactions among the participants and among the participants and the scientists in order to develop participants' social skills. Figure 4.6 illustrates that integration of sporting activities and games in the academic science camp program had a positive outcome. The figure shows that out of the fifteen participants eight strongly agreed that the science camp stimulated their social skills. For Thoko, the activities of the science camp inspired them to make informed life decisions. She said; *'the camp taught us to make calculated decisions. It developed a research mentality before making life time decisions. We also had sport experience, fun games that developed in us to think out of the box'*.

The comments and remarks made by both study participants and Professor Allen, suggest that the varied schedule and the diversity of the activities of the science camps programmes are the best aspects toward stimulating participants' love for science as possible field of study. Participants seemed to have grasped and valued the principles for the science camps and would be able to apply them in everyday life.

4.7 Summary

The Social Learning Theory of Career Selection by Krumboltz (1976) informing this study states that a choice of a career is influenced by combinations of factors such as; special abilities, environmental conditions and events, learning experiences, and task approach skills influence career choice at different stages in the life of an individual. In addition, the literature reviewed for this study suggested parents/guardians, role models, remuneration/salary, social cognitive factors and career awareness have potential to influence a career individuals select. The results of this study revealed that the above factors play a major role in role in a selection of a career. The results of this study support the theory informing the study and the literature reviewed.

The results revealed that the intervention programme/event (SAEON science camp) positively influenced study participants' career selection. The participants indicated that the science camp equipped them with the necessary knowledge to choose careers and apply the theory behind the information provided.

The results also revealed that financial support, good matric results, job opportunities and surrounding environment had a great influence on the careers of the study participants are following or have followed.

Of the aforementioned factors influencing career choice, job opportunities/security had a large influence on the participants to follow a career in engineering. For example, of the fifteen study participants five selected a career in engineering because of the opportunities engineering offers. The results also show that a lack of financial support has been a deterrent for some participants to enrol for a career at university.

The results of the study also indicated that that various individuals and circumstances influenced the study participants to follow various career fields. For example, Ntsako followed a career in medicine because she was inspired by the family medical doctor who helped her of her medical condition. Her personal interests in a career in medicine also encouraged improve her work ethics.

Finally, the results of this study revealed that the diversity of the activities of the science camps programmes are the best aspects toward stimulating their scientific, knowledge, skills and values and cultivated in them the love for science. Participants seemed to have grasped and valued the principles for the science camps and would be able to apply them in everyday life.

The following chapter will discuss the results of the study in detail and will provide insight into how the SAEON science camps intervention programme encouraged science career choices among the grade 11 Phalaborwa learners. The chapter also attempts to synthesis how the science camps stimulated the participants' scientific knowledge, skills and values. Furthermore, it explains the strengths and the weaknesses of the science camp and concludes by suggesting possible ways of improving the programme.

Chapter 5

DISCUSSION OF MAIN FINDINGS, LIMITATIONS, RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

Preamble

South Africa's workforce like others elsewhere in the world depends on the students who go through the country's education system. Such students should select careers that will equip them with necessary skills that will contribute to the national economies, social well-being, and quality of life. As indicated previously, South African schools have difficulty in developing students' interest, knowledge skills and attitudes required for such careers (Van Esbroeck, 2002; Winberg, 2006). This chapter discusses the findings of this study which investigated the SAEON science camps initiative aimed at encouraging science career selection among selected grade 11 Phalaborwa learners.

The results of this study were presented in the previous chapter and the study identified that the science camps had positively stimulated participants science knowledge, skills and values, and also developed positive attitude toward science as career option. It is acknowledged that the study findings are only applicable to the SAEON Ndlovu node grade 11 Phalaborwa science camp participants. Further studies should be conducted in other SAEON nodes

5.2 Discussions of the Main Findings

5.2.1 Demographic Information of Study Participants and Career Choice Distribution

The SAEON science camps coordinator depended on the schools to select learners to participate in the science camps. Thus the science camps coordinator had no influence on the gender proportion of the science camp participants. This section discusses the demographic information of the participants and the distribution of careers they are following or have followed at high institutions of learning. The study comprised of fifteen participants. Out of the fifteen participants, 60% (n=9) were females and 40% (n=6) males. Nine (60%) of the fifteen study participants were aged between 17 -21 years and six (40%) were aged between 22-26 years.

The results of this study indicated that seven (four females and three males) followed science related fields and eight have selected careers in marketing, communications, civil law, accounting, tourism and logistics. One female did not enrol with any institution. Of the seven participants who selected careers in science, five (three males and two females) have selected careers in engineering; two selected a career in electrical engineering & three selected a career in mine engineering. One female selected a career in medicine, and one female followed a career in Biotechnology. Engineering was selected by most study participants. This suggests that there are influencing factors that encouraged the majority of the study participants to follow a career in engineering. The literature reviewed for this study indicated that students are most to likely select careers that are well paying and offer better fringe benefits. One such career is engineering. Careers in natural sciences (i.e. Horticulture, Agriculture, conservation are not attached to such benefits.

Of the fourteen study participants who enrolled for careers at the institutions of high learning, five were consistent with the careers they selected at high school and nine followed different careers from the careers they selected at high school.

The overall majority of participants; nine (n=9) of the fourteen (n=14) followed science related careers although not environmental in nature, compared to five (n=5) who chose other. The subsequent sections explore the factors influenced the participants' career choices.

5.2.2 SAEON Influence on Participants' Career Choice

A large proportion of the study participants strongly agreed that the camp influenced their career choice. Few participants remained neutral, fewer and none strongly disagreed that the science camp had an influence on their career choices.

Ten of the fifteen study participants strongly agreed that the interactions with other learners influenced their career choice. However, the remarks made by both the study participants and the science camps observers suggest that the science camps developed team spirit and built friendships among the participants. Evidence regarding career choice was less obvious.

The study results indicated that field trips or visit to science centres was the second career influencing factor with nine study participants indicating that their interest in science as a career was sparked. The comments made by participants suggest that it was the first time the students from the previously disadvantaged communities to be exposed to conservation activities. This observation supports remarks made Rosenberg *et al* (2009) in the literature reviewed for the study. Such remarks emphasized that conservation activities were considered of no value to most black families because these activities were judged to be preserved of whites only. Since black people were denied access to many nature reserves and national parks during the apartheid regime such an attitude, although unfortunate, is understandable. It is vital that preservation of the national our heritage becomes important to all South Africans.

Eight participants strongly agreed that interactions with scientists had an influence on their career choice, and seven agreed that engaging with scientific research projects influenced their interest in science.

Literature reviewed for the study indicated that role models have influence on students' career choice. It was expected that a larger number would have strongly agreed that exposure to science career choices would have had influence their interest in science careers.

However, only six of the participants did strongly agree that the exposure to science careers had influenced their career choice. One participant strongly disagreed that interactions with learners influenced their choice in science and participant also disagreed that field trips to science centres influenced her career choice in science. In both instances, the participant indicated that the two factors had no influence on her choice of career since she had already made a career choice before participating on the science camp.

5.2.3 Other Factors Influencing Career Choice

5.2.3.1 Factors Positively Influencing Participants' Career Choice

The results of the study indicated that the factors influencing career choice had a different degree of influence upon participants' career choices. Seven out of the fifteen participants strongly agreed that career opportunities have influenced their career selections. Five participants strongly disagreed that lack of information on careers had influenced their career choice. Ten participants agreed that their career selection was driven by personal interest. Six participants remained neutral that fringe benefits influenced their career choice. The study bursaries, salary, fringe benefits and job security have similar effects on study participants' career choices.

Lebo provides an example of the influence of other factors. He was persuaded to follow a career in engineering despite the fact that the SAEON science camp exposed him to other science related careers. Engineering was considered attractive due to job opportunities and fringe benefits it offers. This supports the theory informing this study and the literature reviewed that students are most likely to pursue careers with better remunerations prospects and high social status.

Grade 12 results influenced the participants' career choices in a contrasting ways. For example, Ntsako's good work ethic at school enabled her to obtain a distinction pass in grade 12 and subsequently opened the doors for her to follow a career in medicine. Themba's grade 12 results were good enough for him to accept financial aid to follow a career in Accounting Sciences.

Although his first choice was horticulture no such financial assistance was available for him to adopt this choice. Ntlhari's results were not good enough for a career in Environmental Law but he settled for a career in Journalism. These decisions made by SAEON participants further support the theory informing this study. The literature reviewed for this study also suggests that career choices subject to many influence as it has been noted above.

5.2.3.2 Factors Negatively Influencing Participants' Career Choices

The results of this study indicate that the majority of participants strongly disagreed that poor grade 12 results, lack of career information, lack of career opportunities, personal interest in other careers, financial cost of science careers, poor science salaries, lack of fringe benefits and poor work conditions negatively influenced their career choices. This assertion by the majority of the study participant is at odds with some of the findings of the study. For example Ntlhari, Themba and Tlangi changed their study and career choices when confronted with financial realities. Furthermore, the reason given by Tlangi for not following a career in environmental sciences and the reasons why Rixongile did not enrol for a degree at university suggest that due to lack of financial support has been a barrier in realization of their dream careers.

A lack of financial resources became a barrier for Rixongile to pursue a career of her choice. Nathan and Hill, 1992; McWhirter, (1997) and Elder, 1963 have all pointed to lack financial resources as a limiting factor in career choice. It is evident that Rixongile's situation regarding unemployed parents supports the findings and conclusions by Larkin *et al* 2007 with regard to family economic background.

5.2.3.3 Individuals Influencing Participants' Career Choices

The results of this study revealed that the majority of the study participants was least influenced by parents/guardians, other family members, school principal, Life Orientation teacher, other educators, peers/friends and role models.

However, role models and parents appear to have had the greatest influence on the career choices of the study participants. In addition, Life Orientation educators, other educators and role models partially influenced study participants' career choices.

Other individuals also influenced participants' career choices. The study participants indicated that after participation in the science and interactions with the scientists, their perceptions about science changed and they considered following science related career fields. The literature reviewed for this study revealed that students are likely to choose science related careers because of good academic preparations and achievement, good role models and perceptions of careers in science. Ntsako who showed exceptional potential followed a career in medicine because she academically prepared herself well, had good role model and her positive perception of the career.

5.2.4 The Science Camps as Stimuli for Scientific Knowledge, Skills and Values

The results of this study revealed that the camps have positively stimulated participants' scientific knowledge, skills and values. A large number of participants strongly agreed that the science camps improved their scientific inquiry, outdoor skills and other abilities. Conducting scientific investigations, collecting and presenting scientific data, and analysing data have all stimulated participants' scientific knowledge, skills and values. Only one participant disagreed that science camp stimulated her outdoor skills.

The participants' remarks, the science camp lecturer's report and the letter of appreciation letter by Professor Allen all suggest that the participants' scientific knowledge, skills and values were positively stimulated. The report and the letter indicate that participants used scientific knowledge to solve problems. Instructors and students worked together to understand how principles of conservation could be applied to local contexts. The participants synthesised the new knowledge and demonstrated the knowledge gained and skills acquired in their enthusiastic final scientific project presentations. The participants acknowledged and valued the knowledge and skills contributed in their lives by teaching them to make calculated decisions and developing a research mentality before making life time decisions.

5.3 The Strengths of the Science Camps as an Intervention Programme

The study participants and scientists believe that the science camp is a wonderful initiative and a powerful concept. The initiative has a potential to encourage the participants to follow careers in science related fields. This is attributed to the strong network the science camp has established with the scientists who provide invaluable expertise to the programme. The same sentiments are shared by Karen Vickers, the science camp lecturer, that it is clear that the science camp coordinator, Joe Sibiyi 'is very dedicated to what he does and has the vision to bring the right people together to deliver a successful programme' (Appendix 8).

5.4 The Weaknesses of the SAEON Science Camps and Recommendations

5.4.1 General Comments and Science Camps Lecturer's Recommendations

- The programme lacks the ability to provide continued interaction among participants and scientists. For example, there are no further interactions between the camp participants and the scientists after the camps. The programme should provide follow up activities at least once a week for six months after the science camps. This will reinforce the knowledge, skills and values gained at the science camps.
- The report by the science camp lecturer revealed that the duration for the camp was not sufficient to cover the planned activities. A full week would provide a better time frame in which to operate a more comprehensive programme while allowing themes and topics to merge nicely. Some important concepts were rushed through and some very relevant scientific issues were only done superficially due to time constraints.
- There is poor representation of black scientists role models especially of South African origin. The same sentiments were shared by Karen Vickers, in her science camp lecturer's report: *'...but being a Canadian female in my 30's I cannot expect*

that these young learners from Phalaborwa would really see me as a role model. Ultimately, if the goal is to inspire learners into a career in science they need to see that people they can relate to are passionate about the field and succeeding in it’.

5.4.2 Study Participants’ Comments and Recommendations Regarding the Science Camps

- Very few learners are enrolled for science education camps whilst there is a substantial need for scientists. SAEON should reach out a large audience by visiting and giving talks especially to the formerly disadvantaged schools.
- The programme does not provide platform for camp participants to share their science camp experiences. SAEON science education should create platform for science camp participants to feedback/share knowledge gained at science camps.
- SAEON does not provide financial support for the science camp participants after exposing them to careers in science to further their studies at universities. SAEON should provide or source bursaries for the learners who have attended the science camps since most of them come from poor family backgrounds.
- SAEON should certificate science camps participants. Certificates serve as reference and open doors for students in their tertiary level.

5.5 Study Limitations

- The results of the study cannot be generalized to the other five SAEON nodes but is limited to the grade 11 Phalaborwa learners who participated in the SAEON Ndlovu node science camps.
- The results may not be generalized to the wider context of other science intervention programmes because of the variations in intervention strategies.

- The instrument was not inclusive of educators as contributors to the selection of the science camp participants.

5.6 Recommendations for SAEON

- Since SAEON is a network organisation it is recommended that it continues to partner with other organisations that have similar programmes to outsource skills that would complement and add value to the science camp activities. Therefore, it will be advantageous for SAEON science education to involve as many community stakeholders, residents, voluntary associations, and community-based institutions in the creation of plans, visions, and projects that support community building (Turner *et al*, 2000).
- Platforms such as educational conferences and articles written to educational journals for high school science learners should be created for camp participants to report back and to showcase their science camp research projects. This will create additional opportunities for youth to build assets and enhance educational programmes by providing real world environments in which students can learn content related knowledge and skills at the same time (Scales *et al*, 2000).
- Therefore it is imperative that schools, institutions of high learning, Business community, Non-Governmental Organisations, Community Based Organisations as well as Government Agencies networks or partner in order to develop learners for the creation of skilled workforce that would benefit the country's economy and ensure quality of life.
- Opportunities in science should be opened across the scale to maximise/increase participation. The results of the study revealed that some participants went for certificate, diploma and degree qualification in other science related fields instead of environmental related fields.

5.7 Conclusions

The study revealed the following:

- The science camp is a valuable tool which could be used to spark love for science and encourage careers selection in science related fields.
- The science camp has positively stimulated participants' scientific knowledge, skills and values.
- The overall majority of participants; nine (n=9) of the fifteen (n=15) followed science related careers although not environmental in nature, compared to five (n=5) who chose other.
- Combinations of a number of factors influence participants' career choices.
- Financial constraint is a recurring theme therefore, appears to be insufficient funding for many students to follow career of their choice. There is likewise insufficient funding SAEON to reach all of its goals.
- Time is another problem. Camps of longer duration are desirable in order for greater depth of knowledge to be developed.
- Follow up longitudinal studies are required so that SAEON may be able to track the paths of science camp participants.

5.7.1 Careers Study Participants Following or Have Followed

Although the study participants have interacted with science camps activities that aimed at persuading them to follow ecological related careers only one participant out of the fifteen sampled is following ecological sciences related career. This is a low a number if one considers the positive responses of the study on how the science camp influenced them to follow science related fields. It would be expected that a large number would follow careers in environmental sciences. The low number of students following ecological related careers might be the reflection of the fact that the once-off-five-day intervention may not be long enough to attract students to ecology.

However, the literature reviewed for this study revealed that the low number of students following ecological related careers could be influenced by politics and financing of the career (Scheringer, 2005; Jeffrey, 2006). Ecological or environmental occupations are associated with low salaries and lack of fringe benefits; therefore as a result such students are not interested in following such careers Teitelbaum (2003), Maguire & Guyer (2004), and Xie and Achen (2009).

5.7.2 Factors Influencing Participants' Career Choice

Some study participants have followed the careers that they selected at high school whilst others followed different careers from the first their choices. The literature reviewed for this study reveals that students are attracted to particular jobs because of the assumptions and beliefs they make about that job (Laker, 2002).

For example, Ntsako and Lebo followed medicine and engineering respectively because of the assumptions they made and beliefs they hold about the careers they selected.

Five study participants selected a career in the mining industry because they believe that the career has a bigger impact in the economy of South African. It seems that the five participants have been influenced by the context as indicated that Phalaborwa is dominated by mines. This supports the theory that informed this study that environmental conditions influence career choices individuals make.

The study participants indicated that despite the fact that the science camp positively influenced them; they did not follow careers in environmental sciences because other organizations sent them for job shadowing and experiential learning at various companies when they in grade 12.

Some study participants pointed out that they had no access to information about the range of career choices. As a result, lack of career information led study participants to making career choices based on limited career alternatives (Buikstra *et al*, 2007; Ozbilgin *et al*, 2004).

Tlangi was sponsored to follow a career in marketing rather than environmental sciences. She took the opportunity provided to add on to her portfolio as it was better for her than doing nothing. Tlangi's career aspirations were negatively affected by her family's economic background (Ladany *et al*, 1997).

5.7.3 Career Choice Change

The study participants who were consistent with their career choices believed in their abilities and had financial support to further their studies at institution of higher learning. Ntlhari and Tlangi's circumstances suggest otherwise. They were compelled to follow careers which were not their first choices because of the grade 12 results and family economic background. However, Ntlhari and Tlangi still hope to follow their first career choices. This suggests the complexities of the process of career choice as revealed by Krumboltz and Worthington (1999).

Furthermore, the study participants realized that they are expected to update their skills and qualifications to keep up to speed with the dynamic employment trends (Krumboltz and Worthington 1999).

5.7.4 Impressions on the Timing of the Science Camps as an Intervention Programme

Both study participants and scientists believe that the science camp is a useful concept that provides platform of interactions for high school learners and scientists; eventually create a pool of science knowledge and career choice awareness among learners. However, the camp lacks ability to ensure continuity and sustenance of participants toward environmental science related careers. Despite the shortfall cited, the scientists feel that outreach programmes of this kind are essential for the future of science in South Africa. Therefore, they do not hesitate that science camps such as the SAEON do more in one week to contribute to the progress of science in South Africa than any classroom learning anywhere else.

5.8 Summary

The results of this study revealed that the study participants were positively influenced by the science camp activities, and encouraged to follow career in science related fields. The overall majority of participants; nine (n=9) of the fifteen (n=15) followed science related careers although not environmental in nature, compared to five (n=5) who chose other. Furthermore, the results of this study revealed that economic background, environmental conditions, learning experiences/abilities, lack of knowledge, and plan and unplanned events affected participants' career choices. These factors are related to Krumboltz's Social Learning Theory of Career Decision Making. The study identified that a once-five-day intervention may not be adequate to motivate students to follow careers in science related fields. However, the science camps do more in one week to contribute to the progress of science than any classroom learning anywhere else.

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Appendix 1: Clearance Certificate

Wits School of Education



27 St Andrews Road, Parktown, Johannesburg, 2193 Private Bag 3, Wits 2050, South Africa
Tel: +27 11 717-3064 Fax: +27 11 717-3100 E-mail: enquiries@educ.wits.ac.za Website: www.wits.ac.za

Student Number:
9613700Y
Protocol Number:
2012ECE195

Date: 23-Nov-2012

Dear Ready Sibiyi

Application for Ethics Clearance: Master of Education by Research

Thank you very much for your ethics application. The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate has considered your application for ethics clearance for your proposal entitled:

**The South African Environmental Observation Network Science Education
Camps And Science Career Choice: A 4-Year Case Study Among Grade 11
Phalaborwa Learners**

The committee recently met and I am pleased to inform you that clearance was granted.

Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

**The Protocol Number above should be submitted to the Graduate Studies in
Education Committee upon submission of your final research report.**

All the best with your research project.

Yours sincerely

M. Mabeta
Matsie Mabeta
Wits School of Education

011 717 3416

Cc Supervisors: Prof E Vhurumuku & Dr B Thorne

Appendix 2: SAEON Letter of Approval to Study



18th October 2011

To Whom It May Concern:

I hereby confirm that Mr Joe Sibiya, an employee of the SAEON Ndlovu Node (hosted by SANParks) has permission to study for an MSc at WITS University, on a part-time basis, from 2010 to 2013.

This thesis will investigate the effect of SAEON education camps on career choices of secondary school learners. The results will be valuable to SAEON, in terms of improving our education outreach programme. This programme aims to increase awareness of environmental issues, and to increase the number of learners pursuing careers in the environmental sciences, and any research on the effectiveness of our education camps is welcome.

Joe therefore has the permission of SAEON to interview learners and educators involved in these camps, and gather any other required information, in the course of his work duties.

Sincerely

Dr Anthony Swemmer
Manager: SAEON Ndlovu Node
Kruger National Park
Phalaborwa

Appendix 3: Consent Form and Information Sheet

Consent form: Students

Title of study	The South African Environmental Observation Network science education camps and science career choice: A 4-year case study among grade 11 Phalaborwa learners		
Researcher	Ready Joe Sibiya	Contact No.	(013) 735 3543
Student No.	9613700Y		
Supervisors	Dr E Vhurumuku	Contact No.	(011) 717 3251
	Ms B. Thorne	Contact No.	(011) 717 3246
Institution	University of the Witwatersrand		
Faculty	Humanities		
School	Education		

Joe Sibiya of student number 9613700Y, a master of education student at the University of the Witwatersrand School of Education, has requested my participation in study that will be conducted at SAEON Ndlovu node in Phalaborwa.

The purpose of the study is to determine the effect of the South African Environmental Observation Network (SAEON) initiative of using science education camps to influence science career selection among the grade 11 Phalaborwa learners.

My participation will include responding to the questionnaire and participate in the interview. I am aware that the data of the study will be safely stored at the researcher's office for five years and thereafter will be destroyed.

I understand that the results of this research will be presented at Masters Dissertation and that part or all the results of the study may be presented at conferences and/or published in academic journals or SAEON annual report/journal but my identity will remain anonymous.

I have been informed that I will not be compensated for my participation in the study. My involvement in the study is voluntary and I have been told that I may withdraw my participation in the study at any time without consequences of any kind.

I therefore, agree to participate in the study.

Name of participant

Signature (participant)

Date

Witness

Date

Information Sheet for Students

PO Box 1056
Phalaborwa
1390
24 October 2011

Dear _____

Request for Your Participation in the Study

My name is Joe Sibiya; I am a registered Master of Education student at the University of the Witwatersrand School of Education. I am carrying out a study entitled, '**The South African Environmental Observation Network science education camps and science career choice: A 4-year case study among grade 11 Phalaborwa learners**' as partial fulfilment of the requirements for the degree of Masters in Education.

The purpose of this study is to determine the effect of the South African Environmental Observation Network (SAEON) science education camps initiative aimed at encouraging science career selection among the Grade 11 Phalaborwa learners.

You were selected as a possible respondent in this study because you previously participated in the SAEON science education camp. If you agree to participate in this study you will be asked to respond to the questionnaire and participate in the interview. Each segment of the questionnaire and interview should not take more than 30 minutes of your time.

I do not anticipate risks to you or discomforts associated with this study. Your participation is entirely voluntary; you will not be compensated for your participation. The direct benefit to you is that you will have the opportunity to contribute to the findings that could provide SAEON with systematic way to initiate and execute activities that will increase chances for learners to select careers in science.

All information will be treated with confidentiality and your name will remain anonymous. However, any records or data obtained as a result of your participation in this study may be shared with the supervisor/s or external examiner/s for auditing purposes. After completion of the study the raw data will be stored safe at my office for a period of five years thereafter will be destroyed. If you choose to participate or if you choose to withdraw from the study, you may do so at any time without consequences of any kind

My research results will be presented in my Masters Dissertation. Part or all the results of the study may be presented at conferences and/or published in academic journals or SAEON annual report/journal.

Any question/s you may have you may contact the researcher.

If you are willing to participate in this study please complete the attached consent form.

Thank you,



Joe Sibiya
Student
(013) 735 3543
joe@saeon.ac.za

Barbara Thorne
Supervisor
(011) 717 3251
Barbara.Thorne@wits.ac.za

Dr Elaosi Vhurumuku
Supervisor
(011) 717 3246
Elaosi.Vhurumuku@wits.ac.za

Appendix 4: Study Instruments

Questionnaire Number

--	--	--	--	--

Please answer each question by cycling the appropriate number in the box or by writing your opinion in the space/s provided.

A

1. Gender

Female		
Male		

2. Age category

17-21	
22-26	

3. When (in which year) did you attend the SAEON science camp?

2006	
2007	
2008	
2009	

4. Are you currently enrolled at university/college?

Yes	
No (<i>please explain</i>)	

5. What year of study currently enrolled?

1 st year	
2 nd year	
3 rd year	
4 th year	
Other (<i>please explain</i>)	

6. Are you following a career in science?

Yes (<i>please specify</i>)	
No (<i>please specify</i>)	

7. Complete if currently employed.

Are you employed in the scientific related field?

Yes (<i>please specify</i>)	
No (<i>please specify</i>)	

B. To what extent has SAEON science camp influenced your career choice?

Please use one of the following codes:

1 = Strongly disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly agree

I believe the following factors influenced my career choice in science:

8. Exposure to various careers choices in science

1	2	3	4	5
----------	----------	----------	----------	----------

9. Interactions with scientists as role models

1	2	3	4	5
----------	----------	----------	----------	----------

10. Interactions with other science learners (camp participants)

1	2	3	4	5
----------	----------	----------	----------	----------

11. Engagement in scientific investigations/research projects

1	2	3	4	5
----------	----------	----------	----------	----------

12.Field trip to a research centre

1	2	3	4	5
----------	----------	----------	----------	----------

C. The following factors have influenced me to take career in science.

Please use one of the following codes:

1 = Strongly disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly agree

13. Grade 12 results

1	2	3	4	5
----------	----------	----------	----------	----------

14. Availability of study bursaries and study loans

1	2	3	4	5
----------	----------	----------	----------	----------

15. Career opportunities in science

1	2	3	4	5
----------	----------	----------	----------	----------

16. Lack of career information on other careers

1	2	3	4	5
----------	----------	----------	----------	----------

17. Personal interest in a career in science

1	2	3	4	5
----------	----------	----------	----------	----------

18. Salary

1	2	3	4	5
----------	----------	----------	----------	----------

19. Fringe benefits (car/medical/housing/children bursaries)

1	2	3	4	5
----------	----------	----------	----------	----------

20. Job security

1	2	3	4	5
----------	----------	----------	----------	----------

D. The following factors have influenced me not to take a career in science

Please use one of the following codes:

1 = Strongly disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly agree

21. Grade 12 results were not good to study science

1	2	3	4	5
---	---	---	---	---

22. Lack of career information in science at lower grades

1	2	3	4	5
---	---	---	---	---

23. Lack of career opportunities in scientific field

1	2	3	4	5
---	---	---	---	---

24. Interest in other careers than science

1	2	3	4	5
---	---	---	---	---

25. Financial cost of the field of study

1	2	3	4	5
---	---	---	---	---

26. Poor salaries offered in science occupations

1	2	3	4	5
---	---	---	---	---

27. Lack of fringe benefits (medical/house/children bursaries)

1	2	3	4	5
---	---	---	---	---

28. Work conditions/environment not appealing

1	2	3	4	5
---	---	---	---	---

E. Which of the following persons/individuals had the greatest influence on your career choice?

29. Please use the following ranking codes:

1 = Greatest

2 = Partially

3 = Least

Person	Rank
Parents/guardians	
Other family (specify)	
School principal	
Life Orientation educator	
Other educator/s (specify)	
Peer group/friends	
Role model (scientist)	
Other (<i>specify</i>)	

F. Please respond to the following statements on how SAEON science camp stimulated your scientific knowledge, skills and values

Please use one of the following codes:

1 = Strongly disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly agree

30. Improved my scientific inquiry/questioning

1	2	3	4	5
---	---	---	---	---

31. How to conduct scientific investigation

1	2	3	4	5
----------	----------	----------	----------	----------

32. Collecting and presenting scientific data

1	2	3	4	5
----------	----------	----------	----------	----------

33. Handling/using equipment and procedure

1	2	3	4	5
----------	----------	----------	----------	----------

34. Analysing and interpreting research results

1	2	3	4	5
----------	----------	----------	----------	----------

35. Field process/procedure/methods skills

1	2	3	4	5
----------	----------	----------	----------	----------

36. Conceptual/theoretical understanding

1	2	3	4	5
----------	----------	----------	----------	----------

37. Outdoor skills/expertise

1	2	3	4	5
----------	----------	----------	----------	----------

38. Improved my social skills (interpersonal skills)

1	2	3	4	5
----------	----------	----------	----------	----------

39. Please complete the following:

I believe SAEON science camp has a positive role in:

The SAEON science camp should improve in the following areas

40. What other valuable experience/s the SAEON science camp provided you with other than career choices in science, and scientific knowledge and skills?

Thank you very much for taking time to complete this questionnaire.

Joe Sibiyi: 082 802 5587, Office Tel. (013) 735 3543 Fax: (013) 735 3544, joe@saeon.ac.za

Interview Questions

List of questions to be asked during the interviews with science camp participants determine effect of the SAEON initiative of using science camps at influencing science career selection among the grade 11 learners in Phalaborwa

A

--	--	--	--	--

1. Gender

Female		
Male		

2. Age category

17-21	
22-26	

3. When (in which year) did you attend the SAEON science camp?

2006	
2007	
2008	
2009	

4. Are you currently enrolled at university/college?

Yes (<i>go to 5&6</i>)	
No (what are you doing? <i>please explain</i>)	

5. What year of study currently enrolled?

1 st year	
2 nd year	
3 rd year	
4 th year	
Other (<i>please explain</i>)	

6. Are you following a career in science?

Yes (<i>please specify</i>)	
No (<i>please specify</i>)	

7. Are you employed in the scientific related field?

Yes (<i>please specify</i>)	
No (<i>please specify</i>)	

B. To what extent has SAEON science camp influenced your career choice? (*Please explain briefly in each statement*)

7. Exposure to various careers choices in science

8. Interactions with other science learners (camp participants)

9. Interactions with scientists as role models

10. Engagement in scientific inquiry/methods

11. Field work activity/data collection

C. To what extent the following factors influence you to take a career in science? (please explain briefly)

12. Grade 12 results

13. Availability of study bursaries and study loans

14. Career opportunities in science

15. Career information in science

16. Personal interest in a career in science

17. Salary

18. Fringe benefits (car/medical/housing/children bursaries)

19. Job security

D. Briefly explain how each of the following individuals had an influence on your choice of a career.

20.

1. Parents/Guardians

2. Other family

3. School principal

4. Science educator

5. Other educator/s (please specify)

6. Peer groups/friends

7. Role models (*Please specify*)

8. Other (*please specify*)

E. Please explain briefly in each statement below how the SAEON science camp has stimulated your scientific knowledge and skills.

21. Scientific inquiry/questioning

22. Conducting scientific investigation

23. Collecting and presenting scientific data

24. Handling/using equipment and procedure

25. Analysing and interpreting research results

26. Field process/procedure/methods skills

27. Conceptual/theoretical understanding

28. Outdoor skills/expertise

29. Improved my social skills (teamwork)

30. Improved my performance in science

31. In your opinion what greatest

Positive role SAEON science camp has

What areas should SAEON science camps improve on?

32. Is there any other thing you would like to add?

Thank you very much for taking time to participate in this interview.

Joe Sibiva: 082 802 5587, Office Tel. (013) 735 3543 Fax: (013) 735 3544, joe@saeon.ac.za

Appendix 5: Science Camps Programmes



Learners Winter Vacation School 26-30 June 2006

SAEON Provisional Program

Monday 26/06/06

08h30 - 11h30	Travel SAEON
11h30 - 12h30	Check in
12h30 - 14h00	Lunch
14h00 - 15h30	Lesson 1 (Dr D. Balfour)
15h30 - 15h45	Tea break
15h45 - 17h00	Lesson 2 (Dr D. Balfour)
17h00 - 18h00	*refresh dinner SAEON
18h00 - 20h00	Supper

Tuesday 27/06/06

07h00 - 08h00	Breakfast
08h00 - 10h00	Lesson 3 (Dr D. Balfour)
10h00 - 10h15	Tea break
10h15 - 12h00	Lesson 4 (Dr D. Balfour)
12h00 - 14h00	Lunch
14h00 - 15h30	Lesson 5 (Dr D. Balfour)
15h30 - 15h45	Tea break
15h45 - 18h00	*refresh dinner SAEON
18h00 - 20h00	Supper

Wednesday 28/06/06

07h00 - 09h00	Breakfast
09h00 - 13h00	Drive to Kapama Choolah Breeding Project (KCBP)
10h00 - 16h00	KCBP
16h00 - 17h00	Drive to SAEON
17h00 - 18h00	Refresh
18h00 - 20h00	Supper
20h00 - 20h30	How to write a report

Thursday 29/06/06

07h00 - 09h00	Breakfast
09h00 - 10h00	Lesson 6 (F. Hendrik Sithole KNP)
10h00 - 10h15	Tea break
10h15 - 12h00	Lesson 7 (F. Hendrik Sithole KNP)
12h00 - 14h00	Lunch
14h00 - 15h30	Report Writing
15h30 - 15h45	Tea break
15h45 - 18h00	Finalize reports (learners)
18h00 - 20h00	Supper
20h00 - 21h00	Reporting on work done (learners)

Friday 30/06/06

07h00 - 08h00	Breakfast (pack and go)
08h00 - 18h00	Drive back to Phalaborwa through Kruger National Park

*Any other changes will be communicated to you

ADVENVIRO CAMP 2008 JULY 7-11

TRACKERS

Day	Time							
	06:30 07:30	08:00 08:30	08:30 12:30	13:00 14:30	14:30 16:30	17:30 18:00	18:00 19:00	19:00
Mon	Travel to Trackers		Rules & Settle in	Lunch	Orientation Looking & Listening	Bath	Dinner	Stars & 1 st Aid
Tue	Up early Listening & Interpretation	Breakfast	Ecology Geology Soils Erosion		Ecological Principles River Fish Boat Trip Blyde Dam			Animal Behaviour
Wed	Quiet Time		Reptile Park Plants Veld Assessment		Trees Reptiles Insects			Quiz
Thurs	Writing & Drawing		Moholoholo Animal Rehabilitation Centre		Mammals Tracking/spoor & Signs			Camp Fire
Fri	Pack & Clean up		Re-cap Report by learners & Conclusions	Travel back to Phalaborwa				

Final program for the ADVENVIRO Winter School, 6 July – 10 July

Tshulu Camp, HaMakuya

6 July 2009, Monday

- 8h00 Depart for Hamakuya
(with packed lunch)
- 13h00 Arrive and unpack
- 14h00 Introduction to week (*all*)
Introduction to diary and Goldsworthy awards (*Karen*)
- 14h30 Learning the Scientific method (*Nikki*)
- 17h30 Flags (*all*)
- 19h00 Student introductions
- 19h15 Dinner

7 July 2009, Tuesday

- 06h30 **Group 1:** Bush walk and identifying (*Graham*)
Group 2: Goldsworthy and diary time (*Karen and Nikki*)
- 07h30 Breakfast
- 08h30 Climate change and impacts (*Dave*)
- 13h00 Lunch
- 14h00 Sustainability introduction
15h00 The Amazing Race
- 18h30 Dinner
- 20h00 **Group 1:** Inconvenient truth movie
Group 2: Planet earth

8 July 2009, Wednesday

- 06h30 **Group 2:** Bush walk and identifying (*Graham*)
Group 1: Goldsworthy and diary time (*Karen and Nikki*)
- 07h30 Breakfast
- 08h30 Natural resources and ecosystem services (*Karen*)
- 09h30 Interviews (*all*)
- 12h30 Lunch
- 13h30 Field work introduction
- 14h00 Field work (*all*)
- 18h30 Dinner
- 20h00 **Group 2:** Inconvenient truth movie
Group 1: Planet earth

9 July 2009, Thursday

06h30 **Group 1:** Traps (*Graham*)
Group 2: Optional yoga (*Karen*)
07h30 Breakfast
08h30 Discussion of results
09h00 Analysis of results in small groups
12h30 lunch
13h30 Presentations
15h00 Soccer
18h30 Dinner

10 July 2009, Friday

06h30 **Group 2:** Traps (*Graham*)
Group 1: Optional yoga (*Karen*)
08h45 Breakfast
09h00 Fill in evaluation
09h30 Goldsworthy presentation - and prize
Depart

Appendix 6: Learners' Science Camp Reports & Project Presentation

22/02/2013

Adenviro Camp submits proposal for eco-club — SAEON



Adenviro Camp submits proposal for eco-club

Following the success of the Winter School - ADVENVIRO 2006 - SAEON received the following proposal from the learners who attended the School:

ADVENVIRO CAMP MAKES A PROPOSAL FOR AN ECO-CLUB!

As we are the first group of learners to attend a camp organised by SAEON, we felt it a necessity to extend our learning experience through an eco-club. What we have learned at the camp is beyond words and explanations. We have been given a whole new perspective towards nature conservation.

As Jacques Moller* once said, 'Environmental education is the key to conservation'. We now stand firm on those words.

SAEON has changed us, made us products of their knowledge and invested in us. It would only be our pleasure to show them how much this has advanced our knowledge. An eco-club is a great and exciting way of creating young and up-coming scientists, biologists and conservationists to fight against the destruction of nature.

ADVENVIRO 2006 can make that happen! Yes, we can kick-start this eco-club, not on our own, but with anchorage and kind support from SAEON. This eco-club can help ADVENVIRO 2007 to arrive at the camp with some background knowledge of the overall course that will be given.

The group of 2006 will help collect (identify) and train three potential learners from every school to form this club.

SAEON will provide the club with activities on which the club will lay their focus, while the group of 2006 shares some topics which they received at their camp.

The group of 2007 will then do the same to advance the potential group of 2008.

We are overloaded with visions and ideas to make the club a great success, through dedication and determination, WE CAN!!!

We feel proud and brave to say that SAEON needs us in order to have an even brighter future. Invest in this Eco-club and it WILL benefit you, us and the rest of the people!

ADVENVIRO CAMP - ... Conserve today for a better tomorrow.

* Jacques Moller is a conservation officer at the Hoedspruit Endangered Species Centre (HESC), one of SAEON's partners in Education Outreach. Jacques was one of the presenters at the Winter School.

Johan Pauw, Head of SAEON, Sibongile Mokoena, SAEON's Education Outreach Coordinator, and Joe Sibya, Education Outreach Facilitator at the Ndlovu Node, are to convene a meeting to consider the proposal.

"SAEON's response to the proposal is positive and the suggestion has been that the ADVENVIRO ECO-CLUB should produce an action plan for SAEON's consideration and endorsement," says Sibongile.



www.saeon.ac.za/newsletter/archives/2006/november-2006/adenviro-camp-submits-proposal-for-eco-club

1/2

Group Report by the 2007 Advenviro learners

“Education should be aimed at improving people’s physical and mental freedom in order to increase their control over themselves, their own lives, and the environment, in which they live. “__ Nyerere, 1967

Good morning ladies and gentlemen and my fellow peers. I am Kabelo Setsiba from Frans du Toit High school. I stand here before you as a representative of the Advenviro 2007 learners. I’ll be giving you our group report, but before that allow me to give thanks to Mam Pulane, Mr. Moses and Mrs Sibiya who have continuously showed their love by looking after us and making sure that our needs have been met. I would also like to thank the staff of the Southern Africa Wildlife College for their excellent hospitality, not forgetting the scientists and all the other dignitaries who passed their knowledge with us. Lastly, ladies and gentlemen allow me to sincerely thank SAEON (and its key representative My Joe Sibiya) for organizing this long-term winter camp and ensuring that the youth are exposed to nature conservation, teaching them the role they play in the environment and hopefully interesting them to pursue a career in nature.

Apart from that “Mr. Sibiya, we thank you for your dedication, passion for nature and the great leadership role you displayed here at the camp. We hope that this doesn’t end here, in fact, we hope that you continuously promote SAEON and serve as a key example for every child in your community”.

Ladies and gentlemen it is of tradition that before we take a journey we should start from the beginning, so without any further a due, let me begin. On Monday the 25th of June 2007 we arrived at the SAWC and after getting to know each other very well, we were due for our first representation. Our first representation was about the ‘History and Development of Nature Conservation in south Africa’, which was presented by Mering. We were taught about nature conservation- how the definition gradually changed from preserving, managing and enhancing nature to meeting the needs of people and the management of human use of biosphere so that it may yield the greatest sustainable benefit to present and future generations.

We were also taught about the economic importance of nature- SAN PARKS. In fact, the government claimed wildlife and game reserves as their property because of its economic value. The three objectives of successful nature conservation were also highlighted. Our second presentation was about ‘Environmental Management’ by

Cathrine. We were taught about the importance of conserving nature and the detrimental effect pollution has over nature for example, when we pollute rivers animals can't drink from them and certain water animals will die from this.

We were also taught about the role nature plays for the community – which is employment. Nature gives community members an opportunity to make sculptures and sell them to tourists and in turn make money for them. Ladies and gentlemen, apart from this, nature offers leisure facilities and serves as a de stressor or inspiration to millions. The last representation for the day was a movie “Running Dry”. Ladies and gentlemen I speak for every learner when I say after watching the movie our perception and understanding of the importance of water was improved.

Just the thought and sight of our fellow brothers and sisters not having access to adequate water served as an awakening for us and it reminded us how fortunate we are to have pure water and with this knowledge and experience, we all plan on spreading the knowledge with our community, friends and educators. If it were possible, it would be great to have them watch the documentary themselves.

The 26th of June 2007 was filled with great presentations and our first presentation for the day was by Dr. Thomas Gyedu – Ababio who talked about “The Environment and water”. But before I get into that, I think it will be wrong of me not to talk about the role of Peace Parks foundation and their role (which we learned from our second presentation by Catharine) Peace Parks Foundation is an organization that ensures that nature is conserved, the Hydrological system is not affected, tourism is promoted and the starting of sister organizations around the world that ensures that the main objectives are met. An example of the great work done by Peace Parks is the TFCA (Trans Frontier Conservation Area). Now moving on with Dr. Thomas's presentation – He taught us about the importance of the environment which he defined as the sum of all the conditions under which we live. He also explained how the environment is categorized into two (Internal and external). He also explained that as human beings we have the right to clean water and a healthy environment, however, we have the responsibility to conserve our environment and water – which is one thing that our society is failing to do.

The importance of wetlands was also given to us and the reason why we should manage water was highlighted. Dr. Thomas shared a very interesting story with us about how he found an individual irrigating in the bush, when asked what was he doing, he replied “Nothing sir, I think it's best if we turn around”. When Dr Thomas insisted that they go back to the place the man had been – he discovered- I quote “A heap of faeces that would probably need a bull dozer to pull you if you out were to step on them”. Now ladies and gentlemen, these are some of the issues we have to deal with to ensure a diverse and pollution free environment.

One crucial matter raised by the Doctor was that certain rivers no longer reach the sea- now this matter ladies and gentlemen is an indication that we have to do something about our environment before it's too late. We also learned about the "Catchment System" plus "Testing Water Quality" by Jenny Newerham. This was our second presentation for the day and it was interesting to learn how certain invertebrates such as frogs automatically tell you the quality of water. Apart from that, we learned how to use the Mini SASS (South African Scoring System) when determining the quality of water. Luckily; the river we worked with was clean and healthy.

Our last two presentations for the day were by Edward Kohi who addressed us about Science and Ecology. He explained that we were in the century of Science and Technology and further explained how education (which is the development of one's consciousness to think, decide and act) is of importance in order for us to succeed today. Science was defined as a Latin word (Scientia) meaning knowledge. It was further defined as a system of acquiring knowledge based on scientific methods.

The scientific methods being talked about are any methods that can be repeated to get the same results. He further explained that science was divided into two main groups namely: Natural Science and Social Science. Mr. Kohi explained that apart from qualified scientist such as Biologist, anyone can be a scientist just as long as they question things by using the scientific question "why" up until all the questions were answered. Scientists are needed to control disasters (e.g. Fire), medical problems, improve electronics, study, biology and work with infrastructure (e.g. bridges).

Mr. Kohi further taught about his speciality - Ecology. He defined Ecology as the interaction of living organisms and their environment. He explained the ecological pyramid and explained that all the different parts of the pyramid complement each other; therefore one part can't do without the other. He explained the different concepts studied in ecology and explained why we should become scientists. However, he made it clear that being a scientist is a sacrifice, hard work, not always financially rewarding but if there is something you would get, that would be a legacy! The following day was started at Skukuza where we had our first presentation for the day.

The presentation was conducted by Dr. Lin-Marie de Klerk-Lorist who taught us about Game Capture or Bomas and Wildlife Disease in Kruger National Park (KNP). She taught us about the services rendered by Veterinary Wildlife services, which I shall be getting into. Ladies and gentlemen Dr. Lin taught us that the two capture methods used to capture animals are the chemical capture method and the mass capture method. She also elaborated on how different capture methods are used to capture different animals

for example lions are captured by using bait (in the form of a dead animal) before they are darted. She also explained the importance of Bomas for animals before they are sold or transformed. D. Lin also explained the different projects rendered by the Veterinary Wildlife in the KNP such as “The disease free Buffalo breeding projects”.

Ladies and gentlemen the Doc. Explained that research is carried out by the KNP to find better ways of curbing animal diseases and further expressed that they don't treat animals that get sick naturally as this is part of nature. Furthermore, Dr. Lin talked to us about the different diseases attacking animals in the Kruger National Park and the effects these disease have on the animals.

Ladies and gentlemen need I add that we got the opportunity to visit Bomas filled with rhinos. It was interesting to practically see what we have learned in the presentation room. Now ladies and gentlemen our last presentation for the day was a documentary “Inconvenient Truth”. This movie (documentary) was an awakening about the seriousness of global warming and the side effects global warming is already having on us. I'm sorry to say this ladies and gentlemen, but if we don't do anything about this, we face drought and the demise of all living creatures. As people we should start taking care of the environment and look for different ways to better and preserve our environment.

Moving on to Thursday (the last day of presentations by the highly qualified). The first presentation for that day was a field activity by Obeid. The main purpose of the field activity was to get us to understand the importance of savannahs and how useful certain plant are to mankind. For example: we were taught how the silver cluster tree helps us determine whether there will be water under the ground because they grow in sandy soil.

We also visited a bird-hide where we had an opportunity to look at the different bird species and relax after the long walk. Our next presentation for the day was by Ammy Polard who interested us in Ecology. She basically elaborated on what was said by Edward Kofi. However, apart from the lesson, we played a game that helped us put what we practiced to the test. The game also tested our general knowledge about the KNP and the environment as a whole.

Ladies and gentlemen need I add that teamwork was put to the test! On to our final presentation on the camp by Nikki Stevens who addressed us on “Termites in Savannahs”.

Nikki explained how termites differ from ants (simply because they belong to the Isoptera family and they don’t have eyes) Nikki further explained that termites live in different places and are divided according to what they eat.

We get two different types of termites namely: The one piece type which nest in the place where they obtain their food (wood feeders) and “The separate feeder type”.

The separate feeder type nest in very large mounds and one colony can have up to 200 000 individual members – the colony functions as an organism. What we found fascinating about termites is that there are different groups in the colony with different jobs, but they all have one purpose, which is to serve the queen. For example, there are soldiers (that are specialized for defence and their heads are bigger than their bodies).

There are workers who build and maintain the nest, obtain food and feed all the other members. Lastly, we get the King and Queen. The King is very small whose main job is to mate with the queen. The queen is 6X the size of worker termites and its main purpose is to reproduce. Most termites’ mounds are extremely large and the reason behind this is because the termite mound serves as an air conditioner. It has openings like lungs that enable oxygen to come through. Another interesting fact about the termite mound is that its temperature remains constant at 32°C simply because termites are like farmers – they collect food and turn it to fungus.

Termites enjoy nitrogen and because fungus has a lot of nitrogen termites enjoy it. Termites are of importance in the savannahs because they indicate a healthy ecosystem. The termite mounds have openings, which enable rainwater to easily get to the roots of the plants. The nitrogen produced by the termites fertilizes the soil and is also good for the plants. Ladies and gentlemen the words of Nyerere are quoted in beginning, which read as follows “Education should be aimed at improving people’s physical and mental freedom, in order to increase their control over themselves, their own lives, and the environment, in which they live...” Now ladies and gentlemen we – the 2007 advenviro pupils – have decided to pass the knowledge we have gained from the camp with everyone we come to contact with. Lastly we would like to once again thank SAEON for this great opportunity and we will make sure that this long-term programme meets its objectives – Thank you.



An impossibility is an opportunity

- By THE BLYDECHOES

Following the success of ADVENVIRO 2008 - the SAEON Ndiyvu Node's Winter Adventure School for learners in the Ba-Phalaborwa region - Education Outreach Officer Joe Sibilya received the following report from the learners who attended the event. The report is published in its original format and has not been edited.

The 7th of July was the day which the 12 learners (one from each local school) stepped into an unknown, lonely world where they only knew themselves and had the choice to either befriend with someone or walk the 5-day journey alone.

We made no bones about being friends, in fact, it took us no less than an hour to know each other and discover that Noel Rissenga was a comedian and an advisor because he always made sure that no one left with question marks concerning daily life problems. This very day was the day in which we met a very intelligent man called Dave Rushworth, who was going to be our nature lecturer during our visit in Trackers.

Our journey started with the study of the topographical map and the orthophoto map. We realised that maps aren't just for directions but are the two scale diagrammatic representation in natural and manmade features.

We also noticed that we were situated near a river called the Blyde River and that's where our group's name originated from. We visited the river and learnt about different trees like the Matumi tree which grows on rocks in the river, not in soil, and gets its nutrients from the water. It's also known as the mixing tree because of its branches (it's used by the African people to mix porridge). There was also a magnificent tree, which doesn't burn from fire, called the Rauvolfia Caffra tree.



SAEON'S Advenviro Kids who attended the Ndiyvu Node's 2008 Winter School. Standing, from left: Cynthia Mohale, Mahlatse Letsoalo, Hunadi Makua, Eugene Maleyana, Noel Rissenga, Clement Hungwana. Seated, from left: Nkhensani Mametwa, Morning-Prayer Maluleke, Philani Mdhuli, Gaynelle Makhubele, Mavis Malatji, Molgadi Seale (Picture © Joe Sibilya)



Wow look at me now! The Advenviro Kids pose with a python at Kamal Reptile Park near Hoedspruit. The lesson they took home that day is that "snakes don't attack people out of the blue and warn you when you're too close or if they are about to strike". (Picture © Joe Sibilya)



Members of the team mark and measure trees for the SAEON tree monitoring project at Blyde River (Trackers) (Picture © Joe Sibilya)

"We bonded strongly like a hydrogen bond .."

Following the success of ADVENVIRO 2009 - the SAEON Ndlovu Node's Winter Adventure School for learners in the Ba-Phalaborwa region - Education Outreach Officer Joe Sibiya received the following report from the learners who attended the event. *The report is published in its original format and has not been edited.*

THE ADVENTUROUS SAEON CAMP 2009

Who would have thought that **Tsulu camp** in **Hamakuya** would be this adventurous? With twelve learners from **Phalaborwa** from different schools, and a great combination of five students from **Vhembe district**, making a tough, extraordinary team of 17 learners with one goal in mind; **learning about nature conservation in all aspects!**

By the time we were applying, we were overwhelmed by great expectations, beliefs and courage from our science teachers, not knowing at all that it was an eye opener to the real science world - **the hustle and bustle of rivers, bird watching, mountain climbing, long bush walks and early vibrating sounds of different animals, such as baboons**, as they followed their daily traditions.

Not knowing that, we would be accompanied by a great group combination of experienced scientists, both locally and internationally, educating us about the sustainability of our environment in this alarming era of **GLOBAL CHANGE!** In five days, adventurous moments such as the **Goldsworthy pictures**, the **Amazing Race**, **Fieldwork** and **Interviews** with the community of Hamakuya, were experienced.

Within five days we had investigated Hamakuya's biodiversity status through **fieldwork, surveys, and interviews** with the community members. We gained knowledge in **scientific investigations, in data analysis and presentations**. Not forgetting the fun we had as students. Even though we did not know each other, we bonded strongly like **a hydrogen bond**. We left behind our normal schedules, heading to a new road to success, far away in the wilderness, between two mountains, separated by a wide river called **Mutale**, in the Northern Hemisphere of SA.

Making the entire camp more interesting, with learners like **Avhapfani, Azwipfanele, Bongani, Ditshidze, Mogale, Ntwanano, Tihlologelo, Lungile, Masingita, Nhlamulo, Mudalo, Nelisiwe, Pharidah, Rembuluwani, Sindi, Thabiso and Tsakani**, producing the best highlight of the camp; **THE AMAZING CAMP!**

Overall, if you are considering pursuing a career in science, start focusing on Environmental Sciences because the limelight is not only on engineering and information technology.

To succeed in life consider this: Be Spectacular
 At an
 Environment
 Of a
 New world.

SAEON, THE STEPPING STONE TO A BETTER FUTURE!

Compiled by **Azwipfanele Dhandavhudzi, Bongani Mkhonto, Nhlamulo Mabunda, Nelisiwe Mmola, Ntwanano Mapfumari and Pharidah Machaka**



"We bonded strongly like a hydrogen bond .."

Following the success of ADENVIRO 2009 - the SAEON Ndlovu Node's Winter Adventure School for learners in the Ba-Phalaborwa region - Education Outreach Officer Joe Sibya received the following report from the learners who attended the event. Read the original report in its original format.



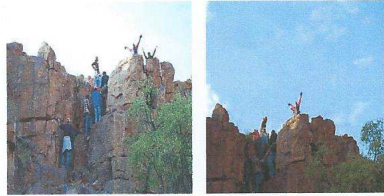
Roles are reversed as learners take turns in explaining the results of their scientific study. Here Nelisiwe Mmola addresses camp participants (Picture: Joe Sibya)



Current and future scientists get together one final time at the end of the 2009 ADENVIRO Winter School (Picture: Elizabeth)

4.

Mountain climbing



1.

The adventurous SAEON camp 2009

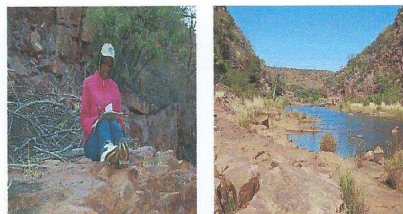


The stepping stone to a (my) successful future!

Nelisiwe Mmola

5.

Had to write diaries



2.

About the camp

- An eye opener to the real science world.

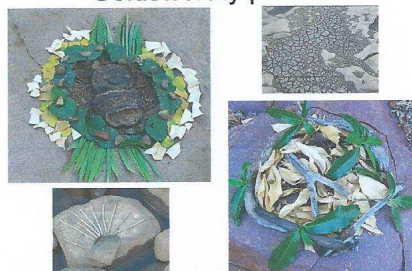


- It was adventurous.



6.

Goldsworthy pictures



3.

Long bushwalks



10.

Fieldwork



7.

Climate change



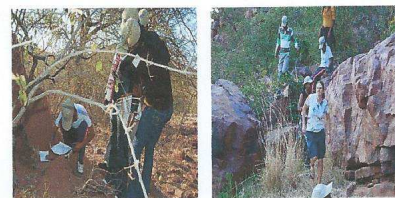
11.

Data analysis



8.

The amazing race



12.

Presentations



9.

Massive interviews



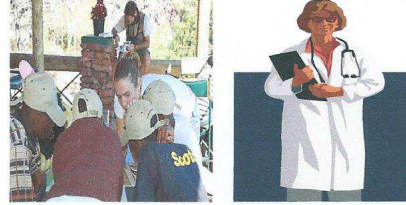
16.

Introduction

- Previous studies (done by Shackleton S.E and Shackleton C.E) have reported on the direct harvest and use of a diversity of wild resources from communal woodlands for consumption and sale.
- Two-thirds of resources are traded locally rather than being used at home.
- Economic return from trading resources is higher than working as an agricultural wage labour.
- Important resources are probably not sustainable.

13.

Scientific investigation



17.

Hypotheses

- Rural households are dependant on natural resources.



- The most commonly used resources are the most available in the community.

14.

Scientific method

- Introduction
- Aim and questions
- Hypothesis
- Methods
- Results and discussion
- Conclusion

18.

Methods 1: Interviews

What was used:

- Questionnaire
- households (how many, where, experience)
- Interpreter



15.

Aim 1

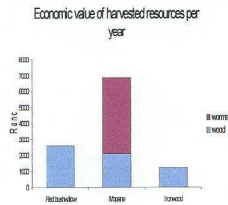
To investigate the use and value of resources for rural households in Hamakuya



22.

Results and Discussion cont.

- ◆ In terms of wood resource, the Red bushwillow is the vital resource
- ◆ Red bushwillow brings in good economic value since it costs approximately R2600
- ◆ But for the Mopane, we included the Mopane worms



19.

Multi-Pass Forest Resource Use Questionnaire

Name of interviewee: _____ Date: _____

1. Please indicate the number of members of each sex in the household and indicate their ages.

Sex	Age	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71+
Male																
Female																

2. What do you use the resources for?

Resource	Use	Frequency	Quantity	Value
Red bushwillow	Firewood	10	100	2600
Mopane	Firewood	5	50	1500
Ironwood	Firewood	2	20	500

3. How much do you spend on the resources?

Resource	Spent	Frequency	Quantity	Value
Red bushwillow	10	100	2600	
Mopane	5	50	1500	
Ironwood	2	20	500	

4. How much do you spend on the resources?

Resource	Spent	Frequency	Quantity	Value
Red bushwillow	10	100	2600	
Mopane	5	50	1500	
Ironwood	2	20	500	

5. How much do you spend on the resources?

Resource	Spent	Frequency	Quantity	Value
Red bushwillow	10	100	2600	
Mopane	5	50	1500	
Ironwood	2	20	500	

6. How much do you spend on the resources?

Resource	Spent	Frequency	Quantity	Value
Red bushwillow	10	100	2600	
Mopane	5	50	1500	
Ironwood	2	20	500	

7. How much do you spend on the resources?

Resource	Spent	Frequency	Quantity	Value
Red bushwillow	10	100	2600	
Mopane	5	50	1500	
Ironwood	2	20	500	

8. How much do you spend on the resources?

Resource	Spent	Frequency	Quantity	Value
Red bushwillow	10	100	2600	
Mopane	5	50	1500	
Ironwood	2	20	500	

9. How much do you spend on the resources?

Resource	Spent	Frequency	Quantity	Value
Red bushwillow	10	100	2600	
Mopane	5	50	1500	
Ironwood	2	20	500	

10. How much do you spend on the resources?

Resource	Spent	Frequency	Quantity	Value
Red bushwillow	10	100	2600	
Mopane	5	50	1500	
Ironwood	2	20	500	

23.

Aim 2

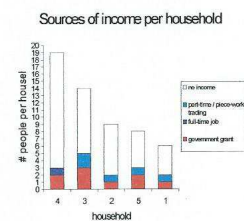
To investigate the availability of natural resources for use by rural households in Hamakuya



20.

Results and Discussion

- Overall income is very low
- 1 Person out of 50 households has a full time job
- Even big households still have small income



24.

Methods 2: Fieldwork

Method

- Used 20m by 20m plots.
- Measured height of the trees.
- Had to observe whether the measured trees produced seeds.
- Had to observe whether the measured trees had how many stems.



21.

Results and Discussion cont.

The following table indicates the resources mostly harvested in Hamakuya

English	Venda
Red bushwillow	Musingidzi
Mopane	Mopane
Ironwood	Musimbiri
Baobab	Muvhuyii
Sickle-bush	Murenzhe
Other	Fish
	Thatch grass
	Water

28.

Conclusion

- ❖ The study has demonstrated that rural households in the studied village make use of a range of red bushwillow plants from the woodlands around them.
- ❖ Red bushwillow is mostly used and also most common in the area
 - Appears sustainable
 - Only if small trees are harvested
- ❖ Mopane appears to be the second most common, but uncommon
 - In the community
 - It appears not sustainable
- ❖ Maybe overharvesting is the cause of shortage of Mopane trees.
- ❖ Other factors which would affect sustainability are;
 - Accessibility
 - Population
 - Alternatives
 - Preferences

25.

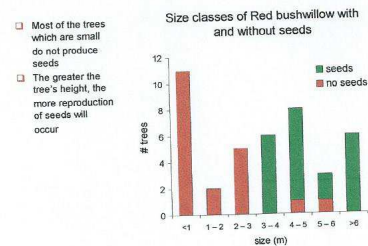
Results and Discussion

The following table indicates the resources mostly available in the field of Hamakuya

Scientific name	English
<i>Combretum apiculatum</i>	Red bushwillow
<i>Croton gratussimus</i>	Lavender Croton
<i>Dichrostachys cinerea</i>	Sickle bush
<i>Grewia bicolor</i>	White-leaved Raisin
<i>Strychnos madagascarensis</i>	Spineless Monkey Orange
<i>Colophospermum mopane</i>	Mopani
<i>Androstachys johnsonii</i>	Lebombo Ironwood

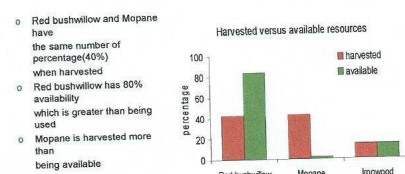
26.

Results and discussion cont.



27.

Results and discussion cont.



Appendix 7: SAEON Electronic News Articles and Newspapers Articles

22/02/2013

SAEON ADVENVIRO Kid opts for a career in medicine — SAEON



SAEON ADVENVIRO Kid opts for a career in medicine

- By Joe Sibya, Education Outreach Officer, SAEON Ndlovu Node

A question ADVENVIRO Kids are invariably asked before a camp is what their career choices are.

This was no exception with the class of 2008. One of the learners, Gaynelle Makhubele confidently responded: 'With the abilities and talents I have, I'm planning to study toward medicine. I will also be involved in the business world.'

These were big dreams for a learner of her age, but judging by her grades, positive attitude towards life and exuberant confidence no-one doubted her claims. Gaynelle proved to be one of the strong and focussed learners at the camp. The group chose her as the 2008

ADVENVIRO Kids representative. She led the group in putting together a well-documented camp learning experience report entitled 'An Impossibility is an opportunity'.

In October 2009 we were again in contact with Gaynelle and found that she was still keen on following her dream career in medicine. In January this year we tracked down all the 2008 ADVENVIRO Kids to find out how they had performed in grade 12. It was no surprise to discover that, with four distinctions, Gaynelle was one of the top performers at Frans Du Toit High School.

When asked whether she still intended to pursue a career in medicine, she replied: 'With these results the doors are open - It is my dream to be a medical doctor.' Gaynelle was ready to leave Phalaborwa for Cape Town to start a new life as a medical student at the University of Cape Town (UCT).

On 19 January this year I paid Gaynelle a surprise visit at her parents' home to ask her to write a brief story about her achievements. Below is her unedited story on how she aced grade 12:

'Yes I did it! I'm finally done with matric and a lot of doors are open for me. Thank you Lord for helping me through a tough year.'

'What a year 2009 was. Busy, busy, busy was my daily song. I was a Learner Representative Council member, an athlete, netball player and a debater at Frans Du Toit High School. I had a busy year - every weekend I was either doing my bus duty (when going to other schools for sport meetings or participating in a sport event). Busy was my middle name.'

'I catered for my studies during weekends too. I made sure that I followed my study timetable which I drew up every term to balance sport activities and studies. This helped me to maintain my position in the Top



Voted Face of 2008 by SAEON's Advenviro Kids (Picture: Joe Sibya)



Gaynelle (right) chairs group discussions during the science camp (Picture: Joe Sibya)



Gaynelle - ready to face the challenges of a career in medicine (Picture: Joe Sibya)

www.saeon.ac.za/newsletter/archives/2010/february2010/doc12

1/2



Active scientists for a day : Learning about environmental science, SAEON-style

- Dr Dave Thompson, Senior
Scientist, SAEON Ndilovu Node

For the fourth year running, the SAEON Ndilovu Node's ADVENVIRO winter school camp for grade 11 learners in the Ba-Phalaborwa municipality turned out to be a huge success.

Funded by the Department of Science and Technology, this initiative aims to encourage learners to pursue careers in environmental sciences by exposing them to environmental scientists, and by increasing their awareness of the valuable role science plays in our everyday lives.

Competition to qualify for the camp was intense, with 64 Geography and Life Sciences learners applying. Joe Sibiyi, Education Outreach Officer for the Node and organiser of the ADVENVIRO camp, with SAEON's Education Outreach Coordinator, Sibongile Mokoena, ultimately selected the twelve most deserving candidates for the camp (eight girls and four boys).

On July 6 these learners, together with support staff from SAEON and local environmental science professionals, headed to Tshulu camp near the northern Limpopo village of HaMakuya. On arrival at camp the Ba-Phalaborwa participants were joined by five learners (three boys and two girls) from HaMakuya Secondary School.

The intriguing world of environmental science

Over the next four days the learners were caught up in the intriguing world of environmental science. Mornings began with sunrise walks along the nearby Mutale River during which time Kruger National Park (KNP) Research Technician Graeme Ellis taught learners how to recognise and identify different birds and plants.

Days were packed with



The ADVENVIRO Kids head out on an information-packed morning walk. Leading the group is Graeme Ellis, Research Technician of the Kruger National Park (Picture: Joe Sibiyi)



SAEON's Nikki Stevens (centre) challenges participants to ask questions and to think like scientists (Picture: Joe Sibiyi)



Learners get a clear illustration from SAEON's Dr Dave Thompson that all life on our planet is connected (Picture: Joe Sibiyi)



PHALABORWA
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VOLUME 24 NO. 30

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Friday 31 Julie 2009



For the fourth year running, the Phalaborwa-based Ndlovu Node of the South African Environmental Observation Network (SAEON) hosted its Adventure in Environmental Science (ADVENTURE) winter school camp for grade 11 learners.

The initiative was funded by the Department of Science and Technology and aims to encourage learners to pursue careers in environmental sciences by exposing them to scientists and by increasing awareness to the valuable role of science in our everyday lives. Twelve Grade 11 learners from different schools in BaPhalaborwa municipality were selected to attend the camp.

The learners and staff from SAEON and local environmental science professionals, headed to Tshulu camp near the northern Limpopo village of HaMakuya where they were joined by five learners from HaMakuya Secondary School.

With their four day course, learners were caught up in the

world of the environmental scientists. They began with sunrise walks along the nearby river during which time learners were taught how to recognize and identify different birds and plants by Kruger National Park Research Technician Graeme Ellis and environmental science, Nicki Stevens, GIS expert and Data Manager for the Ndlovu Node, put the learners through their paces by developing their understanding of the scientific method, and then watched as the learners used their new-found skills to solve a fictitious crime, SAEON-style!

Issues of biodiversity conservation and climate change were tackled by Dr Dave Thompson, Senior Scientist at the node, who challenged learners to make some difficult decisions regarding the conflicting needs of humans and the environment.

The theme of 'All life is Connected' was developed further by

Continued on p 5...

Camp successful

Continued from p 4...

Karen Vickers, Ecology Lecturer for the Kruger National Parks Organization for Tropical Studies, who explored sustainable resource use with the learners.

Learners then had the chance to be active scientists for a day and, working in groups, conducted valuable scientific investigations into the use of plants and other natural resources by local community members and also

participated on Amazing Race, racing to complete science-based activities. All activities took place under the watchful eye of Sibongile Mokoena, SAEON's National Environmental Science and Education Outreach Coordinator.

"We would like to thank everyone who took part in our camp and we are looking forward to our next camp to be held next year," said Sibaya



Nellise Mokoena, a grade eleven learner from Sebalamakgolo High School, stands next to a bar chart that contains the results of her scientific study to the

Kids enjoy ADVENVIRO winter school hosted by SAEON

For the fourth year running the Phalaborwa-based Ndlovu Node of the South African Environmental Observation Network (SAEON) hosted its ADVENVIRO winter school camp for grade 11 learners. This initiative is funded by the Department of Science and Technology and aims to encourage learners to pursue careers in environmental sciences by exposing them to scientists and by increasing awareness to the valuable role of science in our every-day lives.

Competition to attend the camp was intense, with 64 grade 11 Geography and Life Science learners from secondary schools in the BaPhalaborwa municipality applying. Environmental Science and Education Outreach Manager for the Ndlovu Node and ADVENVIRO camp organizer, Mr Joe Sibongile, together with Mrs Sibongile Mokoena from SAEON's head office, ultimately selected the 12 deserving learners (8 girls and 4 boys) who would attend. On 6 July 2009 these learners, together with support staff from SAEON and local environmental science professionals, headed to Tshulu camp near the northern Limpopo village of HaMakuya. On arrival at camp the BaPhalaborwa participants were joined by 5 learners (2 boys and 3 girls) from HaMakuya Secondary School.

Over the course of the next 4 days the learners were caught up in the world of the environmental scientist. Mornings began with sunrise walks along the nearby river during which time learners were taught how to recognize and identify different birds and plants by Kruger National Park Research Technician Mr Graeme Ellis. Days were packed full with presentations, group activities and workshops that engaged learners in some of the more important fields in environmental science. Ms Nikki Stevens, GIS expert and Data Manager for the Ndlovu Node, put the learners through their paces by developing their understanding of the scientific method, and then watched as the learners used their new-found skills to solve a fictitious crime, SAEON-style!



Left: ADVENVIRO 2009, Current and future scientists stand together after a long and enjoyable week.

Issues of biodiversity conservation and climate change were tackled by Dr Dave Thompson, Senior Scientist at the node, who challenged learners to make some difficult decisions regarding the conflicting needs of humans and the environment. The theme of 'All Life is Connected' was developed further by Ms Karen Vickers, Ecology Lecturer for the Kruger National Parks' Organization for Tropical Studies, who explored sustainable resource use with the learners. Learners then had the chance to be active scientists for a day and, working in groups, conducted valuable scientific investigations into the use of plants and other natural resources by local community members. Another highlight was ADVENVIRO's hotly-contested version of the Amazing Race, which saw learners racing to complete science-based activities and interpret biological clues! All this took place under the watchful eye of Mrs Sibongile Mokoena, SAEON's National Environmental Science and Education Outreach Coordinator.

All involved in making the camp a resounding success are thanked for giving their valuable time to the promotion of science education and scientists in our country. The learners are also thanked for their enthusiastic participation which allowed them to make the most of this opportunity, and for proudly representing their respective schools and communities.



Weekly News Round-up In The Lowveld

31 July 2009

Appendix 8: Science Camp Lecturer's Report and Tshulu Camp Letter

SAEON ADVENVIRO CAMP 2009

July 6-10, 2009

Report compiled by Karen Vickers (lecturer on the program)

September 4, 2009

Overview

This year the ADVENVIRO Camp was held at a small camp near the rural village of Hamakuya in Limpopo Province. I was invited by Joe Sibiya of SAEON to help co-ordinate and lecture for the week of the camp. Joe and I were introduced earlier in the year and collaborated on a project where university students from the study abroad run by the Organization for Tropical Studies (on which I am lecturer) ran a project at a local high school in Phalaborwa aimed at getting students to think about sustainable use of natural resources. As a conservation biologist and environmental educator I was excited at the prospect of being involved in the SAEON camp and getting the chance to pass on some of the passion and inspiration that I feel about South Africa's natural heritage. The experience was more than I had hoped for.

The week was composed of a number of lectures and activities that were designed to teach learners about some of our current thinking on topics like Biodiversity Conservation, Ecosystem Services, Climate Change, and Sustainable Use of Natural Resources. While our most obvious goal was education, there was a strong emphasis placed on interactive learning and having fun as I feel quite strongly that the most effective learning happens when students feel connected to the material at hand. One of the best ways to achieve this is to get them actively participating in the learning process. Science is about inquiry into the world around us and scientists are not experts but are there to facilitate society's understanding by using tools to investigate and understand the environment. Therefore, the best way to teach science to young learners is to teach them about the tools needed to conduct good science and the importance of these tools for understanding matters relevant to society. With this in mind, the focus of the camp was to arm learners with tools related to the scientific method, including problem solving, measuring and identification of birds, rodents, and vegetation, data analysis and the use of Microsoft excel, and conducting questionnaires with community members to investigate how they use resources. Moreover many activities such as nature walks, watching BBC's Planet Earth and even an environmental scavenger hunt, were designed simply to inspire a sense of awe and appreciation for the natural environment.

The Venue

Tshulu camp is located on the banks of the Mutale River near the rural village of Hamakuya. The camp is beautiful with very comfortable accommodations in luxury en-suite tents. The camp itself is enough to inspire most anyone and was definitely a treat to spend the week in. The kitchen facilities were suitable as was the common area. The one issue with Tshulu camp was the lack of power, as it is ideal to deliver lectures using

PowerPoint and a projector. However, I know there are plans to purchase a generator in the future, so if this happens, then it will make the venue more ideal as a teaching location. From what I gather the students were very comfortable and enjoyed the camp setting immensely.

The Staff

The camp was organized by Joe Sibiya. I really enjoyed working with Joe. I find him to be organized and efficient and he deserves a large amount of the credit for the camp's success. He knew every student by name on the first day they arrived and took a large interest in their progress and growth as the week went on. It is clear that Joe is very dedicated to what he does and has the vision to bring the right people together to deliver a successful program. In addition to myself, Nikki Stevens was the other main lecturer/co-ordinator of the program for the week. Nikki brought a great deal of energy and expertise to the week. Her workshop on the scientific method was really enjoyed by the students and was put together in a very clever manner. She was well organized and after working with Nikki on this camp I can conclude that she is very good at what she does. Dave Thompson led a great session on climate change and provided help on a number of other academic activities. I believe the students had a great deal of respect for him after their interactions with him. Robert Buitenwerf assisted with the academic activities and was in charge of the catering for the week. Robert is not only a fantastic scientist, but I discovered he is a great cook too! Selma Sibiya also assisted with the catering and I believe her presence on the program was an important one as she was a great link between staff and learners and provided support for both parties.

What worked

Overall I think the ADVENVIRO 2009 winter camp was a great success. Judging by the diaries and the comments from the students, I believe we achieved what we set out to. Students learned a lot and were inspired by their surroundings. I think the varied schedule and the diversity of activities was one of the best aspects of the program. Students were kept busy; they worked hard, but were never bored as the activities were fun and did not feel like traditional classroom learning.

I also believe the diversity of staff had a large role to play in the camp's success. It requires a great deal of energy and motivation to run a camp such as this one and I think we were the perfect number of staff with a great compliment of skills. This made my job much more enjoyable and I was able to contribute a great deal of my energy to the students which I feel is needed for a short intense program of this nature.

As mentioned above the venue worked well, particularly with the theme of this year's camp. Nikki, Joe and I were adamant that the material we were teaching had to be relevant to the learners. While many of them are familiar with, and utilize natural resources in their own homes, I think it was quite an experience for them to see just how dependent some of the rural households in Hamakuya are on harvesting natural resources. The topic was one they could relate to, and is one of high conservation importance. The fact that they were able to visit some local households and speak to

them about their livelihoods was a great experience for the students. I think in the future there should remain some aspect of visiting a community as part of the camp because science is inextricably linked to the society it operates in and is useful to all types of communities regardless of wealth, race or religion. I also think it was fantastic having an integration of learners from Phalaborwa and Hamakuya. The students interacted very well and learned a great deal from one another.

Future suggestions

While there was no aspect of the program that I could claim did not work I do have some suggestions for the future. The first would be that the camp be a full week rather than 4 days. With travel to and from Hamakuya we only had 3 full days to teach and inspire the students about science. I believe that a week would provide a better time frame in which to operate a more comprehensive program while allowing themes and topics to merge nicely. As it was, we rushed through some important concepts that I would have felt more comfortable teaching in a little more depth. While we were able to expose the learners to some very relevant scientific issues, many were only done superficially due to time constraints.

If however, it is not feasible to extend the length of the camp, then I suggest focusing on one topic only. Climate change is an important topic and as mentioned Dave ran a great workshop, but I do feel that an entire afternoon devoted to climate change took away time from the main theme of sustainable resource use. By the same token if the camp's theme had been about climate change I wouldn't propose doing an afternoon workshop on rural resource use. If more time were allowed the topics could have been linked so that learners could understand the relevance and importance of the global environment on their local resources.

A final suggestion would be that in the future a scientist whom these learners can relate to be included in the teaching staff. I enjoyed engaging with the learners and I enjoy passing on my enthusiasm for what I do, but being a Canadian female in my 30's I cannot expect that these young learners from Phalaborwa would really see me as a role model. Ultimately, if the goal is to inspire learners into a career in science they need to see that people they can relate to are passionate about the field and succeeding in it.

Conclusion

On the last day of the camp one of the learners, Nelisiwe, addressed the staff and students to provide a summary of the week. Her speech indicated to me that as a group the learners had got more out of the program than I ever could have hoped for. Moreover, I myself took more away from the experience than I thought I would. I have spent the last 3 years working with university students from all over the US and South Africa trying to teach them about the conservation of South African ecosystems. While my job is quite rewarding, I found the week at the ADVENVIRO camp to be one of the

more rewarding weeks I've ever had. I was blown away by how enthusiastic and hard working the students were, I didn't hear a single complaint all week (try this camp with 17 year olds from America and I think you would find different), and I was impressed by how much determination and maturity went into each exercise we conducted. I learned as much from these students as I hope they learned from me. On all accounts the program can be considered an undisputed success.

I feel that outreach programs of this kind are essential for the future of science in South Africa. Too often in my career have I heard of, or seen positions sit vacant because of a lack of qualified individuals. The truth is that most scientific and environmental careers do not pay as well as the many other corporate jobs that exist and we must recognize that this drives a number of young people when choosing a career path. Scientists do what they do because they are passionate about what they do and so what we really need to focus on is instilling passion about science and the environment in young South Africans. This is not the kind of thing done easily in a classroom or with a blackboard. In order to instil this passion we must get students out into the environment, understanding how it works, or at least interested enough to ask questions about how it works. It is only this understanding and appreciation for our ecosystems and the services it provides that will ultimately conserve them. It is only an excitement for science and an understanding of its relevance that will see it progress as a tool for solving societal problems. I do not hesitate to say that camps such as the ADVENVIRO camp do more in one week to contribute to the progress of science in South Africa than any classroom learning anywhere else. I would feel privileged to be part of the camp again in the future.



Joe Sibiya
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10 August 2009

Dear Mr Sibiya

I write to congratulate you and SAEON on the great success of the Grade 11 Winter Camp held here in Hamakuya last month. The staff and volunteers of the Tshulu Trust were impressed by the enthusiasm and knowledge of the participating learners. They made substantial progress over the course of the week, and it was particularly rewarding to watch friendships develop between the Hamakuya and Phalaborwa learners. In particular, I would like to commend SAEON for the high quality of the program's instruction and activities. Beginning with the high energy of the Amazing Race, where teams of learners used GPS units and scientific knowledge to solve clues, instructors and students worked together to understand how principles of conservation could be applied to local contexts. To the credit of all involved, each and every participant strove to understand the particular context of Hamakuya. Through their interviews of local families about resource use, the learners delved into how a family's socioeconomic status affects its relationship to natural resources. And in their enthusiastic final presentations, the learners synthesized this new knowledge, exhibiting high stands for themselves and for each other. We all learned from them.

Perhaps the most telling sign of the program's success was the way it concluded. In the final presentations and afterwards, the learners began to refer to themselves as "scientists" and declared that their relationship to science had changed. It was a memorable and rewarding week, and Tshulu Trust was glad to be a part of this initiative. Thank you for providing such an incredible opportunity, particularly for the Hamakuya learners. I hope we can do it again next year, so please do let us know how we can help.

Yours sincerely

Prof. Lara Allen
(Executive Member: Board of Tshulu Trust Board)

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