Natural Science Teachers' perceptions of their Teaching Competence in Senior Phase Township Schools in Soweto Area, Gauteng Province

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ABSTRACT Transformation and reconstruction have characterized the South African educational arena for more than a decade. This process of change was necessitated by a legacy of the apartheid regime that included inequalities in the educational budget, poor teacher training, especially within the Sciences, and poorly resourced Science classes. In order to gain an in-depth understanding of NS teachers' perceptions of their teaching competence in Senior Phase township schools in Soweto, a qualitative research method was used. This type of research approach was appropriate for this study as the researchers intended to explore NS teachers' perceptions of their teaching competence in senior Phase township schools in Soweto. From this paper, it was found that there is a lack of qualified NS teachers in Soweto township. This means that South Africa is thus still faced with major challenges regarding the teaching of NS subject.

INTRODUCTION

This paper is based on the Natural Science teachers' perceptions of their teaching competence in Senior Phase township schools in Soweto. Moves to reform South Africa's education system through the implementation of the Curriculum and Assessment Policy Statement (2011) are currently being implemented. The publication of a National Qualification and Assessment Policy Framework (NQAPF) has provided a blueprint for change, and is intended to improve the quality of Science education. According to Onwu and Mogari (2004), learner-centred and inquiry–based approach showed up teachers' lack of competence in teaching Natural Science (NS) as one of the constraints to effective teaching and the effective reform of South Africa's Education system. As researchers, we have observed that teachers in the NS classrooms are faced with over-crowding, poor resources, inappropriate or inadequate teacher training, and are also under-qualified teachers.

Nevertheless, the last two decades have seen a declining interest in Science amongst learners, as cited by Goodrum et al. (2001) suggested that too many secondary school learners perceive Science as a difficult subject which they failed to find engaging. These negative attitudes appeared in the Senior Phase level of township schools within the context of this study.

The Research Problem

According to Setati et al. (2002), many parents, teachers and learners see the role of NS as a necessity and a prerequisite for gaining access to social goods, as well as social and economic positions. Social goods in this context meant a good job, top position at work, modern house and car, and a respectable position amongst members of society. NS Learning Outcomes (LOs) illustrate what learners should know and be able to do at the end of the modules. If properly addressed, these LOs play a major role in preparing learners for future careers, such as doctors, engineers, pilots, pharmacists, politicians, and scientists. Careers in the Sciences field of study require learners to have competency in NS, but in order to have access to tertiary education, which will lead to careers in important fields of Science, the teaching and learning of NS has to be taught by competent teachers in the Foundation, Intermediate and Senior Phases.

However, poor matriculation results achieved by township schools (where the population of learners is predominantly African (Black), suggest a lack of well trained, effective, competent and specialized NS teachers. A correlation can thus be drawn between the above statement about the quality of teaching and teachers' teaching competence. The high failure rate of South African matric/grade 12 learners, especially within township schools reflected a need to critically

examine Science teachers' teaching competence. Thus as part of the understanding of the teaching and learning that takes place in such context, this paper focuses on exploring NS teachers' perceptions of their teaching competence with reference to Senior Phase township schools in Soweto.

The researchers' observations have taught them that teachers commonly fail to complete the curriculum of one grade before the learners are promoted to the next, a reflection of the lack of competence in the teaching of NS within township schools in Soweto. Briefly, many of the teachers positioned to teach NS are not only unqualified but their lack of passion for such facilitation results in incompetence that deters the completion of the curriculums. Learners are often taught cumbersome and time-consuming methods for solving, investigating and researching simple tasks.

Theoretical Framework

Research based on the Self Determination Theory had explicated that self-determined motivation is related to important behavioural characteristics, such as persistence and future intention outcomes (Deci and Ryan 2000; Vallerand 1997; Vallerand and Ratelle 2002). The higher the motivation, the more the person experiences positive competence outcomes, including persisting in the activity. For instance, research by Vallerand (1997) on high school drop-out, showed that learners' self-determined motivation toward school influenced their intentions to pursue their education, while a non-self-determined motivation toward school influenced their intentions to drop out. The paper was therefore placed within the theoretical framework of self-determination. NS teachers' self-determination motivation influenced their intentions to pursue their teaching of NS. In this paper, the researchers examine, through the theoretical lens and understanding of the Self-Determination Theory, the teachers' perceptions of their teaching experience as being affected by their motivation.

The researchers found it relevant to base this study on the Self Determination Theory (SDT) developed by Deci and Ryan (2000), as motivation builds competence and confidence. Research, according to Cheong et al. (2004), Ratelle et al. (2005), and Zusho et al. (2003), had identified the role of teachers' behaviour, especially in terms of their teaching competence and learners'

motivation as key elements in their persistence within an NS education. This model of self-determination was thus based on the well-developed theories of intrinsic and extrinsic motivation as interpreted by Deci and Ryan (2000) and Vallerand (1997).

Motivation, within the theory of Self-Determination, was viewed as intrinsic by Deci and Ryan (2000) by stating that it is when a person does something for their own sake or for the pleasure experienced in the process. This explanation was further strengthened by them when mentioning that learners who go to an NS classroom for the fun of learning something new, became intrinsically motivated. This proposed model postulated that NS teachers' competence in teaching, especially, played an influential role in the development of the teachers' motivation and competence. Reeve (2006) showed that an autonomously supportive teaching style, referred to in this paper as teachers' teaching competence, represented an important variable that contributed to a high quality, but not necessarily good achievement in a Natural Science relationship between teachers and learners.

The theory on motivation emphasized that beliefs, interest and values are changeable rather than static, and are strongly influenced by what a teacher does and believes in, in the classroom. Learners' current beliefs and values about learning in NS have been moulded by their previous experiences in NS classes, so it would be expected that learners' future beliefs about learning would be strongly influenced by their current experience in the classroom. There is evidence that quality teaching by competent teachers can change learners' goals and beliefs for the better, therefore, as motivation theory suggests, what the teachers do in an NS classroom is very important and significant.

Research Question

The following research question has thus been developed as:

What are the perceptions of NS teachers on their teaching competence in township Senior Phase schools in Soweto area, Gauteng province?

Aim and Objective of the Study

In view of the problem formulated above, the aim of this study was to explore NS teachers'

perceptions of their teaching competence in Gauteng Province Senior Phase township schools in Soweto. In order to achieve the aim of this study, a primary objective was explored, namely, NS teachers' teaching competence in Senior Phase township schools in Soweto.

RESEARCH METHODOLOGY

In order to gain an in-depth understanding of NS teachers' perceptions of their teaching competence in Senior Phase township schools in Soweto, a qualitative research method was applied. Using a qualitative approach is also useful to the educational research in a variety of contexts, assisting the educational researchers to obtain in-depth data both within and outside of the school (Flick 2006). Qualitative interpretive research explored attitudes, behaviour and experiences through methods such as interviews. It also attempted to get in-depth opinions from the participants (Dawson 2006). This type of research approach was appropriate for this paper as the researchers intended to explore NS teachers' perceptions of their teaching competence in Senior Phase township schools in Soweto.

Research Design

Research design is a plan for collecting and analyzing evidence that makes it possible to answer the research questions (Flick 2006). De Vos (1998) referred to research design as a detailed plan of how research will be conducted, providing the framework according to which the data is collected, so as to investigate the research question. It thus involves making a plan of the structure and the procedures to be followed when the researcher gathers data, as a base for testing a hypothesis and analysing the results. The researchers therefore used qualitative interpretive research design to explore NS teachers' perceptions of their teaching competence in Senior Phase township schools in Soweto.

Sampling

Sampling for the purpose of this paper was defined by Merle and Charles (2005) as identifying and selecting subgroups, or people, to represent the much larger population in its entirety. The researchers used the purposive sampling technique so as to gain participants' perceptions, through a technique of selecting a portion of the study population with a specific purpose in mind. In this study, participants were seven NS teachers from three township schools South West of Johannesburg. In other words, three senior phase schools/secondary schools within the Johannesburg North district and four Senior Phase NS teachers from each grade 7, 8, and 9, making a total of seven NS teachers were the sample of the paper.

Data Collection

Data collection, according to Denzin and Lincoln (2003), takes place when the researcher uses various techniques in order to gather information, for instance interviewing, field-guides, checklists and open-ended narratives. Schurink (1998) further stated that data collection is the way in which information and knowledge about the topic of research are obtained. For collecting data the researcher used the method of individual interviewing.

Structured Individual Interviews

Data was collected by means of structured individual interviews, which assisted the researchers in the collection of feedback with regards to the subject matter of this paper. The term 'interview' is defined as a way of life in society (Atkinson and Silverman 1997). The researcher used semi-structured means of individual interviews, which according to Gray (2004) builds trust and maintains confidentiality between the participants and the researcher.

Data Analysis

Data analysis, according to Mouton (2001), is a process involving "breaking up" data into manageable themes, patterns, trends and relationships. Data analysis in qualitative research is said to be an on-going, emerging and interactive or non-linear process. Before analysing data, the researchers transcribed the recorded individual interviews verbatim, as text from individual interviews typed up as a word-processing document. This facilitated the analysis process, in which they used the qualitative content analysis method. The researchers also used coding to represent each category that is a systematic means of organizing and interpreting data. Once

coded, they categorized the codes, which in turn led to themes as summarised below:

RESEARCH FINDINGS

Structured Interviews

Seven participants were supplied with a copy of the interview schedule before it commenced and were also given an opportunity to read carefully through the questions in their own time, before responding. Assistance was available after posing the questions aloud. The interview schedules were used to facilitate the completion of the research paper, and all the participants were asked to respond to the same questions for the sake of consistency. This was in line with recommendations made by de Vos (2005) that the researchers follow this procedure in order to gain a detailed picture of the participants' beliefs, accounts or perceptions of a particular topic or question.

Five of the participants responded to all of the questions without hesitation, whilst two did not respond to a question based on their NS qualifications. Otherwise none of the seven participants wanted clarity on the meaning of concerns, such as "passion", "competence", "qualifications", "experience", "professional commitment", or expressed other concerns within the schedule. The participants therefore responded openly and answered the questions to the best of their ability.

Responses

The participants' responses are presented in Table 1 with questions numbered. The answers to the questions are been included in the table because the participants were allowed to elaborate on their own with reference to specific questions. As reflected in the structure of the table, School One ("Knowledge Combined School")[1], had three NS teachers ("Hector", "Kwena" and

Table 1: Participants' responses

Key questions	Natural sciences senior phase teachers							School 1 NS 3 teachers		School 2 NS 2 teachers		School 3 NS 2 teachers		Total 7	
	T 1 S1*	T 2 S1*	T 3 S1*	T 4 S2*	T 5 S2	T 6 S3	T 7 S3	Y	N	Y	N	Y	N	Y	N
Are you passionate about teaching NS?	Y	Y	Y	Y	Y	Y	Y	3	-	2	-	2	-	7	0
Have you any NS qualifications?	Y	N	N	N	NR	NR	Y	1	2	-	1	1	-	2	3
Do you know what competence is and what constitutes it?	Y	Y	Y	Y	Y	Y	Y	3	-	2	-	2	-	7	0
Are you able to work without any supervision?	Y	Y	Y	Y	Y	Y	Y	3	-	2	-	2	-	7	0
Do you display attitude that foster learning amongst learners?	Y	Y	Y	Y	Y	Y	Y	3	-	2	-	2	-	7	0
Do you maintain your professional committed at all times?	Y	Y	Y	Y	Y	Y	Y	3	-	2	-	2	-	7	0
Does the school have a lab and various support materials?	Y	Y	Y	Y	Y	Y	Y	3	-	2	-	2	-	7	0
Do you often make your NS learning environment conducive?	Y	Y	Y	Y	Y	Y	Y	3	-	2	-	2	-	7	0

T1 - Hector, T2 - Kwena, T3 - Bonolo, T4 - Lizzy, T5 - Moses, T6 - Pule and T7 - Brian
*Audio recorded   (Hector, Kwena, Bonolo and Lizzy)
Moses, Pule and Brian declined audio recording.
NR = No Response; Y = Yes; N = No

"Bonolo"), while School Two ("Lights-Up Secondary School"), and School Three ("Luthuli High School") employed two NS teachers each ("Lizzy", "Moses", "Pule" and "Brian").

The researchers conducted individual interviews at different times and venues. For the purpose of gathering in-depth data from the questions, the following questions were clustered together because of their common features or themes. The following questions were set as standard questions to start the interview:

- Are you passionate about teaching Natural Science, please give reasons for your response?
- How many years of experience do you have and what is you Natural Science qualification?
- What do you understand by the term "Competence" and a competent NS teacher and what constitutes competence?
- Does the school have a laboratory and does the laboratory have a variety of learning and teaching support materials?
- As an NS teacher how do you display attitudes that foster learning amongst your learners?
- How often do you make the NS learning environment conducive to learning?
- How often do you think about your lesson plan, show your expertise and use science resources positively?
- How do you maintain your professional commitment and depict working without being monitored?

DISCUSSION

For the sake of the length of this paper, the researchers only discussed the first three responses in more detail below and are written without rectification of grammatical errors. The comments or information in brackets, should there be any, are added for the purpose of clarification and qualifications.

Finding 1: Passionate About Teaching NS

Seven participants interviewed agreed that they were passionate about teaching NS. Hector stated that: *"Yes, I am passionate about teaching the subject because it broadens my scope and allows me to interact with pupils and find their interests in the field of sciences"*.

Kwena made a point that: *"I... will say yes... and the reasons are... they are many, but to mention few... ah... I am passionate about teaching because science is very interesting... ah... it's an... it's an learning area that doesn't have conclusions. You are always researching and Science... ah... ah... you get an opportunity to share new things. So the knowledge that you'll have, you will never say is enough in terms of science. So always, everyday you are always learning new things, so I am interested in being in a learning area of this calibre"*.

Similarly, Bonolo also indicated that: *"Yes, I am passionate about teaching Natural Sciences since learners derive great pleasure from doing module, discovering things and then... ah... it's fun teaching the children Natural Science"*.

Lizzy said that: *"Yes, I am passionate about teaching Natural Sciences because it is a learning area which accommodates all learners when teaching as it consists of practical activities and theory... theory and practical activities"*.

Moses, responded in writing that: *"Yes, because I learn more about the world that I am living in, why things happen and the process thereof. It also helps the learners know more about their world, why things happen and how. Learn about catastrophes such as earthquakes, volcanoes, tsunamis and how they affect us. Learn about diseases. How they affect us and how we can cure them or how we can behave responsibly for example, AIDS/ H1N1/ Diabetes. It also raises questions about science and...*

Pule indicated in writing that: *"Yes, letting kids know about nature is awesome"*, and Brian noted an opinion also in writing that: *"Yes it is because... it is practical and one can prove his or her findings through experiments"*.

In total, seven of the participants said that they were passionate about teaching NS, with three acknowledging that it was very interesting and they derived great pleasure from doing so. Two said that it was a practical learning area, and one that it was "awesome". The other one said that it was fun teaching NS.

Finding 2: NS Qualification and Experience in Teaching NS

Asked in the individual interviews whether they were teaching NS with the required qualification and experience, namely a university degree, diploma or certificate, as a prerequisite for

teaching NS at Senior Phase level, Hector replied that: *"I have got no qualification but experience in teaching"*, and *"... lack of teachers in this field... I compromise to teach the subject until a qualified teacher is found"*. A qualification denotes that one has undergone a certain level of appropriate training, but three of the participants stated that they did not have any for teaching NS.

Kwena said: *"ah... mmm... no but I've got Natural Sciences 1 that is under the Department of Maths, Science and Technology that I am currently doing with ah... ah... ah Tshwane University of Technology"*. Meanwhile, Bonolo replied that: *"My highest, I think I specialized in, I majored Natural in Science... Physical Science and then... ah... I think my highest will be... ah... ah degree but not in Natural Sciences as such but a degree in Education"*. Therefore, Kwena is not yet qualified, because Kwena still has to study NS 2 and 3 to obtain a university qualification. In the case of Lizzy: *"I have no qualification, I only have experience of teaching it"*, while Moses and Brian did not respond to the question. Pule and Brian declined to be audio-taped, preferring to respond in writing on the interview schedule. Pule said that he had a *"certificate in education",* but did not indicate if it had related to NS.

From the researchers' experiences, most Black teachers in the townships are very outspoken about their qualifications, but lack of NS qualifications is a particular challenge within the South African Education system. This is confirmed by Goodrum et al. (2001) when stating that the lack of qualified and competent NS teachers has in the last two decades seen declining enthusiasm in science learning. Poor Science results performance and achievement by learners within township schools could thus be as a result of lack of well-trained, effective, competent and specialized NS teachers. This was also confirmed by Hector/participant when stating that he was only teaching NS until a qualified teacher would be appointed.

Natural Science in Senior Phase township schools in Soweto is generally conducted in a formal way. Even where teachers do practical teaching, this often consists merely of verification activities, 'minds-on' rather than 'hands- and minds-on' activities, with very little realization of science as enquiry. In summary, one can question the training and qualifications that many of those NS teachers had or had not received.

Finding 3: Learning and Teaching Support Materials (LTSMs)

With reference to Natural Science laboratory and a variety of learning and teaching support materials, where experiments must be performed, participants Hector, Kwena, Bonolo, Pule and Brian responded in the affirmative, *"yes",* when asked if they had laboratories as well as learning and teaching support materials. Participants Lizzy and Moses responded that "*no*", they did not have a Science laboratory, only a mobile laboratory, while Hector said that *"Yes, though it's a mobile"*. The participant went on to say with reference to having a variety of learning and teaching support materials that *"No... It's very few because it's a mobile laboratory"*. Bonolo said that *"Yes we do have a Science laboratory"*. The participant further said that in terms of having a variety of learning and teaching support materials that *"Ah... yes, we do have a variety of teaching ah...support materials in our laboratory where ah...ah...because of time and because so many activities teachers are not able to use or utilize it as regularly as... as... ah... supposed to be utilized"*. Kwena said that *"Yes we have a wonderful Science laboratory"*, and in terms of learning and teaching support materials, Kwena said that *"Yes they are there. We've got the department there in the lab. We have things that belong to the Department of Technology, others to the Department of Social Sciences, so in that you can see their variety"*. Lizzy said that *"No we don't have a Science laboratory, we only have mobile laboratory*, and went on to say that "*Yes it does, no it does not have all the necessary learning and teaching materials"*.

Moses said in writing that *"No there is a variety of learning and teaching support materials that include, chemistry kit, science equipments-like glass beakers, circuit boards, burnsen and burners. But these are not enough. Internet is available for the big classes that we have"*. Pule also wrote that *"Not as such, not equipped"*. In terms of learning and teaching materials, the response was *"Few available".* Brian, with reference to the question on laboratory, teaching and learning support materials said that *"Yes but without laboratory"*.

From the above responses it was clear that improving Natural Science teaching in South Africa's schools, especially township in Soweto, will be crucial. The researchers argued that failure to improve Natural Science Education is one of the most significant obstacles to Soweto township schools' advancement. Research by the Centre for Development Enterprise (CDE) suggested that between 1991 and 2003, enrolment in higher grade Science, the essential requirement for entry into higher education plummeted considerably (Science in Africa 2004). So, despite South Africa's "economic muscle, it seemed it was performing poorly in Natural Science education, and was regularly outclassed by its Tunisian and Moroccan counterparts (Science in Africa 2003).

Summary of the Findings

The lack of qualified NS teachers in Senior Phase township schools in Soweto have resulted in the deterioration of the culture of teaching and learning. This problem has brought about a lack of enthusiasm and the decline in NS enrolment at higher levels on the part of township learners in Soweto. NS township teachers have lost confidence and commitment to teach NS and learners have also lost ambitions to perform and achieve.

CONCLUSION

The research into the perception of NS teachers' teaching competence reflected that education was not only about the acquisition of skills and knowledge. It was about the mental or cognitive aspect of teaching and learning. This means that if the cognitive skills were developed and expanded, then teaching and and learning were more efficacious and lasting. Those cognitive skills greatly assisted teaching as well as added value to the life skills in general.

RECOMMENDATIONS

The following recommendations were made, that in-service training in NS Education principles is essential. This should be pragmatic in setting goals for the improvement and development of NS teachers at all levels. This should be done on long term bases by the Department of provincial education and not once a term as indicated by the participants during individual interviews. That initiatives such as Dinaledi Programmes (where good Science schools are nurtured should be implemented on a broader scale).

NOTE

[1] Pseudonyms were used for the schools and participants to preserve anonymity.

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