THE IMPLICATIONS OF THE INTRODUCTION OF OUTCOMES BASED EDUCATION IN THE NATURAL SCIENCES CURRICULUM AT CAPE COLLEGE OF EDUCATION

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DEDICATION

I dedicate this work to my mother, Mandisa Margaret Booi, who has been both a mother and a father to us. She gives us a drive to persevere in all odds of life.

ABSTRACT

This pilot study is a survey of practices of natural sciences educators at Cape College of Education to establish if they reflect the conceptual development, development of skills, change of attitudes and values that are the pillars of the Outcomes Based Education (OBE). Their approaches of lecturing have been assessed to determine if they incorporate investigative approaches based on social constructivism, the theory underpinning Curriculum 2005. The status of science education in the college has been analyzed to establish whether the curriculum can adapt itself to the specifications of the new curriculum. It has been concluded that the educators at Cape College of Education need to be empowered about strategies that will help them function along the principles embracing Curriculum 2005 specifications. The educators have shown not to be ready to practice social constructivism and the assessment strategies incorporated in their programmes do not embrace a variety of approaches that will enable their learners to develop conceptually, skill wise and enable them to develop change in attitudes and values. Investigative approaches to practical work appear to be lacking in the college teaching/learning and this also indicates that Curriculum 2005 will take time to be properly implemented at Cape College of Education.

1. INTRODUCTION

Curriculum is regarded as being central to the education process. Curriculum policies are developed and changed in specific circumstances involving political and economic considerations. The curriculum of the former dispensation (the apartheid era) has been regarded as irrelevant for some learners. It has, moreover, been regarded as not giving a proper reflection of the perspectives of particular groups of South Africans.

The notion stated above has resulted in the education sector being at a crossroads. On the one end there is an old traditional apartheid education system with which many educators seem to be comfortable, whilst on the other end is an Outcomes Based Education system which is still in its early stages of development in South Africa. The paradigm shift in the education system has been effected because the South African education system has been racially and culturally segregated (Buckland, 1982). The segregation of schooling according to race has had a tremendous impact on education in South Africa in that there has been unequal status in education. This segregation was made possible by the introduction of fundamental pedagogics whose purpose was to ensure that the learning environment of a learner was guided and shaped by the value systems of the community it serves rather than the vision and values the nation share (van Harmelen, 1997). The traditional behaviourist approach to teaching and learning was then used as a learning theory underlying the curriculum and teachers were trained and groomed to be influenced by its principles (van Harmelen, 1997).

As South Africa is undergoing transformation, nationally, from the apartheid era to the democratic era, education has been identified as one of the major areas to be transformed since it has been affected by apartheid practices (South Africa, 1995). The change has been done to normalize and transform teaching and learning.

The colleges of education as well are facing a major challenge because of all this change. To them it means transforming their curricula to suit the needs of the national education system. Colleges of education fall under the institutions of higher education and the Green paper on Higher education transformation notes higher education as one of the most important activities organized in society (South Africa, 1997b).

Higher education intends to create a demanding but a rewarding environment in which individuals may realise their creative and intellectual potential. Through a high level of education across disciplines, it is aimed at equipping people with the necessary knowledge, skills and values necessary to play a wide range of social roles producing effective citizens (South Africa, 1997b). The above statement or rather assumption holds, if college educators are effective in producing better educators through adopting appropriate lecturing/teaching strategies.

Dreckmeyr (1994) advocates a changing role of educators, from being predominantly disseminators of information as their teaching strategy, which has been characterised by a ‘jug and mug’ approach (lecture method) to a learner centred approach. In the former approach, teachers told learners exactly what they were expected to learn and thus

leading to information being communicated to learners. In this approach, learners are viewed as empty vessels in which nothing is written (*tabula rasa nihil est scriptum*) (Bodner, 1986). With the implementation of Outcomes Based Education in South Africa, Curriculum 2005, it is assumed that, the role of science educators will change to that of facilitators, implementers of learning activities and suppliers of learning materials (Dreckmeyr, 1994).

The change in approach would result in educators being critical reflexive practitioners who would be keen to analyze their teaching strategies making sure that necessary adjustments are made in their practice. This change will promote inquiry and emphasize the learner-centered approach in their practice.

Outcomes Based Education (OBE) has the potential of creating a successful classroom environment of focused learning, raised expectations, student accountability and expanded opportunities for motivated students. With OBE, students focus on what is to be learned, by knowing in advance the outcomes. They are encouraged to develop conceptual understanding, to develop skill wise and to develop values and positive attitudes contrary to the previous curriculum that emphasized factual recall that resulted into rote learning of unconnected “facts”. The emphasis is placed on developing quality problem solving skills and conceptual development rather than memorizing a given quantity of information (Kudlas, 1994).

With Outcomes Based Education, there is no given syllabus. One of its benefits is that it will give a teacher room to create the kind of lesson any creative teacher would like to teach and lesson can be designed to suit the needs of learners in the class. This introduces a remarkable amount of flexibility into the teaching/learning process (Lister, 1997).

As it has been noted earlier in this report, the traditional school curriculum in South Africa has been content-based and science education has been affected by the traditional approach adopted by the then apartheid educational system. Curriculum 2005 (OBE) calls for it to be learner-centered and multicultural. The specific outcomes in the Natural Sciences Learning Area extend well beyond the traditional science knowledge and skills to include understanding and its contexts (cultural, environmental and economic). While there are different levels of 'learner-centered' science education, it requires ultimately an understanding of learners' educational purposes and interests, the socio-cultural context in which they live and the kinds of learning they find powerful (Swift, 1992 in Malcolm and Smith, 1997).

Kuiper (1997) states that, science is not a culturally independent phenomenon. It comes with a way of viewing the world and with certain values attributed to the kind of knowledge it deals with. I would further add the fact that, as much as most of writings in the natural sciences curriculum have been constructed within the western culture, there is room of interpreting the knowledge to fit the South African context. In Botany, for instance, there is a vast diversity of plants found in South Africa. It is amazing to find the educators being stereotyped in using examples that do not exist in South Africa instead of

using familiar illustrations to the learners, that would make sense to them and also enhance the process of learning.

2. CONTEXT

According to Ogunniyi (1996), curriculum adaptation in Africa (including South Africa), as elsewhere, has not been free from cultural biases of the people who originally developed it. In South Africa, science education programmes, as well as other educational programmes have until recently been fashioned along racial lines (Buckland, 1982). Kahn (1995) state that science education in South Africa is in crisis in that, the problem facing the new South Africa is how to satisfy the demand for science education for all in the face of gross resource shortages, both human and material.

In the past, the Department of Education in the central government used to prescribe the syllabi to the colleges of education, which were prescriptive in the sense that they duplicated the work done in secondary education. This really did not make sense because the admission criteria in the colleges of education are still rigid. Only those candidates with a minimum E Higher Grade (40 % to 49 % marks obtained from the examination based on higher order questions asked and more content area covered from a syllabus) or a D Standard Grade (50 % to 59 % based on low order question and less content area covered from a syllabus) in sciences are admitted to major in natural sciences.

Outcomes Based Education is concerned with transformation as opposed to reformation. Doll (1989) views transformation as a change in view, in perspective and in methodology. Cape College of Education's curriculum has to be transformed if a traditional behaviourist curriculum is still followed to meet the needs of a better learning situation. There is no point in adhering to the traditional content based curriculum whilst the schools in which the educators-to-be will get a future employment are busy restructuring their curriculum into Outcomes Based Education. They will find themselves wanting or having wasted their time and money undergoing a pre-service training that would not have benefited them.

Educators need to be empowered to be able to understand and practice OBE in their teaching. Before the actual implementation of the curriculum, people need to be enlightened of its merits and its problems and be carefully guided through its implementation (Kudlas, 1994).

3. AIMS AND OBJECTIVES OF THE RESEARCH

This is a pilot study aimed at surveying practices of natural sciences educators at Cape College of education that are inherent to the implementation of OBE (curriculum 2005) in the natural sciences curriculum in the college. The other important aspect of this research has been the identification of potential inhibitors of the implementation of curriculum 2005.

The research goals are as follows:

- to survey the teaching strategies applied by the lecturers at Cape College of Education whether they support or encourage what OBE stands for
- to identify whether the assessment strategies applied mirror the learner-centered approach or promote rote learning
- identifying the inhibitors of OBE implementation in the natural science curriculum at Cape College of Education

4. RESEARCH METHODOLOGY

Methods in social research are ways of proceeding in the gathering and collection of data. They consist of listening to the subjects, observing what people do and say or collecting and examining documents which human beings constructed (Hitchcock and Hughes, 1995).

Methods that have been used in this research for data collection have been described under section 4.2 below and the paradigm underpinning this study is described under section 4.1 below.

4.1 RESEARCH PARADIGM

According to Bogdan and Biklen (1992), a paradigm is a loose collection of logically held together assumptions, concepts or propositions that orientate thinking and research.

All research is guided by some theoretical orientation. Interpretive paradigm has been used in this research. According to Kuiper (1997) the general aim of interpretive paradigm is to describe the phenomena and to some extent explain them. The assumption underlying this paradigm is that human beings are rational beings that have reasons for their actions. These reasons are the object of the research and hence understanding them will enable the researcher to formulate explanations to human behaviour. In other words, Bogden and Biklen (1992) state the tradition of the interpretive paradigm emphasizes the interpretive understanding of human interactions.

On the basis of the description of the paradigm stated above, the researcher has attempted in this research to gain entry into the conceptual world of the research subjects (the natural sciences lecturers at Cape College of education) in order to understand and interpret experiences pertaining to their practice as educators. This has been made possible by adopting a qualitative approach to research.

Including qualitative data has enabled me as a researcher to learn at first hand about the social world under investigation, (Hitchcock and Hughes, 1995), which is Cape College of Education natural sciences department in this context. This has been done by means of involvement and participation through a focus upon what individual actors (learners and lecturers) said or did. The other reason for following this research approach/style has been that, qualitative data is more amenable to teachers as it has an advantage of drawing both the researcher and the subjects of the research closer together. According to Kuiper (1997), there is a growing realization that educational research involving human beings

does not really compare well with research into science concerned with phenomena. There is a move now towards an approach where actions, ideas, thoughts, priorities, problems, etc. of people in education are described in a qualitative way (Hitchcock and Hughes, 1995).

According to Eisner and Peshkin (1990), the classic and pervasive purpose of qualitative research has been to adopt, create and use a variety of non quantitative research methods to describe the rich interpersonal, social and cultural contexts of education more fully than can be done with a quantitative approach. This approach has been seen to be more appropriate in bringing about and documenting changes in the context where research is done (Eisner and Peshkin, 1990).

The qualitative techniques used in this study fall under a survey, which is a descriptive method of educational research (Cohen and Manion, 1994). Surveys gather data at a particular point in time with the intention of describing the nature of existing conditions. As most surveys are quantitative, the reason for adapting this research into being a small scale survey was to avoid quantifying the human behaviour, reducing it into numbers for statistical analysis as this would not be consistent with the paradigm underpinning this research. Kuiper (1997) asserts the above statement by noting that the problem of adopting the quantitative approach is that it is difficult to quantify human behaviour as people are relatively unpredictable.

4.2 INSTRUMENTS FOR DATA COLLECTION

Research techniques that have been followed in this particular study involved qualitative data by interviews, questionnaires and document analysis. Two questionnaires were developed and administered to lecturers and learners for natural sciences at Cape College of education. In the questionnaire for lecturers, background information was required (Appendix 1 questions 1 to 9). This information enabled the researcher to assess the qualifications and teaching experience of the lecturers. The purpose of including this category of questions to the questionnaire was to establish lecturers' readiness to handle the changes that are taking place in the South African curriculum development process. The justification of the inclusion of such questions is based on the general notion that there is a gross shortage of qualified science educators in South Africa.

The next set of questions was based on the teaching strategies used by these lecturers in science education if they promote better science learning in the students at Cape College of Education (Appendix 1 questions 1 to 12 on opinions). These questions were based on the role the syllabus plays in their teaching programmes, the views they have about the usefulness of the syllabus, teaching strategies that are dominating in their practice, the role of practical work in their science teaching and the role of group work and project work in their practice as educators. These questions would reveal to the researcher the theory that informs the educators' practice as science educators. The questions would also indicate if their teaching/learning programmes promote investigative skills, conceptual development, inquiry in science education and the change of values and

attitudes in their learners. These will then enable the assessment of the implication of their lecturing strategies on OBE.

To assess the status facilities available at the college, it was necessary to investigate the role they give textbooks in promoting science learning and to assess if students are encouraged to use other facilities available at the college for science learning. It was important to find out how these are made available for learners to use (appendix 1 questions 16 to 17).

To find out about the assessment strategies by the lecturers, the questionnaires had question 11 to 15, (appendix1). The aim of these questions was to establish whether they meet the specifications of Curriculum 2005, which are skill development, conceptual development and change of attitudes and values. These would bring about the realization of the nature of assessment strategies adopted if they reflect the nature of inquiry and investigation in the sciences.

The last set of questions was based on the identification of inhibitors on the implementation process of Curriculum 2005 in the natural sciences curriculum. To achieve this goal, the attitudes that lecturers have towards OBE in South Africa were assessed. To aid the attitudes' assessment, questions on the changes they expect to effect in their curriculum to meet the OBE needs were asked and they were asked to identify inhibitors of OBE implementation in the natural sciences curriculum at Cape College of Education. In the end, they will be assessed whether they have enough expertise to

develop their natural sciences curriculum to be based on OBE principles. Their readiness to implement the new curriculum would be assessed based on the last three questions in appendix 1.

The main aim of including the questionnaires for the learners (Appendix 2) was to cross check by triangulation the validity of the information supplied by the lecturers. Background information was included on the learners' questionnaires to make sure that the learners' responses on the opinions section are not influenced by the attitudes they have on the science subjects they are taking or their attitudes towards their lecturers.

The first three questions and questions nine to ten on opinions were constructed with the aim of identifying the teaching strategies used in the college for science learning. These were for assessing whether these strategies used in the college are in line with the investigative nature of science. The questions on the assessment strategies used were also included to check whether they correlate with what is said by the lecturers. The issue of whether the material resources available at the college are effectively used has been addressed by questions four to eight.

To verify the data obtained from questionnaires, questions papers on previous examinations were analyzed as well as the syllabi for natural sciences.

4.3 SAMPLING METHOD

Cape College of education is comprised of various departments under the supervision of a head of department in each department. The Natural sciences department is one of those departments that make up the structure of the institution. Subjects offered under this department are mathematics, physical science, biology, environmental education, agricultural science and needlework. Since my interest lies specifically in science education I have decided to involve lecturers, lecturing biology and physical science as well as students doing the same courses.

Out of 35 students doing their second year of study who were doing both major courses, 20 students were given questionnaires. Ten questionnaires were administered to students doing Biology in their second year in secondary teachers' diploma course and to 10 students doing second year in physical science. The advantage that I had when administering these questionnaires is that, I knew most of the learners since I lectured Biology method and both physical science academic and method in their first year.

By the time the research was conducted, there were two lecturers lecturing physical science, one lecturing general science method and four lecturing biology academic and method. They were all approached to participate in a research and hence questionnaires were handed to them.

5. DATA ANALYSIS

5.1 LECTURERS

- **Background information**

Five lecturers responded out of the seven that were given questionnaires and only two were available to clarify ambiguous responses that needed clarity. The return rate of lecturers' questionnaire was 70 %. This is regarded as a good return rate despite the fact that only two were available for clarifying some ambiguous responses. The reason for getting only two respondents in this instance could be that people were engaged in other activities at the college during the time the data collection sessions were arranged with them and were not flexible to make time for interviews. They also noted that the questionnaires took much of their time, as they had to write more as the questionnaire was long. Resorting to postal questionnaires at the later stage of the research made it even difficult for the researcher to get in touch with the other three respondents.

All five respondents have professional qualifications with one having UED and BED, three have HDE and one simply stated the fact that he is qualified professionally. All of them registered that they have more than ten years natural sciences teaching experience. Two noted that they have been teaching matric science and they have only taught in the college of education for two years, whilst the rest have been at the college for more than five years of their teaching experiences.

- **Role of the syllabus in science teaching**

All respondents felt that a syllabus is their guiding document on what to teach and what strategies to be used. They noted that the syllabus documents the detailed sections to be taught. They often consult syllabi before teaching and some lecturers felt that they have been teaching for some time in such a way that they know exactly what is required by the syllabus to be taught.

The general response was that it is difficult to cover all aspects in the syllabus due to many disruptions that occur time and again in the college. Some felt that they use the time available and try to cover as much as possible, whilst others felt that they teach what they can teach during the time students are available. One lecturer stated that she organizes biology chapters in the order of importance and then these are taught according to their priority. In a nutshell, they all agreed that it is very much impossible to cover all aspects covered in a syllabus.

One lecturer noted that in biology, he divides work according to the sections outlined in the syllabus and then attempts to follow each chapter within a prescribed number of lectures allocated for that section in a syllabus. Extra lessons are arranged to cover those aspects not covered in their specified time if something comes up that disrupts their planning.

“Syllabus is much useful in that it directs you on what aspect one needs to cover in a level as well as how much time you have to spend in each section and what aspects to be covered per chapter. It also prescribes practical work to be covered in each section”, stated one respondent. Generally, it was felt that a syllabus gives direction to the program of the year. One respondent also felt that syllabus makes it possible for the systematic organization of the lecturing schedule.

One respondent noted that even though there are positive aspects attributed to following the guidance of a syllabus, one negative aspect related to following it is that it restricts people’s creativity due to its prescriptiveness and does not allow people to contextualise their teaching. “If you can be allowed to be ruled by a syllabus in your teaching activity you could end up leaving other learners having learnt nothing, whilst rushing to cover a certain amount of work at a given space of time”, was the feeling of one lecturer towards the syllabus.

All views shared by the lecturers about using a syllabus as guide reflect the popularity of the syllabus in their practice. If these educators have to be guided by the syllabus in the practice, more facts are channeled to the learners, whether connected or not. This gives an indication that the view to learning that they hold is the teacher centered approach. Learners feature last in their planning when they have to be recipients of information that comes from the educators. These educators’ practice is obviously underpinned by a traditionalist behaviourist view to learning. These educators reflect more about their activity isolating learners’ involvement in the teaching/learning situation. The aspect of

trying to cover as much content as possible in the available time also reflects teacher centered approach that puts emphasis on rote learning. The prospects of learning in this situation are smaller as learners as well tend to regurgitate as many facts as they can absorb in order to regurgitate them back to the owner of information when required. Teachers in this approach tend to be possessors of information and learners the beneficiaries of information given to them by the teachers. It is also encouraging to learn that there are some educators who are concerned with learners' involvement in their programmes even though they still hold a beviourist view to learning. A wise use of a syllabus could serve as a guide to specific sections that could be covered in a learning programme and it can be used as a guide as to what strategies that could be used to enhance learning activities rather than as a tool to enforce a teacher centered approach. In other words, it appears from the data obtained from this study that the syllabus is not used effectively.

- **Teaching strategies**

All respondents registered the fact that they use a lecture method to cover much of the topics in a syllabus but some are taught through group work where learners are given topics to learn and make presentations to the rest of the class. Physical science lecturers noted that they mainly give them problems to work on developing their problem-solving skills. All lecturers felt that if they give more responsibility to their learners to work on specific tasks given to them, life gets easier for them in that they cover most of the topics in the syllabus and this makes it easier for them to plan evaluation as well.

Respondent	lecture	Practical	Group work	Individual work
1	60%	20%	20%	-
2	85%	15%	-	-
3	60%	30%	-	10%
4	60%	20%	10%	20%
5	50%	40%	5%	5%

Table 1. Teaching strategies utilized by the natural sciences lecturers at Cape College of Education and the percentage of time used for each strategy

Table 1 confirms the view that the lecture method is a dominant teaching strategy employed by the lecturers at Cape College of education. This again reveals more on how far they are into incorporating the learner-centered strategies in their learning programmes. These educators assume a powerful role of being in possession of information and have to use a jug and mug approach to give the learners information. Learners are viewed in this approach, as *tabula rasa*, the empty vessels.

Both lecturers and learners at Cape College of Education generally use school textbooks for reference purposes. It was felt that some of the content covered in the class is in the textbooks and then each person uses his/her own discretion on which other sources to add, in supplementing the information in the textbooks.

Other books in the library were stated to be additional references for teaching/learning in the natural sciences. For biology, models and charts that have drawings and labels have been quoted as being the additional resources used for lecturing. In an interview, one other thing that came out strongly was that, the natural environment in itself contains a wealth of information in sciences, especially in biology, but evidently the study reveals that the environment is not used as a resource for science learning.

- **Role of practical work**

All respondents noted that practical work is important in sciences. Two respondents stated that the laboratories are not well equipped for practical work and on probing them, they stated that due to the lack of funds at Cape College of Education, many years have gone by without having ordered anything, from chemicals to models for science teaching and learning. In a nutshell, it was felt that practical work takes a little percentage of time in their lecturing programmes due to these problems. The other factor registered by other respondents is a lack of time and hence the little that they do as far as practical work is concerned is conducting demonstrations since they save much time. All responded that they sometimes do practical work as opposed to always and never and due to the problems stated above, they all felt that the practical work strategy that they apply in their lecturing is demonstration. Reflecting back to table 1, it is evident that the most possibly better indication that reflects the percentage of time spent on practical work could be the respondent who spends 15% of the time on practical work and the remaining 85% on lecturing. If 15 % of the time for practical work is spent on using a demonstration, then

learners are limited to observation. The learners will have a problem in getting to know how to manipulate the apparatus, let alone conducting an experiment. Consequently, when these learners get employed as educators there is a possibility of them lacking skills of conducting practical work. This will result in the continuity of teacher centered approach that has been practiced on them, now passed on to the next generation.

- **Role of group work**

Respondents noted that at times they involve group work in their lecturing by grouping learners according to some qualities. One made an example of the fact that he combines those that are quicker to grasp and understand information with the 'slow learners' when he gives them tasks. These then decide on who will be their leader and scribe and the leader with a group will decide on the individual that will present the work given to the class. This approach again on group work indicates that the lecturers are just grouping the students to ensure that they have less work to do and for ensuring better management of the students. This again reveals to the researcher that the aim of group work is far away for ensuring social constructivism or rather indicate a naive way of incorporating a social constructivist approach in their practice.

- **Projects**

Concerning project work, they all felt that it is still difficult for them to incorporate projects in their teaching/learning programmes and one lecturer felt that the only project

she gives to her learners are posters. She asks them to choose any aspect in biology, be it a structure to be drawn or a process to be illustrated and she evaluates them according to their correctness, creativity and presentation.

Everybody felt that involving project work is good work but the problem that was highlighted was the lack of enthusiasm and diligence on the learners' side. It was argued that resources and time could also be a limiting factor in exploring these diverse strategies, as well as an extreme shortage of science lecturers in the college. All respondents noted that they have too much work to do and they are extremely over worked in the college.

They noted that their department needs more lecturing staff to reduce the burden of work that they have. It has been impossible for me to assess this aspect, as I could not access records on their time they spend lecturing. According to my knowledge, lecturers are required to spend 32 periods of 35 minutes each week in contact with students and senior lecturers and heads of departments spend 18 periods in contact with their students. The researcher had to take their word in that, when two lecturers left the natural sciences department in 1998, no new appointments were made to substitute the posts and therefore, the number of periods that belonged to those lecturers had to be redistributed to the available lecturers in the department. Added to their tight schedule was the inclusion of physical science and biology in their secondary teachers' diploma curriculum since 1997. There were no appointments made for lecturers to compensate for the load that has been added to their department.

- **Assessment**

At Cape College of education, assignments and tests play a major role in assessment. Two tests and two assignments are required for evaluation per annum. All respondents revealed that the two assessment strategies stated above are the ones that are used in the college. Reflecting on this, it is evident that these two assessment strategies applied could yield good results if properly implemented but based on the strategies used at the college, it is apparent that tests and examinations are used for assessing how much the learners can regurgitate the facts given to them. On assessing the tests given in biology and physical science it was apparent that lower order questions were asked that required factual recall. These gave an indication that rote learning is being promoted instead of inquiry questions that require critical thinking from the learners.

- **Resources**

All respondents felt that they encourage learners to utilize their library when they give them assignments to write. Students are encouraged to develop teaching skills, observation skills, creativity and independent working skills. Writing skills are encouraged as well as planning and styles of presentation, even though it was stressed that these are enhanced by the subject didactics.

- **Attitudes towards curriculum change**

From the questionnaires, it came out strongly that people in the college have conflicting ideas concerning transforming their curriculum to be in line with OBE. One respondent pointed out the fact that there have been tensions in the college emanating from their curriculum development and thus they find it difficult to address the problems they have, as well as the demands of the department of education to restructure their curriculum.

The respondents also registered that people are adamant to get involved in curriculum restructuring programmes due to the fears they have regarding the future of Cape College of Education since colleges in the province and nationally are faced with the possibility of being scaled down. They also noted that they are disillusioned by their possibility of being redeployed or retrenched. Respondents referred the researcher to many aspects stated above as the stumbling blocks to the development of a new curriculum in the college. They all noted that there is no one at the college who has enough knowledge pertaining to OBE and they would welcome to be empowered so that they could manage to restructure their curriculum to meet the OBE specifications.

They registered the fact that they all have been to workshops organized by the department of education as well as by Rhodes University but they still lack expertise that would enable them to implement the new curriculum in their college. They felt that OBE is still theoretical and as such some noted that they want to see it work before they can be able to implement it.

5.2 LEARNERS

- **Background information**

Out of 20 learners, only five returned completed questionnaires. There could be a number of reasons to this poor return rate of questionnaires. One reason could be that by the time these learners were given these questionnaires they were busy with their evaluation (teaching practice) which is one of their major evaluation strategies for their training as prospective teachers. All five respondents were males, doing secondary teachers' diploma in their 2nd year. The cause of this gender bias could be that there were a significantly high number of males enrolled for the second year in secondary teachers' diploma as most females were admitted to junior and senior primary teachers' diplomas. Learner A and Learner B obtained a D in Biology (HG), Learner C obtained an E in Biology (HG), Learner D got a C in physical science (SG) and a D in mathematics (SG), and Learner E obtained an E in physical science (HG) and a B in Biology (SG). Of the respondents 3 stated that they did practical work, reasons for this

- Learners D and E felt that they had enthusiastic teachers who went out of their way to even organize with the other places other than their schools to make sure that practical work was done
- They even stated that even when their schools did not have laboratories they did some practical work.

Most of the respondents felt that little practical work is done in biology due to the fact that biology has more information to memorize rather than to be practiced. Learner A and C, in contrast, felt that they did not do practical work at school because they did not have laboratories. Learner B noted that their teacher did not really know his subject well and he felt that they did most of their work themselves to memorize the text in their note books and they also used other materials like study guides to try to understand the content in biology.

All respondents unanimously felt that the college made them choose their majors based on their matriculation results. Learner B noted that he would opt for doing languages, instead of doing biology because of his interest in them. The other reason stated is that he got better grades in them, otherwise four of the respondents felt that they are more comfortable with sciences and they registered the fact that as much as they like being in the college, they are keen to pursue sciences even further. Learner D noted that if it were not for financial constraints, he would have gone to the technikon to do some technological courses.

- **Teaching strategies**

All of them registered the fact that they like the way sciences are lectured at the college, but unfortunately they all could not say why. They all felt that that most of the time they are lectured but then they are at times given assignments to write and in physical science they are given some problems to work on as individuals and as groups. This confirms the

findings from the lecturers' point of view. Again, the dominant teaching strategy is reflected as lecture method.

- **Group work**

To establish if they are encouraged to work in groups, they all felt that they are often given opportunities to works in groups but most of the time they work as individuals. "Group work benefits others who are prepared to work before they meet to do the task" said Learner B. Otherwise it was noted that other students copy down the work done by the others. Learner A noted that individual work forces them to do their work. Some felt that they understand their work better because they have to read and work first as individuals before embarking on a group work. To cross-check the patterns of these responses with the lecturers' views, it becomes clear that group work is indeed used for making the burden of too much work lighter for lectures but not ensuring socialization skill development in the learners. Social constructivism does not feature in this instance as it views learning as being learner centered as opposed to the philosophy that underlies the functioning in this college which is teacher centered.

All respondents felt that they are encouraged to learn from textbooks and other papers they are given by the lecturers and none of the 5 gave reason to this. Only Learner E noted that they use the library for referring to other books, otherwise the rest of the learners did not give a response to this. This could be that learners get content with the little information they have and as such they don't see a reason of making their lives

complicated by doing more than what is expected. This view reflects a lack of motivation on the students. This could be the result of the teaching strategies employed at Cape College of Education that emphasize factual recall at the expense of other forms of learning.

The other factor that was put across by the learners which is a cause of concern is that, the college curriculum is crowded with a lot of courses where you'll find each learner doing more than eight courses in one year. This exerts a lot of pressure to the individual learners and as a result of this they would look for any short cut into making sure that they succeed at the end of the year. They all agreed to be using other sources other than their textbooks and they stated that they use the library when they are told to do so by their lecturers, mainly for writing assignments. This view corresponds with the fact raised by the lecturers that they use school textbooks for reference purposes. The use of other sources of reference other than the school textbooks could be an indication of learners' involvement in accessing information if properly used. It seems to be important for these learners to strengthen this skill, as they will have to be equipped with this skill when they practice as educators.

Learners stated that they do practical work in physical science but biology learners indicated that they did not do practical work in biology in both first year and second year but could not give a reason as to why they did not do practical work in biology. They all felt that practical work is important because it makes science more understandable.

Information supplied by learners in view of the role of practical work in their learning is in agreement with the information that is supplied by the lecturers. Practical work is not conducted, as it should be. Learners are not involved into conducting individual practical work, let alone the hands-on activities. These learners are faced with a problem of leaving this institution with qualifications in science education, but without skills of ensuring proper science learning in their prospective learners.

They noted that they did project work in the form of models in their second year of study. Asking them whether these projects help them to understand natural sciences better, they felt that there is no connection between these models and theory and the only thing they can master from these models is to draw or label those structures they made models on. This strategy of doing project work could be a good strategy if social constructivism underlies its planning and execution as learners could develop a variety of skills from doing such simple projects. The danger occurs where learners are just given such projects to be kept busy or for making sure that a certain amount of work is dished out to the learners without negotiating outcomes of the task given to the learners.

- **Assessment**

They all stated that two tests are written and two assignments are given in a year and they are not required to do any presentation. Learner E noted that it is necessary to be given projects to stimulate their thinking and creativity in science and that projects give them

the opportunity to know how scientific problems are solved and applied in their daily lives.

Three respondents who made general comments stated that their college has laboratories for each science subject but they are rarely given an opportunity to use them. It was also impressed that too much work is given and this leads them to have too much to memorize for examinations.

Cross-checking the trends from the section of assessment of lecturers and the learners', it is clear that test and examinations are used exclusively at Cape College of education. These assessment strategies aim at assessing one aspect, the ability to recall facts by learners if the educators' practice is underpinned by the behaviourist approach. In this case, learners tend to be forced to embark on rote learning, as this is the only way they can cope with the amount of work presented to them and the way it is presented.

6.1 DISCUSSION

- **Teaching strategies**

There is evidence that circumstances at Cape College of Education have led to the belief that the respondents are favouring a traditional approach to science teaching. These educators at Cape College of Education have developed pedagogical content knowledge that relates their teaching approaches to ensure that students are learning the content knowledge outlined in the curriculum. This could even be that this knowledge is taught in an unrelated manner. This has been echoed by the plight of all respondents that they have to cover as much as possible for them to be able to assess enough work or meet certain standards prescribed in the syllabi by the planners of the syllabi.

Hand and Treagust (1995) also highlighted concerns educators have about changing their current pedagogical practices as including being able to adequately cover the syllabus within the time allocated. These concerns have been identified as being the major concerns in this case as well.

Kahn (1995) identified an academic bias in the natural sciences syllabi as lying in the dominance of a narrow inductivist view of the scientific method, an emphasis on the factual content of science that is presented as a fixed body of facts. The philosophy that seems to dominate the practice of educators in this institution is mostly behaviourism. It has transpired from the research that the dominant strategy that is used is ‘teacher tell’,

the “jug and mug” approach. In this sense the syllabus was part of a pedagogy that had as its principle to achieve changes in the learner by means of focusing on content areas. The danger of this method is that it reduces learners into ‘robots’ that are unable to challenge any truth that is given to them by their teachers. This raises some concerns in that the very same people that are taught in this institution are the very same people that have to teach their learners after graduating as educators.

According to Wheatley (1990) the kind of school practice that is determined by textbooks, reflects a behaviouristic set of assumptions. In this instance, learning is seen as the slow accumulation of knowledge through practice. The content is broken down into smaller chunks of information. The experts (the teachers) carefully sequence this information for the learner. A teacher assumes a powerful role in the learning situation in that he is a possessor of information, a mastermind whose role is to be in control of the school environment (van Harmelen, 1997). Learners are seen to be “helpless parrots” that rely on the teacher for information. They assume their role when they have to regurgitate the information given to them to prove how capable they are to memorize. This fact reflects the situation at Cape College of Education as the teaching strategies adopted reflect a traditional behaviourist view to learning.

Change in this case will be difficult as far as the transformation of the natural sciences curriculum is concerned, unless the educators are willing to examine their teaching strategies. It has been clear from the results obtained that these educators could be more

comfortable with the traditional behaviourist approach that has a reductionist view to learning.

Educators need to be aware of the fact that the nation is changing and as such curriculum is undergoing transformation. The implication of a change is that, all the stakeholders in the education system have to be aware that they have to participate in the process of transformation of curriculum and educators need to take an initiative in this regard. According to van Harmelen (1997) teachers need to be informed of the theory in which they base their practice as educators. The benefit of this is that they will be effective in ensuring that learners are given opportunities of constructing their learning and as a consequence to that, there is a greater chance that learning will be successful.

The research done by Smith in Smith and Anderson 1983 cited in Holland and Mansell (1983) reports that teachers are perceived of teaching science in one of the two ways, which are ‘didactic’ and ‘discovery’. These have been explained as that the didactic science teaching, being equated to the cook book approach to experimentation. Teachers following this approach have the attitude of rejecting any incorrect students’ response, ‘according to them’, and acts as a traditionalist teacher who uses a transmission approach in his teaching whilst discovery teaching views students as developing knowledge for themselves through active investigation and discovery. These teachers’ focal point is the students as opposed to themselves. It is then clear that the educators at Cape College of education are more on the side of the didactic approach. This view is reflected by the dominance of a lecture method as a strategy for science teaching. In instances where

practical work is conducted, demonstration is used as the approach/method of doing practical work. Learners are less involved as they only assume their roles when they have observe the outcome of the practical without being involved in the planning or in doing the task.

Some of the major highlights of science education are the development of investigative skills, and problem-solving skills. These are attained or achieved only if learners are provided with the opportunities to practice them. According to Saunders (1992), the use of manipulative activities has been shown to be more effective in producing more achievement of learning as opposed to observation and reading about phenomena. As it has come to the open that the most popular strategy of presenting practical work in the sciences at Cape College of Education is demonstration, this approach limits learners to observation and cancels any possibility of inquiry in their learning. Saunders (1996) points out two views to laboratory instruction as the traditional verification laboratory which mirrors exactly the findings obtained from the research and investigative or inquiry approach. The latter has better prospects if utilized in that it promotes investigative and problem-solving skills and it promotes inquiry on the learners as well. Based on the data obtained from this study, lecturers at Cape College of Education have not even adopted the traditional verification laboratory approach. They still have to be empowered on the importance of incorporating practical work in their programmes and advantages of learner involvement in problem-solving activities.

- **Resources**

Educators noted the lack of resources as one of the problems that limit them to involve learners into doing practical work on their own. For lack of resources for science education to be rectified the government has to take a responsibility of providing for these institutions to address the challenge of equity in the education sphere. Ogunniyi (1996) noted that the African governments have to stop merely paying lip service to the development of school science, technology and mathematics education in terms of adequate funding and provision of essential infra-structural facilities. For the teachers to be motivated to operate in their potential they have to have enough facilities that will enable them to utilize proper teaching strategies for science education. This issue does not end with the department, but with teachers as well.

As it has been pointed out that the institution has laboratories with some equipment for science education, Ogunniyi (1996) stressed that wise use of the available equipment is quite critical. In science education we talk of improvisation, which means that rather than not doing practical work in science education, educators could provide the learners with some substitutes to the pieces of apparatus that are not available or enough.

Being a former member of staff in the natural sciences department of the same institution, the researcher noted that there is a wealth of skills that could be developed in learners majoring in biology. The institution has for instance, quite a number of light microscopes and some few dissection microscopes. These microscopes have been used during the

period I was employed at the college. To name but a few skills that could be gained from the experience of using these apparatus, learners would develop skills of cutting microscopic sections and preparing permanent slides which they can use for sharpening their observation skills when viewing material under the microscopes.

Learners could be trained on how to make a dissection from fresh specimens of plants and animals and they would be able to identify different organs and systems on their own. This could have imparted some investigative skills on them. Critical thinking could have resulted from this because the learner-centered approach would have reduced a lot of rote learning and dissemination of information that is a dominant strategy in the college.

These findings then led the researcher into undertaking an analysis of syllabi and tests and examinations written in biology and physical science. It was observed that the syllabi are overcrowded with a lot of information and this issue could have resulted in the in the lecturers' practice being underpinned by behaviourism. The burden of having a wide scope of work that they have to cover in a year results into these educators being monitored by the heads of department to ensure that they are at par with the amount of work that they are required to cover in a specified period stated in a syllabus. To meet this requirement the educators have to use strategies that will ensure that they are moving with a quicker pace in trying to cover enough information before they can be able to assess the learners' progress by tests and examinations. Unfortunately, learners are mostly left behind, whilst their educators are trying to satisfy their authorities.

- **Assessment**

Tests and examinations written reflect a great deal of lower order questions that require factual recall. This is influenced by the fact that these learners are encouraged to exercise rote learning at the expense of critical thinking which could be promoted by higher order questions that reflect inquiry and sharpen the critical thinking skills of the learners (see appendix 4).

Multiple strategies of assessment could be mirrored in the practice of these educators as they would be assessing the skills acquired by learners as opposed to how much the learners can memorize the given content of science. This would also enhance attitude changes in the learners as well as educators and they will both see and approach science the way it has to be approached. They will accord it with the learning and teaching styles it deserves.

6.2 INHIBITORS OF OBE AND RECOMMENDATIONS ON THE IMPLEMENTATION OF OBE

The low morale of teachers, which has been documented in Ogunniyi (1996) is an inhibitor to the development of OBE at Cape College of Education. Lecturers are complaining of being overworked due to the shortage of science educators. Science graduates avoid the teaching profession due to the reputation of poor salaries; shabby treatment of personnel, like redeployment, retrenchments and the fears that these

educators have, of losing their jobs due to rationalization of the colleges of education because of lack of government's lack of funds. These could indirectly affect the effectiveness of these professionals and could affect the vision that they would have if they were not the victims of circumstances.

Teachers face the uphill task of coping with bare laboratories and resources centers for science education. This puts an enormous strain on the practice of teachers and this could suppress their innovative practices in science education (Ogunniyi, 1996; Urevbu, 1984). Unless the government take some urgent steps in rectifying this problems the shortage of learners in the natural sciences will escalate rapidly and this would virtually affect the economic state of the country (Nell, 1995; Kahn, 1995).

Educators need to be involved in their own professional development and in the process of curriculum development. It is quite evident that these educators have not been properly informed about the progress in the curriculum development even when it was stated that Curriculum 2005 is a 'grass roots enterprise'. In practice this has not taken off fully in the province and consequently, these educators are taking a spectator stand in the curriculum reform effort. Educators need to be empowered to be able to understand and be part of the change that the curriculum is undergoing (Prawat, 1992).

The problem of the congested syllabi that the teachers adhere on, reduces the creativity of teachers. This creativity could result in the improvement of strategies for science education that could enhance the implementation of OBE in the college by the educators.

Teachers are more comfortable with the routine they are used to and as such to change would mean that they have to get out of their comfort zones. Prawat (1992) views teachers as gents of change in the educational setting and if they don't play their role in this change, a change is doomed. Paradoxically, the same teachers could be major obstacles to change because of their adherence on their outdated modes of instruction that emphasize factual and procedural knowledge at the expense of the deeper levels of understanding and promotion of critical thinking skills.

Hand and Treagust (1995) cautioned that a change does not take place all at once. A period of time is needed for educators to become comfortable and familiar with the new approaches. They need the opportunity to be reflective and to consider the relationship between theory and practice when adopting new teaching approaches.

The other serious inhibitor of the OBE implementation process in the college is probably the whole curriculum of the institution that is congested. In this case, the whole curriculum of the college needs to be restructured to meet the specifications of OBE. Every educator in the college needs to be aware of the changes that are taking place nationally and in the college and be prepared to change in order to embrace OBE specifications.

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7. CRITICAL REFLECTIONS ON THE RESEARCH PROCESS

The first aspects that need reflection are the instruments that were developed by the researcher for data collection. Open-ended questions in the questionnaire posed a number of problems. Questionnaires were not pilot tested and as a result there were many problems encountered due to this fact. Some of the questions asked made respondents uneasy to respond to, like the information based on their academic qualifications and professional qualifications were sensitive questions to ask. The questionnaires were long and this could be the reason why the return rate of questionnaires from the learners was 25 %. Open ended questions as well pose some problems because respondents sometimes misunderstood the questions asked or sometimes they felt tired of having to give explanations (Cohen and Manion, 1994). Open-ended questions could have contributed to the very low return rate but on the other hand enabled me to get more information that the three lecturers that were not available for follow up sessions. As a result of the very low return rate of questionnaires and having only two out of five lecturers who participated in interviews that were meant for clarifying the ambiguous responses in the questionnaires, the data presented in this research could not be representative of what people think, do and feel at Cape College of education. This therefore means that only rough conclusions can be made that could stimulate further research on issues raised on this study as the sample is not representative.

Learners' responses were supposed to be used for triangulation. It became clear to check the validity from the few learners who responded, as the information they gave in their

questionnaire was congruent to the data obtained from lecturers' questionnaire. The questionnaire did somehow produce what the researcher hoped to establish. Probably, interviews could have been used as a tool for triangulation to monitor the number of respondents.

Survey is used mainly when a positivistic approach is adopted in research projects but they are rarely used in qualitative research projects. This study is a pilot study conducted in a single institution and therefore it may serve as a starting point for people who are interested in conducting research projects on the subject in order to develop a better picture of a situation in the colleges of education concerning the implementation of Curriculum 2005.

The time chosen for data collection has an influence on the research process and the research outcome. I spent about two weeks at the college administering questionnaires but could not come up with any better number of questionnaires that were submitted. The time that was selected was quite busy at the college as lecturers and students were busy with their teaching practice, which is one of the major evaluation activities at the college. This could be one of the reasons why the return rate of learners' questionnaires was low.

The paradigm for this research project made it possible for me to be able to reflect on every aspect of the data and teasing out the trends that are based on the data obtained from questionnaires.

It was difficult to get access to documents, as the people seem to be suspicious when copies of the documents that they use were requested. Again, time factor is important in this case as well, as trust needs to be established between the researcher and the respondents. Without trust, respondents tend to keep information or give a distorted picture of the issue that is being investigated.

To improve this research it would be necessary to redesign the questionnaire into categories that would address the objectives of the research project. The categories in this study tend to be mixed up since initially they were not arranged according to their importance.

8. CONCLUSIONS AND RECOMMENDATIONS

Since this small research project appears not to be representative of what lecturers at Cape College of education do or feel, the following tentative conclusions can be drawn:

- For OBE to be implemented at Cape College of Education, lecturers have to be prepared to undergo transformation. They have to examine their approaches to find out whether they reflect the OBE approach to teaching or not. If not, they have to be willing to transform their methods of practice by undergoing some retraining that will enable them to function effectively to meet the standards required by the new curriculum. More workshops on curriculum 2005 have to be organized for these lecturers to come into grips with teaching approaches that reflect the OBE approach to teaching. They need to reflect on the learning theories underpinning their practice to find out if they are in line with social constructivism, which is the learning theory that underpins curriculum 2005. It is clear from this research that the lecturers at Cape College of Education are guided by the traditional approach to their teaching and therefore need support to realize that a change is inevitable. If they are not willing to change, OBE is bound to collapse in the institution, even before its implementation. Epistemological empowerment could be the key solution to the change in the educators' practice and therefore people with expertise on curriculum development and with expertise in OBE are needed to empower and support the educators. In-service training of teachers could be beneficial and if teachers are given opportunities to model OBE in the in-service programmes, perhaps, they can be eager to incorporate the new strategies in their practice.

- It has been evident that the assessment strategies that are used in the college are not consistent with what curriculum 2005 stands for, as only tests and examinations and assignments are the only strategies used. These strategies encourage rote learning that hampers proper conceptual development in the learners, as learners learn in order to regurgitate information when they are being examined. I would recommend that continuous assessment be applied as it embraces a number of assessment strategies. Learners could be assessed on practical work to ensure if they have developed observation skills, investigative skill, reporting skill and whether they are able to conduct individual research as they will be responsible for handling science with their learners after they have graduated.

- As documented by Ogunniyi (1996), a drastic reduction of the natural sciences content in the curriculum and an emphasis on the critical concepts and principles might make the syllabi more accessible to a much wider ability range than at present. This would lessen the concern that these educators have on how much content they are required to cover in a year and would make them concentrate on the acquisition of skills by learners and conceptual development, which are some of the pillars of OBE.

- This study indicates that the resources that are available at the college are not adequately used. I would, therefore, recommend that workshops on improvisation techniques be organized for these educators so that they can be able to develop the improvisation skills on their learners. These learners are the future educators who will

be faced with the reality of practicing in the schools where facilities for conducting practical work will be scarce.

- As this institution has the library, it is clear that this facility is underutilized and as such learners are not encouraged to work independently to develop skills on scientific writing and reporting. This would be achieved if learners were given an opportunity of working on projects and be encouraged to write reports on the projects based on journals and books available from their library and other libraries. Learners could be encouraged to consult local libraries as well as university libraries within their periphery for information that is not available in their library.

- To enhance the enthusiasm of these lecturers the government needs to supply funds for improving the condition of resources in these institutions. In a nutshell, the government needs to help the institution by preparing the ground for the implementation of the new curriculum. This could act as an incentive to improve science learning.

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MASTERS IN SCIENCE EDUCATION
RHODES UNIVERSITY

QUESTIONNAIRE

Implications of introducing OBE in the Natural Sciences Curriculum at Cape College of Education.

Dear Natural Sciences Lecturer

(Natural sciences refer to biological science, chemistry and physics)

Today we are faced with many challenges in the education sphere here in South Africa. One of the challenges we are faced with, is the transformation of higher education in South Africa and one of the aspects covered in one of the documents released by the National Department of Education is the transformation of the Curriculum.

I would like to ask you to participate in this research by answering the questionnaire as honestly as you can and as elaborate as you can. Your co-operation will mean much to this study.

Kwanele Booi

Tel: 083 3343714 (Cell)

021-4023357 (W)

For the sake of confidentiality your name will not be put down in the research reporting.

QUESTIONNAIRE TO LECTURERS

BACKGROUND INFORMATION:

INSTRUCTION: Please think critically about these questions and supply your well thought for responses.

1. Gender

MALE	**1**
FEMALE	**2**

2. State your highest academic qualifications, as well as your major courses.

_____

3. At what level of training have you done Natural sciences?

_____

_____

4. Do you have any professional qualifications, and state them.

_____

_____

_____

_____

5. For how long have you been teaching?

_____

_____

6. For how long have you been teaching Natural Sciences?

7. At which levels?

8. For how long have you been lecturing in a college of education?

9. For how long have you been lecturing Natural Sciences in a College?

OPINIONS:

1. How often do you consult a Syllabus?

(a) If more often, how is it helping you in your Natural Sciences teaching?

(b) If seldom, why do you think you don't need it for your lecturing ?

2. (a) Are you able to cover all the aspects of Natural Sciences for a year in a syllabus ?

2 (b) Please describe how do you use a syllabus in your lecturing?

3. How do you view the usefulness of the syllabus described by the department in your lecturing of Natural Sciences student teachers?

4. Please indicate 2 or more strategies you use in your lecturing and please state the percentage of time that you use these strategies.

4. Describe in what way do you use a textbook in your lecturing?

6. Which other resources do you think are appropriate for lecturing Natural Sciences, and why?

6. What is the role of practical work in your lecturing and state how much time do you spend on it?

8. How often do you do practical work in Natural Sciences for your students?

1	NEVER	
2	SOMETIMES	
3	ALWAYS	

9. What kind of practical work strategy do you apply in your lecturing?

1	Teacher demonstration	
2	Student demonstration	
3	Group practical work	
4	Individual practical work	
5	Projects	
6	Never do practical work	

10. Does group work have a role in your lecturing? Please motivate!

_____

_____

_____

_____

11. (a) What is your view about involving project work in your teaching ?

_____

_____

_____

_____

11 (b) How do you plan projects for your students and how do you assess them?

12. What sort of projects do you include in your teaching?

1	**Posters**	
2	**Research**	
3	**Others (Please mention)**	

13 (a) What sort of assessment strategies do you employ in your Natural Science teaching?

13. (b) Supply a reason why do you feel these are important.

14. Which assessment strategy do you use most often, and why?
(Once a week, once a month, once a term, once a year)

15 Which assessment strategy do you seldom use, and why?

16 (a) Do you encourage your students to make use of the facilities available at the college for learning Natural Sciences, and how? (eg. Library, etc.)

16 (b) If YES, do you think they use these facilities properly?

17 (a) What skills do you encourage to develop in your students?

17 (b) How do you make this possible?

18. What are your views about the changes in the curriculum in South Africa?

19 How do you see these changes affecting Natural Sciences curriculum in your college?

20 What changes would you effect in the Natural Sciences curriculum at your college?

21 What are the stumbling blocks that you encounter in developing a new Natural Sciences curriculum at your college?

22 Do you feel that you have enough expertise pertaining to Outcomes Based Education to help develop a new Natural Sciences Curriculum for your college?

23 Have you attended any in service programmes on OBE?
If YES, what benefit did you gain from them?

If NO, are you willing to attend in service training?

24 Would you welcome any kind of assistance in curriculum development (especially in Natural Sciences)

25 Is there any general comment you would like to make?

THANK YOU SO MUCH FOR YOUR TIME.

MASTERS IN SCIENCE EDUCATION
RHODES UNIVERSITY

QUESTIONNAIRE

Implications of the introduction of OBE in the Natural Sciences Curriculum at Cape College of Education.

Dear Natural Sciences Learner.

(Natural sciences refer to biological science, chemistry and physics)

Today we are faced with many challenges in the education system of our country, South Africa. One of the challenges we are faced with, is the transformation of higher education (including colleges of education) and one of the aspects involved in this, is the transformation of the Curriculum. To meet the needs of the community in which you serve at the on attaining your college qualification, it is important that you must be made aware of the introduction of OBE in the Primary and high schools (Curriculum 2005) and the challenge you will faced with after you have completed your studies.

I would like to ask you to participate in this research by answering the questionnaire as honestly as you can and as open as possible. Your co-operation will be highly appreciated.

Yours sincerely

Kwanele Booi
Tel: 083 3343714 (Cell) or 021-4023357 (W)

For the sake of confidentiality you don't have to put your name in this questionnaire.

QUESTIONNAIRE TO LEARNERS

BACKGROUND INFORMATION:

INSTRUCTION: Please think critically about these questions and supply your well thought for responses.

1. Gender

MALE	**1**
FEMALE	**2**

2. At what level are you doing natural sciences at the college this year?

_____

3 (a). What was your highest symbol of biology and/or physical science in matric? (State)

_____

_____

3 (b). Did you do practical work in natural sciences at school? (Why / why not)

_____

_____

_____

4. What made you choose biology and/or physical sciences and for physical science as a major subject?

_____

_____

_____

5. If you were given an opportunity, would you opt to choose another major instead? (Why / why not)

OPINIONS:

1. Do you enjoy the way natural sciences are lectured at the college?

1 (a) If yes, what makes you enjoy it?

1 (b) If not, why not?

2. How often are you given opportunities to work through natural science problems on your own or are you lectured all the time?

3 (a). How often are you given opportunities to do natural science tasks in groups or are you required to work individually?

3 (b). How do you benefit from group work?

3 (c). How does individual work benefit you ?

4. Are you encouraged to learn natural science from textbooks? (Why /why not)

5. What other resources do you need to learn natural science?

6 (a). Are you encouraged to consult with natural sciences sources from the library?

6 (b). If yes, which sources do you normally use?

6 (c). How often do you use the library for natural sciences? (why)

7. Do you do practical work in natural sciences at the college? (Why / why not).

8. Do you think practical work is important in sciences? (Why)

9 (a). Do you do any projects in natural sciences? (How many in a year?)

1

10 (a). Complete the table below: How many of each do you do in a year?

1	TESTS	
2	ASSIGNMENTS	
3	PRESENTATIONS	

10 (b). What sort of presentations do you give?

(eg. On certain general topics that you write on, or on any scientific aspects or certain chapters in your textbooks, etc.)

_____

_____

_____

_____

10 (c). If no, do you think it is necessary for the projects to be given, and why?

_____

_____

11. Is there any general comments you would like to make?

_____

_____

_____

THANK YOU SO MUCH FOR YOUR TIME.

THE ASSESSMENT OF PERCEPTIONS OF SQUATTER CAMP TEACHERS IN KHAYELITSHA TOWARDS THE OUTCOMES BASED EDUCATION

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF EDUCATION (Science Education)

of

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by

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TABLE OF CONTENTS

ABSTRACT

This study is based on the practices of science educators in the squatter-camp school in Khayelitsha, a densely populated area for blacks near Cape Town. Teachers at Vuselela primary school were interviewed about their teaching assessment strategies to establish whether they incorporate a learner centred approach, which is the necessity for the Outcomes Based Education approach. Also some of the lessons they taught were observed in order to find out whether they validate what transpired from the interviews through a process of triangulation. It has become evident that the teachers are to some extent aware of the changes the education system is going through in South Africa. It also became clear from the study that the teachers are still lacking expertise as to how to practice along the lines of Curriculum 2005, the South African version of Outcomes Based Education (OBE). They also showed that they are keen to learn and practice OBE even though more opportunities need to be created for their epistemological empowerment as well as empowerment on the content of science.

1. INTRODUCTION

The introductory chapter to this report gives the overview of what the transformation of South African education system entails. It briefly describes the curriculum in general and points out briefly the differences between the traditional behaviourist curriculum and the Outcomes Based Education (OBE) curriculum. The context of this research report explains the reason why the curriculum had to be transformed in South Africa and the processes involved in the transformation of the curriculum. This study as a whole examines the readiness of teachers at Vuselela primary school towards OBE by analysing their practise through interviews, observation and the analysis of documents.

The previous dispensation promoted a racially and culturally segregated and differentiated education system based on the philosophy of Christian National Education (CNE). This has resulted in an excessive fragmentation of the South African education system. This move was to ensure that Blacks would not be over-qualified for positions not at all envisaged for them (Ashley, 1989; Buckland, 1982).

Introduction of fundamental pedagogics in the South African education system was used by the then apartheid government to perpetuate its own political ends. Fundamental pedagogics was purported to ensure that the learning environment of a learner should be guided and shaped by the value systems of the community it serves rather than the vision and values that the nation share (van Harmelen, 1997).

A curriculum is believed to be central to any education system. According to Doll (1989), the

curriculum reflects the type of the education system that is adopted by a particular country. Reflecting on the South African education system prior to 1994, teachers were not made to be part of the decision making process in curriculum development. They were passive recipients of the curriculum that was developed by experts – the bureaucracy. Not all stakeholders of the education enterprise were involved in the design of the curriculum, yet everyone had to accept it whether they were pleased with it or not and had to operate in it without any question. Presently, the situation is changing, as all stakeholders (especially teachers) have been given an opportunity to develop the curricula for their schools.

In the past education system the syllabus was part of a pedagogy that had as its principle to achieve changes to the learner by means of focusing on content areas (van Harmelen, 1997). The traditional behaviourist curriculum assumed that the teacher had to be directed by a syllabus and that teaching should happen only in the schools in order to work through the syllabus in a systematic way. This view gives power to the teacher as being the possessor of information - the mastermind who is guided by the syllabus on how much work has to be covered at the specified time. This leads to the dissemination of information to the learner. If this approach is followed, this curriculum is likely to be irrelevant to the learner's needs as Bodner (1986) states that knowledge is never transferred intact from one person to the other.

A change was necessary in the South African educational system, if transformation in a broader context is to be achieved. The government gazette (1997, 382: 17944) states that the National Qualifications Framework (NQF) document informed by principles derived from the white paper on education and training (1995) emphasises the need for major changes in education and training in South Africa in order to normalise and transform teaching and learning (South Africa, 1997b).

Education in South Africa is now indeed undergoing a paradigm shift, from a content-based, traditional behaviourist approach to Outcomes Based Education system that is learner-centred.

The Outcomes Based Education system is a learner -centred, outcomes-orientated system that is based on the belief that all individuals can learn. The Outcomes Based Education system focuses on what is to be learned, i.e. the outcomes, which are explained by Kudlas (1994) as a demonstration of learning. Outcomes are defined by Spady (1996) as being clear, observable demonstrations of student learning experiences. These demonstrations or performances reflect what the student knows, what he/she can actually do with what he/she knows and the student's confidence and motivation in carrying out the performances. According to Spady (1996), the purposes of the Outcomes Based Education are based on the premise that all students can learn and succeed, but not on the same day in the same way. OBE assumes that successful learning promotes more successful learning and that schools control the conditions that directly affect successful school learning.

2. CONTEXT

Actions in the classroom cannot be divorced from either the philosophy within which the curriculum is situated or from the educator's philosophy or worldview (van Harmelen, 1997). The way we teach and interact with our learners is influenced by how we think about the nature of education. Since all learning/teaching practices are informed by theory whether consciously or unconsciously, teaching and learning is referred to as "praxis" (van Harmelen, 1997). The praxis approach to curriculum, according to Bellis (1997), offered a way of integrating content and product and process.

As all teaching/learning is praxis, it is argued by van Harmelen (1997) that the better informed teachers are about the theory on which they base their teaching, the more effective they are likely to be as teachers and the more likely learning will be successful. If teachers understand why they do what they do in the classroom, they will be able to reflect critically on their teaching and learning environment and thus they will be able to develop their teaching skills.

In an education system where teachers are better informed and are critically reflexive practitioners, there is less chance of them being marginalised and oppressed by the education system in which they operate. Knowledge about education and expertise in one's chosen area of learning is the foundation of and is fundamental to all teacher empowerment. Without this epistemological power, teachers have no authority (Prawat, 1992).

Teachers empowered epistemologically will in the first instance be equipped with the capacity to critically analyse the curriculum and to view it not as a prescription for education based on given

truths that cannot be challenged, but as that which is located in a particular value-system. Any curriculum must be subjected to the same sort of critical questioning that is given to all value systems. Through this, teachers are able to evaluate and to understand what they are expected to teach and if needs be, to challenge the perspective of knowledge that the curriculum presents.

The curriculum ought to provoke critical thinking skills, problem solving skills, decision making and conceptual development in the learners. Implicitly, the curriculum ought to outline a non-authoritarian atmosphere in which reflective, critical and intelligent thinking takes place (Buckland, 1982). It must reflect a situation where authority and domination is scrutinised publicly, where learners have more power to construct their own knowledge. The result of this will be a situation where learners can empower themselves to actively learn via their own exploration, experiments and experience, as well as where learners will freely interact with each other and with their educators (Prawat, 1992; van Harmelen, 1997).

Etchberger and Shaw (1992) state that teachers need to reflect on what they are doing in the classroom i.e. whether they are equipping learners to solve problems or merely showing them how to solve problems. For instance, the investigative character of knowledge acquisition in the natural sciences should be reflected in education. The Natural Sciences Technical committee reports on the fact that learners should be active participants in the learning process in order to build a meaningful understanding of concepts which they can apply in their lives (South Africa, 1997a). Teachers must constantly be aware of what knowledge base each individual learner has and must use this information in planning and implementing the learning programmes (van Harmelen, 1997). Dreckmeyr (1994) noted the changing role of the educators. This is explained by the fact that teachers were perceived initially as disseminators of information because of their teaching which

was predominantly lecturing to pupils and telling the pupils exactly what they are expected to learn. The consequence of this practice is science being communicated to the learner by a "jug and mug" approach. The role of teachers is expected to change to that of facilitators, organisers, and implementers of learning activities and suppliers of learning materials (van Harmelen, 1997). This, therefore, calls for educators to be the reflexive practitioners and to analyse their teaching strategies to determine their functions and to make some necessary adjustments in their practice in promoting inquiry and emphasising the development of skills in their learners.

Dowling and Dauncy (1984) in Griffiths (1987) define skills as the learned habits which learners need to acquire to work confidently, creatively and independently. This poses a challenge to the educators to examine their practices to find out if they will yield such desired results. Etchberger and Shaw (1992) emphasise the fact that teachers have to move away from the traditional behaviourist approach to teaching into adopting social constructivism.

If the philosophy on which the curriculum is based views knowledge as socially constructed in many and varied situations that include more than simply the formal classroom situation, then the theory of learning will be based on attempts to replicate and to extend the learning situations that occur in non-formal learning environments. The classroom in this case becomes an extension of the learner's environment. The interpretation of what constitutes knowledge will be extended to accept and to build on the existing knowledge of the learner gained through social interactions other than those in the formal classroom (van Harmelen, 1997; Etchberger and Shaw, 1992; Driver and Oldham, 1986; Driver and Erickson, 1983).

The theory that underpins Outcomes Based Education in South Africa (Curriculum 2005) is constructivism, particularly, social constructivism. Bodner (1986) states that learning is

constructed in the mind of a learner through the interplay of cognitive processes, assimilation and accommodation to form schemas. In this way, a learner constructs his learning cognitively. Social constructivism takes the theory further by asserting that communication plays a significant role in the learning process as group work is encouraged and therefore a learning process is interactive between all that are involved in the learning situation (Ernest, 1993).

Learners in this educational theory are perceived to be active participants in the learning process and are expected to take responsibility for their learning. The teacher acts as a facilitator who provides particular opportunities for learning to take place and included in his duty is the structuring of the environment in which learning is to occur. A teacher may be a 'scaffolder" (a person who helps the learner to move from one stage of understanding to another), by demonstrating, explaining, role-playing or modelling what needs to be learnt. Sometimes, a teacher is viewed as a co-learner, where learners and teachers embark on a joint project of learning and discovery (van Harmelen, 1997). Where teaching and learning is based on social constructivism, facts are emphasised far less than conceptual understanding and the acquisition of skills. Skills' development and conceptual understanding will both facilitate understanding and enhance learners' abilities to operate as individuals and in their societies.

Assessment and evaluation of learning needs to be both varied and continuous to ensure that all aspects of knowledge are fairly and adequately assessed and evaluated. According to Le Grange and Reddy (1998), continuous assessment has clear advantages over traditional forms of assessment as it advocates a system of continuous learning and improvement which focuses on the development of the whole learner. In implementing continuous assessment, less emphasis should

be placed on memorising content and more emphasis should be placed on the attainment of a variety of learning outcomes, as the learning outcome require a variety of assessment strategies and not only written tests and examinations (Le Grange and Reddy, 1998). The main focus of continuous assessment is therefore, on the acquisition of skills, conceptual development and the development of values and attitudes.

Gipps (1994) defines assessment as a wide range of methods for evaluating learner's performance and attainment including formal testing and exams, practical and oral assessment; classroom based assessment carried out by teachers and portfolios. Gipps's definition fits closely with what continuous assessment ought to be. The traditional behaviourist approach to curriculum adopted the summative assessment that is norm referenced. Summative assessment refers to the assessment that takes place at the end of the learning experience for a purpose of determining how much of the subject's content the learners know. Summative assessment is always norm referenced (Le Grange and Reddy, 1998). This means that the learner's achievement is compared with that of other learners or with pass marks to determine how well or poor the learner is doing. This, in reality reflects little about what the learner has mastered or understood. This assessment method is in agreement with the traditional behaviourist teaching approaches that focus largely on developing a learner's memory capacity. Judgements are made about what the learners know at the end of the school year in order to decide whether they can proceed to the next grade.

On the other end, formative assessment is conducted as the learning process takes place and is used to influence or to inform the learning process. It is criterion referenced, meaning that it consists of certain criteria that learners are expected to achieve in a particular grade. It therefore

provides more information about a learner's competence in a particular area.

As the system of education is undergoing a paradigm shift from traditional behaviourist education system to the Outcomes Based Education system underpinned by social constructivist learning theory, the formative, criterion referenced assessment has a potential of playing a greater part in the assessment of outcomes. The success of OBE curriculum depends largely on the assessment of outcomes and therefore proper assessment strategies and criteria need to be established to avoid fear of lowering standards.

3. RESEARCH GOALS

This research has been aimed at identifying the perceptions that the teachers have of the paradigm shift in the education curriculum in South Africa. The following goals were identified:

- to determine whether the teaching strategies used by teachers are in line with the OBE approach of science teaching
- to determine whether the assessment strategies used by the teachers enhance conceptual and skill development in the learner

4. RESEARCH METHODOLOGY

Hitchcock and Hughes (1995) define a methodology as a theory or an analysis of how research should operate. This research is based on a case study. This approach has been chosen because a case study has a potential of providing schools teachers with tools that they should use for improving their condition (Jackson 1995). Cohen and Manion (1994) state that the case study

researcher observes the characteristics of an individual unit. This is quite powerful in that the researcher learns at first hand about the situation of the context in which the research is done. The purpose of such observation done by the researcher is to probe deeply and to analyse intensively the many phenomena that constitute the life cycle of the unit (Cohen and Manion, 1994). It is on this basis that I have decided to select one school out of several primary schools in the Site C area in Khayelitsha.

Observation forms a basis of a case study (Cohen and Manion, 1994). The researcher chose to be a participant observer as opposed to being a non-participant observer. Being a participant observer enabled the researcher to observe and influence the respondents towards the process of transformation of curriculum in South Africa and also, the participation of the researcher made it possible for the data obtained to be validated in many ways. Cohen and Manion (1994) state that the task of a participant observer is often to explain the means by which an orderly social world is established and maintained in terms of its shared meanings.

4.1 RESEARCH PARADIGM

According to Robottom (1993), different traditions within educational research are referred to as paradigms and are referred to as being epistemologically and ideologically different. All research is guided by some theoretical orientation (Bogdan and Biklen, 1992). This research falls under the interpretive paradigm and Kuiper (1997) states that the general aim of interpretive paradigm is to describe phenomena and to some extent explain them. The assumption underlying the interpretive paradigm is that human beings are rational beings that have reasons for their actions. The reasons

that the humans have for their actions are the object of the research and in understanding them the researcher is able to formulate explanations to human behavior. The tradition of the interpretive paradigm emphasizes the interpretive understanding of human interactions (Bogdan and Biklen, 1992).

A qualitative approach to research has been adopted in order to help the researcher gain access to the conceptual schemes of the research subjects, in this case, science teachers and management of Vuselela primary school.

4.2. DATA COLLECTION METHODS

Data collection is guided by the method one will use in analysing the data (Hitchcock and Hughes, 1995). All human sciences stress the need for research to be commensurate with the nature of the social world, hence the natural science model for social and educational research has been abandoned and replaced by an interpretative, ethnographic (more broadly qualitative) model of research (Hitchcock and Hughes, 1995). This research aims at the investigation of a phenomenon and it aims at probing deeply the quality of the phenomenon (Kvale, 1996).

The qualitative methodology refers to approaches that enable researchers to learn at first hand, about the social world they are investigating by means of involvement and participation through a focus upon what the subjects (individual actors in question) say or do (Hitchcock and Hughes, 1995). A qualitative approach is viewed as offering those involved in the study with the opportunity for planning any changes and carrying out any evaluation (Hitchcock and Hughes,

1995).

According to Eisner and Peshkin (1990) the purpose of all qualitative research is to probe the deep understanding of educational institutions and processes through interpretation and narrative description. All forms of enquiry necessitate openness to make its practice viable (Eisner and Peshkin, 1990). It has been on the basis of the above argument that this research has been based on the qualitative approach to research.

The tools that have been used in this qualitative research involve capturing data through semi-structured interviews, and in situ observation of the research environment.

4.2.1 **INTERVIEWS**

Semi-structured interviews were used which are between the structured and unstructured interviews. This approach enabled the researcher to structure the questions that were to be asked before hand in a way that is done when planning for the structured interviews. This also made an allowance for some flexibility that would enable the researcher to probe for more information when the responses given by the interviewee lacked clarity (Cohen and Manion 1994).

- **Background information**

To know more about the teaching strategies applied by the science teachers at this school, background information on their teaching experience and their professional qualifications would

give the researcher an idea of whether they are qualified to teach science or not. The other purpose of including these questions were to find out whether they have an adequate understanding of the content they teach and if they were able to use the understanding they have to teach science better.

- **Teaching strategies**

Questions about the teaching strategies they use would enable the researcher to assess the theory that informs their practice. This will then give an indication of whether appropriate strategies are used for science teaching. This category would make it possible for the researcher to critically assess the first objective of the research (refer to the chapter on goals of research).

- **Assessment strategies**

As with the teaching strategies, an understanding of the assessment strategies should indicate the philosophy that underpins the teachers' practice. In the end, the researcher's critical lenses will open up to reflect on whether the educators are informed about the other available strategies that are used for appropriate science teaching/learning. This will in turn inform the researcher about the view they have towards learning and provide an opportunity for the researcher to analyse whether teachers incorporate the assessment of skills developed by learners in a learning process and the learners' conceptual development.

- **Resources available**

Questions on the resources available at the school for science learning would enable the researcher to assess whether there are enough resources for science teaching/learning and whether these are used or not. This would still enable the researcher to question the strategies that are used for science learning based on whether investigative skills and inquiry are promoted in the teachers' practice.

- **Attitudes toward OBE**

Questions about their understanding and their views about OBE would enable the researcher to assess their attitude towards OBE. This would result in the critical analysis of whether they are positively inclined, negative or just neutral or confused by the new system.

4.2.2 OBSERVATIONS

Information given through interviews has to be checked if it is congruent with what is happening in reality. In this study, congruency has been checked through observations. Cohen and Manion (1994) state that there are problems that appear to attend the use of the interview as a research technique and one of these is congruency. It is important for a researcher to crosscheck the congruency of the responses supplied to him by the respondents by the process of triangulation (Cohen and Manion, 1994). One way of checking the coherence in the interview data is to compare the interview data with another measure that has really shown to be valid. In the case of

this research, observation of how lessons are taught by the teachers (interviewees) and activities that were taking place during the time the research was done, was necessary to give an indication of whether they correspond to the information obtained from the interviews. The researcher became a participant observer (Cohen and Manion, 1994). A participant observer does take part in the activities that are being observed, to some extent, with the view to bring about changes or provide tools that are necessary to bring a change whilst observing the detailed activities that are taking place in order to document them.

4.3. SAMPLING METHOD

One public primary school has been selected for this research. This school is situated in the central part of site C squatter camp at Khayelitsha, the area near Cape Town with a high population and is one of poverty stricken areas in Cape Town. Vuselela primary school starts from grade 1 to grade 7. The enrolment of pupils in 1999 was 1846 pupils. The staff of Vuselela is comprised of a headmaster (Mr Xhonti), two deputy principals, one for senior primary, now a combination of the intermediate phase and the senior phase (Mr Ntlabathi) and the other for junior primary, now referred to as the Foundation phase (Miss Nabe). Vuselela has five heads of department, three for the senior phase (Mrs Moyikwa responsible for grades 6 and 7, Miss Matshoba responsible for grade 5 and Mrs Henda responsible for grade 4 and two heads of department for the Foundation phase. These teachers form the management structure of this school. There are 48 teachers of which six are science teachers, teaching science from grade four to grade seven.

There are 24 classrooms made by brick structure, four prefabs that are used as classrooms and one multipurpose room, which was meant for needlework, sewing and art subjects which is presently used as a classroom. There are no laboratories, which is a common case in most public primary schools (the state primary schools). Due to the shortage of classrooms, some teachers have to share classrooms and have to accommodate up to 100 learners in a classroom. To demonstrate the impact of shortage of classrooms and big numbers of learners, two grade 4 classes have to be accommodated in one classroom. This puts the two educators who have to share a crowded classroom in an awkward situation. For storing science equipment, a bookstore is used and these apparatus are stored together with the books. Four science teachers participated in this research (Mr Ndaba, Mr Mandla, Mr Mbewu and Miss Ntloko) as well as two members of the management team (Miss Nabe and Mr Ntlabathi – both deputy principals). The names of teachers are not the real ones as they preferred their identities to be concealed when this report is written but the principals' and other members of the management team's names are the real one as they did not have problems with their names being used in this study. Permission for using the school's name was granted by the principal as well.

5. DATA ANALYSIS

5.1 **Management**

Miss Nabe supplied the researcher with the information pertaining to the number of teachers, number of pupils and number of classrooms and has arranged and made almost everything possible for the researcher to meet with the interviewees.

5.1.1 **Interview**

Mr Ntlabathi (deputy principal) participated in the interview as part of the school management team. On how often the effectiveness of teachers is stimulated at Vuselela, he stated the fact that the management stimulate teachers quite often by encouraging them to attend workshops and that, teachers are always told that in the workshops they get resources and ideas that would help them teach science effectively. He revealed the fact that it is not easy for them to get qualified science teachers. This fact is understandable since there is no specialisation in primary education when teachers undergo pre-service training courses from the colleges of education.

On the strategies that he would like his science teachers apply when teaching science, he stated that group work is a possible approach and some of the teachers at Vuselela use it. He pointed out the fact that group work is not that much effective, as classroom control is a problem due to congestion in classes emanating from high numbers and lack of space in the classrooms.

To improve the standard of science teaching, Mr Ntlabathi stated the fact that he would like the teachers to be up to date with new approaches to science teaching. He said that this could be achieved if teachers are prepared to attend workshops and that it is in these workshops that teachers would be equipped more on the current trends and methods of teaching science. He stated the fact that he would be keen that OBE be implemented at Vuselela. He registered the enthusiasm they always have to effect a change where change is needed by citing an example of a programme that was in place in 1989 organised by Miss Ngcelwane from the area office in Port Elizabeth. This programme was known as programme C (Cutting across the Curriculum).

Vuselela was the only school in the Western Cape that participated in programme C and he felt that OBE is similar to programme C. Since this programme was not part of the study, I did not investigate further about what it entailed. The little explanation I got about this programme is based on the informal conversation I had with Miss Nabe, a deputy principal for the foundation phase during one of my follow up visits to the school. She stated that the Cutting across the Curriculum Programme was based on the themes that were developed and these themes were used to teach different sections in different subjects. There is nothing more that was done beyond this, as the researcher was content with the fact that this response gave an indication that these teachers are pro transformation in their school.

Mr Ntlabathi stated the problems that would make OBE not to take off as follows:

- Lack of resources
- Physical space for learners in the school due to big numbers and shortage of classrooms.
- Publishers have not yet published books showing the practicality of OBE and that there is no syllabus.

The first two factors above stated as the inhibition to OBE implementation at Vuselela are congruent to the personal observations that the researcher made during the time the research was conducted.

Mr Ntlabathi stated that OBE needs the environment that is keen to participate in education. He pointed out the fact that parents with pupils at Vuselela do not participate in their children's education and that they have attendance problem (attributed to both learners and teachers). He

also reported on the high incidences of pupils losing their books and the problem of child abuse in the area where the school is. The facts made by Mr Ntlabathi could have ramifications on the success of OBE implementation at Vuselela, as OBE requires both learners and educators to participate fully in developing the learning programmes in their curriculum and implementing them. OBE needs constant monitoring of the development of skills and conceptual understanding and the lack of monitoring of outcomes could result in the teachers sliding back to traditional behaviourist approaches. Consequently, Curriculum 2005 would collapse and the time and effort spent on the transformation of curriculum would have been wasted.

5.2 Teachers

5.2.1 **Interviews**

- **Background Information**

On the question of teachers' qualifications, Miss Ntloko holds a senior primary teacher's diploma, having upgraded her primary teachers' certificate, which she obtained in 1979. She has 26 years teaching experience. She has taught primary physical science and mathematics for more than ten years and she stated that these subjects are the most enjoyable and challenging ones in her experience as an educator. On the question of whether she received any prior training to teach science, she stated that, when she went to the college of education to upgrade her teacher's certificate, she did biology as one of her major courses for the diploma. This was due to the fact that she had a good grade for it in her senior certificate. She also stated the fact that she obtained her senior certificate by correspondence.

Mr Ndaba received his senior certificate in 1989 and then went to do his higher education diploma at Cape Town College of Education. He has been teaching for four years now and he did mathematics and Biology as his major courses for the diploma. He stated that he has been teaching science for a year now in grade seven.

Mr Mandla obtained a B. A. degree from the university of the Western Cape in 1994 and did H.D.E. (post grad.) in 1995. He majored in History and Psychology and he did guidance and history methods in his H.D.E. Mr Mandla has been teaching for three years and he only taught science for one year in grade four.

Mr Mbewu has obtained HDE from Bellville College of Education, majoring in Art and Geography. He has been teaching for four years and has taught science in grade 6 and grade 7 for three years.

- **Empowerment**

Asking them whether they have attended in-service training for science education, they revealed the fact that they have been attending a lot of these courses for some time and they have gained a lot of experience in this regard. Mr Ndaba stated that he has attended three workshops on curriculum 2005 at Uluntu centre and at the old Good Hope college, Mr Mbewu stated that he has attended two of these courses at Mowbray. Miss Ntloko has attended such courses at these venues whilst Mr Mandla stated the fact that he has only attended courses on curriculum 2005 organised by SADTU. They all felt that in-service training has been a programme where they got more ideas on how to approach certain topics in both physical science and biology, that could

have been difficult for them to handle. It was observed that these teachers were more enthusiastic about science education from the statements they made on improving their knowledge on science education.

- **Teaching strategies**

Regarding approaches they are keen to apply in their science teaching, they stated the fact that they interact with one another in order to help one another with problems they encounter in their science teaching. They said that they don't have laboratories but have some science teaching equipment that they share and whenever they need something that they do not have at school, they are not scared to borrow from other schools. Mr Ndaba registered the point that their deputy principals, Mr Ntlabathi and Miss Nabe have been more supportive and whenever they need something they don't have which they can buy they always buy it and submit the receipt to the deputy principals who then organise their refund. This statement supports the fact that the management is supportive to teachers' professional development and this shows a positive influence on the encouragement the teachers need in order to work in a better environment.

They all felt that they don't believe in teaching science by transmission of knowledge only, which they referred to as the textbook knowledge. They stated the fact that they use their syllabi to guide them on what topics they must teach and use some suggestions on whether they should use exploratory strategies or expository teaching strategies in their practice. They also pointed out the fact that they are encouraged a lot by experts on science education that they meet in courses they attended on involving a hands-on approach in their teaching. They stated the fact that the

ridiculously high number of pupils in their classes (50+ pupils in each grade 7 class and 100+ in grade 4 classes) is the most restricting experience in hands-on approach. They stated that when they don't have enough resources they rely more on demonstration as a way of approaching practical work. Hands-on approach is not synonymous to constructivism. The facts stated in this paragraph display the fact that these educators could have a serious misunderstanding of approaches that inform OBE curriculum. Etchberger and Shaw (1992) demonstrate a similar situation of a teacher who is struggling to come into grips with the constructivist approach and she later discovers that she has been operating in traditional behaviourist principles using the hands-on approach, thinking and hoping to be a constructivist practitioner. This case shows an ideological side step that the teachers could embark on.

Huge numbers of learners in their classes could be a limiting factor on the adoption of hands-on activities during science learning but it was encouraging realising that the educators were still striving to involve learners in such activities rather than opting not to do practical work at all.

They noted the fact that they always work under pressure because of the department's expectation of how much they are supposed to deliver in each level. They rely on the syllabus for teaching and they use textbooks for approaching topics in a syllabus. Relying on a syllabus gives an indication that the strategies used are informed by a behaviourist view to learning. The syllabus has been used mainly to give a lot of information to learners and they are expected to regurgitate them back to teachers when they are assessed on the content that was given to them by teachers.

As to how they cope with teaching science in the squatter camp area, they felt that the area in which they teach is just like an area for black people in South Africa that struggles for survival.

They felt that there are few cases where their pupils would neglect their work but they felt that there is nothing peculiar about the place, in terms of the culture of learning. They all stated that the culture of learning has not been there in the 1990s especially despite the pleas of the government for betterment of the culture of learning.

Despite the scraping off of corporal punishment by the government they still exercise, some disciplinary measures on their pupils and they have been working very well with the parents through the parents association, that is a component of school governance. They stated the fact that they have an extreme shortage of textbook and as a result they have to give some notes to their pupils at times. Three of these teachers are in favour of giving notes except for Mr Ndaba. Mr Ndaba stated that he does give notes to pupils but he is aware of the fact that giving notes to pupils retards their learning process, as they don't concentrate with the hope that they will get notes. The statement made by this teacher show a simplistic view that he has on the impact of giving notes to learners. Giving notes to learners is an act of providing a learner with information for rote learning. In other words, this notion promotes regurgitation of facts and this is evident from the assessment strategies that these educators use as explained in the assessment section below. This shows a view that they all have towards learning, which is behaviourist view to learning.

On whether they exercise group work approach in their science learning, they stated that huge numbers (approximately 50 learners in their grade 7 classes for an example) in their classrooms and the limited apparatus drives them to group their pupils into manageable groups where they give each group apparatus and worksheets on certain experiments that they have to do. They

stated that in this way they are able to concentrate on the individuals in each group and that these pupils sometimes scaffold one another in the process as they embark on dialogues and disagreements on certain tasks and their roles as teachers is to guide them during this process. Group work in the case of Vuselela primary school, is used as a remedy to the crisis they have caused by big numbers of pupils and shortage of apparatus (resources). It is interesting to note that even in the light of big numbers they are able to devise means of being creative in persevering in such condition and go out of their comfort zones in still being creative to incorporate practical work in their programmes.

Mr Mandla stated the fact that it has been difficult for him to use a group work approach on his pupils are in grade 4 and that it is their first time to do science at school. Due to the time spent by the researcher at the school, it was not possible to probe deeper on this aspect as it was expected the number of pupils in the class could be the source of difficulty in incorporating group work as one of his teaching approaches.

- **Views about OBE**

On asking them about their views about OBE, Miss Ntloko stated the fact she has been practising OBE for some time, and the only difference between her approach and the new curriculum is the change of terminology. She felt that specific outcomes echo the same principles as objectives. Mr Ndaba, Mr Mbewu and Mr Mandla felt that OBE could improve the way science is taught at their school. They echoed their familiarity with the concepts like child-centredness, application of learned knowledge to real life situation, continuous assessment, giving the learner an opportunity

for maximum participation in their learning, teacher acting as a facilitator in a learning situation as explaining their understanding about OBE.

Probing these teachers about their knowledge of the fact that learners do have the way they interact with scientific world and these could have an effect on their learning, Miss Ntloko felt that their duty is to show them the 'truth' about science. This also made me realise that, in a way they still have to deconstruct their views about learning and reconstruct them with the new ideas that are in line with the Outcomes Based Education curriculum. This has given me an indication that these teachers tend to embark on an ideological side step. They tend to indicate that they practice OBE whilst in reality they practice the behaviourist approach in a mild way.

- **Assessment**

On assessment I got the opportunity of going through the test books, question papers and the records that these teachers have on assessment and evaluation of learners progress. I noticed that they all have been giving classworks, homeworks and tests to their learners. From the interviews they stated that they are aware of other assessment strategies but due to the number of their learners it is difficult for them to explore other methods like projects. They also stated the fact that they do not have libraries in their schools and area and this make it impossible for them to test the learners' ability of writing up project reports. On asking them on whether they have given a thought about giving them projects on the available material like recycling they stated that they have not tried that aspect but will welcome the ideas in that regard. This statement gives an indication that these educators are keen to embrace in their practice other approaches of teaching

and assessment that would transform their practice to meet the OBE needs. Tests and examinations are the major assessment tools used in this school. They write tests quite often and they felt that this approach is the one that is required by the department of education, as this is a continuous assessment. They explained that their understanding of continuous assessment is to test the learners continuously to ensure that you don't get surprises of high failure rate when they have to assess them at the end of the grade. They stated that these marks form some percentage (33.3 %) of the final mark of a learner when learners are assessed at the end of the year. This view reflects that these educators adopt summative assessment strategy. Summative assessment is not in line with the learner's holistic development in learning.

The view of a continuous assessment that they have indicates a naive understanding of continuous assessment. Again the view of continuous assessment they have indicates an ideological side step, as their assessment practice is not continuous assessment but a series of tests that are informed by a behaviourist view to learning. These teachers keep on moving back and forth in the process of change and therefore need a lot of support and guidance on the implementation of approaches that are in line with the OBE system. The educators need to reflect on why summative assessment does not promote learner centredness and how formative assessment could be incorporated in their learning programmes and the relationship between formative assessment and continuous assessment. This would probably shed a light on why continuous assessment is an assessment strategy that fits in with the needs of OBE.

5.2.2 **Observations**

I got the opportunity of observing some science lessons that were offered during the time of my visits at Vuselela primary school.

1. Lesson topic: The structure of the Breadmould.

Teacher: Miss Ntloko

Grade: 7

Number of learners: 57

Teaching strategies Used: Group practical work, Demonstration.

Even though the grade seven classes were big in numbers, these pupils were given an opportunity of germinating this fungus on their own and the teacher acted a part of advising them and helping them understand the conditions under which this fungus would germinate. Upon germination, they were given some magnifying glasses to view the structures of this fungus, which made them to be excited. I noticed the fact that there were several magnifying glasses for each group of pupils, as pupils were grouped into smaller groups that would fit into the number of magnifying glasses available.

There was interaction in each group and the teacher was facilitating the whole process of discussion in the class. There after, they were supplied with the drawing of the breadmould in a chart and they were asked to identify structures from their specimens and were then given flash cards to paste labels next to their structures in the diagram. They were then given an opportunity

of making drawings of this fungus from the chart. They were later lectured on the functions of the different parts in the structure of the breadmould. The learners were enthusiastic as they asked questions throughout the lesson.

This lesson demonstrate the fact that the educator slightly tries to bring hands-on activities in the lesson but keeps on going back to the traditional approach. The lesson displays the evolution of behaviourist tendencies as the lesson goes on whilst it started with the learners being involved. Their participation in the germination of the fungus could provide them with a learning experience, but as the teacher gets herself side tracked into a telling method, learners' involvement becomes minimal. Again, hands-on activities do guarantee the incorporation of constructivist approach to learning but in this case, indicate the opportunities of involving learners in a lesson that is taught.

2. Lesson topic: the types of seeds.

Teacher: Mr Mbewu

Grade: 6

Number of learners: 94

The class was full and there was a limited space for teacher to move between the chalkboard and the desks. Learners were sharing desks and I observed the fact that there were four learners in each desk, which are designed for two learners each.

This lesson looked a bit different from the story I got from the interviews, as it was dominantly

theoretical. The teacher came into the class with some notes on the types of seeds and the chart with the types of fruits and seeds drawn and some pictures pasted on the chart. Introducing the lesson, he asked them to identify different kinds of fruits from the chart and asked them to match the seeds in the chart with fruits in the chart. He then explained the content of the lesson about types of seeds and asked them to give explanation on how a seed from apples differ from the peach seeds. Towards the end of a lesson pupils were asked to draw different seeds and classify them based on the information he has given them. At the end of the lesson pupils were grouped and were asked to collect different kinds of seeds for the project that will be done by the class.

The lesson reflects a traditional behaviourist approach from the beginning. Evidence of this is the lecture method the teacher uses and notes given to learners. For assessment of learning, the classification of seeds based on the information gained from the lesson reflects a behaviourist approach to learning. This approach requires rote learning and in turn results in the regurgitation of information back to the teacher. The purpose of the project was not explained to learners and assessment of a project was not indicated with learners. Immediately, what comes into mind is the teacher centred approach. Imposing ideas to learners is an indication of a traditional behaviourist approach.

The high numbers of learners in the class indicates how much these educators persevere into functioning in the almost impossible situation. This could be the reason why teachers resort into employing traditional behaviourist approaches.

3. Lesson topic: Energy

Teacher: Mr Ndaba

Grade: 7

No. of learners: 61

The classroom was crowded with limited space of movement for the teacher. Mr Ndaba defined energy to the class as the ability to do work and gave examples to the class (eating, running, switching the lights on) and asked them to give other examples. He lectured to them giving examples of energy and he asked the pupils to give examples of each type of energy given (e.g. Heat energy- they gave bulb, stove, heater, fire, etc.). He then tackled the next topic on transference of energy by using a bulb demonstrate the transference of energy. He asked the pupils to give more examples on the transference of energy. Another example was that petrol causes a car to move and this pupil stated that since the teacher said that energy is the ability to do work, the energy in petrol is transferred into the car and causes the car to move. The researcher interrupted to scaffold them on the concepts of potential energy and kinetic energy. Pupils were asked at the end of the lesson to find pictures on five different uses of energy and paste them in their science notebooks.

Giving examples to the learners indicate a teacher-tell method. Defining energy to the class again indicates a teacher-centred approach to learning. On assessing the learners at the end of a lesson, the assessment criteria are not negotiated by the teacher with the learners. OBE requires assessment to be negotiated with the learners so that they can be able to understand what is expected of them.

Lesson topic: Force

Teacher: Mr L. Ndaba

Grade: 7

No. of learners: 58

Classroom arrangement: The class was full with desks shared by two learners in each end of the table. The teacher was mostly positioned at the front and the movement towards the class was restricted. There was a little space between chalkboard, the table and desks.

Strategies used:

Questions on good and bad conductors of heat were asked to introduce the lesson. The approach used was more practical as he used a tennis racquet and ball as well as items like table, desks and chairs to demonstrate the concepts “push or pull”. He brought in the topic the concepts, energy and work which were defined by learners. He explained work, linking it with energy. Mr Ndaba explained that force is used for pulling, lifting and pushing objects. There is a stage in a lesson when he used ‘exerting pressure’ as in explaining force. At this stage, one of the learners asked a question of whether exert is similar to push or pull or force. The explanation given by the teacher was that they are not similar but related in terms of their application. He then explained that when pulling or pushing an object, pressure is exerted on an object, in other words he referred pressure as an example of force. He asked pupils to demonstrate concepts like push/ pull. He also referred to a pulling action as an attraction and a pulling action as repulsion. He did not use objects like bar magnets in explaining these concepts even though when I asked him if they have magnets he brought six boxes that I used to scaffold him and his learners in finding out for themselves what attractive and repulsive forces are. He then explained force as being applicable in real life situation in that it can cause objects to move or it can stop moving objects. He asked his pupils to give

examples of these actions. He used his racquet and ball to demonstrate these actions. An interesting question was asked by a pupil on whether to move a car a force is applied. A teacher could not answer the question but asked me to help in explaining how a force can cause a car to move without being pushed. Knowledge of Newton's first and second law of motion and friction on wheels, that the researcher simplified for the learners made him able to attempt to answer the question but then he asked them to find out more about what was discussed.

To wrap the lesson up, Mr Ndaba asked the learners to find out more about the application of force in a real life situation. He brought two Force-meters that he did not use but he stated that they were going to be used to demonstrate the concept of balanced and unbalanced forces. At the end of the lesson as we were discussing he registered the fact that he thought that the researcher was going to talk about petrol and engine in explaining the challenging question that was asked by the learner since they did energy before.

Introduction used was not linked to the topic of a lesson as Good and Bad conductors of heat were not related at any stage of a lesson to Force. Demonstration as a strategy of practical work limits learners to observation and the teacher tends to spend much of the time dominating the lesson (Teacher-centred approach). Concepts like pull, lift and push were used as being synonymous to exerting pressure. Using these concepts interchangeably created some confusion of learners at some stage that almost put Mr Ndaba on a tight corner. As stated in the report, Mr Ndaba could have given learners the opportunity to find out on their own the meaning of these concepts. Alternatively, he could have asked them to explain with examples what they understand about the concepts.

Similarly, attraction and repulsion are used synonymously with pull and push. In the same way, more practical means of explaining the concepts could have resulted in more understanding of concepts. The teacher could have supplied the learners with bar magnets and let them find out on their own about the attractive and repulsive forces.

Generally, it appears that the lesson is crowded with a lot of new concepts being introduced at the same time. He tries to involve the learners to some extent but since the lesson is crowded with a lot of new information, he ends up resorting to the behaviourist approach to learning putting the emphasis on rote learning.

4. Topic: Kinds or Families of animals

Teacher: Mr Mandla

No of learners: 93

Grade: 4

The classroom was extremely crowded with two teachers sharing the class, Mr Mandla and Miss Qoko. Mr Mandla asked the pupils to give examples of animals. He then grouped the animals as mammals, reptile, birds and fish. He lectured on characteristics of different groups and he was asking questions as he was explaining these. He gave them pictures of animals asking them to pin them next to the group names where they belong and asked them to give names of the animals in the pictures. The participation of learners in the lesson was good and they seemed to enjoy what they were doing. Each table with a group of learners was given pictures of animals and was asked to identify the animals, classify them into their respective groups and classify them as being wild

or domestic and labelling structures where there was an indication.

I looked at their class work books, test books, question papers from tests, note books, text books and I noticed that at least two class works/home works are written weekly, they are taught skills like drawing and labelling. Tests were given in English and low order questions were given (which was still proper for the level they are in). Types of questions given to them were true or false items, fill-in items, multiple-choice questions, matching of columns, one word answer questions and labelling of diagrams.

Generally, the lesson seemed to have been rehearsed before the observation was done. The evidence of this is learners' regurgitation of characteristics of animals that they did not understand. Obviously, grade four learners would not find it easy to give a characteristic of a reptile as being cold-blooded. It is clear that a chalk and talk method was used and it is apparent that the learners have memorised the concepts rather than making meaning from them.

5. Lesson: Uses of wind

Teacher: Mr Mandla

Grade: 4

No. of learners: 95

The classroom was extremely crowded. Pictures of Kites, Windmill, Sailing ship were given to pupils and were asked to explain the action of the objects in the pictures. They explained that they fly kites when there is wind when they are playing and that ships in the picture sail because of

wind action and that the windmill rotates when it is windy to pump water.

At this stage, the teacher explained the fact that wind causes the weathering of rocks and the significance of weathering to the soil. He also explained how the wind causes plants to grow by explaining the process of seed dispersal by wind and pollination by wind with the use of charts with diagrams explaining the processes.

Towards the end of the lesson the pupils started to construct kites with the material given to them by Mr Mandla.

Hands-on activities are used in this lesson. The wind action was introduced well. Mr Mandla could have continued in the same way in establishing the learner's conceptual schemes but tends to be side tracked into a lecture method. Learners could have been involved in the process of unpacking the meaning of different concepts.

The task given to learners at the end of the lesson was not explained to be assessable or it was just a hands-on activity. The purpose of constructing and flying of kites could have been discussed unless the discussion was scheduled for another time, perhaps after the completion of the activity.

6. DISCUSSION.

- **Background information**

Based on the information obtained from the interviews, all the interviewees are qualified professionally and some have an adequate science background. It has been evident that they need to develop themselves within the profession as some of the concepts seem to be a bit above their heads (see data analysis, lesson 3 on force). If these teachers can be empowered by attending more courses like the Primary Science Programme (PSP), they would be more confident to deal with any section in primary science education.

- **Views about OBE**

The data provided reveals that more workshops still have to be organised for teachers to come into grips with the actual understanding of how to base their practice to be in line with Curriculum 2005 specifications. OBE is not only about understanding the concepts in it but to understand how to operate within the curriculum. The key to understanding OBE could be the incorporation of the learning theory that underpins the curriculum in their practice and these educators need adopt social constructivism in their teaching/learning activities and to adapt the social constructivism in their practice. It has been clear from the interviews and observations that the teachers at Vuselela primary school are keen to practice OBE as they registered the fact that they are in favour of strategies embodied in the curriculum. They have stated clearly that they are willing to undergo empowerment so that they can be effective in their practice.

They need to deconstruct the views they have about learning and reconstruct new views that are in line with the learner centred approach to teaching/learning. It has been evident that they still need to be made aware of the differences that are between the traditionalist behaviourist curriculum and Curriculum 2005 as they tend to confuse the two (ideological side step).

- **Teaching Strategies**

Teaching strategies used by these teachers, even though the conditions at their school are bad (e.g. Over-crowded classrooms, few textbooks for learners), reflect that they are trying to get into grips with learner-centred approach. Despite their limited background of natural sciences they are eager to get acquainted with science content and are willing to practice various strategies for science teaching. Hands-on activities seem to be confused with learner-centredness. Hands-on activities could still be used in the system informed by a behaviourist view to learning. These activities on the other end give learners a chance of developing skills to manipulate and work with scientific materials if properly used. This could result in a situation where learners could build up their understanding of how scientific knowledge was developed and this would probably result in learners developing a better conceptual understanding.

It appears that these teachers are limited into using demonstration as part of their practical work strategy due to the lack of space and big numbers of their learners. Demonstration limits learners into observing an experiment that has been done by the teacher and consequently restricts the learning process. This approach is quite popular at Vuselela. They registered the lack resources as a contribution to the exclusive use of this approach in the midst of many other approaches that

could be used. If a demonstration is well planned and learners are involved from the planning to the execution of the experiment, more skills are expected to emerge, like the development of problem-solving skills, investigative skills and reporting skills, especially if the learners are made part of the planning process.

When more facts about improvisation were discussed and involvement of learners in projects like recycling of materials like bottles, cans, plastic bags, papers, etc., the issue of the syllabus restricting them was raised as a hindrance. As the researcher explained that such projects have positive benefits in skill development, in enhancing change in attitudes and values and conceptual development they showed some eagerness to implement these in their teaching. The practice informed by a syllabus indicates that the teachers still need to be empowered epistemologically as a syllabus does not feature in Curriculum 2005 but has been used in the traditional behaviourist curriculum. A syllabus in the case of the South African education system has been used to enforce rote learning as it was crowded and this was driven by the adoption of a behaviourist view to learning.

The pupils appear to be eager to learn as well and this is evident from the way they interact with each other during arguments in the classes as well as when teachers avail opportunities for them to discuss in their classes. The fact that there is no laboratory in this school does not hinder them from learning science, practising science and applying science as they learn. I have observed a very good rapport between these teachers and learners in all lessons that were observed. The managers of the school seemed to be supportive to teachers and seem to be encouraging teachers to attend courses and workshops to improve their strategies and seem to be willing to incorporate new

trends in education to their school. This notion is in line with the statement made by teachers when interviewed in stating that the deputy principals make materials available to support the teachers when the need arises.

- **Resources**

Saunders (1992) states that teachers need to use the manipulative activities as these show to be more effective in producing more achievement of learning as opposed to observation and reading about phenomena. The major restricting factor to this approach is the lack of facilities in the schools for science education. The government has a major task at hand of providing enough resources for better quality science education to address the problem of imbalances in the education based on the racial segregation. Ogunniyi (1996) registers the fact that the government has to act instead of talking about the change. For teachers to be motivated to exercise better approaches that are in line with science education, they need to have enough resources that will enable them to use better teaching strategies for science education.

- **Assessment**

Assessment strategies need to reflect the demonstration of the attainment of specific outcome instead of ensuring that learners are capable of memorising and regurgitating information given to them by teachers. It has been evident from my observations as well as interviews that the strategies that are used by these science teachers are based on the assessment of factual recall as opposed to the demonstration of the attainment of outcomes. From the interviews teachers stated

the fact that they give tests and examinations for assessment. Tests and examinations are but a few assessment strategies and projects, practical work, scientific writing and reporting could be some of the strategies that would make these teachers to be in line with the principles of curriculum 2005.

The assessment strategies employed by teachers in the classroom need to be directly linked to and reflect growth of a learner in relation to skill development. The other aim of assessment is to give feedback to the learners and their parents. This will give a realistic picture of where the learners stand in relation to the outcome expected. Establishing where a learner stands in relation to a skill assessed or concepts developed would give the educators an indication of how they can adapt their strategies to suit individual learners' learning demands.

It has been clear from this study that teachers are still unaware of how they can plan their strategies to incorporate the assessment of skill developed by learners. Educators still need to be equipped on how they can incorporate strategies that would develop various skills in the learners on the learning programs and be able to assess the acquisition of skills. Continuous assessment is still confused with one assessment strategy, which is a summative assessment. A series of tests and homework still assess how much a learner can remember (regurgitation of facts).

7. CRITICAL REFLECTION ON THE RESEARCH PROCESS

Knowledge on philosophical debates, educational theories, issues on curriculum development and some aspects on research principle helped the researcher to reflect on issues raised by the respondents in this research.

A qualitative approach was chosen in this research due to the difficulty of quantifying human behaviour. This approach is in agreement with the interpretive paradigm whose purpose is to interpret humans actions and develop an understanding as to why things happen the way they do.

The open-ended questions which were used in constructing interview schedules provided some flexibility for restructuring questions during the time the interviews were conducted. Categories of questions included; Background information, teachers' view about OBE, teaching strategies and assessment strategies. Background information and facilities could have been omitted because they did not fit into investigating the research goals stated in the study.

Conducting interviews meant that the conversation between the researcher had to be recorded. The use of a tape recorder could have resulted in more data captured through the analysis of tone of the respondent when responding to questions asked by the researcher and relating the tone to gestures used when the interviewees respond. On the other hand, the tape recorder could have made the respondents to keep information to them that could prove important to the research due to the fear the respondents could have of being tricked into saying things that could lend them into trouble. Weighing the two possibilities, the researcher resorted into going on without the tape

recorder for the sake of building trust between the researcher and the interviewees. This made the process awkward and the researcher ended up listening and reporting later. The problem with this approach, even if it made the atmosphere of dialogue desirable, was that some information was misunderstood and sometimes forgotten.

Classroom observations have their problems. Pupils had to be prepared to ignore the stranger in their midst. This was impossible as they got distracted from time to time by their curiosity. This is understandable because these pupils needed some time to adjust and get used to me and unfortunately there was no time for the researcher to keep going to the school where research was conducted. The approaches used could be deceiving in that appointments had to be made in good time before just popping in the school. This could have resulted into lessons being rehearsed before they are observed and this would give a distorted picture of the reality in the school. The researcher had to fit in on the visiting times given by teachers as the school had its own activities. This resulted in some delays experienced during the time the research was conducted. More lessons could have given a better picture that is closer to reality. A researcher in this case could have established more trust between himself and the teachers and the researcher could be accepted as part of the system and not regarded as a stranger.

The sample size was representative. Out of six science teachers, four volunteered to participate in the research. These teachers were patient and were keen to have the researcher participating in their programmes.

8. CONCLUSION AND RECOMMENDATIONS

From this small case study, it appears that teachers still need more empowerment on Curriculum 2005. Empowerment on epistemological basis of Curriculum 2005 could enable them to take part in the transformation of curriculum. Educators need to be made aware of what OBE is and be guided through the implementation process. They therefore, need to be encouraged to experiment with new ways of teaching and be encouraged to reflect on their experiences as they go on with the process of changing their practice. Through experimentation, educators will reappraise their view of learning and the goals for primary science education.

Educators need support in deconstructing and constructing the way they view learning to be in line with the specifications of Curriculum 2005. The government need to improve conditions in the schools and this will create incentives for educators to work and exert more of their energy into adopting various strategies for better learning. It can be argued that big numbers in classes retard the practice of educators and limit them to using approaches that could limit the better application of Curriculum 2005 approaches.

Assessment of skills is still lacking in these educators' practice. Educators need to be empowered on how to incorporate acquisition of skill development in the learning programs and how to assess these. It appears that rote learning is still dominant because of the teaching approaches used by the educators at Vuselela. Tests and examinations are still used and this reflects the summative assessment strategy that is norm referenced.

Continuous assessment needs to be adopted as it reflects where the learners stand in relation to conceptual development and skills developed during the learning process. It is recommended that more inservice training be organised for educators so that they can be equipped on how they can practice formative assessment and continuous assessment that will enable them to monitor learners' holistic development in learning.

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MASTERS IN SCIENCE EDUCATION
RHODES UNIVERSITY

SEMI - STRUCTURED INTERVIEWS CONCERNING

ASSESSMENT OF THE PERCEPTIONS OF SQUATTER CAMPS SCHOOL TEACHERS IN KHAYELITSHA TOWARDS THE OUTCOMES BASED EDUCATION AND THE IMPLICATIONS THESE PERCEPTIONS COULD HAVE ON THE IMPLEMENTATION OF OBE IN THESE SQUATTER CAMPS SCHOOLS.

Dear teacher

These days, we are in the midst of a paradigm shift in the history of education in South Africa, from an apartheid traditional approach which is teacher - centred to an Outcomes Based Education which is learner - centred.

The goal of this research is to identify your perceptions about this new curriculum which is being implemented with the hope of providing you with some tools that will facilitate your further understanding of Outcomes Based Education and also if needs be, to be an eye-opener to you on how you can improve your teaching strategies to be in line with OBE.

I would like to ask you to participate in this research by taking part in the interviews as well as workshops which I hope will try to address some questions you might have.

I wish to appeal to you to be as open as possible.

Your sincerely

Kwanele Booi

Tel: 021 – 4023357(w)
083 3343714 (Cell)

QUESTIONNAIRE FOR INTERVIEWS

BACKGROUND INFORMATION:

1. GENDER

MALE	**1**
FEMALE	**2**

2(a). Highest academic qualifications obtained?

2(b). When ?

2(c). Where?

3. State your major courses.

4. Do you have any professional qualification(s), and state them?

5. For how long have you been teaching?

6. If you've been teaching science, for how long have you been teaching this subject?

B. OPINIONS:

1. What problems have you encountered when teaching science?

2. What role would you give a textbook in teaching science?

3. Do you have enough textbooks for your learners?

4. How do you manage to arouse and maintain interest in science for your students?

5. What is the role of practical work in your science teaching?

6. How often do you incorporate practical work in your teaching, and why?

7. If practical work is done, what type of practical work do you feel is suitable for your school, and why ? (demonstrations, group practical work, individual practical work)

8 (a). Do you feel that pupils should be given a chance of doing some practical work on their own, and motivate.

8 (b). Do you give your students a chance to work on their own during practical work? (How do your manage your class?)

9 (a). Do you incorporate group work in your teaching?

9 (b). If yes, how do you go about planning these activities?

10. How do you manage to give your learners individual attention?

11. Do you view projects as important in science teaching?

11 (a.1) If yes, do you ever give projects to your learners?

11 (a.2) What sort of projects do you give them?

11 (b). If not, why do you think they are not important?

12 (a). What other sources do you have to consult before teaching science to your learners?

12 (b). Do you find them useful to you?

13. What is your view concerning giving notes to your learners?

14 (a). Which areas do you find difficult in teaching science, and why?

14 (b). Which areas do you find easy to work with in teaching science, and why?

16. What is your understanding of continuous assessment?

17 How often do you consult a syllabus for science teaching?

18. Do you think the background of the learner contribute in their conceptual understanding of science (since they come from squatter camps, are they able to link science with their daily lives ?

19 (a). Have you ever been to any OBE workshop: where, when and how many times?

(b). What do you understand about OBE?

20. Do you feel OBE can improve the way science is taught at your school?
(ie. do you feel that it can improve your teaching strategies?)

21. If you were to undergo in-service training to give you an understanding on how to incorporate OBE in your teaching, would you be willing to take that course?

22. Is there any general comment you wish to add on this conversation?

MASTERS IN SCIENCE EDUCATION
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I wish to appeal to you to be as open as possible and participate as much as you can in the workshops.

Your sincerely

Kwanele Booi

Tel: 021 - 4023357 (W)
083 3343714 (Cell)

INTERVIEW SCHEDULE TO MANAGEMENT

1. How often do you stimulate the effectiveness of the teachers?

2. What strategies would you like your science teachers to use when teaching science?

3. Is it easy for you to find qualified science teachers to teach science?

4. What would you like your teachers do to improve the standard of science teaching?

5 (a). From your judgement, are the learners given an opportunity of working out science programmes / solve science problems confidently, creatively and independently?

5 (b). How is this made possible?

6. Do you feel that your teachers need to be equipped more on understanding the current trends and methods of teaching science to make it more interesting to your learners? Motivate.

7. Are you keen that OBE should be implemented in your school?

8. What problems do you find or anticipate that would make OBE not take off the ground?

9. Is there any general comment you would like to mention in this interview?

THANK YOU SO MUCH FOR YOUR TIME AND SUPPORT

OBSERVATION SCHEDULE

LESSON:

TOPIC:

CLASSROOM ARRANGEMENT:

NO. OF LEARNERS:

GRADE:

TEACHING STRATEGIES USED:

GROUPWORK:
#HOW IS IT ORGANISED?

LEARNERS INVOLVEMENT:

TEACHER'S INVOLVEMENT:

PRACTICAL WORK:

STRATEGY USED AND WHY?

ASSESSMENT STRATEGIES APPLIED:

OBSERVATION OF TESTS AND EXERCISES GIVEN:

TESTS:

HOW CONTINUOUS ASSESSMENT IS APPLIED:

OBSERVATION OF LEARNERS BOOKS AND TEACHERS ASSESSMENT RECORDS:

COMMENTS:

THE EVIDENCE OF SOCIAL CONSTRUCTIVISM IN THE OUTCOMES BASED EDUCATION

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF EDUCATION (Science Education)

of

RHODES UNIVERSITY

by

KWANELE BOOI

February 2000

TABLE OF CONTENTS

1. INTRODUCTION

The highly competitive and dynamic world that confronts young people has increased the demand for schools to develop competitive citizens, capable of flexible thinking and independent learning, as well as people that are capable of functioning properly in the integrated environment to share their expertise and vision toward the betterment of their environment. To meet these demands schools must have an ongoing commitment to an appropriate and relevant curriculum, with quality teaching and learning informed by good practice in assessment and reporting (Nel, 1995). Learners need to be given appropriate support as they strive to reach their highest possible standards of achievements.

To a large extent, education systems affect life chances of citizens and access to their opportunities in society (Nel, 1995). South Africa is in a 'transition phase', characterized by transformation in every sphere of life, including the sphere of education and training (South Africa, 1995). Embraced in this transformation is the significant paradigm shift in the way people think about learning and the way it is organized in education and training (South Africa, 1997b). A paradigm is a shared set of assumptions, a framework of thought, and a game with a set of rules. It is a basic way of perceiving, thinking and doing associated with a particular vision of reality, a set of rules and regulations that first define boundaries and tell you what to do to be successful within those boundaries (Berger and Luckmann, 1966).

Gaddis and Volmink (1993) in Volmink (1994) point out the fact that the curriculum is constituted by educational experiences that involve learners and teachers that have as

their own focus some chosen themes that take place within an immediate, a societal and a cultural context. The curriculum therefore is the interaction of the following features: - the learners, the teachers, the setting, community, institution, society and culture within which the educational experiences take place, as well as, the chosen themes themselves.

2. DEVELOPMENTS ON THE SOUTH AFRICAN CURRICULUM – THE ROUTE MAP

> The present socio-economic system is responsible for the distorted Bantu Education system. Education for blacks is geared towards serving the needs of the dominant white ruling group. It was never meant to be an educational system that frees the mind that leads towards the growth of communities of men. In as much as the socio-economic system has not been allowed to experience a controlled dynamism – always responding to the needs of the capital. (Thlagale 1983:12 in Ashley 1989: 46)

Buckland (1982) points out among many facts that the situation in South Africa has been that of a segregation of schooling according to race. This has had a tremendous impact on education in South Africa in that there has been unequal status in education (Buckland, 1982; Ashley, 1989). The inception of segregation was when the Bantu Education Act was implemented in 1954 which was designed primarily to head off black aspirations to political and economical participation in the state. The Act involved direct state control of schooling for blacks to discourage political and social aspirations above certain forms of labour (Buckland, 1982). The curriculum has therefore perpetuated race, class, gender and ethnic divisions and has emphasized separation.

In the White Paper on Education and Training (South Africa, 1995) the former Minister of Education, Professor Sibusiso Bengu reiterated the central problem facing education and training in South Africa, namely, that

"South Africa has never had a truly national system of education and training" (1995).

This is due to the previous dispensation which promoted a racially and culturally segregated and differentiated education system based on a philosophy of Christian National Education (CNE) as stipulated in the National Education Policy Act (No. 39 of 1967). The racially exclusive departments, provinces, homelands and self-governing territories have resulted in an excessive fragmentation of the South African education (Buckland, 1982). Such a fragmented management structure has prevented the implementation of a single national policy on any matter (Buckland, 1982; Ashley, 1989; van Harmelen, 1997).

In South Africa, the apartheid regime has used education as weapon to legitimize the capitalistic ideology of unequal status in society where some people necessarily occupied elevated positions and possessed more wealth than others do (Buckland, 1982). In the South African context, education has been designed to socialize children into beliefs and value systems that accept the lower status of working class sector, hence stifling the will to create, criticize and the ability to develop means of self-determination (Buckland, 1982; Nel, 1995; van Harmelen, 1997). This has been the case at least during the apartheid regime and South Africa at present, is in a stage of redressing the past imbalances in education (South Africa, 1997b).

Fundamental pedagogics was the tool that was used by the then apartheid regime to perpetuate its political ends (van Harmelen, 1997). Its purpose was that the learning environment was guided and shaped by the value systems of the community it serves rather than the vision and values the nation shares. A traditional behaviourist approach to

teaching has been adopted in the design of the previous South African education system as the theory underpinning the curriculum.

In the traditional approach, teachers conceive their roles to be concerned with revealing or transmitting the logical structures of their knowledge and directing students through rational inquiry toward 'discovering' the predetermined universal truths expressed in the form of laws, principles, rules, and algorithms (Taylor *et al.* 1993;van Harmelen, 1997). In this approach, the students' role is seen as paying strict attention to teachers' expositions for the purpose of receiving an accurate version of teachers' knowledge (Bodner, 1986; van Harmelen, 1997). The traditional classroom environment is seen to be emphasizing the authority of teacher knowledge, and gives rise to classroom management strategies that enable the teacher to exercise strong control over the content and timing of student learning activities, but not over the quality of student learning outcomes (Taylor *et al.* 1993; Hand and Treagust, 1995; van Harmelen, 1997).

The way the 'teacher and learner' are perceived, is in the sense of how they are identified or personified as well as their relationships towards each other. This determines the way in which interactions are structured between teachers and learners in a learning context. The way teachers and learners are thought about and people's behaviour or actions in a learning context is a result of the dominant philosophy that operates within the teaching/learning situation (van Harmelen, 1997).

Over the last decade there has been increasing research emphasis on the epistemological assumptions underpinning the classroom learning environment (Prawat, 1992). The traditional teacher-centered, didactic approach to teaching has been extensively criticized for its association with student underachievement and rote memorization of algorithms (Prawat, 1989; Taylor *et al*, 1993; Dreckmeyr, 1994; van Harmelen 1997). The epistemological assumptions of this approach have been identified with empiricist-positivist and rationalist views that knowledge is 'discovered' by scientists. (Mathews, 1992; Taylor *et al*, 1993; van Harmelen, 1997).

As the education system in South Africa is adopting an OBE approach to curriculum, the whole curriculum has to change and be shaped by principles underlying the OBE system. According to Kudlas (1994), change is inevitable and necessary as more functional instructional strategies are continually evolving. Changing to a new paradigm would mean changing to a new game which would require setting a new vision and approach for education. This approach would shift the state's regulatory emphasis away from the amount of time spent in school to the specification of rigorous outcomes for student achievement (van Harmelen, 1997).

Change in the education system will require a shift from focusing on teacher input to focusing on learner outcomes (Bodner, 1986; Etchberger and Shaw, 1992; Prawat, 1992; Selby, 1993; Dreckmeyr, 1994; Hand and Treagust, 1995).

The moral or ethical basis of OBE is that of respect for persons and is located in the Bills of Rights and the Constitution:

> Respect for persons' is based on the understanding that all persons have value. (South Africa, 1994)

The teaching/learning situation within the Outcomes Based Education principle is based on the learners' respect for the teacher and the teacher's respect for the pupils as persons (Kudlas, 1994; van Harmelen, 1997). A central issue in this ethical structure is the belief that the learner and the teacher take equal responsibility in the learning process (Taylor *et al,* 1993; Selby, 1993; van Harmelen, 1997).

3. UNDERSTANDING OUTCOMES BASED EDUCATION

Outcomes Based Education is a learner-centered, outcomes-oriented education system based on the belief that all individuals can learn (Kudlas, 1994; Bray, 1998; Kuiper, 1998). OBE is a process that focuses on what is to be learned (outcome). The outcome is a demonstration of learning. The process involves sticking with the student until he/she learns the outcome (Bray, 1998; Malcom and Smith, 1998). The strategy for outcomes-based education system implies the following:

- What learners are to learn is clearly identified
- Each learner's progress is based on demonstrated achievement
- Each learner's needs are accommodated through multiple teaching and learning strategies and assessment tools
- Each learner is provided the time and assistance to realize his/her potential. (Bray, 1998; Malcom and Smith, 1998)

It is basing curriculum design, content and delivery on the assessment of the knowledge, skills, attitudes and values needed by both learners and society (Malcom and Smith, 1998).

Key attributes of Outcomes Based Education system include:

- focussing on purposes and ends: what learners should know and be able to do,
- making expectations and educational goals explicit,
- Shifting primary focus from teaching to learning. (Bray, 1998)

According to Kudlas (1994), OBE can promote educational success for all learners if appropriately implemented and delivered. Each learner's needs are accommodated through multiple teaching and learning strategies and assessment tools (van Harmelen, 1997; Volmink, 1997). Instructional decisions are based on each learner's needs, desires and readiness for achieving outcomes.

Instructional design for each learner is an ongoing process of reflection and analysis that is focused on meeting the learner's needs. Educators facilitate the learning process and coach learners based on the best theory, research and analysis (Macolm and Smith, 1998). Hence assessments are effectively used to practice and substantiate learning and provide data for further learning decisions (Volmink, 1994). Learners become progressively more able to design their own learning options and assessments (Malcolm and Smith, 1998). In this paradigm the teacher is no longer seen as the all-knowing transmitter of facts who will mould the child but as a facilitator, a scaffolder and a co-learner. The teacher's role is to construct an appropriate environment for learning (Bodner, 1986; Dreckmeyr, 1994; van Harmelen, 1997).

The design and developmental strategies of OBE flow from an equally straightforward principle: that all other levels of outcomes in an instructional system/environment – Learning Area Outcomes, specific outcomes – should be derived directly from and align with the critical outcomes (South Africa, 1997b). This suggests that there must be clarity of focus on outcomes (Kudlas, 1994; South Africa, 1997b).

At the beginning of all courses, units and lessons, the educator should clearly describe to learners the outcomes they expect them to demonstrate as a result of the learning experiences (Bray, 1998). At all times, learners should know what the goals of their learning experiences are, what criteria will be used to assess their performance on those goals and where they stand in relation to each of those goals rather than to each other (Gipps, 1994; Volmink, 1994).

In OBE there exists expanded opportunity for the learner as well as instructional opportunities and support. Instead of merely covering the content in a syllabus, educators ensure that learners have mastered content, concepts, or skills before advancing (van Harmelen, 1997). In practice this means 'grading in pencil rather than in ink.' The assessment strategy adopted in Curriculum 2005 is a formative assessment. Formative assessment is conducted as learning progresses and is used to influence or to inform the learning process. This assessment strategy is criterion-referenced. Criterion-referenced assessment provides more information about a learner's competence in a particular area, i.e. where the learner stands in relation to the outcome that he/she is assessed on. This strategy is an opposite of assessment is described by Le Grange and Reddy (1998), as the assessment that takes place at the end of the learning experience for a purpose outside the learning experience. The aim of the assessment in this case is to determine how much of the subject's content the learner remembers or is able to memorize.

Educational theory influences perceptions of teachers and learners and the subsequent relations and interactions that take place in the classroom is where the dominant

philosophy is based on the belief that knowledge is constructed through social interactions (Solomon, 1994; van Harmelen, 1997; Hodson and Hodson, 1998). The theory that underpins the practice of Curriculum 2005, which is the South African version of OBE, is social constructivism.

4. UNDERSTANDING CONSTRUCTIVISM

According to Wheatley (1990), constructivism can mean different things to different people. Constructivist theory facilitates a focus on understanding. It is a model of how learning takes place rather than a theory of how rationality develops (Yager, 1991; Cobern, 1996). Saunders (1992) defines constructivism as that philosophical position which holds that any so-called reality is, in the most immediate and concrete sense, the mental construction of those who believe they have discovered and investigated it. It is based on the fact that learners neutralize perturbations that arise through interactions with learner's world in their functioning schemes (Steffe, 1990 in Wheatley, 1990).

It is further explained by the fact that learners respond to their sensory experiences by building or constructing in their minds, schema or cognitive structures that constitute the meaning and understanding of their world (Piaget in Bodner, 1986). Meaning is created in the mind of the learner and cannot be communicated to the learner by the teacher (Bodner, 1986; Etchberger and Shaw, 1992; Appleton, 1993; Saunders, 1992). This philosophy asserts the fact that knowledge is constructed inter-subjectively, i.e. it is socially negotiated between significant others whom it enables to construct highly congruent meanings and social perspectives (Berger and Luckmann, 1966; van Harmelen, 1997; Hodson and Hodson, 1998).

A learner comes to the learning situation bringing all previous experiences, which are arranged into schema (Piaget in Bodner; 1986). A learning experience begins with some

new encounter which the learner interprets and makes sense of in terms of his or her existing cognitive experience (Bodner, 1986; Etchberger and Shaw; 1992). Tobin (1989) in Etchberger and Shaw (1992) succinctly outlines a process of knowledge construction as follows:

- Sense perception where information comes into the mind of a learner through senses (multi-sensory stage). This is often where most education stops and learners switch into rote learning, memorizing information and regurgitating it when it is required. Their ability to regurgitate it is considered to indicate how much they know, even though in the real instance it does not measure how much they know but how much they can remember for evaluation purposes.
- Reflection which is sense making of the gathered data. The learner relates the new information to what is already known, webbing the known and the unknown.
- Collaboration, consensus and sharing follow which involve group work (one of the strongholds of OBE, which according to Taylor *et al.* (1993) is a strong hold of social constructivism.

In supporting Tobin (1989)'s view, Mathew (1992) refers to constructivism as stressing on learner's engagement in learning. Teachers need to emphasize the importance of understanding learners' current conceptual schemes in order to teach fruitfully and progressively. This notion is stressed by involving dialogues, conversations, and arguments in the learning situation and the justification of student and teacher in a social setting.

Constructivists believe that the data-gathering stage is only the beginning of knowledge construction (Etchberger and Shaw, 1992). Bodner (1986) supports the above process based on Piaget's argument that states that knowledge is constructed as the learner strives to organise his or her experiences in terms of preexisting mental structures or schema.

The classroom context of the learning experience influences which schema of the learner's cognitive structure are used to interpret the experience, both in terms of which sensory input to attend to and which memories are activated in order to construct meaning for the experience (Bodner, 1986; Appleton, 1993; van Harmelen, 1997). The learner will perceive that either existing schema provide an adequate explanation for the experience or there is some inadequacy in that the experience cannot be fully explained (Bodner, 1986; Etchberger and Shaw, 1992; Appleton, 1993).

Bauersfeld (1988) in Wheatley, (1990) states that learning is characterised by the subjective reconstruction of societal means and models through the negotiation of meaning in societal interaction. Etchberger and Shaw (1992), also assert the importance of socialization in the classroom by suggesting collaboration, consensus and sharing as stages in the learning process. Cobern (1996) states as well that in constructivist's thought, it is fundamental that learning involves negotiation and interpretation influenced by prior knowledge. Successful communication requires a threshold of shared prior knowledge (Berger and Luckmann, 1966; Etchberger and Shaw, 1992; Cobern, 1996; Hodson and Hodson, 1998).

The constructivist model of knowledge has important implications for instruction. Social knowledge such as the symbols for the elements can be taught by direct instruction. It can be argued that this is the only way that the children can learn social conventions, but physical and logico-mathematical knowledge cannot be transferred intact from the mind of the teacher to the mind of learner (Bodner, 1986; Etchberger and Shaw, 1992; Appleton, 1993). Hodson and Hodson (1998) point out the fact that there is a need for the development of an appropriate pedagogy or teaching strategy that will enable learners to move from common sense to scientific understanding.

Vytgotsky (1962) in Hodson and Hodson (1998) states that the relationship of a scientific concept to an object is mediated from the beginning by some other concept(s) and the idea of a scientific concept implies a certain position to other concepts. This suggests that the most effective form of learning is likely to be inquiry-oriented, personalized and collaborative and conducted in accordance with the norms and values of the community of scientists under the guidance of a skilled practitioner, the educator (Etchberger and Shaw, 1992; Hodson and Hodson, 1998). The constructivist model therefore requires a major shift in perspective for the individual who stands in front of the classroom. A shift from one who teaches, to someone who tries to facilitate, shifting from teaching by imposition to teaching by negotiation (Bodner, 1986; Dreckmeyr, 1994; van Harmelen, 1997; Hodson and Hodson, 1998).

5. ROLE OF A CONSTRUCTIVIST TEACHER IN A LEARNING SITUATION

> Most recently, research attention has focused on the role of the teacher in promoting and encouraging teaching strategies which allow students opportunities to become more involved, and responsible for their own learning, (Hand and Treagust, 1995).

The adoption of teaching/learning approaches informed by constructivism has been an important framework by which teachers can explore and construct meaningful interpretations of their changing roles within the classroom (Bodner, 1986; Etchberger and Shaw, 1992; Dreckmeyr, 1994). Dreckmeyr (1994) emphasizes a changing role of science teachers, from being dispensers of information to agents of the construction of knowledge. According to Hand and Treagust (1995), the adoption of teaching/learning approaches informed by constructivism has been important in providing a framework by which teachers can explore and construct meaningful interpretations of their changing roles within the classroom.

According to van Harmelen (1997), teachers influenced by a constructivistic epistemology in their practice are expected to reflect an understanding of the philosophy underpinning their practice. In the light of teachers adopting the constructivist approaches to teaching, they ought to be facilitators in a learning process in their learners, be organizers of their teaching/learning environment, implementers of learning activities and suppliers of learning materials (Taylor *et al.* 1993; Dreckmeyr, 1994; van Harmelen, 1997). According to Harlen and Osborne (1985), the teacher's role is a crucial one in

providing the resources and social classroom organization, and the encouragement and opportunities for children to learn.

An important role a teacher has to play in facilitating learning is to give a learner his/her cognitive autonomy (Osborne and Wittrock, 1983; Harlen and Osborne, 1985; Taylor, Fraser and Fisher, 1993). Teaching should provide opportunities for learners to engage in purposeful problem-posing and problem-solving activities and exercise deliberate and responsible control over their cognitive development, including determination of the viability of their newly constructed knowledge. (Bodner, 1986; Etchberger and Shaw, 1992; Taylor *et al*, 1993; van Harmelen, 1997).

Teachers need to understand that knowledge cannot be transferred by means of words without first an agreement about meaning and some experiential base (van Harmelen, 1997; Hodson and Hodson, 1998).

Teaching/learning approaches informed by constructivism can be a means for promoting change in a classroom practice (van Harmelen, 1997). Changing teachers' conceptual lenses can be empowering, but has also a potential of making the educators' lives complicated in that a dramatic change in the focus of teaching or philosophy informing their practice could result in major changes in the teacher's role (van Harmelen, 1997). According to Prawat (1992), teachers who decide to abandon their traditional practice and take the path of constructivist epistemology ought to work harder, concentrate more and embrace larger pedagogical responsibilities.

Prawat (1992) asserts that it is important teachers that honour students' own efforts to gain meaning, even when it reflects less mature understanding. Teachers must strike a balance between their obligation to the discipline and obligation to the learner. According to Driver and Oldham (1986), it has become widely accepted that children develop ideas and beliefs about the natural world long before they are formally taught, and the importance of these conceptions for learning has been recognized by many researchers. These views and ideas are known as alternative frameworks, children's science or alternative conceptions (Driver and Erickson, 1983; Driver and Bell, 1986; Driver and Oldham, 1986; Gil-Perez and Carrascosa, 1990; Hodson and Hodson, 1998). According to Hodson and Hodson (1998), conceptual change is made possible when learners understand the limitations of their current views and recognize the need to replace them.

Teaching as an activity cannot be separated from learning (Bodner, 1986; Etchberger and Shaw, 1992; van Harmelen, 1997). Teaching should rather be seen as a process of social interactions that takes place between learners and teachers in particular contexts (Etchberger and Shaw, 1992; Hodson and Hodson, 1998). Every classroom situation is as unique as the teachers are and as the learners in each classroom. Each classroom situation is determined by the teachers' own thinking or lack thereof about the nature and point of knowledge, the context in which the teaching is taking place and by social values of those particular learners and teachers as it is by the parameters within which the curriculum operates (Taylor *et al*, 1993; van Harmelen, 1997).

Teachers need to help learners use knowledge and skills. They can provide learning experiences where learners:

- make decisions
- solve problems
- teach others
- create problems
- critique/defend
- predict (van Harmelen, 1997; Hodson and Hodson, 1998; Malcom and Smith; 1998)

Teachers cannot base their teaching in autocratic principles (van Harmelen, 1997). This does not mean that teachers have no authority but they are seen to be an authority because of their knowledge about their field and of their particular areas of expertise. It is their expertise that enables them to assume various roles that are required for learning to be effective. We can therefore conclude that without a sound knowledge of education theory and of their areas of learning (specialization), teachers are unable to be anything other than transmitters of prescribed information (Prawat, 1992; van Harmelen, 1997).

6. EVIDENCE OF SOCIAL CONSTRUCTIVISM IN OBE

The rationale for the Natural Sciences Learning Area states that the development of appropriate skills, knowledge and attitudes and an understanding of the principles and processes of natural sciences...

- enable learners to make sense of their world;
- contribute to the development of responsible, sensitive and scientifically literate citizens who can critically debate scientific issues and participate in an informed way in democratic decision-making processes; (South Africa, 1997a)

The investigative character of knowledge acquisition in the Natural Sciences should be mirrored in education. Learners should be active participants in the learning process in order to build a meaningful understanding of concepts, which they can apply in their lives. The learning and teaching approaches should be appropriate to the outcomes and learners. Appropriate types of learning and teaching approaches are used for different types of outcomes (South Africa, 1997a).

Saunders (1992) states that science learning is the acquisition of meaning rather than the mere rote memorization of information. The use of manipulative activities has been shown to be far more effective in producing large gains in achievement than merely having students observe or read about phenomena or events (Saunders 1992).

In laying out a generative model, Osborne and Wittrock (1983) argue that students invent a model or explanation which serves to organize the information obtained from experiments or demonstration, and Hewson and Hewson (1981) in Osborne and Wittrock (1983) have developed teaching materials based upon a model of conceptual change.

Teaching for construction rather than transmission of knowledge suggests that teaching, ought to facilitate negotiation and interpretation based on learner's prior knowledge (Solomon, 1994; van Harmelen, 1997; Hodson and Hodson, 1998). Construction involves interpretation influenced by prior knowledge and this suggests a conceptualization of scientific knowledge. The curriculum 2005 document for Natural Sciences, senior phase (1997), notes that the demonstration of learner's understanding of concepts and principles of should be reflected as happening most meaningfully in those specific contexts which involve learners' activities (South Africa, 1997a).

As a social constructivist view focuses on learning, rather than teaching, attention is paid to learners' conceptual development by eliciting intuitive knowledge and providing challenges and other opportunities to further develop and restructure understanding (Kuiper, 1997). Theoretical knowledge is necessary in learning science but not sufficient. The ability to apply knowledge is essential. It is through the ability to use, extend and apply knowledge that a learner can be said to 'understand' concepts and principles in the natural sciences (South Africa, 1997a).

According to Kuiper (1998) the Outcomes Based Curriculum for the Natural Sciences presents a number of changes compared to the old curriculum viz. the 9 specific outcomes, the integration of disciplines through four themes and the implied approach to science learning. Kuiper (1998) further states that the 9 specific outcomes are grouped into four categories as follows:

1. The application of Natural Sciences knowledge and skills (specific outcomes 1, 3, 4,5);
2. The acquisition of Natural Sciences knowledge, concepts and principles (specific outcome 2);
3. The nature of the Natural Science (specific outcomes 6, 7);
4. The use of the Natural Sciences in society (specific outcomes 8, 9).

The second category of specific outcomes which entails the acquisition of Natural Sciences knowledge, concepts and principles is regarded by Kuiper (1998) as being central to all specific outcomes. Acquisition, integrating and finding meaning in knowledge involve developing learners to:

- create analogies;
- construct outlines;
- develop visual representations;
- build concept maps;
- compare/classify;
- and to abstract (Selby, 1993; van Harmelen, 1997).

These are possible when learning is negotiated and learners are given opportunities to construct their own learning as opposed to the transmission of knowledge, concepts and principles (van Harmelen, 1997).

The social context plays a key role in the constructivist approaches to teaching and learning (Wheatley, 1990; Prawat, 1992; van Harmelen, 1997; Hodson and Hodson, 1998; Kuiper, 1998). Teachers and learners are viewed as active meaning-makers that continually give contextually based meanings to each other's words and actions as they interact. This process is viewed as a process of negotiating meaning rather than imposing fixed procedures (Taylor *et al.* 1993; van Harmelen, 1997; Hodson and Hodson, 1998).

To illustrate how educational theory influences perceptions of teachers and learner and the subsequent relations and interactions taking place in the classroom, is where the dominant philosophy is based on the belief that knowledge is constructed through social interactions (van Harmelen, 1997; Hodson and Hodson, 1998; Kuiper, 1998). Since social interactions occur in all aspects of society and between all members of society, learning is seen as occurring in the classroom and beyond the classroom (Volmink, 1994; van Harmelen, 1997; Hodson and Hodson, 1998). Social interactions take many forms and therefore learning cannot be seen only as occurring through the transmission of information (Bodner, 1986; Etchberger and Shaw; 1992, Dreckmeyr, 1994). Wells (1995: 23) in Hodson and Hodson (1998) expresses a similar view:

> The most effective learning takes place when the learner, faced with a question or a problem arising from an inquiry to which he or she is committed, is helped to master the relevant cultural resources in order to construct a solution. Procedures and knowledge

which are thus initially co-constructed in interaction with others are then internalized and reconstructed to become a unique personal resource that is often used for further creative, problem solving, both alone and in collaboration with others.

7. SUMMARY

This study set out to draw comparisons between the former behaviourist traditional approach to curriculum in South Africa and the present Outcomes Based Education system approach to curriculum that is underpinned by social constructivism. It has attempted to draw the route map to the developments involved in the change of the education system to show where we come from and has pointed out the trends that are evolving in the new curriculum, Curriculum 2005.

Social constructivism, as a theory underpinning Curriculum 2005 has been outlined briefly and the role that teachers will have to take in the new curriculum has been briefly highlighted in this document.

The issue in this document was to trace the evidence of social constructivism in OBE particularly Curriculum 2005 and this has been done through examining the nine specific outcomes in the natural sciences curriculum. Evidence of social constructivism has been teased out from looking at the range statements of the Natural Sciences curriculum. It was found that there is indeed the evidence of social constructivism in Curriculum 2005. This conclusion is based on the outcome of the examination of the 9 specific outcomes of the Natural Sciences curriculum in this report.

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