

How inclusivity, integration and equity are incorporated in the teaching of Life Sciences in
Inclusive schools

by

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DECLARATION

I declare that the thesis, which I hereby submit for the degree Philosophiae Doctor at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at any other institution.

.....

M. J. Gumede

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ABSTRACT

How inclusivity, integration and equity are incorporated in the teaching of Life Sciences in inclusive schools

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This research aimed at exploring how inclusivity, integration and equity are incorporated in the teaching of Life Sciences in the inclusive schools where learners with visual impairment attend.

The issues of integration, i.e. being part of the learner population, full participation and acceptance, is a strategy for fostering integration; the issue of equity, i.e. reasonable accommodation relating to assistive technology, accessibility of learning material and access to learning activities in the classroom, as a strategy for equalization of learning opportunities in the classroom; as well as the issue of inclusivity, i.e. adaptation of learning material curriculum adaptation and curriculum differentiation, a strategy for ensuring learning experience formed the core of the research. This research took place in the Mpumalanga province. In this study teachers were interviewed in order to explore their views on how they incorporate integration, equity and inclusivity when teaching Life Sciences to learners with visual impairment in the inclusive schools. Further, it was to determine what influences these have on their daily work. District officials were also interviewed to explore their views on the support they provide to these schools and to establish how the lessons learnt from this experience could be implemented to the advantage of learners with visual impairment in the inclusive schools elsewhere in South Africa.

Teachers and district officials were interviewed through the use of the Qualitative Inquiry methodology as well as its techniques and strategies for data gathering. Analysis of the transcripts resulted in the development of themes/codes discussed in the research study.

Teachers depict limited exposure to Education White Paper 6 and their understanding of Education White Paper does not translate into useful instrument that equips them to address the enormous challenges posed by the nature of the subject Life Sciences for the blind and visually impaired learners in the inclusive schools. Their endeavour to teach these learners is extensively theoretical and the blind and visually impaired learners are not equipped with basic science processing skills and as such learners who are blind miss out on developing advance science process skills that are indispensable for learning the subject Life Sciences. There is very limited tactile learning material on Life Sciences to provide adequate and crucial experience for learners. Accessible teaching and learning resources are but limited as well thus hampering teaching and learning in the classroom.

Inclusive schooling offers enormous opportunities for both learners with visual impairment and those without such impairment to learn to live, support, respect and understand each other as equal members of society. The strategy adopted in the inclusive classroom that is most successful is co-operative learning. The sighted learners describe and tell the blind learners what happens when the experiment is done or when there is an activity that requires observation through vision. This is what most teachers depend on. They are not trained on the education of the blind and as such they marginalize their blind and visually impaired learners. Inclusive schooling will be an iridescent dream if Life Sciences teachers are not equipped with adequate and relevant skills and competencies that are required in Life Sciences to teach the blind and visually impaired learners in the inclusive schools; if there are no Life Sciences resource and support for both learners and teachers by the education system.



Key Words

Basic science process skills

Advance science process skills

Inclusivity

Integration

Equity

Index for inclusion

Visual impairment

Assistive technology

Curriculum adaptation

Curriculum differentiation

District support team

Observation

Co-operative learning

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CHAPTER 1: Problem statement research questions and aim with the investigation

1.1 Introduction

The nature of curricula in the education and training system in the education dispensation prior to 1994 has contributed to the creation of barriers to learning and development for many learners. These barriers are related to various components of the curriculum, such as the content of learning programmes, the medium of teaching and learning, the management and organisation of classrooms, teaching style, pace, the materials and equipment which have been available, assessment methods and limitations in choice of subjects.

In an inclusive education and training system, Education White Paper 6 on inclusive education, (Department of Education, 2001), the curriculum should be responsive to the needs of all learners. It needs to be flexible and accessible to accomplish this. Accessibility includes providing the opportunity for all learners to gain entry into the education system and to participate fully in the learning process.

Since 1994 educational transformation in South Africa has focused on redressing historical inequalities in providing for the needs of learners with visual impairment. This study specifically addresses integration, equity and inclusiveness in the teaching of life sciences in inclusive schooling.

Booth, (1992:72) points out that the curriculum areas which involve practical activities in life sciences, such as observation of the phenomenon and the analysis of the experiment, pose a greater challenge. The teaching approach has to be adapted and should be supported by specialised equipment.

Booth, (1992:52) refers to the limitations that result from visual impairment. Understanding these limitations are critical in the context of learning in life sciences, where observation and analysis is the core of the experience. Booth notes that the hands

cannot transfer information to the brain about the relationships between objects, as easily as the eyes can.

This is one reason why Haring and Schiefelbusch English, (1985) as far back as 1967 highlighted the importance of maximizing the visually impaired learner's possibility to utilize that sensory information which do come in through his intact sensory modalities. It is generally accepted that partial loss or absence of vision reduces the amount of sensory data available to the learner (English, 1985).

The teaching of life sciences and the learning of learners with visual impairment need firm grounding in a multi-sensory approach (English, 1985).

For proper understanding, seeing objects as a whole as well as in parts is critical. Distant objects need to be observed and their structures analysed. However, some of these objects and structures cannot be touched or manipulated by hand. A possible solution to the problem may lie in the view that concrete-empirical proposition serves to enhance the transition from concrete to abstract cognitive functioning (Horton, 1988).

1.2 Educational transformation and disability

In this section, some background is provided which is essential for understanding what takes place when teaching and learning life sciences. It indicates the paradigm shift from special and specialised settings to inclusive settings, which is the object of the current research.

Emerging education development policies served to concretise the vision for an inclusive society and democratic practice. The first of these was the White Paper on Education and Training, which recognised the state's obligation to protect and advance the rights of all citizens. The focus is on teaching and learning factors and emphasis is to be placed on the development of good teaching strategies that will benefit all learners; on overcoming barriers in the system that prevent it from meeting the full range of learning needs; and on

adaptation of support systems available in the classroom (Department of Education 2001:19).

These focus on working with schools as they currently are in order to bring about more inclusive practice (Ainscow and Kaplan, 2005; Carrington, 1999; Carrington and Robinson, 2004; Deppeler and Harvey, 2004; Forlin, 2004).

According to the Department of Education, (1995:21), education and training are basic human rights and disability is not only a welfare concern. The human rights approach to disability thus focuses on the removal of barriers (inclusivity), to equal participation (equity), and on the elimination of discrimination based on disability (integration).

The broad objective of the human rights-based model is to create conditions for integration, equity and inclusivity through the process of integrating people with disabilities into the mainstream of society through inclusive schooling.

Definitions of inclusion are many and varied but amongst the more succinct ones are provided by Lipsky and Gartner (2005A) who describe it in terms of students with disabilities having full membership of an age-appropriate class in their local schools with the required additional support aids and/or services. This view is in line with the South African government move in terms of inclusive schooling (Department of Education. 2001).

Social reformation in South Africa since 1994 has been geared towards inclusive organisational practices as well as the ideology of inclusion. In response to these challenges within its own context, South Africa recognises the scarring effects of segregation and exclusion of groups of people and attempts to address this not just in terms of race, but also other forms of identity which are often the basis for segregation and exclusion, such as disability and special needs (Donald, Lazarus and Lolwana 1997).

According to the Department of Education, (2008:10), the life sciences curriculum supports the implementation of the South African Constitution and the application of the

nine National Curriculum Statement (NCS) Principles as follows in terms of social transformation: if social transformation is to be achieved, all South Africans must receive a quality education. Life sciences will contribute to social transformation by ensuring 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.

The role of training can further entrench the democratic views that have become 'truth' over time and are used to 'socialise' the new member into the profession once they have internalised the skills and knowledge deemed to be important (Mittler, 2000; Riddell, 1996; Slee, 2005).

This move attempts to break down all barriers preventing access and rights to participation for all people, whether or not these were related to disability. However, it remains to be seen how integration, equity and inclusivity will be incorporated in the teaching of life sciences to learners with visual impairment in inclusive schools.

Slee (1998) and Skrtic (1991A) also endorse this understanding with the field of special education.

The government's commitment since 1994 to people with disabilities has been fundamentally entrenched in the Constitution and is supported by emerging policies, including for example the White Paper on an Integrated Disability Strategy (Ministry in the Office of the Deputy President, 1997).

The South African government move to overhaul the education system in this particular manner is against some inclusion proponents to tend identify disability as within the individual so that appropriate interventions can be developed (Kauffman, 1999; Kavale and Mostert, 2005) and holds the belief that within societal structures and beliefs there exists elements which create the disability rather than it being inherently within the individual. This view is endorsed by authors like Barton (1987); Oliver, (1986); Soder,

(1989).

In November 1997 the government of South Africa adopted the White Paper on an Integrated National Disability Strategy (called INDS) (Ministry in the Office of the Deputy President, 1997) which is premised on the social model of disability. The White Paper thus represents a paradigm shift in the conceptualisation of disability from the medical or welfare model of disability which views disabled people as ill, different from their able peers, unable to be productive and in need of care. The focus of this model is on limitations of disabled people and their medical needs, resulting in the neglect of their wider social needs, which in turn promotes the isolation of people with disabilities and their exclusion from mainstream society (Ministry in the Office of the Deputy President, 1997). Consequently, disabled people have trouble in accessing their fundamental rights and in participating fully and equally in all aspects of life.

This is what special education was founded on and continues to operate from this paradigm (Oliver, 1988; Tomlinson, 1985) with a medical diagnosis being required in special schools.

The formulation of the INDS was largely informed by the United Nations Standard Rules on the Equalisation of Opportunities for Persons with Disabilities that were adopted by the UN General Assembly in 1993 and form the most significant international document in the field of disability. These rules are enshrined in the international Bill of Human Rights and provide governments with clearer guidelines on actions to be taken with regard to disability integration (UNESCO, 1996).

The INDS is premised on the 1996 Constitution of South Africa. Chapter 2 of the Constitution guarantees fundamental rights to all citizens, while Section 9 guarantees the right to freedom from discrimination based on a number of social criteria, including disability. Disabled people are therefore guaranteed the right to be treated equally and to enjoy the same rights as all other citizens of South Africa (Ministry in the Office of the Deputy President, 1997).

The INDS was followed by several other policies, including the South African Schools Act (DoE, 1996) which provided further guidelines to ensure access to schooling and quality education for all learners. It emphasised the right of education provision for learners with special educational needs at ordinary public schools and relevant educational support services for such learners (DoE, 1996), as well as physical facilities to ensure access.

Some writers also support the view that education should be guided by democratic principles (Artiles, 2003; Lipsky and Gartner, 2005a; Nilholm, 2006; Skrtic, Sailor, and Gee, 1996) rather than any other factors currently in play such as the demands of the marketisation of education (Bines, 1995; Riddell, 2000).

This shifts in South Africa reiterated the universal commitment of ensuring the rights and dignity of people with disabilities, and the right of choice of learners with special educational needs to be accommodated in their local centres of learning, expressed at Salamanca in 1994 (UNESCO, 1994).

The UN Standard Rules are enshrined in the UN Convention on the Rights of Persons with Disabilities and provide governments with clearer guidelines on actions to be taken with regard to disability integration (UNESCO, 1994). They are aimed at:

- Fostering moral and political commitment by governments to provide equal opportunities for persons with disabilities.
- Offering an instrument for policy-making and action, in order to ensure that disabled people may exercise the same rights and obligations as other citizens.
- Outlining crucial aspects of social policies in the field of disability, and providing models for the political decision-making process required for the attainment of equal opportunities.
- Proposing national mechanisms for close collaboration between the State, organs of the United Nations, non-governmental organisations (NGOs) and disabled people's organisations (DPOs).

The UN Convention (UNESCO, 1997) which was ratified by the Parliament of South Africa on 5 June 2007 recognised the right of persons with disabilities to education, with a view to realising this right without discrimination through an inclusive education system at all levels. The aim would be to ensure the development of the true potential of people with disabilities to enable them to participate effectively in a free society (Article 24). The emphasis is on the inclusion of persons with disabilities in the general education system (not a separate system), to ensure access to inclusive, quality, free primary and secondary education on an equal basis with others in the communities in which they live. This would require accommodation of the individual's support needs and requirements.

The overall challenge since 1994 for educational transformation in South Africa in relation to learners with visual impairment has been to redress the historical inequalities in terms of provision, and with specific reference to this study it is in terms of addressing integration, equity and inclusivity in the teaching of life sciences in inclusive schooling.

One of the key motivations for the proposed structure and ideology of an inclusive education system was based on the findings of a National Commission's review in 1997 of the key barriers in the South African context which rendered a large number of children and adults vulnerable to learning breakdown and sustained exclusion.

In October 1996 the Ministry of Education decided to determine how the old Department of Education managed and accommodated the needs of learners who experienced learning difficulties and disabilities. Two teams were set up to accomplish this and to make recommendations on improving all aspects of special needs and support services in education and training in South Africa. These teams were the National Commission on Special Needs in Education and Training, and the National Committee on Education Support Services. The two research teams presented a draft report to the Minister of Education in November 1997. The final report was published by the Department of Education in February 1998. The public was invited to read the report and to give feedback and advice to the Department of Education Department of Education.

The report, Education for All (Department of Education, 1997:5-40) contained the following aspects:

1. Under the apartheid education system education for learners who experienced learning difficulties and learners with disabilities, was known as special education. These learners were known as learners with special education needs.
2. Special education and support services had been provided mainly for a small number of learners with special education needs, in special classes in ordinary schools or in special schools.
3. Special education and support services were provided on a racial basis with the best resources going to the white learners.
4. Most learners with disabilities were either not in special schools or had never attended school. A few were in ordinary schools unable to adequately meet their needs.
5. In general, the curriculum and the education system had failed to respond to the varied needs of learners. This caused large numbers of learners to drop out of school, or be pushed out of school, or fail at school.
6. While some attention had been given to special needs and support in schools, other levels of education (for example, ECD) had been seriously neglected.
7. In response to this situation the report made many recommendations that the Department of Education included in its new policy, which is briefly discussed below.

The Department of Education took this report and its recommendations seriously and initiated a new policy in July 2001. The policy is called Education White Paper 6 on Special Needs Education: Building an Inclusive Education and Training System. This policy provided guidelines for the new education system it was going to create in South Africa to ensure all learners would have equal opportunities for education. Furthermore, the policy stressed the fact that learners with special or diverse needs should be accommodated in mainstream classrooms (Engelbrecht, Green and Naicker, 2007:54).

In this policy, the Department of Education, (Department of Education, 2001:10-42) committed itself to promote education for all and foster the development of inclusive and supportive centres of learning that would enable all learners to participate actively in the education process so that they could develop and extend their potential and participate as equal members of society.

The guiding principles for the new education and training system focus on (Department of Education, 2001):

1. Protecting the rights of all people and making sure that all learners are treated fairly.
2. Making sure that all learners can participate fully and equally in education and society.
3. Making sure that all learners have equal access to a single, inclusive education system.
4. Making sure that all learners can understand and participate meaningfully with the teaching and learning processes in schools.
5. Addressing and correcting inequalities of the past in education.
6. Making sure that there is community involvement in changing the education system.
7. Making sure that education is as affordable as possible for everyone.

1.3 Research problem

The problem to be investigated in this research lies in the assumption that the inclusive school will offer the visually impaired learners the experience of being accepted as part of the inclusive classroom (integration), reasonable accommodation in terms of accessible material, equipment and environment (equity) and full participation in all classroom activities (inclusivity) in the learning of life sciences, equal to or more than is offered at a special school.

The subject Life Sciences has to do with the systematic study of life in the natural and humanly constructed environment. The current study mainly pays attention to the understanding of basic life processes and the interrelationship and interdependence of components of the living and the physical world. Scientific inquiry, problem-solving, critical thinking and application of knowledge are vital skills in the study of life sciences. Understanding the relationships between life sciences, technology, environment and society helps learners to develop values that add to their development as responsible citizens (DoE, 2008:10).

It is imperative to make a clear distinction between syntax from the linguistic point of view and syntax from the Life Sciences point of view. The former alludes to the sentence construction, while the latter refers to the description of the way in which the knowledge (substantive structure) of the subject is obtained. Both kinds of syntax operate in accordance with specific rules and principles. The syntax of the subject of Life Sciences involves both the methodology and processes of the subject. This structure contains certain competences that have to be mastered. Van Aswegen et al., (1993:6) argued that all competencies described by Gardener (1975:8) in Reigebuth (1987) have their foundation in another more basic and fundamental classification.

Van Aswegen et al., (1993:3) argued that the nature and structure of Life Sciences should not be tampered with. It should instead remain intact and its nature has to be reflected during the incorporating of integration, equity and inclusivity in the teaching of Life Sciences to the blind and visually impaired learners in the inclusive schools.

The nature of the subject comprises the elements that make it teachable, understandable and learnable.

Van Aswegen et al., (1993:3) argued that without thorough knowledge of the structure of Life Sciences, it cannot be taught and learned according to the requirements it sets.

These authors, (1993:3) are also of the view that no methods linked to Life Sciences are complete without a substantial devotion of effort to the development of some appreciation of the structure of Life Sciences as it is related to teaching.

However, the move toward inclusivity poses a number of problems and challenges in respect of the inseparable yet distinguishable nature of the three-pronged approach to teaching life sciences to visually impaired learners. Firstly, integration presupposes the admission of the blind and visually impaired learners in the inclusive schools. These learners must be able to be part of the physical environment of the inclusive school where sighted learners attend. The blind must be able to go and explore, observe, analyse the phenomena under study in the Life Sciences activities.

Secondly, equity as an equalization strategy presupposes equality of both sighted and the visually impaired learners in terms of resources, this includes availability of assistive technology and the study material in the accessible format for the blind and visually impaired learners.

Thirdly, inclusivity presupposes full participation in Life Sciences activities. This means being able to observe, explore, analyse, experiment, discover and tabulate information as part of learning. In other words, the prescribed learning outcomes must be achieved through learning.

Literature informs us that learner-centered approach to observation demands that learners are expected to analyse their observations. The absence of visual ability deprives learners with visual impairment of the advantage of observation (Borg, 1987:157-158). Such deprivation causes blind learners to be less competitive during Life Sciences class.

Regarding this problem, literature say this is so because, at its core, Science and Life Sciences are founded on observation: watching things, measuring them, analysing their properties, figuring out how they work, making analysis of relationships and properties (Kumagai, 1995:82).

1.3.1 Conversion of ordinary schools into inclusive schools

Designated ordinary schools have to be converted into inclusive schools, and the conversion affects the role of a school. According to Education White Paper 6, the former

special schools and settings will be converted to resource centres assuming new roles. The inclusive schools now have to admit learners with disabilities and those who experience barriers to learning, and are expected to provide specialised professional support in curriculum, assessment and instruction, as well as a mentoring and consultative role to neighbourhood schools. This new role is in addition to the teaching and support to their existing learner base (Department of Education, 2001:19).

To ensure that inclusive schools are well prepared for their new role, they need to strengthen their support base, widen their scope, build the capacity of teachers and managers in all diverse educational special learner needs including visual impairment, establish institutional support and raise the quality of their provisioning.

According to Education White Paper 6 (2001:19), it is assumed that when these inclusive schools exist, district-based support teams will have been established, both in terms of posts and filling of those posts. The teams are education support personnel within district support services.

The support group will be trained to support all learners, teachers and the system as a whole to meet the full range of learning needs. The focus will be on teaching and learning factors and the emphasis will be placed on the development of good teaching strategies that will benefit all learners.

My experience as a teacher and when speaking to other teachers has shown that very little is done by the district office for the teachers, in meeting their challenges in the classroom. District officials do not even know how a blind learner can read and write. To them this is a miracle. The district officials need to be equipped with skills. Most of them have no experience of being or teaching at a special school. The education of the blind requires specific expertise and assistive technology dedicated to visually impaired persons.

A district office is expected to provide support to the inclusive schools attended by learners with visual impairment. This means providing support for teachers in teaching

incorporating integration, equity and inclusivity in life sciences. However, the district officials themselves need capacity building so that they will be able to overcome barriers in the system that prevent schools from meeting the full range of learning needs, and so that they will understand how to adapt support systems available in the classroom (Department of Education, 2001:19).

1.3.2 Expanding education opportunities

Expanding education opportunities in the converted ordinary schools now known as inclusive schools poses major challenges. These schools have to extend their support base and solicit support from the former special schools, which are an indispensable resource. However, there are only 19 special schools for learners who are visually impaired, i.e. an average of two special schools for visually impaired learners per province. Given the geographical spread of the provinces, the majority of the designated inclusive schools will not be supported by the special schools catering for learners who are visually impaired, nor will their districts have special schools for the visually impaired integrated into them. Furthermore, most special schools are in urban areas and still mainly provide services to learners from advantaged backgrounds. Ordinary urban schools tend to refer learners to such special education schools, especially where these are located in their neighbourhood.

The implication is that if inclusive schools are not properly resourced, they will be unable to provide adequate and effective education support and services to visually impaired learners who attend inclusive schools.

1.3.3 The field of expertise

The newly established inclusive school serves as a de-specialised special school. This means the converted ordinary schools are now required to diversify their educational services, resources and expertise. Instead of only enrolling and providing education and

support to the specific education special needs of a particular learner population, they also have to accommodate and support learners experiencing barriers to learning due to disabilities. The necessary human expertise, assistive technology, and infrastructural and capital resources supporting learners with all disabilities are absent, requiring huge sums of money, which the department lacks.

The other enormous challenge lies in expertise. The teachers at inclusive schools are expected to teach a learner who is blind and a learner with impaired vision in the same class. This on its own presents huge challenges because the modalities and the modes and media of presentation and access differ. The group of learners is no longer homogeneous. Their educational needs are now varied and diverse. The challenges and limitations of these two varying groups are dissimilar. This becomes even more complex by the nature of life sciences as a learning area that requires vision for most of the activities. This poses a challenge for both the teacher and the blind learner.

Secondly, in addition to blind learners and those with impaired vision, the teacher may have a learner who is visually impaired in the same class with a learner who is deaf, together with other learners who experience barriers to learning. Schoeman recommends that schools addressing the needs of blind and visually impaired learners, also have to focus on equipping learners with the necessary life skills that will prepare them to function independently in society (Schoeman, 1995:427).

The study of life sciences helps learners to develop an understanding of the nature of science, the influence of ethics and biases, and the interrelationship of science, technology, indigenous knowledge, environment and society. Learners explore those concepts, which are essential to basic life processes and the interrelationship and interdependence of components of the living and the physical world. This understanding is directed to the improved quality of life and life support systems in the biosphere. It also allows learners to apply knowledge and skills in a way that will lead to sustainable management of resources and life support systems (DoE, 2008:10).

Booth, (1992:52) points to the limitations that are part of visual impairment. This is critical in the life sciences, where observation and analysis is the core of the experience. Booth, (1992) asserts that the hands cannot give information to the brain about relationships between objects as easily as the eyes can.

A barrier occurs in a classroom where the educator is not able to teach life sciences to learners with visual impairment in an inclusive school, because there is no expertise and assistive technology to allow access and accessibility to curriculum and classroom activities. Another significant factor is that visually impaired learners generally cannot do life sciences because they cannot access the curriculum and be involved, where the learning area or subjects presuppose and are based on vision. The result is marginalisation and exclusion, because on the one hand, the learners cannot see, and on the other hand, there is a lack of expertise on the part of the teacher. A teaching and learning breakdown then occurs.

This challenge must be addressed through capacity building and support from local special schools. Teachers will therefore have to spend lengthy periods of time training other teachers and receiving training themselves, which would impose on time which should be spent with learners in the classroom.

1.3.4 Funding and post-provisioning

Wildeman, (2007:2-5) asserts that provincial funding of inclusive education and training has been influenced by the remnant effects of the 1996-98 periods where wage costs had increased dramatically.

The implication is that large sums of money are required to create posts for teachers in the inclusive schools in order to increase the learner population base. Further funding is required to extensively train the teachers to deal with a wider range of learner needs. However, it is debatable whether a single teacher can acquire expertise in the education

of the blind, excel in the education of learners with low vision and still deal adequately with all other disabilities in one classroom. The truth of the matter is that teachers in the inclusive schools actually have to face these challenges.

Funding is also required to address the question of filling of posts in the district for district officials who will provide indispensable support to teachers in schools. These district officials also require training in a variety of skills and competencies before they are able to render support to teachers in inclusive schools.

The geographical composition poses a further challenge. Inclusive schools are not grouped together in one district. In some provinces, the distance between these schools is too great. This creates a challenge in terms of time and distance between schools and districts, compounding the problem of the limited number of district officials available for dedicated posts.

1.3.5 Personal and contextual challenges

This study focuses on a visually impaired learner at an inclusive school. The notion of visual impairment refers to people with residual eyesight, commonly referred to as partially sighted, and those who depend for information on other senses excluding visual experience, commonly referred to as blind. The partially sighted learner has an educational advantage, since residual eyesight can be of great use in the learning of life sciences. The blind learner has absolute limitations regarding visual experiences. The absence of sight therefore poses specific educational challenges. All learning activities that require vision remain a challenge for the teacher and the learner because an alternative must be found to compensate for vision and thus facilitate participation and involvement in vision-based activities.

Forlin, (2004:4) maintains that teaching in key learning areas has to become more embedded in authentic pedagogy with an emphasis on adaptation and differentiation in

curriculum through the provision of diversified tasks, rather than providing an alternative curriculum to meet the needs of individual learners. In other words, the focus is on a quality of education that accepts diversity and the varied abilities of learners.

1.3.6 Integration in teaching

Sacks and Silberman, (2000) holds the view that learners friendships are like templates on which the child builds subsequent relationships beyond the school environment and into adulthood. Social skills are fundamental to becoming better integrated into society and later, to finding and maintaining employment. Therefore, a strategic time to intervene directly with children and an optimal time to facilitate social competence is from a young age. By fostering appropriate social skills your learner will be more likely to settle well into a variety of environments and become better able to work co-operatively, confidently, and independently by experiencing social success from an early age.

Engelbrecht et al., (2007:30) points out that for the curriculum to become truly integrated, all teachers need to know how to review their own understandings of the inclusive education policy and their interpretation thereof, in order to promote integration of all learners in a classroom as a new approach. The role of the teacher is seen as that of someone who accords educational opportunities and learning experiences for all learners. This means the teacher must ensure that all learners are recognised and accepted as members of the class and participate fully and freely in all life sciences activities of a class.

In order to incorporate integration when teaching life sciences to learners with visual impairment in the inclusive school, it is important for the teacher to find answers to a number of questions:

- What type of a learner is in my class? It is important for the teacher to know whether a learner is blind or has low vision. The teacher can then decide which

methods she must use and how she needs to adapt to accommodate such a learner.

- How can I promote mutual acceptance and mutual respect among learners? This is crucial, because experience tells us that there is labelling and stigmatisation in our communities. Persons with disabilities are seen and understood to be different. This perception tends to look down on persons with disabilities. This is quite likely to happen with children, particularly if they are not used to a blind learner who trails along the wall or who needs to be guided by the hand, a child who cannot play with them or participate in their activities like all other children.
- How can I make a learner with visual impairment or a learner who experiences visual barriers to learning, equal to other learners? How can a teacher address the question of equality?

Visually impaired learners are faced with the following fundamental difficulties concerning integration in an inclusive school:

- Visually impaired learners are in a strange environment and they are bound to be stressed. They are limited in terms of orientation and mobility. They are often complete strangers to the other learners.
- Sighted learners find themselves in the same class with blind learners.
- The class teacher has forty active children in his class to attend to while at the same time accommodating the one or two blind learners or one with low vision.
- Blind learners are often obliged to learn largely by listening and by touch or using a noisy Braille machine.
- The class teacher will have some problems when using visual material. She must learn to describe, substitute or provide tactile material. In the absence of help, the teacher might resort to verbatim: talking and talking only to the learner with visual impairment.
- Reading and writing present technical problems and need assistive technology.

- Many teachers will be quite unaccustomed to dealing with the blind and their attitudes may differ greatly from one teacher to another.

1.3.7 Equity in teaching

Booth, (1992) refers to six factors that can help when teaching a visually impaired learner. In this regard, the researcher has added another factor, so there are seven general factors that need to be considered when devising appropriate equity in teaching (reasonable accommodation) for any child with a visual impairment. These accentuate and are embedded within the principles of reasonable accommodation in teaching. All these principles have a foundational element of accessibility. These can be summarised under seven headings:

1. Learning and support material: This refers to accessible instruments, for example, a talking scientific calculator, braillewriter, low vision equipment and material, tactile rulers, maps, diagrams and all other forms of teaching and learning support material. These materials assist with incorporating equity when teaching life sciences to learners with visual impairment in inclusive schools.
2. Position: This refers to an accessible learning environment, in other words an appropriate place and work area suitable for using large books and equipment. A learner with visual impairment needs to observe, analyse and systematise as part of life sciences activities.
3. Presentation: This encompasses accessibility of material when teaching life sciences to learners with visual impairment. The teacher must provide accessible learner support material in the format and medium suitable to the learner. For instance, low-vision learners that have a narrow field of vision are actually hindered if they are given enlarged text on which they can see fewer letters at a glance. The best size of print is usually the one that the child can read most quickly and accurately.
4. Experiences: This refers to accessible learning experiences. The teacher must allow first-hand experience where possible. A learner must not be exposed to

- verbal cues only. A blind learner can do the observation with sighted learners, who will explain the process or changes of the phenomenon under observation for the life sciences activities.
5. Expectations: this refers to an accessible standard of teaching and learning. The teacher must set a standard for the class and not for individuals. This standard must not be compromised to accommodate a learner who is visually impaired. However, in order to reach the set standard, the other two concepts (integration and inclusivity) must be adhered to, to avoid unrealistic expectations by the teacher. Expectations ensuing from a compromised teaching and learning situation cannot be realised. In other words, the teacher must ensure that a blind learner is able to participate in the life sciences activities.
 6. Giving information: This refers to accessible information. The teacher is the main source of information. It is the primary responsibility of the teacher to mediate between the world of information and a visually impaired learner. This means a teacher must bring the world of information to a visually impaired learner or the teacher must lead, guide and support the visually impaired learner to reach and access the world of information in life sciences activities.
 7. Speed of working: This refers to an accessible pace. Reading braille one character at a time, or finding a place in a book or reading a part of a diagram at a time, is time-consuming.

Access involves much more than providing a suitable physical environment for visually impaired learners. Access is also the key element of maximising human potential and quality education, which involves much more than placement in a particular setting. The relationship between integration, equity and inclusion may not be obvious to individuals who are not familiar with the educational and social impact of a vision loss. Placing a learner with a visual impairment in an ordinary or mainstream classroom does not, necessarily provide integration or equity and the learner is not necessarily included.

1.3.8 Inclusivity in teaching

According to Farrell, (2000:3), the term inclusion refers to a way of describing the extent to which a learner with special education needs, in this instance a learner with visual impairment, is truly included in life sciences activities in class.

In order to assist teachers to translate the principles of outcomes-based education into effective inclusive practice, certain approaches to curriculum adaptation and curriculum differentiation in life sciences should be followed. Inclusivity when teaching life sciences can be achieved in various ways. A teacher may consider some of the following methods for inclusivity when teaching life sciences:

- Setting a substitute life sciences task of similar scope and demand.
- Replacing one life sciences task with a task of a different kind.
- Allowing the learner to undertake the life sciences task later if a learner with visual impairment is unable to undertake it with others or perhaps requires the teacher's assistance.
- Allowing the learner extra time to complete a task.
- Using technology, aides or other special arrangements to undertake a life sciences activity or tasks.
- Using an estimate based on other assessments or work completed by the learner (in circumstances where the other provisions are not feasible or reasonable).

The format in which the task is presented also plays a role, for example the complexity of graphs, diagrams, tables, illustrations, cartoons, etc. A range of strategies can be followed to make these accessible to learners who are visually impaired to learning of whatever nature, such as:

- Picture or diagram embossed, simplified or shown differently without compromising the complexity of the question.
- Picture or diagram replaced by written description.
- Picture or diagram supplemented by written explanation.

- Picture or diagram replaced with a real item or model.
- Unnecessary picture or diagram removed.
- Amount of information reduced.
- Measurements altered or assistive technology used.
- Inherently visual material replaced with equivalent non-visual material.
- Using another planned task to assess more outcomes or aspects of outcomes than originally intended.

Learning therefore has to be active and the teacher is a facilitator of learning which is in turn constructed by learners and goes beyond memorising. Learning programmes are viewed as guidelines that teachers can use in designing creative and responsive activities to include every learner and enable them to participate to achieve to their potential.

The notion of inclusivity should become a central part of the organisation, planning and teaching at each school. This can only happen if all teachers have a sound understanding of how to recognise and address the education needs of the visually impaired learners and how to plan for inclusivity.

Learners with visual impairments will not be integrated, attain equity or be included unless their unique educational needs for learning are addressed.

A complex and dynamic relationship exists between integration, equity and inclusivity. This complexity of relationships plays a key role in whether effective and quality teaching and learning of life sciences takes place. When a problem exists in one of these areas, it affects the teaching and learning process, causing learning breakdown or learner exclusion. If the system fails to meet the different needs of a wide range of learners or if problems arise in any of these components, then the learner may be prevented from engaging in or sustaining an ideal process of learning.

1.4 The aim of the study

The aim of this study is to explore how the inclusive policy informs us on how to incorporate inclusivity, equity and integration in teaching. Furthermore, the study aims to determine how these concepts manifest themselves as being foundational for inclusive schooling and what the envisaged influences of these concepts are on the quality of teaching and learning of the life sciences in inclusive classrooms.

The aim is also to explore what variables restrict integration, equity and inclusivity when teaching life sciences in order to achieve the learning outcomes (highest possible learning quality) specified for the life sciences. The study will examine the adaptations required to support visually impaired learners at the inclusive school as part of incorporating integration, equity and inclusivity in teaching life sciences.

This will also inform us on how teachers in the inclusive schools should be prepared to adapt and differentiate their teaching to incorporate integration, inclusivity and equity and thus achieve the learning outcomes for the life sciences.

1.5 Research question

The research question of the current study consists of a primary question and secondary questions.

1.5.1 Primary question

- How do district officials and teachers deal with integration, inclusivity and equity in the teaching of life sciences to blind and visually impaired learners and how do these concepts manifest themselves as being foundational for schooling, and what influences do these concepts have on the teaching and learning of life sciences to blind and visually impaired learners in inclusive schools?

1.5.2 Secondary questions

- How does the inclusive policy inform us on inclusivity, equity and integration and what are the envisaged influences of these concepts on the quality of teaching and learning of the life sciences?
- Which variables restrict inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the life sciences?
- What adaptations will be required to support visually impaired learners at the inclusive school to facilitate inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the life sciences?
- How should teachers in the inclusive schools be prepared by the districts to adapt their teaching to incorporate integration, equity and inclusivity in their teaching, to achieve the learning outcomes (highest possible learning quality) specified for the life sciences?

1.6 The objectives of the study

Placing a learner with a visual impairment in a regular classroom does not necessarily translate into integration and the learner is not necessarily included. A learner with a visual impairment who does not have access to a curriculum that is adapted and differentiated to attain inclusivity is excluded, regardless of the physical setting. Learners with visual impairments will be excluded unless their unique educational needs for access through reasonable accommodation are addressed by equity in teaching.

In addressing the above issues, the researcher formulates a set of objectives that will serve as a guide for this study:

- To determine how the inclusive policy informs us on inclusivity, equity and integration and to determine what the envisaged influences of these concepts as

foundation for inclusive schooling are on the quality of teaching and learning of the life sciences in inclusive (inclusive) schools.

- To determine which variables restrict the incorporation of integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school in order to achieve the learning outcomes (highest possible learning quality) specified for the life sciences.
- To determine what adaptations will be required to support visually impaired learners at the inclusive school, to incorporate integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school in order to achieve the learning outcomes (highest possible learning quality) specified for the life sciences.
- To determine how teachers in the inclusive schools should be prepared by the district officials to adapt their teaching to incorporate integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school and thus achieve the learning outcomes (highest possible learning quality) specified for the life sciences.

1.7 Theoretical framework

1.7.1 Introduction

The theoretical framework underpinning this study is firstly based on the meta- and holistic approach of Engelbrecht, Green, Naiker and Engelbrecht (2007:3-4) towards inclusive education, and secondly on the cultural reproductive systems model of Bowles and Gintis as explained and highlighted by Skiba, Simmons, Ritter, Gibb, Rauch, Cuadrado and Chun (2008:264) and Apple (1988:231). A third notion that was taken into consideration in the development of a theoretical framework is documented evidence of the importance of the substantive structure (body of knowledge) and the syntactical structure (scientific method) of the biological and life sciences (Du Preez & van Wyk, 2007:24-25).

According to Engelbrecht et al., (2007), the new educational dispensation brought about dramatic changes in South African society that have affected both general and special education, shaking the comfort zone in the education fraternity. Engelbrecht et al., (2007:3) state:

"As one is attached to one's established ways of thinking, dramatic changes in society are often experienced as a crisis (cf. Bradley et al., 1997: Skrtic & Sailor, 1996). It is therefore not surprising that the restructuring and redesigning of education, including the movement away from segregated settings for learners with special needs, to the provision of education for all learners in an inclusive and supportive learning environment, have been received with misgiving by some people. An understanding of the context in which the movement towards inclusive education has developed provides an important opportunity to reframe people's perceptions of these changes."

1.7.2 A meta-approach

Engelbrecht et al (2007:3) believes that in order to comprehend the true perspective and the realities of the new education dispensation as a movement in education in South Africa, it is essential to adopt an explanatory framework that refers to social life in general, not just to education. A meta-approach as a theoretical framework is considered appropriate in this regard, since it provides a more comprehensive awareness of the reality that human experience and action are interrelated and take place in daily life as part of the broad human, political and ethical effort of securing a better life.

Engelbrecht, in Engelbrecht, Green, Naiker and Engelbrecht (2007:3) argues that such an approach makes it possible for us to transcend the simplistic reduction of the movement towards inclusive education. Engelbrecht further relates to the index of inclusion. The index of inclusion is discussed in detail in Chapter 3 of this study. Engelbrecht, in Engelbrecht, Green, Naiker and Engelbrecht (2007) points to the development of an inclusive philosophy in schools that poses critical questions about the changes that are essential if schools are to become fully inclusive, as well as the possible limits to inclusion:

- In order for the schools to become a reflection of the wider society's emphasis on equality, they must exist as a reflection of society as a democracy where all members have rights and responsibilities.
- Furthermore, a community-based approach is essential. This implies that membership of the school community should be open, positive and a reflection of the diversity in the community.
- In the process, accessibility is promoted to all who become members, physically in terms of the buildings, educationally in terms of curricula and support systems, and emotionally in terms of a philosophy of acceptance and the celebration of diversity.

1.7.3 The cultural reproductive systems model and educational equity

According to Smith and Kozleski (2005), in Skiba, et al (2008:264) “national special education legislation emerged from the struggle of the civil rights movement”. The authors come to an interesting conclusion:

“Racial disparities in rates of special education service remain one of the key indicators of inequity in our nation’s educational system.”

Skiba, et al. (2008) and Apple (1988:231) explained how Bowels and Gintis succeeded in developing a model based on the social sciences to explain how inequality is maintained in education by default through poorly trained teachers, segregated schools, uneven resources and poor teaching. Furthermore, Skiba, et al (2008:274) add additional factors such as curricula, instructional presentation, physical facilities, inequitable school funding formulas, inadequate teacher preparation, teacher experiences, teaching in challenging areas, teacher expertise, limited educational opportunity, graduation and dropout, placement of students in programmes for talented and gifted learners (p. 276), recruiting and maintaining teachers.

1.7.4 The substance and syntax of the biological and life sciences

Both the substantive structure (body of knowledge) and the syntactical structure (scientific method) of the biological and life sciences have to be taken into consideration in the teaching of this specific field of specialisation (Du Preez & van Wyk, 2007:24-25; Le Grange, in Maree & Fraser, 2008:164-176). This means that the teaching and mastery of biology is not only based on the memorisation of terms, concepts and facts, but also on learners' active engagement in scientific investigations where a number of process skills such as observation, tabulation, problem solving, experimentation, the drawing of conclusions, predicting and inferring, to mention only a few, have to be taken into consideration during the teaching of biology and life sciences to sighted as well as to visually impaired learners.

1.7.5 Conclusion

Access involves much more than providing a physical environment for visually impaired learners. Access is also the key to maximising human potential and quality education, which involves much more than placement in a particular setting. The relationship of integration, equity and inclusion may not be obvious to individuals who are not familiar with the educational and social impact of a vision loss. Placing a learner with a visual impairment in an ordinary or mainstream classroom does not, necessarily provide integration or equity and the learner is not necessarily included.

Contrary to popular belief, the movement towards inclusion represents much more than just the physical placement of learners with difficulties in mainstream classrooms. The proposed meta-approach to inclusive education provides a holistic perspective on inclusion which is not directly tied to any specific trend or theoretical approach. This approach has particular relevance to understanding that the origins of issues around the discourse cannot be separated from the broader context and systems in that context. Successful teaching about contemporary developments in education requires a clear

understanding of how prevailing values and ideas within the entire social system influence all levels, from the wider community to schools and individuals.

1.8 Research methodology

This research investigated the incorporation of integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive schools.

This research took place in Mpumalanga at the kaMagugu and Silindokuhle schools. Teachers from these schools as well as the district officials responsible for these schools were interviewed.

1.9 Data analysis

A qualitative method was used in the research design in this study, and data was collected through interviews and observation. All the data was coded using the grounded theory approach. The codes are derived from the responses of the participants, and only the critical issues that emerged from the response were used. Each respondent is given a number or letter. A table in Excel is used to write the information or data for analysis. Correlations or similarities will be checked in the respondents regarding issues as codes. Codes will be clustered where similarities are found. The clustered codes will then form the themes. These themes are critical in that they are discussed in chapter 5. In chapter 5 the themes are used with direct quotations from the respondents to support the argument under discussion. The interpretation of data will occur when data is confronted with theory. The relational or corresponding themes will emerge as new findings.

1.10 Outline of the research

The researcher seeks to address the following issues in the next chapters:

Chapter 1 covered the introduction, problem statement, research question, aims and objectives and the methodology.

Chapter 2 focuses on the theoretical framework of incorporating integration, equity and inclusivity.

Chapter 3 addresses the implementation of the three-pronged strategy of incorporating integration, equity and inclusivity.

Chapter 4 focuses on the qualitative research design of this study.

Chapter 5 covers data collection techniques and strategies applied, the data and content validation of inventories, composition of research sample and selection of the participants, data collection processes and method of data analysis and significance of the study.

Chapter 6 covers the findings.

Chapter 7 deals with resolutions, recommendations, limitation of the study and conclusion.

1.11 Conclusion

This chapter provided the background to the study. The problem to be investigated and the subject of the investigation were discussed. The aim of the research and the objectives of the research were given. Now the next chapter will provide the theoretical perspective of incorporating integration, equity and inclusivity when teaching Life Sciences to learners with visual impairment as foundations for inclusive schooling.

CHAPTER 2: The Theoretical Perspective of Incorporating Integration, Equity and Inclusivity when Teaching Life Sciences to Learners with Visual Impairment as Foundations for Inclusive Schooling

2.1 Introduction

This chapter focuses on a theoretical perspective on incorporating integration, equity and inclusivity when teaching life sciences to the visually impaired learners as foundation for inclusive schooling. In order to understand the complexity of the inseparable yet distinct nature of incorporating integration, equity and inclusivity when teaching life sciences to learners with visual impairment, a literature study concerning these components and the envisaged concepts is made. This chapter discusses selected theories dealing with integration in relation to prejudice and discrimination, equity as reasonable accommodation and inclusivity as full participation. The strategies aimed at creating conditions for integration, equity and inclusivity will be explored at the conclusion of the chapter. The purpose of this chapter in the context of this study is to provide the philosophical framework and the underpinnings of integration, equity and inclusivity as foundations for inclusive schooling, the implementation of which will be dealt with in Chapter 3.

2.2 The theoretical perspective of incorporating integration when teaching life sciences to learners with visual impairment as foundation for inclusive schooling

2.2.1 Introduction

In this section, the researcher discusses the emergent and increasingly homogeneous view of disability as cultural, advancing a discussion of multiculturalism and offering a critical

review of the main thinking in this arena within the context of current multicultural thinking. The teaching of life sciences to learners with visual impairment incorporating integration occurs in this kind of milieu.

Charles and Yewpick Lee, (2003:53), argued that integration benefits both the blind and the fellow sighted learners. Blind and visually impaired learners are able to contribute to the learning act by bringing their expertise and experience to enrich the integrated class.

According to the Department of Education, (2008:10), if social transformation is to be achieved all South Africans must receive a quality education. Life sciences, in this regard, will contribute to social transformation by ensuring 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. The Life Sciences curriculum supports the implementation and application of the nine National Curriculum Statement (NCS) principles.

Gilson, Tusler and Gill, (1997) believe that impairment as culture transcends internal determinants of disability, subsumes social and political definitions, and creates a cultural discourse that characterises the collective of disabled persons.

Cultural views of disability suggest that all individuals who define themselves as disabled belong to a unique group which shares experiences, tacit rules, language and discourse. In this view the notion of disability is one of group belonging and distinction from other groups who do not share the disability identity.

Terzi, (2005b) launched the ground-breaking perspective in special education. She held the view that it provides basically novel insights into the conceptualisation of impairment and disability.

This perspective is an approach that transcends the dilemma of difference by conceptualising difference as a particular variable of human diversity. This means the blind and visually impaired learners are different from sighted fellow sighted learners due

to human differences. If sighted learners can do Life Sciences, so can the blind and visually impaired learners. The difference is in the mode of delivery or teaching of Life Sciences to the blind and visually impaired.

The commonly accepted viewpoint was that learners who are visually impaired were different from non-impaired learners and their unique educational needs therefore exclude them from participating in public school programmes (Fulcher, 1989).

White Paper 6 thus represents a paradigm shift in the conceptualisation of disability from the medical or welfare model of disability which views disabled people as ill, different from their non-disabled peers, unable to be productive and in need of care. The focus of this model is on limitations of disabled people and their medical needs, resulting in the neglect of their wider social needs which in turn promotes severe isolation of people with disabilities and their exclusion from mainstream society. Consequently, disabled people have trouble in accessing their fundamental rights and in participating fully and equally in all aspects of life (Department of Education, 2001:42).

Burchardt, (2004), argued that the blind and visually impaired learners do not lower the standard or level nor impoverish the quality of education by requiring extra resources that will make them equal to fellow sighted learners.

2.2.2 Incorporating integration as foundation to inclusive schooling

Because this study focuses on incorporating integration, equity and inclusivity when teaching life sciences to learners with visual impairment in general and with specific reference to incorporating integration in inclusive schools, one needs to explore inclusive schools in relation to integration and prejudice as well as disability as a culture in schools. In the context of the newly adopted single, unified and integrated education inclusive system in South Africa, a school could consist of learners from various socio-economic, racial and ethnic backgrounds together with different disabilities with diverse

learner needs.

Florian, Hollenweger, Simeonsson, Wedell, Riddell, Terzi, and Holland (2006:42) pointed out that seeing differences as a human factor, can serve as a ground for education as a cross-cultural perspective for learners with visual impairment and the sighted fellow learners in the Life Sciences class in the inclusive school.

2.2.2.1 Freedom for tactile experiences

The paradigm shift of inclusive schooling occurs against the backdrop of polarisation, segmentation and segregation of South African society. This state of affairs has led to societal misconceptions, misunderstandings, labelling and stigmatisation of persons of different groups and abilities as being different and not belonging to the rest of the group.

Whether a blind and visually impaired learner is disabled is, therefore, dependent on other factors than the effects of a set impairment (Terzi, 2005a:203).

Van Huijgevoort, (2002:60), pointed out that limitation and constraint on the blind and visually impaired learners is not only confined by physical barriers, but the attitudes of other sighted learners and the teachers is very crucial and critical as well.

Certain black communities regard it as taboo to have a disabled child. In Sesotho (Northern) a blind or visually impaired person is referred to as "faceless person". Often this child would suffer inhumane degradation and would be reduced to an inert entity. The prospects of such a disabled child developing his/her potential are very limited. In numerous cases an age-limit, as a result of long hospitalisation and a long waiting list at a special school, entails an educational cul de sac. This means that where such a child is over the school's age limit, s/he thus becomes an out-of-school youth with disability. Often socioeconomic realities put these children at an enormous disadvantage.

Integration of the blind and visually impaired learners with sighted fellow learners during Life Sciences class does not deny an underlying reality or experience that differentiates disabled and non-disabled learners (Barnes et al, 2003:9-78).

It is important that everybody at the school (teaching and support staff, and learners) feels welcomed, valued and supported. Learners with visual impairment must share the opportunity to participate in life sciences activities. A school needs to be a place that is caring and psychologically safe, where diversity is celebrated and everybody is made to feel welcome.

Visual impairment constitutes one among a great deal of distinctions that interact together with social, economic, and physical environments and bring into being a profile of advantage or disadvantage for individuals (Burchardt, 2004).

Where a learner with visual impairment has to participate in practical life sciences activities where observation and analysis is involved, s/he must be free to touch and examine where possible. In certain instances, the fellow sighted learners will have to assist by describing the object under observation. It may be a fairly easy experiment but a learner with visual impairment will not be able to see it.

The most exceptional feature of an inclusive school is that it is a safe and welcoming place. Establishing a school of such a nature might require that certain psychological and physical adaptations are made to accommodate visually impaired learners. This can often be done with minimum effort and resources.

Schools can be made safer, accessible, welcoming and thus conducive for integration by immediately attending to minor maintenance work and by keeping them clean, because learners with visual impairment trail along when walking or touch and examine with hands when observing objects. This may be something as minimal as handles, decorations, and study materials. Everybody should be on the lookout for safety risks such as broken glass, dangerous electrical wires, and sharp edges where learners with visual impairment could injure themselves. Management that takes pride in their school clearly communicates a positive and invitational message to all visitors, learners and staff members.

A positive and welcoming atmosphere and school ethos is created when school management is prepared to consider and respond equally to the needs of everybody without intimidation, harassment or discrimination and exclusion. A positive resolution of conflict and the effective management of responsibilities and discipline are essential. At the very basis of this is the development of an ethos where management, teachers and learners make decisions and work together. As inclusive managers, those in such positions are challenged with the task of building communities based on a commitment to equality, mutual respect and responsibility and supporting the development of responsible social citizens.

Fraser et al., (1996:38) are of the view that learners learn when one or more stimuli are reinforced by social interactions and linked to one or more responses (relations). In addition, learners learn best when they regard learning as the formation of associations between physical stimuli and observable reactions.

In addition, Holdstock, (1987:107) argued that the appropriate attitude on the part of the teacher is necessary for the establishment of a climate in which learning can take place.

Clark, (1982:57) argued that regardless of the disability, personal and professional acceptance of the disabled is the ultimate key to success.

The use of participation and shared responsibility in integration when teaching life sciences to learners with visual impairment in a class with other sighted learners can be a very powerful means of developing an integrated school. If we develop a spirit of participation, responsibility and mutual acceptance within our schools (rather than one of obedience and control), we will be fostering a spirit of cooperation and collaboration among all at the school.

To this effect, Life sciences promotes social skills while encouraging learners to develop inquiring and problem-solving skills which support the practical application of knowledge in life sciences and involves active and high level teaching, learning and

assessment (Department of Education, 2008).

Democratic strategies help develop group moral awareness and a sense of belonging. The emphasis is on shared standards, agreements, values and commitments management; teachers and learners developing a social and moral constitution together that spells out what is right and good, what each member of a school can expect from others, and what each member must give in return.

If social transformation is to be achieved, all South Africans must receive a quality education. Life sciences, in this regard, will contribute to social transformation by ensuring 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 (Department of Education, 2008).

It is important that management have high expectations for all teachers and learners, including learners with visual impairment. The idea of high expectation is congruent with incorporating equity and inclusivity, discussed later in this paper. Learners with visual impairment, as all other learners, are generally more likely to strive to meet expectations when they sense that others truly believe in their potential for excellence, and have expectations that are consistent with this belief. It is necessary for management to model values of respect for all and to acknowledge and appreciate the contributions of all.

If management models these values of mutual respect, acceptance, cooperation and support, teachers and other support staff will model these to sighted learners, who in return will value their fellow learners with visual impairment. The powerful role that observing the attitudes and behaviour of important people has in shaping who and what their learners become can never be underestimated.

Certain prejudiced beliefs have long been in existence and could be entrenched to the extent that a prejudiced person can persist in an attitude, despite information and experience to the contrary (Tomlinson, 1985:136).

2.2.2.2 Integration in diversity

Gill, (1997:39), drawing from theories of personality development, suggests that integration is a theme of identity development and is based on ‘the perennial human struggle to resolve opposing pulls toward separation and unity’. The development of one’s identity is, in part, based upon an effort to integrate identity on both an individual and a community level. When considered within the context of minority identity development, Gill further notes that sound disability identity development occurs within intra-psychic, inter-personal and social domains, and must be accompanied by the integration of oneself as a valued member in a community.

Communities and cultures, in this case the sighted learners and the visually impaired learners exist in juxtaposition to one another. The sighted are initiated into the “world of the visually impaired” and the visually impaired initiated into the “world of the sighted” in commonality as well as contra-distinction. Identity and belongingness that position individuals within groups, distinguishes individuals by including them in some arenas and excluding them from others. However, most critical to this discussion is the notion that communities exist in relative position to one another in political power and resources (Goldberg, 1994).

The paradigm shift that has moved disability from anomaly to social and human diversity has raised many questions and challenges (Charlton, 1998).

However, there are those who believe that the continuance of special education is down to an attempt to maintain the status of the special education 'industry', teachers and principals in mainstream schools (Fuchs and Fuchs, 2005; Fulcher, 1989; Slee, 2001).

Contemporary post-modern discourse positions ‘disability as normal, not inferior, and demands self-determination over the resources people with disabilities need. This new perspective unfolds out of a changing world in which a small number of political activists with disabilities are challenging the old ways of thinking about and treating disability

(Charlton, 1998).

Burrello and Sage, (1979) point out that integration implies trends toward normalisation, giving impetus to special education as an inter-related support system, rather than a separate educational sub-system. Integration has therefore become an effort to eliminate the stereotypic deficient-and-different label for children with impairment while attempting to provide equal opportunity for education.

Bowe, (1978) suggested that mainstreaming is a concept, not a method. This means a teacher who incorporates integration when teaching life sciences to learners with visual impairment, should understand how learners with visual impairment are taught and how they learn. This relates to methodology. When presenting an object to the learner with visual impairment, the observation occurs through the sense of touch and progresses from the parts to the whole. This contrasts with the sighted learner, who perceives an object as a whole before perceiving the parts.

English, (1985) citing Coveny, found that learners with visual impairment achieved within sighted norms on the Stanford Achievement Test. The researcher believes that incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school plays a major role in enabling learners with visual impairment to achieve normally like all sighted learners in their class. This view concurs with English who believed that learners with visual impairment, who were integrated into mainstream school programmes, had greater independence and social maturity than those in special schools.

English, (1985) further believed that learners with visual impairment in the inclusive school could handle inclusive classrooms with considerable benefits to themselves and no special problems for their teachers or their classmates. The researcher believes that this can be attributed to the fact that the teacher has been able to incorporate integration successfully when teaching life sciences to learners with visual impairment in the inclusive school. Sighted learners observed and learned to cooperate with and assist

fellow learners with visual impairment. There was mutual acceptance and mutual respect. Sighted learners learn to live side by side with learners with visual impairment. They learn to do experiments that require group work in observation and analysis of objects. Putting integration to work when teaching life sciences to learners with visual impairment, has untold mutual benefits for both sighted learners and learners with visual impairment.

English, (1985:12) states that there seems to be no clear evidence that incorporating integration on its own is successful when teaching life sciences to learners with visual impairment in the inclusive school. This is because, according to English, none of the existing studies has attempted to define the successful interplay between incorporating integration, equity and inclusivity when teaching life sciences to learners with visual impairment, nor have they identified the factors that contribute to that positive performance.

While legal mandates for integrated placement choices have expanded opportunities for this option, the researcher aims at optimising and pointing out the crucial elements that are foundational to inclusive schooling. This paper attempts to reveal the critical role that these three concepts, namely integration, equity and inclusivity, can play in teaching life sciences to learners with visual impairment in the inclusive school. This can serve as an informative work, serving as guidelines to assist decision-makers in validating their choices.

2.2.2.3 Integration as purposeful and deliberate act

Dunn (English, 1985), states that removing children from mainstream classes contributed to their feelings of inferiority and lack of acceptance. He suggests that these children should be kept in the mainstream of education and given additional support by special teachers. These special teachers are teachers who have mastered the art of integration when teaching life sciences to learners with visual impairment in the inclusive school.

English, (1985) further suggests that the ability of an individual with impairment to

succeed in society depends largely on his skill to get along with his fellow man. For learners with visual impairment to succeed in inclusive schools is largely contingent on the ability of the teacher to incorporate integration when teaching life sciences. The method the teacher uses should involve group work assignments and cooperation, offering opportunities and learning experiences to learners with visual impairment in class. This strategy therefore serves many purposes. Sighted learners are able to learn in the same class as their fellow learners with visual impairment. Both groups learn to work together, play together and grow up together. This has untold benefits for the community within the school and in society.

Martin (English 1985), suggests that the reason for incorporating integration when teaching life sciences is to provide positive interaction between learners with impairment and those without impairment. English further endorses the view that mainstream classroom teachers should be prepared through in-service programmes, if mainstreaming through integration is to be effective.

It cannot be over-accentuated that placement of learners with visual impairment in the inclusive school is not an automatic process. Teachers cannot be expected to automatically know how to incorporate integration, equity and inclusivity when teaching life sciences in the inclusive school. Teachers cannot not be expected to just figure out what factors will promote equality and full participation of learners with visual impairment and what factors restrict their participation. Deliberate actions and intervention strategies must be put in place by the district, as proposed further in this paper on what is expected from the district.

Gickling and Theobald (English, 1985), who studied the attitudes of teachers, both regular and special, across elementary, secondary, and administrative positions, found that slightly more persons favoured mainstreaming if support services were available without the additional special support services; less than half of the respondents were in favour of mainstreaming.

The researcher wishes to point out that mainstreaming without incorporating integration

when teaching life sciences to learners with visual impairment in the inclusive school, lacks foundation. Mainstreaming per se is less adequate.

The researcher's view concurs with that of Kaufman (1995) who uses the word integration in their definition of mainstreaming, thus accentuating the incorporation of integration when teaching life sciences to learners with visual impairment. Kaufman adds that although integration is a necessary component, it is not synonymous with mainstreaming, since physical proximity does not ensure interactive behaviour or acceptance.

2.2.2.4 Integration for total development

Bishop (1985) emphasises the interactive aspect of the mainstreaming principle and maximum integration, i.e. incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school as foundation in the same class with those without impairment, and added the necessity of concrete assistance by teachers from special schools to mainstream teachers.

Bishop (1985) suggested that mainstreaming involved a holistic concentration on the person as an individual. This means incorporating integration, equity and inclusivity as composite and comprehensive interrelated concepts as foundation in inclusive schools, along with providing support for differences; she felt that incorporating integration when teaching life sciences yields acceptance.

Bishop (1985) also proposed that mainstreaming and integration when teaching life sciences to learners with visual impairment were not equal concepts, since true integration requires the support of cooperative and collaborative teaching, a practice not necessarily associated with mainstreaming.

Best, (1981) suggests that incorporating integration when teaching life sciences to learners with visual impairment provides a method for dealing with life.

Kaufman, (1995:180) viewed the incorporating of integration when teaching life sciences to learners with visual impairment as a necessary component of mainstreaming, but suggested that the two terms are not synonymous.

Taylor (English 1985) defines mainstreaming of learners with visual impairment as an education programme in which learners with visual impairment and those without impairment are placed in mainstream classes. Supplementary services and/or special instructional materials and equipment must be available, incorporating equity provided by a trained teacher of the visually impaired.

Teachers of learners with visual impairment must know how to incorporate integration, equity and inclusivity when teaching life sciences to learners with visual impairment.

Bishop, (1985) points out that the mainstream classroom provides the normal life situation which such learners will need in later life, and that enriched experiences are not probable in the exclusive company of other blind children. However, the researcher holds the view that this is not automatic. A teacher ought to know how to incorporate integration when teaching life sciences to learners with visual impairment in the inclusive school because this is foundational in inclusive schools.

Bishop, (1985) believed that it is the attainable and desirable objective of many learners with visual impairment to pursue the same basic curriculum as do their seeing fellow learners.

In order to achieve this goal, teachers in the inclusive schools must be equipped to incorporate integration, equity and inclusivity when teaching life sciences to learners with visual impairment. If not, the joys of being in an inclusive school will not be realised.

Taylor (English, 1985) felt that incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school with contemporaries helped these learners to come to terms with the emotional environment in which the blind child will

ultimately live.

Shumway (English, 1985) further reinforces the "real world" philosophy by saying that learners with visual impairment should be prepared for living in a sighted world. At school level, they are prepared through placing them in the inclusive school and then incorporating integration, equity and inclusivity when teaching life sciences to learners with visual impairment.

Root (English, 1985) states that incorporating integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school, serves as the provision of special educational assistance to learners with visual impairment, designed to and calculated at equalising the opportunity to develop abilities to think and do in order to fully participate in all life sciences activities in the inclusive school.

Hulsey (English, 1985) encourages learners with visual impairment to take charge of their own lives through the development of self-reliance in the inclusive schools. However, the researcher believes that unless integration, equity and inclusivity are incorporated in teaching life sciences, these hopes and dreams might be hard to realise.

Salisbury (1974:14) points out the enormous task of introducing a learner with visual impairment to seeing fellow learners. He suggests that it is important for the teacher to inform the entire class in advance about a visually impaired learner joining the class. The teacher must explain what is expected of them. The possibility exists that because of the past segregation policies in South Africa, learners from varied cultural backgrounds now attending open schools, could have trouble in overcoming the prejudiced beliefs they learnt in their homes and in the wider community.

Botha, (1990) warned that prejudice and racial issues should not be dismissed as trivial or as a non-event. He continues by saying that the future of South Africa or the inclusive education will not be a "miraculous happening"; not something already determined and

formed, waiting for those who have emerged from the transition stage. He points out that the nature of the future is being formed now, by what is happening, by what all those involved in it think and do, and by what they say and how they say it.

2.2.2.5 Integration as human rights in inclusive schooling

According to the Department of Education, (2008:10), the Life Sciences curriculum supports the implementation of the South African Constitution and the application of the nine National Curriculum Statement (NCS) principles, if social transformation is to be achieved, all South Africans must receive a quality education. Life sciences, in this regard, will contribute to social transformation by ensuring 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.

Learners with visual impairment are people with the same rights, interests, needs, fears, and abilities as any other cross-section of the public. Therefore, placing them in inclusive schools needs to be accompanied by measures that will ensure equality. One way of ensuring this equality is by incorporating integration when teaching life sciences to learners with visual impairment, which is foundational for inclusive schooling.

This human variable is the incorporation of integration when teaching life sciences to learners with visual impairment in the inclusive school. This equalisation of opportunities is critical as foundation for inclusive schooling. It will help learners with visual impairment earn respect because they will be seen to be equal to sighted fellow learners. Marginalisation and exclusion will perpetrate prejudice and other negative attitudes, preventing learners with visual impairment from participating or asking for help when doing experiments that involve vision and require assistance from sighted learners.

On the subject of prejudice in schools, Anim, (1991:7) reasons that in South Africa prejudice could be a manifestation of various things. He asserts that divisions between learners in schools should be unacceptable. Learners with visual impairment should not

be labelled because they lack vision when doing experiments, such as observing types of soil or changes of colour in life sciences, or because they ask their sighted friends to describe the activity and the object under observation. In some cases, learners with visual impairment ought to be given an opportunity to imagine activities after proper explanation. This does not make them objects of prejudice in any way whatsoever. This does not make them lesser learners; rather, it indicates that they learn by a different method.

Banks, (1996:57) points out that schools ought to acknowledge and respect varied cultural values and beliefs. This could refer to learners with visual impairment as a disability sector, as discussed in detail in the beginning of this chapter. This culture and beliefs are the result of basic elements of commonality in the method of learning, which does not warrant prejudice or discrimination of being different persons but rather as different ways and modes of learning as those of learners with visual impairment.

Banks, (1996:57) supports their argument by stating that schools do not serve one societal group but rather the citizens of South Africa and persons with varied needs whose beliefs and values may differ.

A school is itself a society and a culture with identifiable values and rituals to which the learners are expected to conform. Because it is a society, it must ensure that prejudice among learners as members of the society is discouraged. Prejudice could be detrimental to the functioning of the school (Banks, 1996:58).

In a school, learners could be plagued with charges of stigmatisation, labelling and marginalisation and might therefore respond defensively. Hostile attitudes, negative incidences and discriminatory practices could have negative consequences for the inter-group relationships formed by learners. Prejudice could undermine the inclusive cultural make-up of a school. Clashes in schools may be the result of a need to resolve conflict across diversity.

Considering the dangers of prejudice in schools, the researcher perceives a need for teachers to devise teaching and learning strategies that would educate the learners to

know, understand, respect and accept group differences. Judging from the views stated, there seems to be a need to eliminate misunderstandings and inequalities that may occur in schools. It is necessary that learners be educated to better understand the diversity that prevails in their schools. Learning should promote appreciation for similarities as well as differences that prevail in societies.

Life in our communities shows that children play together with those with visual impairment. Individuals are not born prejudiced and stereotyped. Sighted learners are not automatically prejudiced against learners with visual impairment in their inclusive school. Accordingly, individuals learn prejudice and stereotyping toward those belonging to a differing group through a variety of factors. These factors, among others, could be influenced by how the teacher incorporates integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. If the teacher decides to exclude and marginalise learners with visual impairment when teaching life sciences, sighted learners will do likewise. If the teacher incorporates integration when teaching life sciences, sighted learners learn to assist their fellow learners with visual impairment during experimentation.

What sighted learners learn in their inclusive environment and from others, including teachers in class, is critical and foundational in the inclusive school. Prejudice in schools is one of many critical issues that teachers need to address as of legitimate concern. Teachers have a responsibility to recognise and acknowledge learner diversity.

While it is not possible to force friendships, it is possible to promote cooperation through group work and creating opportunities for sharing that encourage friendships through common assignments, where learners work together to examine a flower and allow a learner with visual impairment to feel the texture, size, and smell, while sighted learners fill in the rest like e.g. colour veins, to observe and learn. Learners with visual impairment benefit from specific assistance with adapting to the school's social environment. The Circle of Friends (Perks and Perske 1988) is an approach that can be used to create opportunities for friendship available to the learner with visual impairment. This is the kind of friend that will help learners with visual impairment in the observation

and analysis when carrying out an experiment in the life sciences class. The learners with visual impairment will benefit enormously through the description given by their fellow sighted learners when doing observations or analysis. Partially sighted or learners with low vision who have been at the same school with learners who are blind, offer this type of help with relative ease. In the inclusive school, the same environment or conditions can be created.

Circle of Friends is a support structure that aims to assist, but a learner with visual impairment is a stranger in the inclusive school and his lack of vision presents the learner with difficulties in forming friendships. The object is to make sure the learner is included in activities and feels part of a group. The process provides peer support, encouragement and friendship to the learner.

Prejudice could create difficulty in efforts towards maintaining harmony in schools. This demands that the teacher incorporates integration when teaching life sciences to learners with visual impairment in the inclusive school. This is foundational to ward off negative attitudes that might result in prejudice. It is incumbent upon the teacher in the inclusive school to promote equality of opportunities and collaborative learning with all learners, those that are sighted and those with visual impairment, in life sciences activities. Where adaptation or modification is necessary, the teacher should endeavour to do so

Prejudice in schools could have disastrous effects. He warns teachers to pay attention to the mistaken belief that children cannot acquire prejudice. Imagine what would happen to learner with visual impairment in a class where a teacher does not incorporate integration when teaching life sciences. This would mean a learner with visual impairment is marginalised and excluded from all life sciences activities. Such a learner could be sitting right at the back of the classroom wondering what is happening. Such a learner is mainstream excluded. Those who are naive and ignorant might celebrate placement in the inclusive school as victory for learners with visual impairment. The truth of the matter is that this is gross injustice and violation of human rights of the individual. It is an entitlement on the part of those in authority.

Whether or not they have vision impairment, all children must engage in appropriate social interactions to ensure appropriate social, emotional, cognitive and academic development. However, social skills are more difficult for a learner with vision impairment than for peers without vision impairment. It is not sufficient for learners with visual impairment to simply live in a sighted world and attend their local school. We cannot assume that such learners will effectively interact with sighted peers or be accepted, unless teachers incorporate integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school as well as provide necessary support. Teachers must do all in their power to promote peer acceptance through common and collaborative learning through learner participation. It cannot be over-emphasised that the teacher ought to incorporate integration when teaching life sciences to learners with visual impairment. Through incorporated integration, sighted learners learn to value learners with visual impairment as fellow learners in the inclusive school.

Most of the skills that sighted learners use in their everyday social interactions have been learned through observing others and by imitating or modelling their behaviours and then adapting the behaviours to their interaction style. For example, a learner learns how to use both verbal and non-verbal communication when greeting adults or peers by observing others in his or her environment. These observed skills are then adapted into the learner's interaction style.

In addition, Banks, (1996:335) pronounces that preconceived attitudes could affect learner actions towards those of other groups and as such motivate them to act either in a friendly or hostile way. He goes on to say that prejudiced learners might ignore the behavioural and the personal characteristics of other learners even if the characteristics displayed are inconsistent with their beliefs.

It is naive to expect marginalisation, exclusion, stereotyping, prejudice and over-generalising to vanish in the inclusive schools. In other words, if the teacher does not incorporate integration when teaching life sciences to learners with visual impairment in the inclusive school, he is endorsing the status quo. Not to act by incorporating

integration when teaching life sciences to learners with visual impairment in the inclusive school, is to act in default. Allowing stereotyping and prejudice to prevail in schools is ensuring that marginalisation, exclusion and prejudice will always persist.

Prejudice could lead to discrimination that can vary in degree and form, thus undermining shaking the very foundations of inclusive schooling. In other words, incorporating integration, equity and inclusivity in the school is foundational and indispensable to promote equality and all democratic values and human rights. Prejudice in some cases may consist of little more than name-calling, labelling or the telling of disability jokes. In other cases the negative actions might be more serious as in, for example, the denial of various opportunities to learners with visual impairment as different members of certain groups and even the physical destruction of human life and property.

The typical classroom day provides many incidental teaching moments upon which the teacher can capitalise. For example, when giving a life sciences assignment where learners need to observe a chemical reaction while performing an experiment, blind learners may have difficulty in initiating conversation if they are unaware of who is nearby. As a result, a learner may choose to remain socially passive rather than risk embarrassment (Bishop, 1996). These highly important “teachable” moments can be used to help learners to interact with one another in collaborative and productive ways, such as by encouraging peers to inform the learner with a vision impairment that they are in the area. This is important because the learner might not be aware of their presence. Another example may entail providing suggestions to the learner on topics they could talk about with their peers. The greater benefits of social skills instruction is that both the academic and social functioning of individual learners could improve, together with the interpersonal climate of the classroom for all learners (Siperstein and Rickards, 2004).

2.2.2.6 Social skills facilitating integration in class

The role of a teacher in helping learners with visual impairment acquire social skills is a critically important one. The classroom teacher has an important and central role in

providing social skills support by incorporating integration when teaching life sciences to learners with visual impairment. The other elemental or foundational element is incorporating equity and inclusivity. These two concepts will be discussed in the relevant sections but they are essential, critical and inseparable. The teacher cannot incorporate integration when teaching life sciences to learners with visual impairment at the inclusive school and omit the other two foundational elements, namely, equity and inclusivity.

The teacher, in collaboration with other teachers from special schools, may provide strategies to promote skills in interacting with others. S/he can encourage learners to be assertive in expressing their needs and preferences to ensure the development of positive self-esteem, self-confidence and sense of identity that is essential in the learning of life sciences in the inclusive school. This skill will help a learner with visual impairment to participate during experimentation and observation. In this way, a learner with visual impairment will learn and participate as equal member of the classroom. The everyday experiences children have in relationships with their parents are fundamental to children developing social skills (Corn and Koenig, 1996).

Teachers and parents can work in collaboration to encourage and nurture the development of social skills in children. This collaborative approach can stimulate the growth of effective social skills by providing the learner with a range of learning experiences inside and outside the classroom. The teacher ought to ensure that she incorporates integration when teaching life sciences and the group work assignment done with other learners even during extramural activities. The parents of a learner with visual impairment ought to be informed about this purposeful and deliberate attempt made by the teacher.

Full participation and equal access to life sciences activities in the inclusive schools by learners with visual impairment signifies the ending of marginalisation and exclusion in education as a human rights issue which belongs within equal opportunities policies. Marginalisation, exclusion and segregation in education caused by visual impairment are a contravention of human rights.

According to Botha, (1990:74) classroom life poses many social challenges for learners both sighted and those with visual impairment throughout their years in school. He feels that the manner in which classroom activities are organised and conducted, is the way the teacher incorporates integration when teaching life sciences to learners with visual impairment, which could affect learner choice of social interaction. In view of the newly adopted education system for South African schools where a classroom could be composed of learners from differing abilities, special education needs and diversity, it is questionable how learners in such heterogeneous classrooms relate to one another. The solution lies in the fact that the teacher incorporates integration when teaching life sciences to learners with visual impairment in the inclusive school.

The education system and a school that does not plan to address the issue of prejudice through incorporating integration when teaching life sciences to learners with visual impairment in a responsible way, are not fulfilling their duty towards all learners and the broader community. Our rainbow nation can ill afford not to address the question of incorporating integration, equity and inclusivity when teaching life sciences to learners with visual impairment in inclusive schools.

Farrell, (2000:35) explains that teaching methods are neither devised nor implemented in a vacuum. Design, selection and use of particular teaching approaches and strategies arise from perceptions about learning and learners. This tells us that it is incumbent on the teacher to know and understand her learners with visual impairment and how they learn and should be taught. The strategy of incorporating integration is a deliberate and purposeful attempt aimed at ensuring cooperation, mutual acceptance and mutual and collaborative learning. Even the most pedagogically advanced methods are likely to be active in the hands of those who implicitly or explicitly subscribe to a belief regarding some learners at best, as disadvantaged and in need of fixing; at worst, as deficient and therefore beyond repair.

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Learners with visual impairment in the inclusive school feel that their safety and security are uncertain when schools and teachers allow marginalisation, exclusion and labelling to exist. Although teachers could, in other ways, be rendering their education services as is required of them, it is important that they work towards knowing and understanding how learners feel and what teaching options could be available to address diversity.

Booth, (1992:45) accounts the schooling experiences of a totally blind pupil at an ordinary school. The significant difference experienced by the visually impaired learner is that it is a school for seeing children and that his education rests solely on support service. It was expensive but was essential if the blind pupil were to succeed in their studies. The work often had to be prepared in two forms. Typed work was done on a Braille machine for the blind pupil so that the pupil could read and correct it. The work was then transcribed into print for the teacher to mark.

The focal point in this regard is how the teacher incorporates integration when teaching life sciences to learners with visual impairment. To ignore individual differences between the sighted and those with visual impairment and variations in ways of learning is, in fact,

probably to make learning very much more difficult for many learners. It is detrimental to regard every child who responds differently to expectations as an oddity, failure or problem. It is manifestly unfair to expect a widely differing group of people to conform to unrealistic expectations and then to criticize as problems or deviants those whose behaviour is not uniform. Most often, visually impaired people are regarded as having their world, i.e. the world of the blind (Blunkeft, 1992:1-2).

What is involved in incorporating an integration strategy when teaching life sciences to learners with visual impairment in the inclusive schools are the rights of people with visual impairment to participate in the activities of everyday school life.

The idea of incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is similar to the idea of integration being a means to an end. Although both ideas enable a more dynamic view of the process of normalisation, these views obscure the crucial question regarding the ends of integration (Mittler, 1993:55).

It has been shown in Africa that incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school together with sighted learners is a two-way process. It not only trains the blind child, but because it exists and functions in the midst of communities, it educates the local population about the visually impaired (Salisbury, 1974:3 5).

Further, mainstream education offers company instead of physical isolation: the knowledge that one is wanted and is part of a community (Salisbury, 1974:35).

Dawkins (1990) pointed out that in creating integrated schooling visual impairment has many aspects to consider. Taylor (1986) considers that among other aspects of their role to classroom, teachers should explain effects of visual impairment. This view is supported by authors like Jan, Freeman and Scott (1977); Dobree and Boulter (1982); Jose (1983); Fitt and Mason (1986) and Lomas (1986).

Hermelin and O'Connor (1971; Loomis 1981; Young 1982). Believe that as the blind learners use hands to read, write and get some information, teachers must not limit them to a particular hand or fingers. A second finger or second hand can also have a valuable part to play in reading.

Waldron, (1996) advised that, despite the most carefully written IEPs and the best of plans, in an inclusive school, teachers are faced with concerns over equity and excellence,

Sacks and Silberman (2000:637) and Low, (2006) point out that a teacher can also encourage sighted learners to help the student with the vision impairment to engage in social experiences throughout the day

Kekelis, Sacks and Wolffe (2000) have suggested that "...there are no easy 'how to' lessons that teach social skills. Yet there are moments each day when parents and teachers can respond to situations in ways that help learners with visual impairments learn social skills" (p. 20).

Mangold and Olson (1981). Hold the view that teachers must encourage the blind to use their hands and fingers for information. The sighted learners will know that this is how the blind learners access some information. The use of hands and fingers activities will develop control of the fingers and independent movement and strength. Practice in the use of hands for gaining information should lead to accurate tracking of a line of braille. Another set of factors needs to be considered to ensure the development of reading techniques and these involve elements in the environment for the reader and attention to the use of hands and fingers. Braille is felt with the pad of the finger, the area between the tip and the first joint. The tip of the finger is not large enough, nor does it have appropriate nerve endings, to be used for reading.

Jamieson et al. 1977; Benton 1982; Millar 1986) Argued that it is essential to identify the information and skills needed by the inclusive school teacher.

This information will help to equip the teacher so that such a teacher can have a realistic expectation of the learner with visual impairments. This is achieved by explaining the problem and limitations which stem from visual impairments,

Murphy and O'Driscoll (1989) warned the inclusive teachers that there are hindrances involved in the teaching and learning of the blind and visually impaired learners in the inclusive schools.

Through such knowledge, the teacher will be able to create conditions that will stimulate responses from the blind learners to be part of the integrated classroom (Nielsen 1979; McInnes and Treffry 1982; Best 1986; Longhorn 1988).

Hinton (1988). Pointed out Life Sciences diagrams can be made using a variety of material. This includes textured papers and cloths, strings and ribbons, plastic and some metal shapes. Each of these materials can be cut out and stuck to a base sheet to build up a tactile picture. The materials are most satisfactory if they are porous as in the vacuum-forming process; a sheet of plastic is placed over the master copy; the plastic is melted slightly in an oven; a vacuum pump then sucks the plastic sheet over the master copy and, as the sheet cools, it takes the shape of the master. To obtain a clear copy, the pump needs to be able to suck air through all the material so that the plastic sheet is drawn tightly into the shape of the master.

The teacher should know also that there are a number of electronic devices with sound or speech outputs which will be relevant to science work. Computers with speech output can be used to help with many types of calculation. A teacher should have knowledge of how can special teaching approaches and specialist equipment combine to give increased access to the curriculums a number of authors, in this regard give specific suggestions on teaching, for example, in maths and science (Fletcher 1970; Heritage 1986; Chapman and Stone 1988; Clamp 1988). The blind and visually impaired learners can do Life sciences because they have the potential and abilities like other sighted learners (Woods 1979; Buell 1983; Fullwood 1984; Norris 1972). The teacher must remember to supplement the print and pictures with appropriate format for her blind and visually impaired learners (Stone.

1988). Being able to identify the level of functionality of residual vision will help the teacher to prepare adequately for her learners with low vision (Hyvarinen. 1988).

Authors like Langley, (1981) and Barraga and Morris (1989) pointed out the importance of making sure that the physical environment for the blind and visually impaired learners is assessed and properly adjusted. Barraga and Morris, K (1989) and Tobin and Chapman, (1989) made clear that some aspects of the use of residual vision could be utilized when clues in the environment are made. Welsh and Blasch (1980) and Dodds (1988) pointed out that the blind learners will rely mainly on auditory clues.

Best (1987b; 1988) accentuates the use of residual vision from the partially sighted learners. Best et al. 1987) highlighted the urgent need for support structure or system with other stakeholders in education in order to produce optimal benefit in the integrated schools. He, with other authors, further suggested that this support must start from pre-primary schools and should include orientation and mobility of such learners (Best 1985; Culpan 1988; Furth 1989). He argued that learners who have learning disabilities should have even more support

However, it must be understood that what is seen as 'real' by those previous education dispensation of special schools at those particular times of history could be seen as a form of 'virtual reality' now it is the new dispensation of inclusive schooling (Giddens, 1984). Harley, (1981) and Hill, (1984) believe that orientation and mobility is important in the inclusive schools. Not only this, but the blind and visually impaired learners must be taught special perception that links with Life Sciences.

2.2.3 Conclusion

Wilson, (1999:43) points out that when a system of division is challenged and people belonging to the discriminated group no longer accepted their group position, those in power form strong prejudiced beliefs founded on racist ideologies. Through this

ideology, the privileged members claim that they are in a superior position because they are naturally superior and that the subordinate members do not possess qualities enabling them to compete on equal terms. This ideology would therefore serve as a philosophical justification for exclusion.

2.3 Theoretical perspective of incorporating inclusivity as foundation of inclusive schooling

2.3.1 Introduction

The proposed study draws primarily on social constructivist theory. This is because constructivism can create the conditions for pedagogy of possibility. Pedagogy of possibility can be understood as a pedagogy that takes on board the diverse needs of all learners, including learners with visual impairment in the inclusive school. In constructivism lies hidden a value ascribed to the notions of diversity and adaptability.

This paper argues for a methodological pluralism and an inquiry that considers a number of pedagogic possibilities that follow from a constructivist conception of scientific knowledge.

This means conditions can be created by the teacher to accommodate diversity in teaching and learning life sciences. The teacher who is innovative and creative or the teacher who has been exposed to how learners with visual impairment learn, can accommodate such learners in a variety of didactical situations.

According to Fraser et al., (1996:51) these educators' immense contributions should:

- Motivate learners to become aware of their own, existing way of learning.
- Assist and encourage learners to develop a deep approach to learning.

- Encourage learners to develop skills with which to exploit their existing knowledge in order to solve future problems.
- Make all experiences, with specific reference to the learning experiences, content related.
- Encourage cooperative learning in the classroom to give learners the opportunity to reflect their own learning and that of others.

This teacher knows how to incorporate inclusivity when teaching life sciences to learners with visual impairment in the inclusive school in the same class as sighted learners. Such a teacher can see what method to use that will increase full participation of learners with visual impairment in the inclusive school. She can plan the life sciences activities for observation and analysis around group work where learners with visual impairment will participate and where the whole group will cooperate and provide assistance where necessary.

According to Fraser et al., (1996:50) learners should be made conscious of all demands relating to their tasks, and this implies knowing exactly what is expected of them as learners.

This cannot be automatic because learners acquire their individual attitudes, values and beliefs. The teacher should be the first to incorporate inclusivity when teaching life sciences to learners with visual impairment in the inclusive school.

As it was discussed in detail in the previous section, marginalisation, exclusion and labelling can be avoided. This is, however, incumbent on the teacher to incorporate inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. Inclusivity means full participation with necessary adaptation or modification of the activities made to create conditions for learning by those learners with visual impairment.

Literature informs us that participation in didactic situation must result in learning. Kokot et al., (1997:26), pointed out that learning implies the outcome or results achieved by means of a completed process. This implies that when learners with visual impairment learn Life Sciences, they must attain the prescribed learning outcomes of Life Sciences in the inclusive school.

Van Der Horst and McDonald, (1997:124) defined learning strategies as a broad plan of action for teaching activities with a view to achieving an aim.

Generally, the emphasis is on developing a pedagogical imagination that offers possibilities and alternatives to both learners experiencing visual impairment and teachers of the visually impaired learners. This argument is within the National Curriculum Statement founded on the outcomes-based education model and Education White Paper 6 on Special Needs Education (Department of Education, 2001:19).

Best, (1985:52) points to the limitations caused by visual impairment. This is critical in the understanding of learning in life sciences where observation and analysis is the core of the experience. It is therefore crucial that the teacher incorporates inclusivity when teaching life sciences to learners with visual impairment in the inclusive schools. English asserts that the hands cannot give information to the brain about relationships between objects and structures as easily as the eyes can.

Regarding this problem explored by this study, literature say this is so because, at its core, Science and Biology are founded on observation: watching things, measuring them, analysing their properties, figuring out how they work, making analysis of relationships and properties (Kumagai, 1995:82).

It is important for Life Sciences teachers to realize that the blind and visually impaired learners will depend on different teaching and learning strategies that will deal with the issue of vision in observation, tabulation, exploration and experimentation in Life Sciences. This is essential because visual impairment would continue. Even though

people with impairments would experience neither marginalization nor segregation, they would continue experiencing restrictions solely due to their visual impairment (Terzi, 2004:150).

Pauw (1990b:31) considered learning strategies as processes through which an individual develops or acquires knowledge, skills or attitudes.

When the teacher uses assistive technology, such a teacher must understand that it is not about exhibiting that every challenge in our teaching and learning can be compensated fully or in all situations for by assistive devices, or good design (Vasey, 1992:44; cited in Barnes et al, 2006:38).

Integrated Life Sciences class allows for an understanding of difference as a function of comparisons between learners rather than distinctions based on fixed categories or impairment (Florian et al., 2006:43).

Reindal, (2008) argues that there must be a theoretical perspective within the theory of justice that endeavours to answer the question of 'equality' in learning and participation.

According to Robeyns, (2005:198) there must be a general framework that can serve as a guide for evaluative activities in the inclusive schools on learning and participation of the blind and visually impaired learners in Life Sciences, in this regard.

Integration and its potential for education in the inclusive schools is highly praised, recommended and accentuated (Saito, 2003).

Nussbaum, (2006:194) understands visual impairment as the loss of functioning and disability consequential to the restriction of function. In her view, handicaps should be reduced by augmenting the resources in terms of assistive technology or dedicated teaching methodology for the blind and visually impaired learners in the teaching and learning of Life Sciences in the inclusive school.

This stride is a wholly community mission because it really means the integration of learners with visual impairments into public space through inclusive school, which requires public planning and a public use of resources Nussbaum, (2006:194)

This view is endorsed by Watson (2005) who argued that those in authority must create equal opportunities and provide adequate resources that will bring about equality in a public place like inclusive school.

Presently, there exists two main perspectives on disability within special education. One perspective accentuates the additionality for the individual child, here recognized as the individualist approach to disability, the other the inclusivity of the system, here identified as a social approach to disability (Norwich, 2002).

Thomas (2004) pointed out that special education has always suffered an inferiority complex in terms of resources. Inclusive schooling is supposed to be better resourced.

Terzi (2004) has criticised the social model for unvaryingly conceptualising disability as generated by social factors, such as marginalization and exclusion. According to her, this is a flawed understanding of the relationship between impairment, disability, and society, and it actually hampers the achievement of the goal of the social model: inclusion

The focal point in this regard is how the teacher incorporates inclusivity when teaching life sciences to learners with visual impairment in the inclusive school together with sighted learners. To ignore individual differences and variations in ways of learning would probably make learning much more difficult for many learners with visual impairment. This could cause learning and teaching breakdown. The didactical situation could fall flat. Learners with visual impairment could be marginalised, excluded and labelled simply because the teacher is unable to incorporate inclusivity when teaching life sciences to learners with visual impairment in the inclusive school where sighted learners are in the same class. Often, learners with visual impairment are people regarded as having their own world i.e. the world of the blind (Blunkeft, 1992:1-2).

2.3.2 Incorporating inclusivity

One of the most important features of outcomes-based education is that the teacher incorporates inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. It is concerned with establishing the conditions and opportunities within the system that encourages all learners to achieve those important outcomes. The critical words that underscore incorporating inclusivity are enabling and achieving. The teacher creates the enabling mechanism that will lead to achieving. If the teacher is not creating i.e. incorporating inclusivity, achievement cannot result. Achievement is therefore contingent on enabling.

An inclusive curriculum means that the teacher incorporates inclusivity when teaching life sciences to learners with visual impairment in the inclusive school and it cannot be inclusive unless all learners, including those with visual impairment, fully participate and are included in learning. This aspect of incorporating inclusivity when teaching life sciences to learners with visual impairment is based on a view that learning takes place when learners are actively involved in making sense of their experiences. They need to find things out and understand things for themselves (Da Costa, 2003:56).

The teacher in the inclusive school must bear in mind that learners with visual impairments need assistance in making the connection between vocabulary, and real objects, body movements and abstract ideas (Bhargava, 2004:12). Important vocabulary and concepts should be pre-taught using concrete, multi-sensory experiences combined with verbal explanations. The teacher must review material by asking the learner to describe what s/he understands about the term or concept in order to verify and consolidate understanding of the concept (Bhargava, 2004). New vocabulary should be spelled out verbally and be accompanied by concrete object or experience where possible (Bhargava, 2004).

According to Fraser et al., (1996:51) blind and visually impaired learners will learn Life Sciences only if facts of reality are placed within the reach of the learner. This must,

however, be done in such a way that details to be observed and perceived by the learners are converted into concrete facts of reality.

Both outcomes-based education and inclusive education have as foundation incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. This strategy is based on principles of learner-paced and learner-centred teaching and learning processes, and that learners should be taught according to their level. Teachers must differentiate and adapt the curriculum to match: this precisely and unequivocally refers to incorporating inclusivity to accommodate abilities of learners with visual impairment abilities (Da Costa, 2003:56).

Literature informs us that learner-centered approach to observation demands that learners are expected to analyse their observations. The absence of visual ability deprives learners with visual impairment of the advantage of observation (Borg, 1987:157-158). Such deprivation causes blind learners to be less competitive during Life Sciences class.

The school where the teacher is able to incorporate inclusivity when teaching life sciences to learners with visual impairment, is an educationally inclusive school and is one in which the teaching and learning, achievements, attitudes and well-being of every young person matters. Effective schools are educationally inclusive schools. This is revealed not only in the performance but also in their ethos and their willingness to offer new opportunities to learners with visual impairment. These schools identify inclusivity and plan to incorporate it when teaching life sciences to learners with visual impairment. Learners who may be missing out, experiencing difficulty in engaging, or feeling in some way excluded from what the school seeks to provide, will be catered for (Farrell, 2000:4).

Erwin et al., (2001:339) argue that learners who have acquired basic science process skills have positive, consistent and successful experiences in science that will enable them to explore, discover and ask questions about the world in which they live.

It needs to be accentuated to all teachers who are involved in the education of learners

with visual impairment that the method of incorporating inclusivity when teaching life sciences to learners with visual impairment may be varied since learners with visual impairment are not a homogeneous group. They are similar to other sighted learners who might need different methods to understand a particular aspect of life sciences. They are not different because they have visual impairment; rather they differ because all people have been created to be different and unique with elements of commonalities or modalities. The range of support needs for each learner differs drastically in terms of his/her specific needs as well as his/her context. For instance, learners who are blind and who have mastered Braille will have less intense support needs than those who still have to undergo Braille training. Within any classroom there is a wide range of cognitive abilities that will require a variety of responses from teachers. Contextual barriers are conditions that will furthermore play a role in determining the level of support that the teacher needs to provide.

The research conducted by Maguvhe (2005) points out that according to evidence, Maguvhe argues that, access to the learning mediation of biology including experimentation and exploration is limited. In his view, he argues that this state of affairs endorses the argument that the learning mediation of biology depends on one's visual ability, thus making it difficult for blind learners to access information

What is of essence in this process of incorporating inclusivity, when teaching Life Sciences to learners with visual impairment in the inclusive school, is the perfected art of blending the diversities in terms of limitations with the commonalities in terms of equalisation of educational opportunities. It is an inevitable logic that the greater the degree of functional impairment, the greater the degree of modification or differentiation needed in the common and flexible curriculum (Mittler, 1993:83).

In supporting This view, Sapon-Shevin, (2001:2) states that by definition, incorporating inclusion when teaching life sciences to learners with visual impairment in the inclusive school relates to implementing changes in the nature and quality of the inclusive education classroom.

Furthermore, according to Sapon-Shevin the instructional strategies: incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school and adaptations provided for such learners in special schools can be provided in ordinary classrooms, on condition that classrooms are reconceptualised in a sense that the teacher incorporates inclusivity when teaching life sciences to learners with visual impairment.

Visual impairment solution must be found where differences among learners, both sighted and the visually impaired are celebrated and appropriate educational experience developed and provided.

Shakespeare (1993) amongst others argues that the inclusive schooling needs to be reconceptualised to include the experience of impairment (Lindsay, 2003; Norwich, 1993; Shakespeare, 1993; Terzi, 2005).

2.3.3 Understanding diversity for inclusivity

According to Forlin, (2004:4), incorporating inclusivity when teaching life sciences to learners with visual impairment can be achieved through adaptation of material and curriculum differentiation. This strategy will cater for all learners with varied needs. In this regard, incorporating inclusivity when teaching life sciences to learners with visual impairment means teachers must reformulate their traditional methods of teaching to include or accommodate learners who are visually impaired (Booth and Amscow, 1998:7).

Many science processes are linked to outcomes and activities that are visually connected or dependent. For example, processes that are linked to changes in colour, size, shape, and disposition and re positioning, movement, changes in direction, and speed or patterns, require careful observation of the changes. Where observation by means of visual perception as skill is found lacking, the execution of the integrated (advanced) science process skills will be poorly performed.

Taking the various degrees of visually impairment into consideration one could assume that the process of incorporating inclusivity when teaching life sciences to learners with visual impairments in the inclusive school is complicated by requirements put forward by the subject and learning area on teachers and trainers. It has therefore become necessary to discover, develop and promote new approaches, strategies, tools, techniques, etc., that are essential for the enhancement of the full and active participation of visually impaired learners in special and inclusive schools (Abantwana-Phambili, 2001:2).

It is the purpose of this research to depict the essences and crucial role that incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive schools will create conditions for success and learning. However, the researcher wants to emphasise the equal importance of incorporating all three concepts, namely integration, equity and inclusivity. Incorporating equity will be discussed in detail in the next section.

There is therefore a general understanding that teaching of life science to learners with visual impairment in the inclusive schools needs to be adapted or modified for the teaching of visually impaired and blind learners in an outcomes-based classroom. Investigation is necessary to fully understand the incorporating of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school to visually impaired and blind learners in general, in terms of the teaching of life sciences and lessons that could be drawn towards inclusive education policy for the outcomes-based classroom.

Booth, (1992:52) points to the limitation that comes through visual impairment. This is critical in the understanding of learning in life sciences where observation and analysis is the core of the experience. English asserts that the hands cannot give information to the brain about relationships between objects as easily as the eyes can.

It should be clear, from thinking about the difficulties that may be stated by blindness or a “visual impairment” that simply placing a learner with visual impairment in the inclusive school or providing a piece of equipment like a Braille writer or sample and

even a model of the object being studied is unlikely to result in the incorporation of inclusivity in the inclusive school or meet the special needs of the learner with visual impairment. Providing a talking computer and Braille embosser to produce reading material in Braille will not help a blind child to read at the same speed as a sighted peer or help in understanding visual concepts that are read about, say, in Life Sciences. Enlarging print or giving a desk lamp to a learner with low vision will not teach such a learner how to scan through texts for key points, understand a diagram or graph which is only seen in part (Booth, 1992).

The other important aspect is that all learning material and information must be tactile or accessible available to his hands. Such a learner is going to use his hands to identify, examine, observe and analyse from parts first then to the whole then back to the parts.

It is quite probable that during exploration say different types of soil, the information available from the tactile environment to both hands and feet will be from a naturally occurring environment.

Sometimes it is crucial that the teacher ensures that he incorporates inclusivity when teaching this aspect of life sciences to learners with visual impairment. It cannot be left to chance that a learner with visual impairment might realise and notice the defences between his hands or under his feet. In some cases, the teacher may incorporate inclusivity by purposefully and deliberately adding special clues or hints. These clues and hints can be added for a learner with low vision or with visual impairment experiencing particular difficulties with the activities.

This view is supported by Horton, (1988:22) who argues that it is the responsibility of the teacher to teach "curriculum plus" skills. These are the additional skills a child needs. These skills include collaborative learning, learning to work in a group, cooperation, freely participating in the activities in the inclusive class, learning to ask for information or clarification when observing or analysing a life sciences object. These skills are crucial and fundamental in learning life sciences by learners with visual impairment. Such skills

serve as catalyst for this section.

Maguvhe (2005) established that there is evidence showing that even if blind learners are not able to observe experiments visually, they still benefit from explanations given by partially sighted classmates and teachers particularly with practicals because of their complexities and challenges that they may pose to blind learners, teamwork between blind and partially sighted learners is encouraged so that they could assist one another.

If the teacher failed to incorporate integration when teaching life sciences as the first step, then both the teacher and the learner with visual impairment will experience enormous difficulty. Learning may break down as the result of this missing link in the incorporation of integration when teaching life sciences to learners with visual impairment.

2.3.4 Teacher planning for inclusivity

Unfortunately, the mainstream initial professional educator training does not include in their teacher programme such skills but such a teacher is expected to deal with the problem directly. The inclusive school classroom teacher does not have special training to teach these skills by incorporating inclusivity when teaching life sciences to learners with visual impairment. These special skills are not included in a mainstream school curriculum but they still need to be incorporated when teaching life sciences to learners with visual impairment. This is placing the teachers in a dilemma and it is the survival of the fittest, or learners with visual impairment are excluded from the inclusive education system that does not provide inclusivity.

Literature informs us that for participatory experience to occur, learning material must be accessible and or tactile for blind learners to manipulate with their hands in case it is visual presentation or vision perceived. New vocabulary should be spelled out verbally (Barghava, 2004).

Teaching, as a human activity, encourages relationships and knowledge development that is particular to that situation and it involves more than the mastery of a set number of skills. This means a teacher in the inclusive school ought to know more than the initial professional educator training programme provides. S/he should know the types of learners s/he may have in class. In this case, it is expected that the teacher knows that s/he will have learners with visual impairment in class. This knowledge should inform her/him of planning and all relevant policy documents and additional resources required and available at the school. If planning does not happen, or if the teacher has no knowledge about her learners, learners with visual impairment are precluded, marginalised and excluded from the beginning. The fact that they attend the inclusive school serves other purposes but surely not educational as is intended by having learners with visual impairment in the inclusive school.

In the observation done by Maguvhe (2005) he expresses the related frustrations experienced by teachers regarding experiments since most of their learners need visual ability to perform and observe. Hence, educators resorted to the teamwork approach (pairing blind and partially sighted learners together) so that the partially sighted learners could supply blind learners with visual experiences.

It can safely be concluded that a teacher of the visually impaired learner needs knowledge about the learner. This would include learner potentials and limitations (Fraser et al., 1996).

There is an enormous challenge in the learning of life sciences by visually impaired learners. Booth, (1992:72) points out the fact that the curriculum areas which involve practical activities create more of a challenge and will require the skill of incorporating inclusivity when teaching Life Sciences to learners with visual impairment by utilising, among other strategies, adaptations in teaching approach and the support of specialised equipment: this refers to incorporating equity when teaching Life Sciences to learners with visual impairment in the inclusive school.

Fraser et al., (1996:68) maintains that from a teaching and learning point of view the ability to observe remains a crucial aspect applicable to teaching and learning in general. Observation is foundation al to the science processes and without observation; learning will be restricted and easily become less meaningful

This aspect is dealt with in detail in the next section, but it shows that these three concepts: incorporating of integration, incorporating of inclusivity and incorporating equity are interrelated and inseparable. A teacher cannot incorporate integration and leave out incorporating inclusivity, or incorporate equity leave out incorporating inclusivity.

Life sciences among other subjects as all likely to require this level of strategy: incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school and particularly so if such learner is totally blind. In all areas, though, the overriding concern will be to ensure that the teacher incorporates inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. This will ensure that such a learner understands the concepts involved in lessons. No item of equipment will do this. It requires the provision of expert teaching with, certainly so, support using specialised equipment. This equipment relates to access and accessibility which is our next discussion on incorporation of equity when teaching Life Sciences to learners with visual impairment in the inclusive school.

It can be seen throughout this study that it cannot be over-accentuated that the three concepts, namely incorporation of integration, incorporation of inclusivity and incorporation of equity form the foundation of inclusive school learners with visual impairment. There is no one aspect that is more important than the other. They all have equal roles and they cannot be exchanged for something else. Where the incorporation of integration is required, a teacher cannot choose to ignore this fact and decide to incorporate equity instead.

Where there is no incorporation of integration, no incorporation of inclusivity and no incorporation of equity, there is teaching and learning breakdown in the inclusive

schools. In other words, the absence of the incorporation of integration, inclusivity and equity is a recipe for an inclusive schooling fiasco for learners with visual impairment.

2.3.5 Inclusivity for vision

In his discussion, English, (1985:39) asserts that learners with visual impairment can learn life sciences and for this to happen, the teacher should incorporate inclusivity when teaching life sciences to learners with visual impairment in the inclusive school by adopting strategies, such as adaptations to the life sciences subject. In other words, there are restricting factors in learning life sciences by visually impaired learners. Conversely, learners with visual impairment cannot be included or a lesson cannot be inclusive and enable learners with visual impairment to learn and achieve and succeed in life sciences unless the teacher is able to incorporate inclusivity by using strategies such as modifications or adaptations in the lesson or activities.

In view of the above statement, there are factors in the system that restricts the learning of life sciences. These factors prevent a learner with visual impairment from learning and achieving outcomes in life sciences. Success will only be achieved when the system is adapted to be responsive to and addresses the needs of a learner with visual impairment in the inclusive school by incorporating inclusivity when teaching life sciences to these learners. As long as the system does not recognise these restricting factors, learners with visual impairment in the inclusive schools will be masquerading as beacons of inclusive schools when in fact they are suffering marginalisation, exclusion, segregation and labelling in the name of inclusive schooling for learners with visual impairment. For such learners, learning becomes “pie in the sky” and there will not be learning in life sciences.

Bishop (1985) described the experience of having a blind boy in his metal shop, saying that there were no changes needed in shop layout or projects, once the learner was safely oriented to each piece of equipment or tool. Bishop (1985) utilised the SAVI (Science Activities for the Visually Impaired) materials in the life science class and found them to

be activities designed to make maximum use of all senses in making observations and drawing conclusions.

Carin and Sund, (1989:215) depict teaching of life science and biology to learners experiencing visual barriers as a reality. This implies, inter alia, that one of the most important qualities that the teacher for learners experiencing visual barriers to learning must possess, is certainly a firm belief in the value of the work being done and the competences that will equip such a teacher to see a project through to a satisfactory conclusion. Teaching may not be considered as another way of transferring knowledge, but as an instrument which can, with appropriate and adequate training, become a massive force in breaking down the visual barriers to learning. Its possibilities are immense, its horizons wide, yet because of the very areas in which it operates, the dividing line between success and failure is sometimes very thin.

Glazzard (English 1985) maintains that adjustments in traditional school programmes should accommodate differences among learners. The strategy to accommodate differences in the case of learners with visual impairment is by way of incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school.

English, (1985) further suggests that incorporating inclusivity when teaching life sciences to learners with visual impairment does not necessarily mean that individualisation should not necessarily as one-to-one tutoring. The focus of incorporation inclusivity when teaching life sciences to learners with visual impairment should be on educational interventions rather than on placement, so that individual differences come to be viewed as the norm rather than the exception.

It is important for Life Sciences teachers that the blind and visually impaired learners will depend on different teaching and learning strategies that will deal with the issue of vision in observation, tabulation, exploration and experimentation in Life Sciences. This is essential because visual impairment would continue. Even though people with impairments would experience neither marginalization nor segregation, they would

continue experiencing restrictions solely due to their visual impairment (Terzi, 2004:150).

Integration of the blind and visually impaired learners with sighted fellow learners during Life Sciences class does not deny an underlying reality or experience that differentiates disabled and non-disabled learners (Barnes et al, 2003:9-78).

The goal of incorporating inclusivity when teaching life sciences to learners with visual impairment as the means of adaptive education is to make instructional provisions that are adaptive to individual differences and to foster learners' ability to effectively assume responsibility for making necessary adaptations to their learning environments, in their own learning process, and in the management of their own learning and classroom behaviours (Bishop 1985).

Under the current dispensation, a large number of learners with visual impairment will be marginalised and excluded from attending inclusive schools simply because of their visual impairment, and because the teachers in the inclusive schools have no inkling of how to incorporate integration, inclusivity and equity.

2.3.6 Curriculum flexibility for inclusivity

Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school and the strategies such as these adaptations should not be viewed as creating a new or alternative curriculum but as curriculum (NCS). The incorporation of inclusivity in the form of adaptations is intended to include so that all learners with visual impairment can access the curriculum. Learning programmes, work schedules and lesson plans can be modified and adapted to cater for the individual needs of learners.

The incorporation of inclusivity is a strategy that serves as curriculum adaptations which are modifications that relate specifically to instruction, method or curriculum content. Incorporating inclusivity when teaching life sciences to learners with visual impairment

is a curricular adaptation in any adjustment or modification that encompasses all three concepts, namely incorporation of integration, incorporation of inclusivity and incorporation of equity to:

- (i) Learning environment: this relates to incorporating integration when teaching life sciences to learners with visual impairment in the inclusive schools.
- (ii) Learning techniques: this is incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive schools
- (iii) Learning support material that creates access and accessibility: this is incorporating equity when teaching life sciences to learners with visual impairment in the inclusive schools. Incorporating equity when teaching life sciences to learners with visual impairment in the inclusive schools creates accessibility that enhances a learner's performance or at least allows reasonable participation in a learning activity.

The National Curriculum Statement (2008) has several components that are sufficiently flexible to allow for adaptation. Examples of these flexible features include:

- Learning outcomes do not prescribe content or method. Therefore, content and methodology could be appropriate for learners' needs (DOE, 2003:12).
- Activities can be flexible (DOE 2003:10).
- The context can be made relevant to the learners' needs (DOE, 2003:10).
- More time can be provided for assessment (DOE 2003:11).
- Methods of assessment are flexible (DOE, 2003:1).
- The learning programme can be structured to meet the needs of the specific learners (DOE, 2003:2).
- Learners can communicate using sign language, Braille, assistive devices or any other communication method (DOE, 2003:1).
- Expectations can be adapted to the abilities of the learner within the framework of the high expectations (DOE, 2003:12).
- The curriculum emphasises the principles of social justice, healthy environment, human rights and inclusivity (DOE, 2003:5).

- Time allocation and weightings regarding learning outcomes and learning programmes are recommendations. It is therefore flexible (DOE, 2003:6).

Teachers are encouraged to consider any particular barriers to learning and/or assessment that exist in different Learning Areas and make provision for these when developing Learning Programmes (DOE, 2003:7). Assessment standards can be broken into finer components (DOE, 2003:1). A Lesson Plan time allocation ranges from a single activity to a term's teaching, or more time if necessary depending on the needs of the learner (DOE, 2003:1).

One of the most serious impediments to inclusivity can be found within the curriculum itself and relates primarily to lack of knowledge or absence of the technical know-how to incorporate inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. Sometimes the impediment is imbedded in the inflexible nature of the curriculum which prevents it from meeting diverse needs among learners. When learners are unable to access the curriculum, learning breakdown occurs. The nature of the curriculum at all phases of education involves a number of components which are all critical in facilitating or undermining effective learning. Key components of the curriculum include the style and tempo of teaching and learning, what is taught, the way the classroom is managed and organized, as well as materials and equipment which are used in the learning and teaching process.

Taking the various degrees of visual impairment into consideration one could assume that the teaching of the life sciences to these learners is complicated by requirements for the subject and learning area of teachers and trainers. It therefore establishes the fact that teachers have no knowledge of incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive schools and others are not able to be innovative and creative to incorporate inclusivity when teaching life sciences in the inclusive schools. It has become imperative to discover, develop and promote new approaches, strategies, tools, techniques, etc., that are essential for the enhancement of the full and active participation of visually impaired learners in inclusive schools

(Abantwana-Phambili, 2001:2).

2.4 Theoretical perspective on incorporating equity as foundation of inclusive schooling

2.4.1 Introduction and Background

One of the most serious ways in which learners with visual impairment are marginalised, excluded and labelled, and thus prevented from accessing the curriculum is through lack of technical know-how or the ability of the teacher to incorporate equity in the inclusive schools. The fact that teachers do not incorporate equity when teaching life sciences to learners with visual impairment in the inclusive schools creates the untenable situation where learners with visual impairment cannot have accessibility or the fact that they do not have access to accessible learning material and an accessible environment that is conducive for learning or participating in learning activities. This is usually exacerbated by lack of reasonable accommodation. This encompasses assistive technology including accessible equipment, tactile learning objects, maps and diagrams, reading and writing assistive technology as well as support structures. This can be in the form of inadequate provision of materials or equipment and accessible environment they may need for learning to take place.

The researcher pointed out in the previous section that when the teacher uses assistive technology, such a teacher must understand that it is not about exhibiting that every challenge in our teaching and learning can be compensated fully or in all situations for by assistive devices, or good design (Vasey, 1992:44; cited in Barnes et al, 2006:38).

Such barriers often affect learners who are visually impaired who do not receive the necessary assistive devices which would equip them to participate in the learning process. For example, blind learners are unable to access the curriculum effectively if appropriate Braille facilities and equipment are not available and if teachers are not able to

incorporate equity when teaching life sciences to learners with visual impairment in the inclusive schools, or where teachers are not skilled to teach Braille or use assistive technology and audio equipment.

Burchardt (2004), argued that the blind and visually impaired learners do not lower the standard or level nor impoverish the quality of education by requiring extra resources that will make them equal to fellow sighted learners.

The inability on the part of the teacher to incorporate equity when teaching life sciences to learners with visual impairment will result in teachers showing lack of provision of assistive devices for learners with visual impairment in the teaching and learning of life sciences as required. the fact of being unable to incorporate equity when teaching life sciences no learners with visual impairment in the inclusive schools may impair not only the learning process but also their functional independence, preventing them from interacting with other learners (this is incorporating integration as discussed in detail in the previous section). The interplay and interrelatedness of these three concepts have a direct influence on one another in the inclusive school) and participating independently in the learning environment, (this is incorporating inclusivity when teaching Life Sciences to learners with visual impairment in the inclusive schools. The researcher likes to accentuate the interplay of the three concepts in the didactic situation in the inclusive school where learners with visual impairment attend together with their fellow sighted learners).

The meta-approach adoption as framework that underpins this research and teachers' practices in the inclusive schools to deal with issues of equity is crucial because it addresses the issue of empowerment and the enhancement of blind and low vision learners potential to learn and become equal and of value (Florian, et al 2006).

This ultimate value in terms of equity that of becoming equal is supported as the objects of value (Burchardt, 2004).

Placing either a blind or low vision learner in an inclusive classroom and not

incorporating equity when teaching life sciences in the inclusive school, by providing the learner with support services does not constitute an inclusive school. The role of the teacher is to incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school and provide the needed support services to enable the learner with visual impairment to have accessibility to learning material in order to be equal to fellow sighted learners.

Given the above constraint, appropriate adjustments can be made to the curriculum that render it more accessible and, as Casimir and Alchin, (2001) have pointed out, thus enabling both teachers and learners with special needs to take advantage of the many rich learning opportunities available to them. For teachers, designing a classroom with assistive technology that is accessible for learners with significant vision impairment can appear a daunting task. Despite such initial apprehensions, curriculum accessibility can be increased with minimal disruption to others in the class through the use of assistive technology.

Incorporating equity when teaching life sciences is to equalise opportunities and bring about access and accessibility to learning material and environment. Incorporating equity when teaching life sciences to learners with visual impairment is to create conditions for reasonable accommodation of access and accessibility.

Incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school is part of the three-pronged strategy that could successfully enable full participation, create a conducive environment and access and accessibility for learners with visual impairment in the inclusive school (Horton, 1988:9).

Booth, (1992:52) points to the limitations caused by visual impairment. This is critical in the understanding of learning in life sciences where observation and analysis is the core of the experience. In this case, acknowledging this limitation, the teacher must be able to incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school. Incorporating equity means creating accessibility that will compensate

for critical visual limitations.

The teacher should be familiar with the available resources at his disposal that will bring about equality in the didactical situation. The incorporating of equity when teaching life sciences would make use of assistive technology like a colour detector when doing an experiment in life sciences that requires learners to observe the change of colour. Sighted learners know that this assistive technology can make learners with visual impairment equal (equity) to them and enable them to participate equally in the learning activities. Learners with visual impairment are encouraged because they can participate through an assistive device i.e. incorporating equity when teaching life sciences. The physical and visual limitations are thus compensated for; and learning is being enabled and achievement made possible by the teacher who has incorporated equity when teaching life sciences to these learners.

Trief and Feeney, (2003:137) argued that, among other things, blind and visually impaired learners learn if they have acquired study and note taking skills using Braille machine, talking computer or braille frame and stylus. These learners should know how to handle the stress of the inclusive classed.

In the case of the observable attribute which serves as a limitation and poses a challenge, a teacher may have said there is nothing to do, so the learner cannot see. Impairment in this case is not a handicap. Visual impairment is not handicapping life sciences activities. However, the lack of knowledge and technical expertise as well as what is available would have discriminated against such a learner with visual impairment. The teaching would have marginalised and excluded such a learner with visual impairment.

Maguvhe (2005) citing Smit, (2001:142) holds the view that lack of appropriate resources and lack of materials exasperates the possibilities of effective teaching and learning in the classroom.

Incorporating equity when teaching life sciences to learners with visual impairment in the

inclusive school entails reasonable accommodation. It creates accessibility to learning material which otherwise would be impossible to deal with. This accentuates the importance of the three-pronged strategy of incorporating integration, incorporating inclusivity and incorporating equity when teaching life sciences to learners with visual impairment.

2.4.2 Understanding technology for equity

Visual impairment is the loss of visual function of such magnitude that special aids and use of other senses are necessary to achieve performance ordinarily directed by visual clues. Learners who have vision impairments range from having total absence of sight to varying degrees of useful vision. Because a learner is vision impaired, it should not be assumed that he or she is unable to participate in educational activities. There is for learners who are blind or vision impaired a wide variety of special aids and/or accommodations that address equity, making learners with visual impairment equal to seeing fellow learners and thus facilitate learning in the classroom setting.

The academic success of learners who are blind or vision impaired, whether in special, integrated or inclusive school settings depends on a variety of factors? Among these is their ability to access the classroom curriculum.

Curriculum access for blind and vision-impaired learners requires provision of the same books and resource materials as those provided for sighted learners. However, these need to be provided in an appropriate format, for example, Braille, large print, e-text and audio), at the same time and at the same level, including the same book edition (Kelley and Gale, 1998).

It is generally accepted that with the loss or absence of vision, the amount of sensory data available to the learner would be reduced (Haring and Schiefelbusch, 1967:268) and for this reason the teaching and learning with visual impairments need be firmly grounded in a multi-sensory approach (Huebner in Erwin, Perkins, Ayala, Fine and Rubin, 2001:339).

In this regard, Dr Mike Steer, (2008) pointed out that there is a wide variety of new technology is currently available to enhance the success of learners with vision impairments in the classroom, laboratory, and workshop or at home. Since it should not automatically be assumed that every tertiary setting, or teacher, nor every disability specialist teacher has a thorough knowledge of the many devices that might meet a vision impaired learner's particular need, the focus of this paper is upon fundamental concepts that considerably enhance teacher and learner effectiveness in using specialised technology.

The term assistive technology refers to items, or pieces of equipment, or products, whether acquired commercially, or off the shelf, modified or customized, that are used to increase, maintain or improve the functional capabilities of individuals with disabilities (Kochhar and West, 1996).

One of the barriers that could occur in a classroom is that the teachers may not be able to incorporate equity when teaching life sciences because the required technology is not available. Another significant factor is some learners cannot participate in life sciences because they cannot access the curriculum and thus cannot be involved due to the nature of the learning area or subjects. This marginalisation and exclusion is because the teacher is unable to incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school in the absence of the required technology.

Research carried out at Glasgow (Disability and Rehabilitation, 2002:2) has shown that huge strides are being made in technology for the blind. This research suggests that a multi-sensory access technology can allow working with complex data. This development is set to optimise learning when dealing with visualisation. Visualisation in this context refers to a situation where vision is required to deal with complex data relationships and observation.

According to the study (Disability and Rehabilitation, 2002:2), learners with visual impairment rely mainly on synthetic speech, tactile diagrams and Braille. Users hear a line of digits read out or, if they read Braille, feel a row of digits – consider a sighted

person reading a matrix of numbers. S/he would immediately be able to make certain inferences about the data.

For example, there may be larger numbers at the bottom right or top left. A blind person would be unable to capitalise on these patterns in the data. S/he would just hear rows of numbers spoken, one after another – this is very slow. In addition there is no way to gain a quick overview or glance at the data as a sighted person could. Listening takes place serially. Things worsen when graphs or complex 3-D plots are used because there are almost no techniques for presenting these in a non-visual way. Various developments in technology have contributed significantly towards improving the plight of the visually impaired in teaching and learning. Computers with speech (screen reader), closed-circuit television (CCTV), taped materials, reading machines, talking machines, handheld magnifiers, Braille, paperless Braille machines, talking calculators, touch and large-print components have become standard equipment for the teaching of the blind.

Incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school should be adopted as strategies for creating conditions for equality, access and accessibility for inclusive schooling.

Booth, (1992:55-70) discusses six useful factors when teaching a visually impaired learner. In this regard, the researcher has added a seventh one. These seven general factors need to be considered when incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school when devising appropriate equity in teaching (reasonable accommodation) for any such learner.

2.5 Seven Basic factors of equity incorporation

These accentuate and are embedded incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school within the principles of reasonable accommodation in teaching. All these principles have foundational elements of

accessibility as reasonable accommodation. These can be summarised under seven headings.

2.5.1 Learning and Support Material

When applying the strategy of incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school, a teacher must ensure that every learner has classroom materials transferred into his or her appropriate reading medium such as Braille, large print, or the necessary contrast in a timely manner.

Failure to apply this strategy, or stated differently, if the teacher does not incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school in this manner, learners with visual impairment will be marginalised, excluded and thus not equal to their fellow sighted learners.

Teachers may need to transfer class notes and copies of overhead slides into the correct medium before class. It is advisable that a teacher should:

1. Consider having all learners share their notes with fellow learners. The reader will notice again the interplay between the incorporating of integration when teaching life sciences to learners with visual impairment in the inclusive schools which was discussed in detail in the previous section. Now we see how this is linked to the incorporating of equity when teaching life sciences to such learners in the inclusive schools. Anything written on the board or overhead should be verbalised (Bhargava, 2004).
2. In advance of the class, the teacher must plan as to how she will incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school by working together with the specialist teacher to provide copies of tactile diagrams, models, notes, hand-outs, and overhead materials in Braille or another preferred medium (Bhargava, 2004).

3. The teacher must provide assistance to the learner in how to take notes independently through assistive technology training with the specialist teacher.

This includes accessible instruments, for example, talking scientific calculator, Braille writer, low vision equipment and material, tactile rulers, maps, diagrams and everything else that forms part of teaching and learning support material.

2.5.2 Position

Incorporating of equity when teaching life sciences to learners with visual impairment in the inclusive school relates to accessibility in terms of where a blind and the visually impaired learners sit in the classroom. This place or position must allow for optimal access and participation in the lesson. This is reasonable accommodation in the inclusive school.

The learner, the specialist teacher and at times, the parent(s) of the visually impaired will help the teacher determine where the learner should best be seated in the classroom. In other words, the teacher may need to be guided on how to incorporate equity, i.e. how to make reasonable accommodation for a learner with visual impairment in the inclusive class (Bhargava, 2004).

When incorporating equity in terms of positioning, when teaching a learner with visual impairment in the inclusive school, care must be taken that learners with visual impairment are not treated as a homogeneous group.

There are those who can use their functional eyesight with variations either in distance from the board or book or in terms of light and even in terms of preferred contrast.

At all times, seat the learner in a location with which s/he is comfortable and is able to make the best use of “functional vision” (Bhargava, 2004:11). In cases where, if a learner is using telescopic lens or a monocular to see from a distance, then sitting at the back of

the room is a better position (Sewell, 2005).

The teacher should be aware of glare. Glare should be eliminated (special dry marker board surfacing) or controllable (e.g. by blinds, shades, indirect lighting and window location) (Booth, 1992:59).

Another important strategy that the teacher can apply when incorporating equity in terms of positioning when teaching life sciences to learners is the lighting.

It is advisable that the teacher should consider using adjustable lighting so that certain parts of the room may be lit while others are darkened (Booth, 1992:63).

It is imperative that a teacher knows the type of learners in her inclusive classroom. This kind of knowledge should extend to how adequately incorporated integration should be applied, incorporate inclusivity and incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school. The use of goodwill and initial professional educator training might not be everything that a new teacher has for situations like this in the inclusive school or the education of learners with visual impairment in the inclusive school and might have unintended consequences.

Colours are another factor. Two colours that contrast sharply to someone with normal vision may be far less distinguishable to someone with a visual disorder (Booth, 1992:65). When incorporating equity in the inclusive school, the teacher should exaggerate light differences between foreground and background colours, and avoid using colours of a similar light adjacent to one another, even if they differ in saturation or hue (Booth 1992:66). The teacher ought to have some kind of knowledge on colour deficits. This is crucial and particularly to those learners with low vision.

It cannot be assumed that the lightness that the teacher or any other sighted learner perceives will be the same as the lightness perceived by learners with low vision and those who experience colour deficits.

The teacher who is not knowledgeable about these conditions can generally assume that learners with low vision will see less contrast between colours than any other sighted learner will.

If the teacher incorporates equity when teaching life sciences to learners with visual impairment, particularly those with low vision in the inclusive school, s/he should lighten her/his light colours and darken her/his dark colours. In this way the teacher will increase visual accessibility (Booth, 1992:66).

Another strategy that a teacher can use with specific reference to those learners with low vision is to choose dark colours with hues from the bottom half of the hue circle against light colours from the top half of the circle. The teacher should avoid contrasting light colours from the bottom half against dark colours from the top half (Booth, 1992:67).

For most learners with visual impairment, particularly those with low vision and/or congenital colour deficiencies, the lightness values of colours in the bottom half of the hue circle tend to be reduced (Booth, 1992).

Avoid contrasting hues when incorporating equity when teaching life sciences to learners with visual impairment, particularly those with low vision. The teacher should try at all times to use adjacent parts of the hue circle, especially if the colours do not contrast sharply in lightness (Booth, 1992).

Hue can loosely be defined as the perceptual attribute associated with elementary colour names. Hue enables a learner with low vision in this particular case, to identify basic colours, such as blue, green, yellow, red and purple. It is crucial that the teacher incorporates equity when teaching life sciences to learners with low vision in the inclusive school. Learners with normal colour vision report that hues follow a natural sequence based on their similarity to one another. With most colour deficits, the ability to discriminate between colours based on hue is diminished (Booth, 1992).

A learner may need additional workspace for any specialised equipment or technology. Appropriate electrical wiring should be available for the learner's assistive technology (Booth, 1992).

Incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school in this case refers to accessible learning environment. This refers to appropriate place and work area suitable for using large books and equipment.

2.5.3 Presentation

When the teacher incorporates equity when teaching life sciences to learners in the inclusive school, she should know that those who are blind depend extensively on the voice. This aspect of incorporating equity in this regard is closely linked to incorporating integration. As it has been shown in this study, the interplay between incorporating integration, incorporating inclusivity and incorporating equity is pivotal and that these concepts do not work independently of each other in the teaching of life sciences to learners. These intertwined concepts cannot be substituted or have any element of the three-pronged strategy excluded or eliminated or not incorporated because this will result in an incomplete cycle.

During group discussions each learner in the inclusive class must identify him or herself before speaking (Keller, 2004). This breaks the ice and it is an important element of incorporating integration for learners with visual impairment. It will enable them to participate and freely engage in the activities and discussion. The incorporation of equity in this regard is preconditioned and is preceded by the incorporation of integration.

When incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school, useful strategies include the use of a tape-recorder for recording and presenting the group's findings of the observation and analysis, or allowing a learner with visual impairment read from her assistive technology device, Braille notes or for a learner with low vision from her large print or any accessible format. It may be helpful if all learners allow presentations to be audiotaped (Bhargava, 2004).

However, some learners may find reviewing presentation tapes time-consuming and boring. It is more effective for the learners' learning in the long run, to encourage the learners to learn and practice taking notes in Braille with a slate and stylus, or in large print with the appropriate pen. In the upper grades it may also be appropriate to encourage learners to take notes with an electronic note-taker if they have mastered this assistive technology. These strategies allow notes to be taken more quickly and easily reviewed.

A teacher in the inclusive school cannot take it for granted that learners with visual impairment understand and have clear ideas about certain concepts used in life sciences. Many objects are freely and easily accessible and seen by sighted learners. These may be from a newspaper, a decoration, a chart, at a park, nature reserve or even in their gardens or on farms. However, this is not the case with learners with visual impairment. Even with those considered having low vision, some of these objects and phenomena cannot be taken for granted.

It is therefore of utmost importance that the teacher incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school. Learners with visual impairments might need assistance in making the connection between vocabulary and real objects, body movements and abstract ideas (Bhargava, 2004:12).

Important vocabulary and concepts should be pre-taught using concrete, multi-sensory experiences combined with verbal explanations. This is crucial with learners with visual impairment. Learners with low vision need to be included in this exercise. Furthermore, the teacher should review access and accessible material by asking the learner with visual impairment in the inclusive class to describe in their own words in their own way, what s/he understands about the term or concept (Bhargava, 2004).

It is essential that the teacher, when incorporating equity, knows concepts and vocabulary should be spelled out verbally (Bhargava, 2004).

- For learners with low vision, use chalk or markers that contrast well with the blackboard or a dry-erase board (Bhargava, 2004).
- When teaching learners with visual impairment, particularly those with low vision, the teacher should ask which colour combinations they prefer.
- As discussed earlier in this section, the teacher should be aware of glare on the board (Bhargava, 2004).
- The teacher should allow the learner to move flexibly in order to gain the best view of the board.
- It may be necessary to confirm whether the adapted material is visible to learners with low vision. The teacher should phrase the question so as to understand whether they can see better or what they see, rather than if they can see whatever is written on the board (Bhargava, 2004). However, the teacher must remember to ask the learner with low vision privately and not in the presence of other learners.

In the end, incorporating equity when teaching life sciences to learners with visual impairment, even those with low vision, is a strategy that must bring about accessibility, thus making learners with visual impairment equal to those learners with sight.

From time to time, the teacher should check these learners' notes for accuracy. This is to ensure that they have copied or have heard correctly or the assistive technology has conveyed the correct information. This is sometimes the case with the voice synthesiser for those who depend on synthetic speech (Bhargava, 2004).

Incorporating equity when teaching life sciences to learners with low vision, Bhargava, (2004:14) offers this suggestion that felt pens, primary pencils, raised and bold lined paper can help make learners' handwriting more legible and easier to produce.

If writing is too difficult or laborious for the learner, introduce computers at an early age (Bhargava, 2004).

This means the teacher must ensure accessible learner support material in the format and

medium suitable to the learner. For low vision learners, those with a narrow field of vision are actually hindered if they are given enlarged text on which they can see fewer letters at a glance. The best size of print is usually the one which the child can read most quickly and accurately.

2.5.4 Experiences

Incorporating equity means bringing the world to those learners with visual impairment or enabling them to access the world when teaching them life sciences in the inclusive school.

Hands-on learning is beneficial to all learners, even to those who have no idea of what some of the concepts and words mean or represent. It is imperative that the teacher makes use of real objects as much as possible. Never assume that a learner with vision impairment already has learned the necessary background experiences and concepts. When exploring new objects or in helping direct the learner's attention, use the hand-under-hand technique, in which the teacher places his/her hand under the learner's and guides their hand (Sewell, 2005). This touches on accessible learning experiences. The teacher must allow first-hand experience where possible. A learner must not be exposed to verbal cues only.

2.5.5 Expectations

This part presents the critical and most crucial evaluative stage of the three-pronged approach which is the core of this study; namely the incorporation of integration, the incorporation of inclusivity and the incorporation of equity.

This part is the confluence of the three-pronged strategy approach. It is the culmination of the point of synergy for three concepts: incorporation of integration, incorporation of inclusivity and the incorporation of equity.

The strength of this approach lies in the weakest incorporation of any of the three

concepts. It stands or falls depending on its three legs of incorporation. The incomplete cycle creates systemic push-out factors through the elimination system.

If one element of the strategy has not been incorporated it will be reflected through the test of expectations. Expectations can never be true, fair, genuine and realistic if one or any of the concepts were not incorporated. It will not amount to true reflection of the learners with visual impairment in inclusive schools where life sciences are taught.

This part refers to an accessible standard of teaching and learning. In other words, it encompasses all three strategies when teaching life sciences to learners with visual impairment. The teacher must set a standard for the class and not for individuals. The class means the inclusive class where there are learners with visual impairment and learners who are sighted. The group of learners with impairment includes learners with low vision. This standard must not be compromised to accommodate learners with visual impairment.

Compromise must not be equated with adaptation or modification: incorporating of inclusivity or be equated with access and accessibility: incorporating equity to bring about equality in terms of accessing and participating fully and equipped in the didactic situation.

For a learner with visual impairment, however, in order to reach, attain and achieve the set standard, the entire approach must have been implemented skilfully, and all relevant strategies must have been applied and adhered to. If the requirements of this approach have not been met, the teacher would be harbouring unrealistic expectations. Expectations ensuing from a compromised teaching and learning situation cannot be regarded as a true reflection of a didactical situation with learners with visual impairment in the inclusive school.

Learners who have been marginalised, excluded and discriminated against in the inclusive school because of their visual impairment are put at an enormous and

humiliating disadvantage. They are made to be nothing but an inclusive schooling caricature and their human dignity and human rights are violated (Bhargava, 2004).

2.5.6 Giving information

The teacher who knows that she has learners with visual impairment in her inclusive class, will always create conditions for accessibility to curriculum, assistive technology, environment and support, to mention just a few. The way to do this is by incorporating equity. The most common strategy is that the teacher must always read aloud anything that is written on the board, and any activity that draws other sighted learners' attention must be described. What happens is that some sighted people think the happening is minor or does not mean anything and sighted learners may laugh, whereas a learner with visual impairment may wonder what is happening. This may create anxiety and uncertainty because they do not know what is happening and become curious and uncomfortable. This applies to all other information on the walls around the classroom such as pictures, charts and other informative diagrams. If the teacher has incorporated integration when teaching life sciences to learners with visual impairment in the inclusive school, fellow sighted learners would be able and happy to do this and even more. This could include some aspects of guiding and leading the way in or out of the classroom (Bhargava, 2004).

Verbal descriptions and directions should be clear and specific. Ambiguous can be seen in the use of the word "right". The teacher may say "right" meaning now we go on or "right" to a learner with visual impairment entering the door advising to turn right in order to avoid an obstacle.

Visual information needs to be described verbally for learners with visual impairment. In many instances the teacher incorporates equity when teaching life sciences to learners with visual impairment in the inclusive class by making tactile diagrams. The Braille embosser or any available sophisticated piece of equipment that can produce tactile

diagrams can be used. In cases where the inclusive school does not have expertise or resources, assistance can be solicited from a neighbouring special school. Some arrangement can be made with the specialist teacher to come and help in the inclusive school about how to involve the blind and visually impaired learners in the class activities. This is where the help from the district subject advisers are important to ensure co-operation between special schools and inclusive schools. It is the responsibility of the district to ensure that there is support in the inclusive schools. This point will be discussed in detail later in the next section. Suffice it to say the district needs to step in and be supportive.

Tactile graphics and raised line drawings are also helpful for conveying information that is normally in illustrations, graphs, and drawings. Outline diagrams, graphs, and pictures with liquid glue make simple raised line drawings (Bhargava, 2004).

It is important for the teacher not to solely rely on tactile graphics when teaching life sciences to learners with visual impairment in the inclusive school. Some models or description by various groups or learners should be encouraged. This will promote learners' vocabulary and the use of descriptive language. In this way, or by incorporating equity in this manner, all learners benefit and not only those with visual impairment.

The fact of incorporating equity by adopting a strategy that depends heavily on tactile diagrams has many challenges. Firstly, learners with visual impairment need to be taught how to read a tactile diagram. The sensitivity of their fingers must be developed to be extremely sharp. Secondly, as explained, it is very expensive to acquire some of this assistive technology. However, the cost factor should not prevent learners with visual impairment in the inclusive school from acquiring the necessary assistive technology. Thirdly, the fact that this need to be produced by the knowledgeable teacher means it is a skill. The teacher must have the skill to use the assistive technology. In some cases, it requires the teacher to be innovative and creative to use readily available materials, such as pieces of string, paper, stones and so on.

Incorporating equity and to promote understanding and using tactile graphics is a special skill that most learners with visual impairment in the inclusive school might not as yet have acquired. It is a skill most probably taught by specialists, and tactile graphics can only be adequate when produced by people familiar with methods for making them useable by learners with visual impairment.

It is important to emphasise the fact the teacher is the main and largely the primary source of information for learners with visual impairment when teaching life sciences. It is the primary responsibility of the teacher to mediate between the world of information and a visually impaired learner. This means a teacher must bring the world of information to a learner with visual impairment or the teacher must lead, guide and support the learner to reach and access the world of information when teaching life sciences.

2.5.7 Speed of working

Incorporating equity demands that such a teacher should have knowledge about the education of the learners with visual impairment. Simply incorporating equity as a strategy that will create access and accessibility is not restoring vision. It is not and can never be equated with vision. Incorporating equity in this regard is to compensate for vision loss and create accessibility that will bring about equality, not similarities in vision.

The point of departure in this regard is that learners with visual impairment, particularly those who are blind, use their fingers to read. This means reading one dot and another dot then a letter then a word. Braille is composed of dots arranged in a particular formation for a particular symbol or letter or any representation as may be required.

Learners with visual impairment, particularly those with low vision, use their functional eyesight in various ways. Some can see partly or need to bring an object closer to their eyes and then try to figure out what it is. In many instances they too need to be taught

how to use their functional vision when reading.

A learner with visual impairment when observing an object or phenomenon starts from the parts then progresses to the whole, then back to the parts. This may also be the case with some learners with low vision. What is of essence in the teaching of life sciences is accuracy, not speed. That the learners are experiencing accurate pictures of what is being observed and analysed is what matters, at least in this regard.

It is therefore crucial for the teacher to understand that when she incorporates equity when teaching life sciences to learners with visual impairment as a strategy she is not restoring vision to such learners. These are measures and strategies to compensate and create accessibility that will bring about conducive and equal opportunities in the inclusive school and not that suddenly, the sophisticated learners with visual impairment can see in the literal sense. They can see in their minds what has been depicted by the assistive technology through their fingers, for example large picture or print.

In this regard, the researcher wishes to bring to the foreground the perspective of visualisation on the part of a learner with visual impairment. It should be clear, from thinking about the complication and intricacies that surrounds the learning of learners with visual impairment particularly in life sciences. It is important to recognise and acknowledge these challenges that simply incorporating equity as a strategy that creates accessibility through a piece of equipment, is unlikely to meet the speed of work or pace in performing a specific task or activity in life sciences similar to sighted learners.

The enormous use and support of assistive technology cannot be over accentuated. It revolutionises the life of a person with visual impairment. Such a person becomes a learner, with opportunities for mainstreaming and inclusive schooling, performing complex tasks, and becoming empowered. However, incorporating equity when teaching life sciences by adopting the strategy of providing a talking or magnifying computer to produce reading material in Braille will not help a learner with visual impairment to read at the same speed as a sighted fellow learner.

The same can be said about learners with visual impairment, particularly those with low vision. Enlarging print or giving a desk lamp to a learner with low vision will not teach that learner with low vision how to scan through texts for key points, understand a diagram or graph which is only seen in part. Reading a character at a time or finding a place in a book or reading a part of a diagram at a time is time-consuming.

What makes a learner with visual impairment work at a slower pace is the area where his/her equipment and learning material is placed. The work surface may need to be larger than usual to give sufficient space to arrange large print material and equipment. This will certainly be necessary for a learner who uses Braille. Braille writing equipment, Braille books, and tactile diagrams all tend to be larger than print material, and the child will also need space to arrange these items so they can be quickly located on the surface and not get muddled up. The child with partial sight may need to read and write at different distances from the work surface.

2.6 Support structures

Education White Paper 6, (Department of Education, 2001) signals a radical departure from the traditional dual system of education in South Africa. It heralded the trajectory of inclusive schooling. This is changing the education landscape in special needs education. Education White Paper 6 is radically overhauling the education system in South Africa. Inclusive schooling occupies a special place in the development of educational policy in the post-1994 period (Wildeman, 2007:10).

According, to Wildeman, (2007:10), firstly, it signifies the culmination, postulation and adoption of the grand policy-making processes for the mainstream education system.

Wildeman, (2007:10) further argues that because of its chronological conceptualisation during the period at the tail end of the policy-making process, it is indicative of a

retrospective revision of all the mainstream education system policies to bring these in line with the concepts of inclusive education.

Wildeman, (2007:10) thirdly believes that no other educational policy in the post-1994 era was as unequivocal, vivid and critical about the present status quo of mainstream education system in South Africa and how it contributes to the perpetuation of marginalisation and exclusion of learners with special needs. Learners with visual impairment in the inclusive schools would be worse off than the rest, particularly in the public ordinary schooling system.

In order to strengthen the implementation of Education White Paper 6, it proposes the establishment of district-based support teams, which would be functional at the district level, and actively supporting both inclusive and special schools (Wildeman, 2007:10).

1. This move of inclusive schooling propelled the incremental exodus of learners with special education needs or put differently, learners who experience barriers in learning and development. Learners with visual impairment, because of their special needs, were no exception to the rule. They qualified to be mainstreamed or rather be placed in the inclusive schools with the view of help and support from the district.

District establishment is critical for learners with visual impairment taught life sciences in the inclusive schools. This move has further serious implications for the teachers in these inclusive schools as far as expertise in the education of learners with visual impairment goes.

The factor of visual impairment is further compounded by the issue that this is not a homogeneous group. One wonders how much of the initial professional educator training was covered in this programme. How much of the expertise is to be offered by the district in the inclusive schools for the teaching and learning of life sciences by learners with visual impairment; both classes those with low vision and those who are blind. This remains to be seen as part of the aim of this research.

1. The planned incremental implementation of inclusive schooling has been hampered by numerous uncertainties that plagued the entire implementation of the practice. The status of the policy was unclear to many practitioners and epicentres. The modalities, strategies and resources were unanswered. These uncertainties filtered through to the conversion of the first designated mainstream primary schools that were to become inclusive schools.
2. Because of the challenges of the delays in the conversion of the mainstream primary school process at the school level, the establishment of district-based support teams as conceived by Education White Paper 6 ground to a halt.
3. What now exists in some provincial education departments in the policy implementation vacuum is an endeavour at reconfiguring the uninterested existing district support services to service a broader client base, while other provinces have not yet made any moves due to the policy implementation vacuum.
4. These policy challenges posed and replicated an unintended trend that is noticeable in the field where policy and implementation vacuums have impelled some provinces to develop their own models and implementation processes that did not comply with policy proposals.
5. In many provinces, the establishment of district-based support teams has been thwarted by these provinces' inability to attract indispensable resources as well as the inability to recruit and retain the professionals with adequate and necessary expertise who would otherwise constitute the district based support teams (Wildeman, 2007:5).

It was the firm belief and view of the policy-makers to consider mainstream schools as the natural conduit through which inclusive schooling could be accomplished. This view of the central role of mainstream schools was not only held by the government; a range of

non-governmental organisations adopted similar positions. If mainstream schools were the pivotal conduits of change, then one would expect future policy and legislation to pay extensive attention to the role of mainstream schools in the overall realisation of inclusive schooling in South Africa (Wildeman, 2007:8).

Wildeman, (2007:10) argues further:

“At the same time when the strategies from the two consultative forums were published, public schools struggled with spiralling teacher costs due to the historic public service agreements (Department of Finance, 1998:16). It is unclear how the inclusive education deliberations were influenced by tensions in public schools, but our reading suggests that the financial developments in public schools were not fully understood at the time. In the context of policy-makers’ priorities to right-size personnel expenditures and restore a better balance between personnel and other critical expenditures, future education policies could not bank on a strong human resource investment and expansion in the ‘special needs education’ sector.”

The process of converting mainstream primary schools in the designated areas to inclusive schools and special schools into resource centres that are expected to provide support to the neighbouring inclusive schools requires resources and expertise to serve as consultative, mentoring, supporting and advising schools about their new role as inclusive schools.

This constitutes the foundation for inclusive schools where learners with visual impairment will be taught life sciences with sighted fellow learners. This presupposes expertise to be deployed in the district to provide the modalities and strategies that will assist teachers in the inclusive schools to incorporate integration, incorporate inclusivity and incorporate equity when teaching life sciences to learners with visual impairment.

Education White paper 6, Department of Education (2001) outlines the development this way:

- A core component of the inclusion model is the establishment of district-based support teams (DBSTs) that are intended to provide systemic support instead of learner level interventions based on the learner deficit model. This support team would consist of medical practitioners, for example, psychologists and occupational

therapists that were previously located at special schools servicing small learner numbers. The reconfiguration of the level of the support they will provide in future will mean that many more learners will be able to benefit from these services albeit indirectly. The role of the new district based support teams would shift to providing training and support to teachers in order for them to deal with the challenges related to multilevel classrooms and the curriculum adaptations that will be needed to ensure effective learning and teaching. Ultimately, learners should benefit from this expertise as barriers within the system that hampers learning, will be systematically eliminated.

Education White Paper 6 (Department of Education, 2001) says that the key purpose and functions of the district-based support teams are:

- To support all learners, teachers and the system as a whole so that the full range of learning needs can be met. The focus will be on teaching and learning factors, and emphasis will be placed on the development of good teaching strategies that will be of benefit to all learners; on overcoming barriers in the system that prevent it from meeting the full range of learning needs; and on adaptation of support systems available in the classroom.

District-based support teams are to be brought together in some way to facilitate a more coordinated and team approach to providing support to schools and other education institutions. There are different ways in which this could happen. Provincial departments of education have the responsibility of identifying and establishing these structures based on their particular local needs. An organising principle that should be used when making decisions about this would be to ensure that the education institutions have relatively easy access to the support they need. Geographical and other factors will play a role in determining this.

Some of the functions according to the Department of Education (2001) are:

- To assist teachers in institutions in creating greater flexibility in their teaching

methods and the assessment of learning. They will also provide illustrative learning programmes, learning support materials and assessment instruments.

- To evaluate programmes, diagnose their effectiveness and suggest modifications. Through supporting teaching, learning and management, they will build the capacity of schools, early childhood and adult basic education and training centres, colleges and higher education institutions to recognise and address severe learning difficulties and to accommodate a range of learning needs
- To provide direct interventionist programmes to learners in a range of settings, and/or, serve as ‘consultant-mentors’ to school management teams, classroom teachers and school governing bodies.
- To foster the development of effective teaching and learning, primarily through identifying and addressing barriers to learning at all levels of the system.
- To develop an on-going support of local institutional-level support teams in schools, colleges, early childhood and adult learning centres.
- To support the capacity building of schools/education institutions; identifying and prioritising learning needs and barriers to learning in their local contexts.
- To identify the support needed to address these challenges, and pursuing these within a strategic planning and management framework.
- To provide indirect support to learners through supporting teachers and school management, with a particular focus on curriculum and institutional development.
- To ensure that the teaching and learning framework and environment is responsive to the full range of learning needs.
- To provide direct learning support to learners where necessary and possible, where institutional-level support teams are unable to respond to particular learning needs.

The conversion of primary ordinary schools to full-service schools takes place alongside the conversion of special schools into resource centres. In both instances, restructuring produces the need for available expertise to guide teachers through the unfamiliar time of

recognising and positively dealing with learners who have diverse learning needs and capabilities. This introduces the notion of district-based support teams that would advise teachers and schools about coping with their learning and teaching challenges. District-based support teams are conceptualised to have core educational, psychological and other medical professional expertise, which would be made available to a full-service school or resource centre. From a costing perspective, Education White Paper 6 argues that deployment of such professionals at the district level is much more cost-effective and embodies one of the cost-saving drives of the White Paper (Wildeman, 2007:9).

Wildeman, (2007:10) argues further in this way:

“Firstly, Education White Paper 6 confirms the central importance of public schools as key centres for the realisation of inclusive education policies. Although Education White Paper 6 makes reference to further education and training colleges and higher education institutions, it is abundantly clear that the main entry point for inclusive education is through public primary schools initially. However, the key role of public ordinary schools does not lead to the destruction of the distinction between public ordinary and public special schools. It does however lead to the conversion of special schools into resource centres and where the latter serve as expert advice centres to other public, special as well as ordinary schools.”

Wildeman, (2007:10) further says:

“Secondly, while the distinction between public ordinary schools and special schools are intact in Education White Paper 6, systemic support in the guise of the district-based support teams does away with the public ordinary-special school distinction. This implies that these teams offer support to both types of institutions without the need to form institution-specific professional support. Thirdly, we believe that the "mainstreaming" of disability, the establishment of district-based support teams, as well as the lengthy period of implementation of inclusive education are the pillars of the government's cost-savings measures for inclusive education and training. Fourthly, it is not yet clear what kind of human resource development strategies will be employed to help teachers cope with increased teaching challenges. However, if recent policy announcements are to be believed, teacher development does not necessarily mean bigger personnel budgets for public ordinary or special schools.”

The conversion of public ordinary and special schools signifies the transformative impetus of the inclusive education and training philosophy at work. The conversion model was premised on pilot projects which seemed to be the result of the international momentum towards inclusive education rather than a cooperative in-country process. The actual field-testing phase of the conversion process was delayed due to the nature of the infrastructure development projects that would need to be undertaken, the lack of sufficient funding for the conversions, and the protracted tender processes to award the redevelopment of the schools to suitable service providers. Provincial education departments have different capacities in terms of the actual number of institutions that can be converted at any one time. This creates a situation where the implementation of inclusive education and training becomes a function of financial, resources and other capacities. Again, the fact that the division is between traditionally poor and rich provinces suggests a reproduction of the old special needs education fault lines of the past. Concomitant with the delay in the conversion of public ordinary and special schools, district-based support teams that should provide professional educational and psychological expertise to newly converted schools have not been constituted. Provinces that have extensive old support services customised such structures to approximate the concept of the district-based support team. Poorer provinces appear to have great difficulty in attracting and retaining skilled professionals. These provinces are also burdened with vast distances, which could severely compromise the effectiveness of future district-based support teams. Other challenges that face provincial education departments include the development of appropriate employment contracts for professional support staff as well as the development of reporting structures for the district-based support teams (Wildeman, 2007:23-30).

Provincial education departments have not established district-based support teams as conceived within the parameters of policy laid out in Education White Paper 6. What some provinces were able to do was to adapt their present educational support services and customise these to approximate district-based support teams. Some provincial education departments reported that plans were in progress and that negotiations were

required and training was being provided to facilitate this re-orientation in approach.

Establishing district-based support teams even in the proposed skeletal form has not proved to be easy for many provincial education authorities. Provinces noted that lack of human and financial resources are the main obstacles to establishing fully functioning district-based support teams. Poorer provinces indicated that they are unable to attract and retain suitably qualified professionals to constitute professional support teams. Provincial education officials also made it clear that a significant portion of new funding is required to support the retraining and functioning of these specialised professionals. That means that this important support mechanism is not available to teachers, principals and governing bodies to facilitate the conversion of the education system (Wildeman, 2007:12).

Other challenges related to the formation of these district-based support teams include transport and employment contract negotiations. Poorer provinces in particular find it difficult to cope with distances between schools, which make it very difficult for effective operation of the professional support teams unless they are mobile. We have already mentioned transport problems as a key funding priority and here we have further evidence how deficient transport arrangements hamper the full functioning of national policy. A further challenge concerns the conditions of service of those professionals who are contractually bound to a specific institution. The formation of district-based support teams requires significant reorganising of the current structures. Provinces are required to revisit their organisational structures and in the same process re-negotiate new service agreements. It is clear that national guidance is needed on this issue as some provinces have had great difficulties re-negotiating employment contracts of such professionals. This higher-level intervention should assist the provinces in operationalising their district-based support teams. Finally, reporting structures have also been mentioned as one of the teething problems in the development of the new support system (Wildeman, 2007:13).

The information in the following textbox represent some of the service delivery

challenges associated with the formation of district-based support teams (Wildeman, 2007:10).

This means, a personnel is attached to a specific school and this problem is not sorted out. There is also a problem and it has to do with line functions, structures as to who should report to whom and that is not sorted out.

There is still the problem of distance which means the district will have to make special attempts and arrangements for the resource centre to be accessible to others.

Finally, the services and information to be provided and generated by the district-based support teams will be integral to facilitate the transformation of the system. Instead of learner level information that is focused on psychometric tests, which was the basis of the medical model, the new focus of the district-based support teams will be to make systemic interventions that support the implementers of the inclusion model, (Wildeman, 2007:20).

It is safe to say that provinces are fully stretched in finding the necessary financial and human resources to establish district-based support teams.

2.7 Conclusion

This chapter has dealt with the theoretical concepts of incorporation of the three-pronged systemic approach of integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive schools, as foundations for inclusive schooling. In this chapter the theoretical framework of the incorporation of integration, equity and inclusivity underpinning this investigation have been explored. In the next chapter these concepts will be incorporated in a particular context. The interrelatedness and interdependence of these concepts will be explored. It will be shown that if one concept is compromised, then teaching and learning breaks down. This is so because these concepts form the foundation for inclusive schooling.

CHAPTER 3: The Contextual Incorporation of Integration, Equity and Inclusivity When Teaching life sciences to learners with Visual Impairment as Foundations for Inclusive Schooling

“If I cannot learn in the way you teach, please teach me in a way in which I can learn.”
(Da Costa, 2003:56)

3.1 Introduction

This chapter takes the discussion on the three-pronged systemic approach of the interwoven concepts of incorporating integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school a step further. In Chapter 2 the researcher focuses on the theoretical foundations of incorporating these concepts when teaching life sciences to learners with visual impairment in the inclusive school. In this chapter, the researcher focuses, firstly on what an inclusive school should look like, then secondly, on the incorporation of the three concepts of integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school as foundations for inclusive schooling in context. The contextual incorporation of integration when teaching life sciences to learners with visual impairment in the inclusive school in relation to the implications for, demands and needs of both sighted learners and learners with visual impairment as well as the implications of and demands that such incorporation make on a teacher when teaching life sciences to learners with visual impairment in the inclusive school will be explored. The curriculum adaptation demands on the teacher, curriculum differentiation and access and accessibility of presentation and provisioning required by the incorporation of equity when teaching life sciences to learners with visual impairment in the inclusive school in an inclusive school will be looked at. Teaching strategies of curriculum modification and curriculum adaptation as integral ingredients and modalities of incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school will be explored and applied in context. The tools available to provide additional district help

and support to teachers incorporating integration, incorporating inclusivity and incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school will be explored.

The life sciences learning outcome will be tabled and discussed in relation to the acquisition and the role of science process skill having bearing on learners with visual impairment.

3.2 The index and inclusive school

Inclusion is about extending the comprehensive ideal in education, and therefore the strive should be more towards what does the education system need to look like in order to promote tolerance, diversity and equity (Ainscow, 1995; Carrington, 1999; Lipsky and Gartner, 2005b; Skrtic, 1991 a; Slee, 2001)

The process and purpose as well as the political, social and educational transformation and development of inclusive schools and institutions of learning were discussed in greater detail in Chapter One of this work. It was indicated that it is in line with global trends that South Africa ratified the Convention on the Rights of Persons with Disabilities in 2008. As a country we have also signed the Optional Protocol for monitoring the implementation of the protocol. The first country monitoring by the UN Commission will take place in 2010. South Africa will have to demonstrate how it has put policy and systems in place for the implementation of the Convention.

In spite of the almost overwhelming acceptance of the concept, if not the reality, of inclusion, there are dissenting voices. Critics of inclusion often refer to ideology or rhetoric (Croll and Moses, 2000; Hornby, 1999; Wilson, 1999).

In 2008 the Presidency issued the National Disability Policy Framework which outlines how the Convention should be translated into the policies, plans and budgets of all

government departments. This policy framework is the revision of the Integrated National Disability Strategy of 1997 (Ministry in the Office of the Deputy President, 1997). .

Underpinned by theoretical framework of this study in Chapter One, the meta-approach, in this chapter the researcher focuses on some of the features that make up an inclusive school, in other words, these features will tell what an inclusive school should look like. These features are the index for inclusion indicators. They will be tabled and discussed briefly first. Secondly, these features, in relation to incorporating integration, equity and inclusivity, will be discussed at length in the respective sections as foundations for inclusive schooling. This will be a discussion on the incorporation of the three concepts that form the three-pronged approach when teaching life sciences to learners with visual impairment in the inclusive school in an inclusive classroom.

The Index for Inclusion was introduced by Booth and Ainscow (2000). The Index for Inclusion is a set of materials that serves as a resource to help and guide schools through a process of establishing and developing an inclusive school. It deals with building supportive communities and fostering high achievement for all staff and learners.

The Index is premised philosophically on the social model of disability as its starting point. This aspect was discussed in greater detail in Chapter One under the theoretical framework that underpins this research. The Index builds and capitalises on all school aspects that constitute good practice. It accumulates these pockets of excellency and then organises the Index work around a cycle of activities. These activities then help and guide schools through the process of establishment. This process comprises the stages of preparation, investigation, development and review (Booth, 2000).

According to the index for inclusion, inclusion in education involves:

- Valuing all learners and staff equally.
- Increasing the participation of learners in, and reducing their exclusion from, the cultures, curricula and communities of local schools.

- Restructuring the cultures, policies and practices in schools so that they respond to the diversity of learners in the locality.
- Reducing barriers to learning and participation for all learners, not only those with impairments or those who are categorised as 'having special educational needs'.
- Learning from attempts to overcome barriers to the access and participation of particular learners to -make changes for the benefit of learners more widely.
- Viewing the difference between learners as resources to support learning, rather than as problems to be overcome.
- Acknowledging the right of learners to an education in their locality.
- Improving schools for staff as well as for learners.
- Emphasising the role of schools in building community and developing values, as well as in -increasing achievement.
- Fostering mutually sustaining relationships between schools and communities.
- Recognising that inclusion in education is one aspect of inclusion in society.

The index for inclusion has the following indicators, according to Booth (2000):

DIMENSION A. Creating inclusive cultures

Building community

INDICATOR A.1

- Everyone is made to feel welcome
- Learners help each other.
- Staff collaborates with each other.
- Staff and learners treat one another with respect.
- There is a partnership between staff and parents/carers.
- Staff and governors work well together.

- All local communities are involved in the school.
- Establishing inclusive values

INDICATOR A.2

- There are high expectations for all learners.
- Staff, governors, learners and parents/carers shares a philosophy of inclusion.
- Learners are equally valued.
- Staff and learners treat one another as human beings as well as occupants of a 'role'.
- Staff seeks to remove barriers to learning and participation in all aspects of the school.
- The school strives to minimise discriminatory practices.

According to the index for inclusion indicators, as proposed by Booth (2000) an inclusive school must show the following:

1. It is a school that is equipped and supported to provide a broad range of learning needs. It may not necessarily have all forms of learner support in place, but it should have the potential and capacity to develop and provide them.
2. It is a school aiming at inclusion in the way it is organised concerning structure, policies, practices, pedagogy and culture to increase learning and participation in curriculum as well as address and remove various barriers that hamper learning.
3. It is a school that understands that barriers to learning are not only intrinsic to learners, but can also be cultural and systemic. Barriers might also be related to a learner's environment. These could include negative attitudes to and stereotyping of learners, inflexible teaching methods and practices.
4. It is a school that has additional support programmes and structures for teaching and learning. All development and work in the school should strive to achieve these goals by sharing expertise (e.g. expertise in orthodidactics) and constantly thinking about the development of both teachers and learners.

5. It is a school that is prepared to explore and address the challenges of everyday school life through capacity building among teachers and on-going institutional development aiming at empowering the whole school.
6. It is a school that wards off practices which exclude learners so that learning and development can happen.
7. It is a school that makes efforts to ensure that all children of school-going age in the locality attend the school and achieve to their potential by ensuring that the school is accessible. Such a school will have a policy of inclusion and on-going programmes on anti-discrimination, democracy and human rights.
8. It is a school with good leadership that serves as a beacon of the transformation process in education by developing cultures, policies and practices that celebrate diversity, respect difference and value innovation and problem-solving.
9. It is a school where both learners and teachers feel safe and supported and where learners feel a sense of belonging and are able to engage in the learning process.
10. It is a school that welcomes teachers from schools in the area to learn new skills and ideas and may admit learners from neighbourhood schools for short periods for intensive training in specialised areas, such as Braille, orientation-and-mobility or skills for daily living. These services might be run in collaboration with various organisations for persons with disabilities.

3.3 The Incorporation of Integration when Teaching life sciences to Learners with Visual Impairment in the Inclusive School as a Foundation for Inclusive Schooling

3.3.1 Introduction

This section has as its point of departure the index for inclusion indicators. It deals with personal and contextual factors that affect both sighted and visually impaired learners in an inclusive school setting. It focuses on the strategies for addressing diversity in class when incorporating integration when teaching life sciences to learners with visual

impairment in the inclusive school as a foundation for inclusive schooling and the challenges in the professional and contextual milieu.

Here in this section the researcher deals with the life sciences learning outcome three and the related critical outcome in relation to incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school.

- Learning Outcome 3: life sciences, technology, environment and society.
- Critical Outcome 2: Work with others as members of a team, group, organisation and community.

Erwin et al, (2001:351) state that:

“The most important responsibilities that teachers of students who are visually impaired is to create a climate of inquiry that is both accessible and meaningful for all the students. Given that children learn by doing, they need multiple and consistent opportunities to engage in hands-on, cooperative, and fun activities that are driven by their own interests and questions. Creating an accessible and meaningful learning environment that balances student-driven and teacher-guided opportunities enables children to follow their own natural curiosity and assume responsibility for their own learning. When children are active participants in their own learning, important science-related outcomes can be achieved. These and other skills are vital because they serve as the knowledge base that children can use throughout their lives.”

In light of the fact that this section focuses on the incorporation of integration when teaching life sciences to learners with visual impairment in the inclusive school, and in view of the newly adopted single, unified and integrated education inclusive system in South Africa, where a school could comprise of learners from various socio-economic, racial and ethnic backgrounds as well as different disabilities with diverse learner needs, the researcher needs to suggest strategies that will create conditions for mutual acceptance, mutual respect, cooperation and collaborative learning in life sciences during experimentation where observation and analysis is required. The incorporation of

integration will also promote and enhance group work as a foundation to the inclusive schools. These are in line with the index indicators.

Here we begin with a learner with visual impairment who arrives at an inclusive school for the first time and a sighted learner who meets a learner with visual impairment for the first time in their school – a school whose teachers might not have adequate information, knowledge and skills of dealing with learners who are blind or have low vision. The various suggested strategies help to inform the teachers as to what to do or how to address a particular situation. Through the incorporation of integration when teaching life sciences to learners with visual impairment in the inclusive school as suggested strategies, a learner will be assisted and supported progressively in accordance with the identified needs and support required.

Salisbury (1974) holds the view that it is critical and essential that the teacher informs the class beforehand about the coming learner with visual impairment. The teacher must tell the class a little more about persons with disabilities and particularly those with visual impairment. The teacher must explain to the sighted learners what is expected of them when the learner with visual impairment joins the class.

This is not only crucial and critical for sighted learners only. The teacher ought to be informed about the type of learner she has. The teacher needs to prepare and plan her work beforehand. If the teacher has such knowledge about her learner, she will be better positioned and equipped to incorporate integration when teaching life sciences to learners with visual impairment in the inclusive school.

Salisbury (1974) suggests that it is important for the visually impaired learner to be informed about the inclusive school and how a special school differs from this kind of a school. The visually impaired learner must be told about sighted learners and what is expected of him in this inclusive school.

Life sciences require cooperation and collaborative learning especially for learners with visual impairment. By cooperative learning as means of incorporating integration when

teaching life sciences to learners with visual impairment in the inclusive school, the teacher creates conditions for integration. The strategy of cooperative learning when teaching life sciences to learners with visual impairment in the inclusive school will create and promote the situation where a learner with visual impairment becomes an integral part of the inclusive school.

Slabbert (1991b:73, 1992c:113) regards cooperative learning as a small group learning activity where members in the group help one another to learn or achieve.

In this case, where the sighted learners and the visually impaired learners exist in juxtaposition to one another, the sighted is initiated into the “world of the visually impaired” and the visually impaired initiated into the “world of the sighted”, in commonality as well as contradistinction. However, most critical to this discussion is the notion that learners, both sighted and visually impaired, exist in relative position to one another in class and at school, sharing common resources (Goldberg, 1994).

The main thrust behind incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is a very specific attitude towards the norms or criteria society uses when evaluating the worth of a human being. It has to do with specific value systems (beliefs) that form the basis of the so-called inclusive schooling philosophy (Hilton and Smit, 1994: 253).

3.3.2 Psychosocial Environment

When incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school, it is important that, firstly, the teacher addresses the psychological needs of both sighted and visually impaired learners, as Engelbrecht et al, (1999:72) point out that learners cannot think well in a harsh, threatening situation or an intimidating environment where group pressure makes independent thinking unlikely.

However, learners with visual impairment need to be kept busy for most of the day but also to be in contact with other learners.

incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is aimed at addressing and warding off the lack of being integrated, seen as part of the inclusive school and belonging to the inclusive school like all other learners. It is a miniature society of learners. This directly links with the learning outcome 3 and the critical outcome of life sciences mentioned above.

Responding to and addressing this issue is contingent on the teacher being able to incorporate integration when teaching life sciences to learners with visual impairment in the inclusive school.

Gale (1998) argues that the teacher ought to incorporate integration when teaching life sciences to learners with visual impairment in the inclusive school in order to create condition for attaining and achieving educational goals for learners who are blind and those with low vision in the inclusive school being the same as for sighted learners.

Incorporating integration through cooperative learning, when teaching life sciences to learners with visual impairment in the inclusive school will create the ethos and conducive environment with some modifications and adaptations according to individual needs as elaborated in the incorporation of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school in the following section. This factor accentuates the interrelatedness of the three-pronged approach as the strategy to adopt in the inclusive school as foundation for inclusive schooling.

Alwell et al, (1994:13) remarked, that the primary focus, therefore, of the educational team planning the instruction of the student ... must be determining the means by which the student will receive information, how instructional techniques will be adapted to the learner, and how the learner will be allowed to demonstrate knowledge and participate in the instructional and social activities which take place at school and in class.

Cooperative learning is the means of incorporating integration as a strategy that will address the psychosocial climate when teaching life sciences to learners with visual impairment in the inclusive school. It must be noted that a learner with visual impairment is in a strange environment, among sighted learners who can see him or her when he or she cannot see them and the surroundings.

Let us say it is time to do observation, experiment and discovery. The life sciences teacher should always make sure that learners know and understand the activity and the related steps or procedures involved. The first step is that of observation and experimentation. For the learner with visual impairment to be able to participate optimally, as well as in line with the LO3, he should be paired with a sighted fellow learner.

The experiment is then repeated to consolidate understanding and learning. It is always advisable that the teacher probes and asks whether the experiment should be repeated for the learner with visual impairment.

The sighted fellow learner then explains and describes the activity. A learner with visual impairment can then formulate possible answer or predictions. The possible underlying principles or the hypothesis can then be made together.

incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school endorses the view echoed by Engelbrecht (1999:72), that learners learn best when they are in a secure and blissful psychosocial climate.

Cooperative learning as means of incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is a strategy calculated at adapting the psychosocial climate of the classroom to be welcoming, invitational and conducive to all learners.

Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive schools ensuring that teachers teach and relation to their learners in a way

that is conducive to their emotional well-being. In other words, it is important not only to welcome learners by making environmental adaptations to the classroom, but by creating safe and comfortable emotional spaces for them within the classroom.

Creating an Emotional Environment which is Conducive to Learning Booth (1992) emphasises the importance of the teacher's understanding of this type of learner in her classroom:

“A visitor was looking round the nursery for blind children and was immediately struck by the quietness and seeming lack of activity. Were the children frightened of the teachers? Was the setting providing very little stimulations? Were the children more handicapped and lacking in initiative than she had expected? Fortunately, she commented on this to the teacher who was able to give her an explanation. No, the children were not being suppressed or under-stimulated, but, in order to understand their environment, they needed to be able to hear. When the visitor entered the room, they noticed and listened intently. Their classroom was geared to enable them to get information about what was going on, by providing a carefully controlled sound environment.”

It is clear that for learners with visual impairment in the inclusive school brings about anxiety; not knowing or not being aware of what is happening in the surroundings is a great concern. Getting to a new school environment can be very frightening. To attend and learn in that environment is to take risks.

Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school will create conditions where feel safe and encouraged to use their senses to obtain the necessary information.

Learners with visual impairment then learn to use their hands to manipulate an object or tactile embossed diagram for observation in class without fear or being intimidated. Sighted learners learn to bring objects for observation to learners with visual impairment without inhibition or feeling as if they are intruding or embarrassing learners with visual impairment.

Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school will make it easier to take risks. If the learners feel that they are not allowed to make mistakes, like feeling around their environment or examining particular object of interest, they will be scared to learn. Blind and visually impaired children experience new environments mostly through their feelings rather than through their thoughts.

The teacher needs to plan for purposeful and deliberate interaction in the inclusive school by incorporating integration when teaching life sciences to learners with visual impairment. It is very important for the teacher to pay attention to the quiet learners with visual impairment. They might not try to initiate collaborative learning or group discussion when working on an experiment in the inclusive classroom. It is easy to ignore them because they do not disturb the classes. Learners who are blind may have difficulty in initiating conversation if they are unaware of who is nearby. As a result, a learner may choose to remain socially passive rather than risk embarrassment.

By incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school, the teacher can harness highly important “teachable” moments and use them to help learners learn how to interact with one another in collaborative and productive ways, such as by encouraging peers to inform the learner with visual impairment that they are in the area. This is important because the learner might not be aware of their presence (Bishop, 1996).

The teacher needs to know that it is important to incorporate integration when teaching life sciences to learners with visual impairment in the inclusive school. They often need the most attention.

The researcher’s experience as teacher has shown that learners are often quiet so that they can hide learning problems they may experience; you need to observe them carefully to see what barriers to learning they are experiencing. If the teacher is not incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school, such learners will be marginalised, excluded and forgotten.

Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school will make learners with visual impairment feel accepted and listened to and understood. Once a teacher starts taking an interest in learner with visual impairment and gets to know this child better by observing her while doing some work, a teacher will react more sensitively to such a learner and try to address her emotional barriers to learning.

The enormous benefit of cooperative learning as means of incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is that it inculcates social skills that can improve both the academic and social functioning of visually impaired learners and improve the interpersonal climate of the classroom for all learners (Siperstein, 2004).

Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school goes beyond the school borders. It extends to their family. There is continuity between school and home in terms of how to incorporate integration. Parental involvement is crucial and critical in enhancing the process of incorporating integration. How children live and communicate with their parents is critical to children's developing social skills (Corn, 1996).

By incorporating integration, teachers and parents can work together to encourage and nurture the development of social skills in children. This collaborative approach can kindle the growth of successful social skills by providing the learner with a range of learning experiences inside and outside the classroom.

The matter of incorporating integration and parental involvement in this regard is extremely significant since teachers need to be aware of the cultural and religious beliefs of the family (Sacks and Thomas, 2000).

The opportune moment of cooperative learning as means of incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school

presents the opportunity to intervene directly with learners with visual impairment and a most favourable time to inculcate social competence is from a young age by fostering appropriate social skills.

Cooperative learning helps learners with visual impairment to settle more easily into a variety of environments and become better able to work cooperatively, confidently, and independently by experiencing social success from an early age (Sacks, 2000).

Having sighted learners together with those with visual impairment in one class may pose some challenges. Here the researcher suggests some of the ways of incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school to adapt the classroom to make sure that learners feel safe and cared for in the classroom:

- Give learners a chance to express themselves and speak about their feelings Allow learners' time to talk about themselves and about their feelings. Listen carefully so that they know that their feelings are important. To make it safer for learners they can talk about their feelings in groups or during pair work. Also allow them to express their feelings through drawing (for those who can see), writing, (for learners with visual impairment and any others) or singing.
- Encourage caring relationships among learners; if learners feel that nobody cares about them they can get deeply hurt and withdraw.
- It is probable that in inclusive schools, learners who are given the opportunity to openly obtain information about learners with visual impairment needs are more likely to treat such a learner with greater respect (Forlin, 2004).
- Allow learners to applaud each other if they succeed or try very hard. Celebrate successes and make sure that you show learners that you really believe in them.

While some learners may conceal their learning problems by being quiet, other learners are disorderly and not easy to manage. They can often take up much of the teacher's time.

This disrupts learning and can make visually impaired learners withdraw even more. Learners learn best in a well-managed and orderly environment. Experience has shown that learners with visual impairment can sometimes demand more attention unnecessarily. The teacher should be able to discern between disruptive behaviour and seeking help. Whatever the case may be, order must be maintained.

Sacks (2000:12) supports the view that cooperative learning as means of incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school takes a while to achieve good communication skills are not developed overnight. It takes practice in a variety of social settings to learn how to be an effective communicator and to demonstrate good social skills.

Incorporating integration promotes cooperation and mutual acceptance. This aspect is critical during group work when carrying out an assignment on the experiment in life sciences. In cases where an error has occurred, it is the group that has made the mistake. It is essential that singling out and labelling be discouraged in the classroom and in the school.

While it is not possible to force friendships, but by incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school, it is possible to create opportunities that encourage friendships to develop. Learners with vision impairment benefit from specific assistance with fitting into the school's social environment. The Circle of Friends is an approach that can be used to make opportunities for friendship available to the learner with vision impairment (Perske, 1988).

In view of the above, Banks (1996:267) shows that incorporating integration helps to reduce prejudice and improve inter-group relations. Learners could be equipped with the ability to think critically and to distinguish fact from opinion and propaganda that might be detrimental to collaborative and cooperative learning in life sciences.

According to Banks (1996:254), to reduce prejudice the teacher should stress the affective and the cognitive development of learners to help them understand the attitudes

towards others. He suggests that learners be introduced to group activities that could help them understand the effects of prejudice on both the prejudiced persons and their victims and recommends exploring activities that promote group discussions, group interaction, cooperative and collaborative learning in life sciences that link social context to the development of individuals and group values. Regarding equipping learners with cognitive skills for prejudice reduction.

Another strategy that will help incorporate integration when teaching life sciences to learners with visual impairment in the inclusive school is for the teacher to try and teach learners to accept and respect human limitations and different abilities. Learners must learn to know and understand the differences as well as to recognise human similarities. When focusing on integration, a common trend is to increase information about different disabilities and disability sector in the hope that this would lead to an understanding and appreciation of those belonging to other groups (Banks, 1996:315).

In an effort to reduce prejudice, activities should be designed as a purposeful and deliberate act. Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is purposeful. This means that for a teacher the activities should be structured in such a way that they would promote working together, interaction in observation and analysis of the experiments in life sciences and so promote diversity and improve human and societal group relations.

In incorporating integration, groups of learners can sometimes be mixed or sometimes teachers may work separately with learners with visual impairment according to their different needs/abilities/paces/levels, especially when basic skills need to be developed.

While the teacher incorporates integration through exclusive inclusivity, as the teacher continues to work with those learners who need more support, the teacher should work out activities for the rest of the class so that they are not left behind.

Banks (1996:47) calls for efforts to increase learner understanding and appreciation for human, societal and cultural diversity. He is of the opinion that learners should learn

about prejudice, stereotypes and attitudes directed at different groups. According to Banks, it is important that the teacher describe the life perspectives of different disability sectors and other cultural groups, their historical backgrounds and their contributions to life to the learners. Learners can have a project on echo access for visually impaired persons. The media centre can be of great use in this regard.

When teaching about diversity, teachers are advised to integrate concepts of social acceptance and humanness for learners from the different groups (Banks and Banks, 1996:53). Accurate information about various societal groups should be imparted to learners. The instructional procedures could include a good deal of cooperative learning, role playing, vicarious and real experiences to help learners develop appreciation for others. Emphasis should be placed on helping learners develop knowledge of cultural groups (Banks, 1996:54).

Vogt (1998:214) endorses the importance of incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school. He argues that tolerance is crucial to a society that values diversity, equality and peace. He is of the opinion that skills such as tolerance, empathy, working with a variety of individuals and groups are needed in order to function positively in culturally diverse environments. He states that tolerance involves taking the view of another or rather, “stepping into someone else’s shoes”.

Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is a strategy that helps to impart tolerance to learners, Vogt (1998:216) calls upon teachers to forbid discrimination and promote tolerance among learners. He reasons that although learners might dislike each other because of their stereotyped beliefs, they could at least be required to be tolerant regardless of their beliefs and attitudes.

Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is like striving to help learners develop tolerance and empathy towards people from different groups. The advocates of the teaching tolerance approach

call upon teachers to support open discussion and self-direction through using cooperative learning strategies. In highlighting cooperative learning, using group work that cuts across diversity and disability lines, they express conviction to teachers that incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school is “the method of best-demonstrated success”.

Incorporating integration when teaching life sciences to learners with visual impairment in the inclusive school serve as strategies outlining broad results to be achieved at inclusive schools which relate to the wider conceptualisation of integration (Department of Education, 2001), including:

- A supportive environment
- The inculcation of a culture of tolerance and respect for diversity; respect for the rights and dignity of all human beings
- The promotion of an environment that is free of any type of discrimination, segregation or harassment
- A mutual respect of learners with visual impairment as equal partners in learning
- The community's respect for the rights of all learners

3.4 The incorporation of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school as foundation for inclusive school

3.4.1 Introduction

The index indicators have provided a framework for the incorporation of the three-pronged approach of incorporation of integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. In this section, the researcher will attempt to show how these strategies can be incorporated by the teacher in an inclusive classroom.

3.4.2 General orientation on the incorporation of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school

Kokot et al, (1997:26) point out that learning implies the outcome or results achieved by means of a completed process. This implies that when learners with visual impairment learn life sciences, they must attain the prescribed learning outcomes of life sciences in the inclusive school.

In this section, the researcher will discuss life sciences learning outcome 1 and the critical outcome 1 contingent on the incorporation of inclusivity to achieve these outcomes.

The classroom teacher is the primary source of information and all activities of learning experience ensue from her interaction with a learner with visual impairment who is enrolled in her classroom. The acquisition of science processing skills is of utmost importance. It will also inform us how teachers in the inclusive schools should be prepared to adapt and differentiate their teaching to incorporate integration, inclusivity and equity and thus achieve the learning outcomes (highest possible learning quality) specified for the life sciences.

It is therefore crucial that the teacher should know the type of learners she has in her class. This will help the teacher to plan and design her lessons with the view of incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. It is the teacher's responsibility to teach all the learners in the classroom including the blind learner or a learner with low vision. The strategy that will help to attain this goal is by way of incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school.

Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school requires that a teacher must plan her work accordingly. Incorporating inclusivity means creating conditions for full participation in life sciences activities. The classroom teacher must give the learner with visual impairment the same

attention and help as she gives the other children in her classroom. The teacher does not need to make special rules or require less work from the learner with visual impairment. However, this statement needs to be qualified because there is a proviso, namely that the incorporation of inclusivity does not preclude the incorporation of integration. Instead, the incorporation of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school presupposes and is concomitant to the concurrent incorporation of integration and equity when teaching life sciences to learners with visual impairment in the inclusive school.

Placing either a learner who is blind or a learner with low vision in an inclusive classroom without providing such a learner with enabling science skills and support strategies does not constitute inclusivity.

The incorporation of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school rests on two fundamental pillars. There are other aspects which are crucial and critical as well in this regard, but the two forms the core of incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school. These are curriculum differentiation and curriculum adaptation, which fundamentally form part of the teaching and learning cycle.

The incorporation of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school by way of these two strategies will help teachers accommodate and address a range of barriers to learning and development. These strategies will be discussed in detail later in this section. Here the researcher wishes to start by elaborating on the advantages of incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school.

3.4.3 The adaptation and modification for incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school

The purpose of incorporating inclusivity by adopting curriculum modification and curriculum adaptation is simply to accommodate the functional differences of learners

with visual impairment. However, some other sighted learners stand to benefit as well from such an incorporation of. The advantages of such an incorporation of inclusivity is that it will assist learners with visual impairment to compensate for visual barriers in order to fully participate and engage and be involved in life sciences activities during the teaching and learning process in the inclusive classroom.

In the context of the preceding discussion, the study now examines the science process skill within the life sciences learning outcome and its bearing on a learner with visual impairment.

- Learning Outcome 1: Scientific inquiry and problem solving skills
- Critical Outcome 1: Solve problems, decision-making and thinking

Life sciences learning outcome 1 relates to science processing skills and has a direct bearing on learners with visual impairment.

Erwin et al, (2001:339) argue that learners who have acquired basic science process skills have positive, consistent and successful experiences in science that will enable them to explore, discover and ask questions about the world in which they live.

Van Aswegen et al, (1993:15) point out that the concept “process” encompasses what is in line with what scientists do: the processes they carry out in their own scientific activities. Through this process, scientists gain valuable information through observing, classifying, inferring, measuring, using space or time relationships, using numbers, communicating, hypothesising, and performing experiments.

The acquisition of basic science process skills serve as a prerequisite for advanced science skills that come once the learner has mastered the basic process skills. The threshold of the learning of basic science skills is crossed through sensorimotor and cognitive skills, which are of great significance because this leads to the development and enhancement of other advanced science skills as specified by life sciences learning

outcome 1 above. These include discovery, observation, inquiry, investigation, experimentation, analysis, measurements, prediction, problem-solving and evaluation.

Learners with visual impairment use their hands to touch and explore the phenomenon. They smell for the burn experiments. They feel the change in temperature or the state from liquid to solid substance. They explore the texture or surface of the ground, whether it is a lawn or soil. These basic skills are essential for transcending to higher skills. By default, learners with visual impairment depend on basic skills for their daily living.

OBE and Training (Department of Education, 2008) aims at increasing the general knowledge of the learners as well as developing their skills, critical thinking, attitudes and understanding.

If learners with visual impairment do not acquire basic science process skills they will only acquire superficial knowledge instead of a knowledge that is scientific and profound. Deprivation of the science process skills leaves learners with visual impairment lacking scientific experiences and data gathered through observations, predictions, experimentation, measurement, problem-solving, communicating, inferring, evaluating, et cetera. Lack of basic science process skills will deprive blind learners of the stimulation and motivation that are crucial during learning.

Lack of these skills will deprive learners with visual impairment of the enhancement afforded by the provision of inquiry activities that are crucial for helping all learners to develop problem-solving skills. Problem-solving skills are crucial in science because learners become creative, initiative and innovative.

Erwin et al, (2001:339) hold the view that these skills enhance the development of higher thinking skills in learners; thus, the main goal of life sciences teachers should be to make learners effective problem-solvers. This is the learning outcome and the critical outcome of life sciences indicated above.

Erwin et al, (2001:339) believe that life sciences inquiry activities help learners enormously to develop questioning and problem-solving abilities in a methodical, scientific manner, through the use of science process skills.

Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school creates conditions for interplay between the incorporation of inclusivity and the incorporation of equity by way of allowing the learner to use tactile skills for access and accessibility (the incorporation of equity) while promoting the development of new ones (the incorporation of inclusivity). This is a perfect demonstration depicting the interplay of the three-pronged approach, in this case between the incorporation of inclusivity and the incorporation of equity during the didactic situation.

The incorporation of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school will create conditions for participation and involvement by warding off dissonance between the learner's skills. This can encompass skills acquired during the incorporation of integration when the teacher was teaching life sciences, where such skills are actualised in the learning activities designed for the class where the teacher incorporates inclusivity. The interplay between the incorporation of integration and the incorporation of inclusivity yields participation and involvement of the learners with visual impairment in the inclusive classroom.

The incorporation of inclusivity when teaching life sciences to learners with visual impairment promotes concept formation on the part of the learners with visual impairment. This aspect will be discussed in greater detail later in this section. Incorporating inclusivity will help to reduce the level of abstract information to make content relevant to the learners' current context and future life.

Erwin et al, (2001:344) believe that learners with visual impairment make important connections to the world in which they live in many ways. They not only master the new vocabulary associated with the activities, but they often generalise the new vocabulary

and concepts across time and contexts. Objects that are in space are near, far, higher, lower, before, behind and next to other things.

Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school synergises commonality between the learning style of the learner with visual impairment and the teacher's teaching style when teaching life sciences to learners with visual impairment in the inclusive school.

Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school helps the teacher to plan and design her activities by forming the basis for curriculum adaptation and curriculum differentiation by way of customising learning programmes by the teacher.

3.4.4 Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school on the basis of outcomes-based-education

Let us look at the principles and practices of outcomes based education (OBE) which form the basis for the curriculum. This is discussed in conjunction with the incorporation of inclusivity when teaching life sciences to learners with visual impairment in the inclusive school.

3.4.4.1 Learner-centered

Learners are unique and individual and have different learning needs.

Learners do not all learn at the same rate and at the same pace.

Van Aswegen et al, (1993:151) strongly believe that learners equipped with basic science process skills are able to determine the validity of the explanations that are in the process of being formulated. Such skills further help learners to:

- Be able to give practical meaning to practical science activities;

- Be curious and knowledgeable about recent issues and problems;
- Use each other's comments, questions and activities as possible resources to motivate each other.

Incorporating inclusivity when teaching life sciences to learners with visual impairment takes cognisance of the fact that all learning and teaching needs to be flexible and learner-centred.

Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school dictates that teachers do all in their power to create an encounter with the learners. This encounter demands that the teacher applies the three-pronged approach to meet their education special needs as learners with visual impairment in the inclusive school and teach them according to their specific needs.

Van Aswegen et al, (1993:14) believe that basic science process skills have the ability to address the unique needs of the learners. This is quite critical and essential for learners with visual impairment in the inclusive school. These skills help learners in the acquisition of skills that inspire imagination, reflection and investigation in science. This means learners with visual impairment must be actively involved and catered for during life sciences lessons in the inclusive school.

The incorporation of inclusivity when teaching life sciences to learners with visual impairment will help to ensure that learning is appropriate, meaningful and relevant to the needs of all learners. This accords an opportunity where all learners should participate in life sciences and should not need a separate curriculum. Further it creates conditions where learners are allowed to learn and develop at their own pace and rate. It is particularly true for learners with visual impairment who cannot read Braille at the same pace as their sighted fellow learners can read ordinary print. The same is true with learners with low vision. This view is corroborated by Booth (1992).

Incorporating inclusivity when teaching life sciences to learners with visual impairment charges teachers with the responsibility of creating learning environments that are welcoming inviting and motivating for ALL learners.

3.4.4.2 Teaching from the known to the unknown

It is true that all learners come to the classroom with prior knowledge. However, this essential truth should be qualified otherwise it might yield unintended outcomes.

Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school poses a huge challenge for the teacher. The teacher ought not to take it for granted that some or all things related to life sciences that sighted learners know and talk about are known to learners with visual impairment. There are concepts that remain abstract to the learner with visual impairment, yet are familiar to sighted learners as something concrete. This understanding is crucial and critical since some life sciences concepts will remain abstract to learners with visual impairment.

Incorporating inclusivity demands that a teacher ensures that a learner with visual impairment understands the concept involved. This aspect was also discussed in the previous chapter. However, this does not mean that learners with visual impairment are “blank slates”. Teachers should build on prior knowledge of learners.

Incorporating inclusivity expects teachers to break their work into manageable chunks to accommodate affordability. Teachers should scaffold activities and tasks that extend and expand learners’ knowledge from what they already know. This means that teachers need to break down tasks, and give learners systematic support towards completing a task.

3.4.4.3 Active participation of learners

Incorporating inclusivity means creating ways of participating and being involved in life sciences lesson. The active participation of ALL learners leads to the development and achievement of learning outcomes as prescribed. Creating conditions for active

participation by learners with visual impairment means creating possibilities for achieving learning outcomes like sighted fellow learners.

Learners need to be active agents in their own learning.

Incorporating inclusivity ties in well with the incorporation of equity when teaching life sciences to learners with visual impairment. This point is elaborated upon under incorporating equity because it focuses on access and accessibility in the learning experience under discussion. To present verbal teaching only because the learners are blind or have low vision is less than adequate and is putting such learners at an enormous disadvantage. The disadvantage resulting from such an imbalance will not help them achieve learning outcomes like sighted learners. This aspect of expectation is discussed in details in the previous chapter under incorporation of equity.

Incorporating inclusivity means meaningful learning takes place where learners are actively involved in constructing, experimenting with and acquiring new knowledge.

3.4.4.4 The traditional role of the teacher as deliverer and transmitter of knowledge is discarded in favour of the teacher as facilitator, guide, and mediator of new knowledge

Teacher-talk needs to be minimised, as discussed previously. Incorporating inclusivity encourages the active involvement and maximum participation of all learners.

3.4.4.5 Creating healthy learning and teaching environments

Effective learning and teaching takes place in warm, welcoming, encouraging, and supportive environments.

The incorporation of inclusivity presupposes incorporating integration. It is important that, firstly, the teacher addresses the psychological needs of both sighted and visually impaired learners, as Engelbrecht (1999:72) points out that learners cannot think well in a

harsh, threatening situation or an intimidating environment where group pressure makes independent thinking unlikely. However, learners with visual impairment need to be kept busy for most of the day but also to be in contact with other learners.

Incorporating inclusivity creates conditions where a healthy and enabling learning environment promotes the freedom to be oneself, the freedom to express oneself, and the freedom to make mistakes. Here, the interrelation and interplay between inclusivity and integration is clearly seen.

Incorporating integration will make it easier to take risks. If they feel that they are not allowed to make mistakes, like feeling around their environment or examining particular object of interest they will be scared to learn. Blind and visually impaired children experience new environment mostly through their hands rather than through their vision.

Learning takes place in classroom environments where learners feel respected and valued, safe, comfortable and secure.

Learners with visual impairment need to be empowered through the knowledge obtained through life sciences lessons. This is in line with the purpose of life sciences as discussed in the previous chapters.

Incorporating inclusivity is to create opportunities for learning experience. The same holds true where the incorporation of equity when teaching life sciences to learners with visual impairment will promote the practice skills and make mistakes. Incorporating equity relates to creating access and accessibility. In most instances, this encompasses utilisation of assistive technology.

Even learners with low vision need to practice the skill of reading and learn how to read using their functional residual vision.

Creating conditions and opportunities like these by way of incorporating inclusivity enhances chances of self-worth and self-confidence for learners with visual impairment

in the inclusive school. This strategy helps learners with visual impairment to stretch their belief in themselves and discover and develop their individual strengths in the inclusive school among their sighted fellow learners. This will help them earn respect and acceptance and provide equal footing and experience. This aspect was discussed in greater detail under incorporation of equity in the previous chapter.

3.4.4.6 Making the CURRICULUM responsive to ALL learners

The main and ultimate goal of the three-pronged approach is that learners with visual impairment must learn life sciences and teachers can teach such learners in their inclusive classrooms. This is one of the ways that the researcher puts forward as the strategy that will make learning meaningful to all learners in the inclusive school. Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school on the basis of the principles of inclusive education.

The three-pronged approach is a systemic approach underpinned by the theoretical framework of Education White Paper #6 on inclusive education (Department of Education, 2001), that embraces the capability approach. It is premised on the notion that learners with impairment are endowed with capabilities taking into cognisance the fact that all learners are different in so many ways.

3.4.4.7 Recognition of learner diversity

There is a great deal of diversity in the learning styles and preferences of different learners. Diversity is a reality of all classrooms.

Life sciences has observation at its core. Observation requires vision in life sciences. Observation is a great challenge to learners with visual impairment in life sciences.

Engelbrecht et al, (1999:117) state that a deliberate observation is a conscious analysis where we question our snap judgments and plan ways of verifying or negating them, rather than jumping to conclusions without real evidence.

Therefore, it is of utmost importance to adapt or modify the experiment to be relevant to the learner with visual impairment. This strategy is endorsed by the NCS that the context can be made relevant to the learners' needs (DOE, 2003:10: Teachers' Guide for the development of Learning Programmes).

Incorporating inclusivity recognises that any teaching model that attempts to accommodate diversity must be based upon the premise that all learners are unique in terms of pace and speed of work. This is supported by the NCS that more time can be provided for assessment (DOE, 2003:11).

Incorporating inclusivity when teaching life sciences to learners with visual impairment in the inclusive school promotes a healthy classroom ethos that guarantees that all learners are valued and catered for irrespective of their differences. This is enshrined in the NCS that the learning programme can be structured to meet the needs of specific learners (DOE, 2003:2)

Incorporating inclusivity recognises the fact that individual learners will have differing levels of understanding of the content they are faced with. There is no "one size fits all" teaching method that effectively teaches all learners. This factor is acknowledged in the NCS and is provided for in that learning outcomes do not prescribe content or method. Therefore, content and methodology could be appropriate for learners' needs, (DOE, 2002:12).

Incorporating inclusivity inculcates the attitude that teachers should accept and respect the fact that all learners are different in some way and have different learning needs. Stereotyping, labelling and stigmatising learners on the basis of their differences should be avoided. This is supported by the NCS in that activities can be flexible (DOE, 2003:10).

Incorporating inclusivity implies that schools and classrooms should be environments that welcome and value different contributions and achievements. Classroom organisation needs to be flexible to allow for creative ways to respond to diversity. What

works well for one learner, may not necessarily work well for another. This important factor has been accommodated in the NCS in that learners can communicate using sign language, Braille, assistive technology or any other communication method (DOE, 2003:1).

It is unrealistic for teachers to expect all learners to benefit from the same uniform teaching. A variety of teaching styles and strategies should be used to cater for learner differences.

3.4.4.8 All learners can learn

Incorporating inclusivity is linked to the theoretical framework that underpins this research, meta-approach and the philosophy underpinning the Education White Paper #6 that endorses namely the capability approach. This means all learners are endowed with the potential to learn. Inclusivity will unlock this potential because the inclusive classroom reflects a society that allows all learners a right to belong (integration), the right to full participation (inclusivity) and the right to have reasonable accommodation (equity).

3.4.4.9 Minimising barriers to learning

Inclusivity is indicative of a paradigm shift in education. Learners with visual impairment are not a problem in the education system, as the medical model purports. The problem is located within the education system that is unresponsive and thus cannot address special education needs of learners with visual impairment. This aspect is dealt with in greater detail in Chapter One under the theoretical framework of the study.

3.4.4.10 Maximising participation of all learners

It cannot be overemphasised that the ultimate goal of the three-pronged approach is to maximise the sense of belonging and being part of (incorporation of integration), full

participation and active involvement (incorporation of inclusivity) and reasonable accommodation with access and accessibility (incorporation of equity). This approach is systemic and is aimed at unlocking teaching and learning in the inclusive school where learners with visual impairment attend and learn life sciences.

The two pillars of the incorporation of inclusivity, namely curriculum adaptation and curriculum differentiation, will contribute to minimising barriers and maximising participation. This will be discussed in greater detail in the next section.

3.4.4.11 Curriculum differentiation

Curriculum differentiation refers to the mediation of the curriculum. In the South African context, it refers to the NCS at an instructional, content and material level to accommodate learner diversity, which takes care of learners who are visually impaired.

Curriculum differentiation is any adjustment or modification to:

- The teaching and learning environment.
- Teaching and learning techniques.
- Teaching and learning support material that enhances a learner's performance or allows at least partial participation in a learning activity.
- Learning programmes.
- Assessment.

The NCS has several components that are flexible enough to allow for differentiation. For the purpose of our study, the researcher will choose just a few of these features to illustrate the point of flexibility. Below follows the examples of these flexible features:

Learning outcomes do not prescribe content or method: Content and methodology in particular should be appropriate for a learner's needs. A teacher who knows that she has a learner who is visually impaired in her class must, when writing on the board for other learners who can see, verbalise or speak as she writes or read it out afterwards for her

learners. If a learner has low vision, the strategies discussed in the other section are quite appropriate, (DOE, 2002:14).

Activities can be flexible: If, for example, learners have to collect objects, pictures, etc., the teacher should ensure that they are in a position to do so or else provide a variety for them to select and collect. The use of real objects or representations of such objects would facilitate learning, for example real flowers instead of pictures or a globe instead of just explaining certain aspects of the earth and beyond. Should the learners be unable to have access to real objects or natural phenomena it should be made available to them. When exploring new objects or in helping direct the learner's attention, use the hand-under-hand technique, in which the teacher places his/her hand under the learner's and guides their hand (DOE, 2003:10).

In the following example, we combine the three features:

- Teachers are encouraged to consider visual barriers to learning and/or assessment that exist in different Learning Areas and make provision for these when developing learning programmes, (DOE, 2003:7).
- The learning programme can be structured to meet the needs of the specific learners, (DOE, 2003:2).
- The context can be made relevant to the learners' needs.

The teacher must remember that some learners coming from different backgrounds may react differently to a specific text. This can be exemplified in the case where one of the areas of development effected by vision impairment is the development of self-help skills. Self-help includes self-routines such as eating, dressing, toileting and grooming. Many of these self-help skills are usually learned through observation. There are qualitative differences between the self-help abilities of a person who became adventitiously blind, after having had the opportunity to see different types of foods, eating utensils, mealtime locations and seeing others eat. Conversely, someone who is congenitally blind and has never had sight requires specific guidance and a variety of experiences in order to understand concepts related to eating. This applies to animals

feeding or walking. These concepts must be explained. The basic rule when exploring new objects or in helping direct the attention of a learner with visual impairment is to use the hand-under-hand technique (DOE, 2003:10).

Lesson Plan time allocation: Can range from a single activity up to a term's teaching or more time if necessary, depending on the needs of the learner, (DOE, 2003:10).

More time for assessment and execution of a task: This refers to accessible pace. For a learner with visual impairment or a learner who uses Braille, reading a Braille character at a time or finding a place in a book or reading a part of a diagram at a time is time-consuming. The same applies to a learner with low vision. It takes some time to examine a model or diagram.

We obtain most of the information about our environment through using our sense of vision. By using our eyes, we are able to see objects as a whole. The blind child lacks this ability to see object in their wholeness. When he feels an object he feels its parts, and puts the parts together to form an idea of whole object is like. Some objects cannot be tactually explored as they may be too big or too delicate. The concept of a cell's division is another example (Horton, 1998:54; DOE, 2003:11).

3.4.5 Curriculum Adaptation

3.4.5.1 Introduction

A useful tool for curriculum adaptation is Gardner's theory of multiple intelligences Gardner, (1983) in Reigebuth, (1987) states that every learner, regardless of his/her academic abilities, has at least one dominant intelligence, although s/he might have more. It is the duty of teachers to establish what their learners can do and develop those skills. Learners are more likely to learn when they can be engaged in activities that really motivate and interest them.

Multiple intelligences are also a useful tool for including learners with visual impairment to learn. It is also useful in designing activities for learners who learn differently. Teachers need to define tasks where learners can show different types of achievement. The following list gives an example of the use of multiple intelligences and adaptation, illustrating how the idea can be easily used in the life sciences learning area in the inclusive classroom:

- Verbal intelligence: presentation/the learners name the parts of a flower.
- Visual intelligence: drawing/ask learners to draw a flower. For the learner with visual impairment, ask him/her to look at the flower and describe what he sees.
- Logical intelligence: reasoning/teacher asks questions about the flower.
- Musical intelligence: sounding/let them sound the rhyming words.
- Interpersonal intelligence: learners help each other in rhyming words.
- Bodily intelligence: playing roles; doing actions, for example swinging or bowing of the branches or leaves in the wind.
- Intra-personal intelligence: naming the parts of a flower individually.

3.4.5.2 Adaptation

According to Horton (1988:107), it is important to think about what you are going to do before starting to adapt a particular material. The following questions can help to prepare for material adaptation:

1. What material am I trying to teach?
2. Why is it difficult for the learner to use this material in its original form?
3. How can I adapt it so the learner can understand it?
4. Do I have all the materials that I need?

When adapting materials, a teacher does not always have to make them look like the print copy as long as they are teaching the same concept. For instance, if a teacher is adapting a Mathematics worksheet that requires the learner to count how many ducks on each line,

the teacher does not have to cut out little duck shapes and paste them on a piece of paper. It would be easier to paste buttons on a piece of paper or make 6 Braille dots. The worksheet is not teaching about ducks, but about counting. It makes no difference if it is ducks, buttons, or Braille dots. Tactual pictures that are shapes of ducks, trees, dogs; or cats look pretty to sighted people but they do not provide much information to the visually impaired learner (Horton, 1988:107).

The teacher does not need to be an artist to adapt the materials, but she does need to be creative and innovative. The teacher also needs to ask herself questions such as: How can a worksheet or graph be put into a new format so that it can be understood and used by the visually impaired learner? The teacher will have to put the material into a tactile format for a blind learner and a large print format for a low vision learner.

Erwin et al, (2001:343) believe that learners with visual impairment should make an effort to experiments in spite of unexpected outcomes or wrong turns. Persistence is also evidence of meaningful engagement and active participations.

The researcher will make a few examples from life sciences concepts to illustrate the point of being creative and innovative. Before making examples, there are a few points worth noting by the teacher. These are:

- Know what concept you are trying to teach and teach only that concept. Do not try to teach six or eight concepts at a time.
- Present the concept in many ways and in many different settings.
- Use the WIW theory of teaching. Whatever works, use it!
- The learner cannot learn concepts by listening to you talk. He has to be active to learn concepts.
- Provide the learner with new and different experiences in order to build and increase the concepts he has.

A number of illustrations follow.

A. Size

Observation is the cornerstone of the basic science process skills. It relates to collecting data, observing the process, observing the product, conversing and conferencing, and organising the collected data.

Engelbrecht et al, (1999:117) hold the view that a deliberate observation is a conscious analysis of the phenomenon. In illustrating this point, the teacher must organise or ask learners to collect different stones and bring them to class. The teacher then asks the learners to put all the big stones in one pile and the little stones in another pile.

B. Shape

The teacher must organise or ask learners to collect different leaves and bring them to class. The teacher then asks the learners to put all the leaves with pointed ends in one pile and the leaves with smooth ends in another pile.

C. Length

In another activity the teacher or learners bring different sticks to class. The teacher then asks the learners to put all the long sticks in one pile and the short sticks into another pile.

D. Weight

For this activity, learners are asked to bring the stones they used in the first activity. The teacher then asks the learners to put all the heavy stones in one pile and the light stones in another pile.

E. Texture

For this activity, the teacher must bring different coins and ask the learners to work in groups. The teacher then distributes the coins to the different groups. The groups are then

asked to put all the coins with smooth edges in one pile and coins with rough edges in another pile.

F. Spatial perception

Erwin et al, (2001:344) concur with Pauw, who maintained that blind learners make important connections to the world in which they live in many ways. They not only master the new vocabulary associated with the activities, but they often generalise the new vocabulary and concepts across time and contexts. Objects that are in space are near, far, higher, lower, before, behind and next to other things.

When teaching spatial concepts to a learner with visual impairment, teach them in relationship to:

1. The learner himself.
2. The learner to other objects.
3. Other objects.

When beginning to teach compass directions, always have the learner face north. Teach the other directions in relationship to north (south is behind, east is to the right, and west is to the left).

First teach the learner the basic concepts, such as:

A sidewalk is located to the side of the street.

Between the sidewalk and the street there is a curb.

On the side of the path is a grass line.

Streets and paths have two sides.

Intersections are formed when two streets or paths cross.

At intersections are corners.

After the learner understands the basic environmental concepts, you can start to introduce the learner to the variations.

- a. Not all streets run true north-south.
- b. There are T-shaped intersections and offset intersections.
- c. Some intersections have traffic circles.
- d. In some countries, traffic can turn right on red lights.

In some cases, the teacher can set a substitute task of similar scope and demand. Sometimes the teacher can replace one task with a task of a different kind. This can happen in cases where learners are asked to draw a diagram. A teacher can use either a thermoform to produce a tactile diagram and then ask the learners to identify from the given diagram or provide an object or model then ask the learners to tell or describe what they see. In certain cases, a teacher may allow the learner extra time to complete task or even allow the learner to undertake the task at a later date. For low vision learners, a teacher may have a picture or diagram simplified, use high contrasts or even shown differently without compromising the complexity of the question. It is also important to have the amount of information reduced so that the picture or diagram is less busy.

It is advisable that the teacher always considers the format in which the task is presented, e.g. the complexity of graphs, diagrams, tables, illustrations, cartoons, etc. If the diagram or picture cannot be embossed through a computer using equipment like Tiger Pro or a thermoform machine or other compatible assistive technology, a range of strategies can be followed to make these accessible to learners who are blind, such as:

- Picture or diagram replaced by written description
- Picture or diagram supplemented by written explanation
- Picture or diagram replaced with a real item or model
- Unnecessary picture or diagram removed
- Measurements altered
- Inherently visual material replaced with equivalent non-visual material

The Learning Areas each have a prescribed number of Learning Outcomes, which should be demonstrated by all learners. These outcomes could be demonstrated in a variety of

ways, using different modes of response. The way in which these Learning Outcomes are demonstrated should NOT be a barrier to learning. A learner may decide to use a Perkins Braille, a computer with synthetic voice or sometimes a recorder.

3.4.5.3 Conclusion

In this chapter, the researcher discusses the teaching and learning strategies for the blind and visually impaired Life Sciences learners in the Inclusive schools' setting, since the points made will be crucial for the supporting inclusive education policy implementation and, in particular, for the teaching and learning of Life Sciences in an Outcomes-based Education learning environment. He addresses aspects such as the importance of proper teaching and learning strategies, the need for mainstreaming the blind and visually impaired learners, the need for teachers to receive specialised training in order to properly accommodate and effectively bring about learning to learners with impairment, and to support the functioning of the district subject advisers.

The purpose of this chapter is to Bring to light the need and relevance of specialised teacher training and suitable teaching and learning strategies for blind Life Sciences learners. Relevant stakeholders in the education of the blind will be acquainted with possible means of making teaching and learning strategies accessible and user friendly.

In addition, the researcher wishes to show that teaching and learning Life Sciences for the blind and visually impaired learners is influenced by many and varied factors. If the specific learning needs of blind Life Sciences learners with visual impairments are not identified, they will not do well in either the special schools or inclusive settings.

Blind learners have other learning difficulties besides their usual visual impairments and if these are not considered, such learners will experience difficulties in an Outcomes-based Education learning environment.

Van Der Horst and McDonald (1997:124) defined learning strategies as a wide plan of action aimed at teaching activities in order to achieve an aim. On the other hand, Pauw

(1990b:31) regarded teaching and learning strategies as processes through which an individual develops or acquires knowledge, skills or attitudes.

Shuell in Schunk (2000), pointed out that learning entails an enduring change in behavior, or in the capacity to behave in a given fashion, which results from practice or other forms of experience.

Reigeboth's (1987:2) pointed out that strategies can include individual strategy aspects, which are the elementary building blocks from which methods are created. Sometimes models of instruction are designed as sets of strategy components that have been combined to optimise the quality of instruction.

However, the researcher wishes to indicate that from personal and through conversation with Life Sciences teachers in the inclusive and special schools there are no specific teaching and learning strategies for blind learners, especially in the teaching and learning of Life sciences and other subjects.

The blind and visually impaired learners in an Outcomes-based Education learning environment make use of ordinary teaching and learning strategies with differentiations and modifications according to the learning needs. A relatively limited amount of literature is dedicated to the subject of Life Sciences and the blind learner. It is incumbent upon the Life Sciences teacher to modify or adapt common teaching and learning strategies and combine them.

What will guide the teacher are the following aspects:

- How do learners learn in general terms?
- How do learners learn Life Sciences?
- How do blind and visually impaired learners learn?
- How would blind and visually impaired learners learn Life Sciences in particular?
- What are the blind and visually impaired Life Sciences learners' teaching and learning difficulties and how

- Do these teaching and learning difficulties impact on the teaching and learning ?

General learning:

Kokot, Du Toit, Van Standen and Van Zyl (1997:26), pointed out that learning implies the results that have been realized through a finished process. This further implies that when learners learn, they engage in learning processes, whether formal or informal, that influence changes in their behaviours, situations and practices. All people, in one way or the other, learn spontaneously. When they come into physical and cognitive contact with situations (through perception), they start to attach meaning to these and thus learn. The environment provides learners with lots of experiences. It is through these experiences that they acquire various life skills, which will be used later in life.

Gagne in Reigebuth (1987:13), described five categories of human learned capabilities, each of which requires different instructional prescriptions. They comprise:

- Verbal instruction: This category focuses on the development of the following skills: recalling, writing, typing, stating, reciting information such as names, labels, sentences, arguments, single prepositions, etc.
- Intellectual skills, with five sub-categories: discrimination, concrete concepts, defined concepts, rules and higher rules , problem-solving. These skills can be realised when learners show competence, or interact with the environment using symbols or language. Learners know how to do something of an intellectual sort (Reigebuth 1987:14).
- Cognitive strategies: Reigebuth argued that this strategy can be realised when learners have developed ways to improve the effectiveness and efficiency of their own intellectual and learning processes; when they can learn independently; when they can propose and solve original problems.

Trief and Feeney (2003:137), pointed out that all learners learn if they have acquired study and note taking skills, know how to properly handle the stress of classes, thoroughly prepare for tests, are able to manage time, and utilise library resources.

Reigebuth (1987:16) argued that learners learn when:

- They are given the necessary attention and introduced to rapid stimulus change;
- They are informed of lesson objectives;
- Their prior learning and recall is stimulated;
- They are presented with stimulus material with distinctive features;
- They are provided with learning guidance;
- Their performance is elicited;
- They are provided with informative feedback;
- Their performance is assessed; and
- Retention and transfer is enhanced.

Arentz and Sterkenburg (2002:1) noted that the most important part of learning is observation.

As argued by Holdstock (1987:72-85), learners learn when teachers realise that there is more to intelligence than the vulnerable intelligence quotient.

Holdstock (1987:73) pointed out that far from being a unitary power of mind, intelligence for Gardner thus consists of a set of mental abilities which not only manifest independently, but probably spring from different areas of the brain.

Mwamwenda (1990:13) held the view that that the law of effect, readiness and exercise should govern all people's teaching and learning. This states that the law of effect show that a satisfying state of affairs leads to repetition of a given behaviour, while an annoying state of affairs weakens a response.

The law of readiness (behaviour approach) possesses three components. As pointed out by Mwamwenda (1990:136), the initial step is to thoroughly get learners ready and

prepared to engage in a certain behaviour, and provided with an opportunity to engage in the behaviour for which they are prepared.

Secondly, instances where learners are denied the opportunity to engage in a behaviour for which they are prepared will lead to frustration and annoyance.

Thirdly, when learners are not ready to engage in certain behaviour, yet they are compelled to do so, the end result will be annoying.

The law of exercise enhances the bond between a stimuli and a response as a result of practice.

Reigebuth (1987:47) pointed out that, a central requirement in classical behavior theory is learner practice (that is, practicing newly acquired skills or body of information) followed by reinforcement. Learners must practice the very performance that they are expected to learn.

In this instance, it is essential regard teaching and learning as the association between physical stimuli and observable reactions. The Life Sciences teacher should stimulate learners' interest so that they can be actively involved in the teaching and learning.

Fraser et al., (1996:39) pointed out that activity as didactic principle is a prerequisite for effective instruction and learning.

Furthermore, learners learn when they actively participate in tabulation, analysis, recording and even investigative activities. When learning, learners should endeavour to fully and appropriately master the characteristics and concepts of Life Sciences.

Fraser et al., (1996:40, 48) talk about “programmed learning”, which permits learners to complete learning tasks at their own pace and according to their own ability. This is an acknowledgement of individualisation, differentiated teaching or target learning. All learners should be equipped with proper learning skills meant to permit them to make a

choice between realistic learning and unrealistic learning. Learning as pointed out by Fraser et al., (1996:48) involves intellectual ability, which will make it possible for learners to link new concepts to relevant concepts already part of his frame of reference.

Slabbert (1991b:71 and 1992:113), meta-learning entails the higher order learning activities or control activities of learning such as planning, executing, monitoring and evaluating one's own learning. Since competences should be the focus of teaching and learning, the attainment of a competence has to be accompanied with the ability to have control over that competence in order to act effectively in any given situation.

In terms of this, the learner will be able to identify the competence necessary to complete the learning task, execute it, monitor the process and evaluate the product in light of the competence accomplished.

According to Fraser et al., (1996:50) learners should be made conscious of all demands relating to their tasks, and this implies knowing exactly what is expected of them as learners.

Learners who have acquired these skills as pointed out by (Slabbert 1992c: 113 and Fraser et al., 1996:50), are set to:

- Allow themselves to be better equipped to compete effectively for jobs and recognition;
- Make themselves better citizens;
- Improve their psychological well-being;

Life Sciences teaching and learning occurs when it is perceptualised in such a way that the details to be observed and perceived by the learner are converted into the concrete facts of reality. Furthermore, learners learn effectively when they know their weaknesses and are also able to know where their strengths lie.

Holdstock (1987:108) advised that not only must educators be able to recognise learners' problems but that they must also be able to respond to them.

Feuerstein (2001:1) argued that human learning, in fact, is fulfilled not only by direct experiences but it is also fulfilled by many requirements including and not limited to cultural transmission and learning experiences.

Trief and Feeney (2003:138) have identified three types of social skills or interaction which are crucial for interaction purposes, namely: assertiveness training, interactional skills, and skills in physical communication. According to these authors (2003:139), teaching and infusion of these skills should be part of any recreational plan.

Feuerstein (2001:4) argued that learners will enjoy and benefit from learning if teachers intentionally take care of them during teaching learning experiences.

The learner learns when and if the teacher endeavours to identify things that have a clear meaning for the learner and leads all learners to auto-motivation in autonomous research into the true meaning of objects, happenings, and learners' existence.

According to Feuerstein (2001) all learners should possess and be exposed to the following characteristics of teaching and learning experiences, in order to learn:

- Intentionality and reciprocity;
- Transcendence;
- Mediation of meaning;
- Mediation of a feeling of competence;
- Mediation of regulation and control of behaviour;
- Mediation of sharing;
- Mediation of psychic individualisation and differentiation;
- Mediation of choice, research, achievement of one's objective(s);
- Mediation of challenge and research attitude;
- Mediation of preference for optimistic choices;

- Mediation of a feeling of belonging.

According to Education White Paper (Department of Education, 2001), all learners are capable of learning, performing activities or carrying out instructions. Learners should receive both training and teaching and learning in order to learn.

- How Learners Learn Life Sciences

Learners will learn Life Sciences if teachers possess the competences and if teachers also make an attempt to expose them to a Teaching and learning experiences situation in which all learners are to be educated.

Furthermore, learners will learn Life Sciences if references are made to the nature and structure of Life Sciences as a science.

and learnable formative Life Sciences contents without losing or compromising the particular content and conceptual structures and the unique nature and character of Life Sciences as a part discipline.

Degenaar (1989:12) pointed out that the inherent worth of Life Sciences as a science must assist in the specific education and development in which Life Sciences has a role to play. The study of Life Sciences, the teaching and learning thereof, must supply a wide spectrum of education to a variety of professions and should be viewed by all as an essential component of general formative teaching and learning.

According to Carin and Sund (1989; Van Aswegen et al., 1993; Wellington. 1994 and Collette. 1989) , learners learn Life Sciences through enquiry, observation, experimentation, self and guided discovery, investigation, exploration, gathering of scientific evidence, application of scientific and technological ideas.

- How Blind Learners Learn Life Sciences

The lack of vision on the part of the blind and visually impaired learners creates perceptual hindrance That fail blind learners in their search to appropriately link the principle of perception and the principle of the so-called primary environment. Lack of perception poses to blind learners the disadvantage of not perceiving Teaching and learning to be as meaningful and effective as that of sighted learners because, in most instances, the Life Sciences, examples which the inclusive school Life sciences teachers presents during Life Sciences teaching and learning do not link up with the learner's previous similar experiences (Fraser et al., 1996:68).

Matthew Dion, Karen and Hoffman Amy Matter, (2005) argued that blind and visually impaired learners have a specific learning style. This style stems from the student's unique perception of the world.

Instead of visual information a blind or visually impaired person would depend on the auditory cues, verbal communication, or information gained from maneuvering around the room. However, there exists limitations. By any of these methods they will find it hard in constructing the entire scene because they do not have information about areas they are not in direct contact with.

The same authors, (2005) pointed out that the blind student has a concrete concept of the world. The objects that are tactually explored and identified will have meaning but a picture of the same object will be difficult to identify. For instance, an outline of a bird is identifiable to a sighted person, but a blind person exploring a raised line diagram of the same picture may be unable to determine it to be a bird or define which points are its wingtips and which is its head.

These authors, (2005) further maintained that there is also a concrete association between an object and the manner in which it is originally introduced. The initial characteristics such as its use or size are understood, but it is difficult to extend the concept of the object to having a different form or use. Because of this, there is difficulty in perceiving the inter-workings of a system, and how each object relates to and affects the others.

Matthew Dion, Karen and Hoffman Amy Matter, (2005) believe that the unique perception of the world is best exhibited in the difference between abstract and concrete conceptualization. Sighted people create abstract concepts by putting many characteristics in a group. This abstract concept can be put to use to classify and recognize objects not previously encountered. In order to illustrate this complexity, these authors, point out that there are many types of birds that can be represented in a number of different shapes and positions. Yet, sighted people can classify them as birds because they have an abstract concept of a bird. This abstract concept is a model in our mind that can be manipulated, rotated, stretched or represented in a two dimensional form.

The same authors, (2005) argue that visually impaired learners tend to conceptualize concretely. Since abstract concepts are based on visual information; a student's ability to form these concepts depends on their amount of residual vision.

Furthermore, the primary environment of the blind learner does not serve as a condition for effective learning. However, regardless of these challenges and frustrations that blind learners may experience during the teaching and learning of Life Sciences in the inclusive school, Life Sciences teachers should endeavor to make features of reality known to the blind learner. If the blind and visually impaired learners cannot go to the world, then the teacher of the blind and visually impaired learners must bring the world to the blind.

Kirk and Gallagher (1989:356) argued that the absence of vision, then, is both a primary hindrance and a condition that can hamper cognitive development because it confines the integrating experiences and the understanding of those experiences that the visual sense brings naturally to sighted learners.

Kumagai (1995:82) further argued that the central focal point of science is the observation. This entails looking at objects, measuring them, analysing their properties,

trying to think how they work. It remains a challenge to think how to proceed when nature's most basic and powerful tool for observing, which is sight does not exist.

According to Carin and Sund (1989); Van Aswegen et al., (1993); Wellington (1994) and Collette (1989), learners learn Life Sciences through enquiry, observation, experimentation, self and guided discovery, investigation, exploration, gathering of scientific evidence, application of scientific and technological ideas, the examination of the power and limitation of science, distinguishing between claims and arguments based on scientific considerations, etc.

Kumagai (1995:83-84) is of the view that the theoretical part of science is not that much harder for someone who is blind or visually impaired, because these learners mostly deal with symbols that could be dealt with assistive technology. As for experimentation, where there may be a lot of apparatus to be manipulated, that can typically be done by working in groups. In studying and doing Life Sciences.

Erwin et al., (2001:339) stressed the point that teaching Life Sciences to learners with visual impairments must be firmly grounded in a multi-sensory approach if learners are to receive positive benefits, such as activities related to tactile and auditory interactions, and therefore ample opportunity to manipulate and explore equipment and materials must be provided.

Higgins and Ballard (2000:172) endorsed this view by pointing out that when teachers teach these learners with similar expectations to those held for others of their age, teach them with recognition and responsiveness to their particular communication and related needs. The blind and visually impaired learners construct blindness as part of ordinary human experience. Such a conceptualisation by blind learners seems to be a key element of inclusive practices.

Clark (1982:61) echoed the same sentiment when he noted that acknowledging that the blind and visually impaired learners are not different, but just have different kinds of

needs and aspirations is the point of departure in adapting programs to accommodate these needs. For the needs of blind and visually impaired learners to be met,

Jacobs, Gawe and Vakalisa, (1996) believed that in classrooms where teachers employ a participative approach to teaching, the teaching-learning relationships between teachers and learners are dynamic rather than static and predictable. There are times when the teacher is at the forefront and teacher-talk and activity predominate, and times when learners are at the forefront, and learner-talk and activity predominate.

It is advisable that teachers should allow the blind person to make whatever arrangements he or she feels would be helpful. It is worth noting that the blind and visually impaired learners can serve as dependable consultants when it comes to their own learning.

Male (1997:13) pointed out that co-operative learning is a cooperative strategy that illustrates the use of the essential components of cooperative learning. If this does not work, the blind and visually impaired learners should be provided with an assistant who would help during experiments. The teacher should, also, allow and promote equal opportunities to take place during activities.

A conducive environment, according to Arentz (2002:1), promotes learning. The blind and visually impaired learners can feel more independent when the environment is familiar.

According to Van Kraayenoord (2001), interaction could occur in many forms. First, blind learners learn by interacting with other learners, family members, community members, etc.

Pijl, Meijer and Hegarty (1997) believe that the way in which teachers realize inclusion in the classroom largely depends on their attitude towards learners with special needs and on the resources available to them.

The other important factor is that the classroom must have the materials and equipment which are accessible and relevant to the learning needs of blind learners.

Higgins and Ballard (2000:173) pointed out that teachers need to know the alternative methods which the blind and visually impaired learners employ when reading, writing and taking notes.

It is important to note the following facts especially when you teach learners with visual impairment. This encompasses most concepts in life sciences. A product comprises facts, principles, laws and theories. The things that are done or created are the source of vital information. They, in most instances, reveal patterns, style, form, character, nature, structure, type, quality, shape, appearance, et cetera, that the scientist wishes to know, learn, understand and correctly apply

3.5 The incorporation of equity when teaching life sciences to learners with visual impairment in the inclusive school as foundation for the inclusive school

3.5.1 Introduction

The index has provided the framework for the implementation of three-pronged approach as the systemic approach. The three legs of the approach is the incorporation of integration, the incorporation of inclusivity and the incorporation of equity.

In section 3.5, the researcher focuses on the incorporation on equity in line with the index indicators. The researcher discusses the life sciences learning outcome 2 and the critical outcome 6 in relation to incorporating equity:

- Learning Outcome2: Construction and application of life sciences knowledge.
- Critical Outcome 6: Use science and technology effectively and responsibly towards environment and people.

Collette (1989:282) believes that learners with visual impairment learn and develop advanced science process skills through both the materials and experiences that are commonly used in hands-on approaches during science teaching and learning.

Placing a blind or low-vision learner in an inclusive class at an inclusive school and not providing such a learner with access to learning material, learning environment and learning equipment does not constitute inclusiveness. The role of the teacher is to incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school by providing the needed reasonable accommodation in the form of access and accessibility so that the learner with visual impairment can successfully be educated in an inclusive classroom. This means that, for the learner with visual impairment to learn and develop the advanced science skills referred to above, such a learner should be exposed to and be provided with specialised modified learning material and equipment. Without such provision, a learner with visual impairment will never be equal to his/her fellow sighted learner (Horton, 1988:9).

3.5.2 Incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school using low tech and conventional methods

This section deals with the incorporation of equity when teaching life sciences to learners with visual impairment in the inclusive school. This encompasses access and accessibility, which pertains to reasonable accommodation for learners with visual impairment in the inclusive school. The researcher suggests strategies that the teacher in an inclusive school may want to adopt to address the issue of the lack of accessibility in a classroom and how to achieve access and success.

In order to demonstrate the effectiveness of access and accessibility through assistive technology, let us make an example of a life sciences experiment where a colour change is involved. This example is that of testing the degree of acidity or alkalinity.

The colours of universal indicators depend largely upon the pH of the acid or alkali to which they are added. The changing of colour is critical and crucial in this experiment. A colour detector that has a synthesised voice will tell the colours. A learner with visual impairment then uses this to participate in this kind of activity. The main problem with an experiment of this kind is that the learner with visual impairment cannot observe the colour change.

3.5.2.1 Learning and support material

It is not expected of teachers in the inclusive schools to know Braille. In order to incorporate equity in the inclusive school, the teacher must work with a specialist or another teacher from a special school who knows Braille. This must be done before the class. Teachers might need to transfer class notes and copies of overhead slides into the correct medium before class.

Every blind learner must have classroom materials transferred into his or her appropriate reading medium such as Braille. Learners with low vision must have large print with the necessary contrast available.

In some cases the teacher incorporates equity by using the benefits of incorporation of integration where learners may share their notes with peers. However, anything written on the board or overhead should be verbalised if not available in Braille (Bhargava, 2004). It is advisable that a teacher, in advance of the class, works with the specialist teacher to provide copies of notes, hand-outs, and overhead materials in Braille or another preferred medium (Bhargava, 2004).

Incorporating equity entails ensuring that the teacher assists the learner in learning how to take notes independently through technology training with the specialist teacher. This includes accessible instruments, for example, a talking scientific calculator, Braille writer, low vision equipment and material, tactile rulers, maps, diagrams and all that forms part of teaching and learning support material.

3.5.2.2 Position

The teacher will not be able to incorporate equity when teaching life sciences to learners with visual impairment in the inclusive school without knowing the type of learners she has in her class.

When incorporating equity, the teacher must know that there are learners with low vision and those who are blind. Those with low vision can use their functional residual eyesight to benefit from being placed closer to the object or writing board. The learner, the specialist teacher, and at times, the parent(s) of the visually impaired will help the teacher determine where the learner should best be seated in the classroom (Bhargava, 2004).

At all times, seat the learner in a location with which s/he is comfortable and is able to make the best use of “functional vision” (Bhargava, 2004:11). For example, if a learner is using telescopic lenses or a monocular to see from far away, then sitting at the back of the room is a better position (Sewell, 2005).

When incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school the teacher should be aware of glare. Glare should be eliminated (e.g. special dry marker board surfacing) or controllable (e.g. by blinds, shades, indirect lighting and window location) (NCSDPI, 1998:23). Consider adjustable lighting so that certain parts of the room may be lit while others are darkened (Bhargava, 2004).

Incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school might mean that the teacher must allow a learner with low vision to determine the best contrasts for reading and writing. Two colours that contrast sharply to someone with normal vision may be far less distinguishable to someone with a visual disorder (Bhargava, 2004).

When the teacher prepares material, she should exaggerate lightness differences between foreground and background colours, and avoid using colours of similar lightness adjacent to one another, even if they differ in saturation or hue (Bhargava, 2004). If the teacher

lightens the light colours and darkens the dark colours, she will increase the visual accessibility of the design (Bhargava, 2004).

Incorporating equity might indicate that a learner may need extra workspace for any specialised equipment or technology needs. Also, have the electrical wiring evaluated for the learner's necessary assistive technology (Bhargava, 2004). This has to do with appropriate place and a work area suitable for using large books and equipment.

3.5.2.3 Presentation

Teaching life sciences to learners with visual impairment in the inclusive school demands that the teacher should know her learners. The incorporation of equity will be effective and fruitful. It is always useful that during group discussions, a teacher must have each person identify him or herself before speaking (Keller, 2004). It may also help older learners to allow presentations to be audiotaped (Kumar, 2001). However, some learners may find reviewing presentation tapes time consuming and boring. It is more effective for the learners' learning in the end, to encourage the learners to learn to and practice taking notes in Braille with a slate and stylus, or in large print with the appropriate pen. In the upper grades, it may also be appropriate to encourage learners to take notes with an electronic note taker if they have mastered using this adaptive equipment. These strategies allow notes to be taken more quickly and easily reviewed.

Equity means that the teacher in the inclusive school must bear in mind that learners with visual impairments need assistance in making the connection between vocabulary, and real objects, body movements and abstract ideas (Bhargava, 2004:12). Important vocabulary and concepts should be pre-taught using concrete, multi-sensory experiences combined with verbal explanations. Review material by asking the learner to describe what s/he understands about the term or concept (Bhargava, 2004). New vocabulary should be spelled out verbally (Bhargava, 2004).

It is advisable that for learners with low vision, the teacher must use chalk or markers that contrast well with the blackboard or dry-erase board (Bhargava, 2004). For older

learners, ask which colour combinations they prefer. Be aware of glare on the board (Bhargava, 2004). Allow the learner to move flexibly in order to gain the best view of the board. It may be necessary to confirm whether or not learners can see the material. Ask what they see, rather than if they can see (Bhargava, 2004). Remember to ask the learner privately and not in front of other learners. From time to time, check the learner's notes for accuracy (Bhargava, 2004). Felt pens, primary pencils, raised and bold lined paper can help make learners' handwriting more legible and easier to produce (Bhargava, 2004:14). If writing is too difficult or laborious for the learner, introduce computers at an early age (Bhargava, 2004).

This means the teacher must ensure accessible learner support material in the format and medium suitable to the learner. In respect of low vision learners, those with a narrow field of vision are actually hindered if they are given enlarged text on which they can see fewer letters at a glance. The best size of print is usually the one that the child can read most quickly and accurately.

3.5.2.4 Experiences

The teacher must not exclude a learner with visual impairment from all activities that can provide opportunities for learning experience. Hands-on learning is beneficial to all learners, more so to the learners with visual impairment. Use real objects or models as much as possible. Never assume that a learner with vision impairment has already learned the necessary background experiences and concepts. When exploring new objects or in helping direct the learner's attention, use the hand-under-hand technique (Sewell, 2005).

The teacher must allow first-hand experience where possible. A learner must not be exposed to verbal cues only.

3.5.2.5 Expectations

This part refers to an accessible standard of teaching and learning. In other words, it encompasses all three strategies: the incorporation of integration, inclusivity and equity

when teaching life sciences to learners with visual impairment in the inclusive school. The teacher must set a standard for the class, not for individuals. The class means the inclusive class where learners with visual impairment learn together with those that are sighted. The group of learners with impairment includes learners with low vision. This standard must not be compromised to accommodate learners with visual impairment.

Compromise must not be equated with adaptation or modification: incorporating of inclusivity or be equated with access and accessibility: incorporating equity to bring about equality in terms of accessing and participating fully and equipped in the didactic situation.

For a learner with visual impairment, however, in order to reach, attain and achieve the set standard, the entire approach must have been implemented skilfully in its entirety and all relevant strategies must have been applied and adhered to. If the requirements put forward by this approach have not been complied with, the teacher will impose unrealistic expectations on the learner with visual impairment. Expectations ensuing from a compromised teaching and learning situation cannot be regarded as true reflection of a didactical situation with learners with visual impairment in the inclusive school.

Learners who have been marginalised, excluded and discriminated against in the inclusive school because of their visual impairment are put at an enormous and humiliating disadvantage. They are made to be nothing but an inclusive schooling caricature and their human dignity and human rights are violated grossly.

3.5.2.6 Giving information

The teacher must know that a learner with visual impairment depends entirely on her. It is the responsibility of such a teacher to ensure that her learners with visual impairment are accommodated or have reasonable access to all classroom activities. In this regard, a teacher must always read aloud anything that is written on the board if it is not available in Braille or large print for low vision learners (Bhargava, 2004). Verbal descriptions and

directions should be clear and specific (Van Wagner, 1994). Visual Information needs to be described auditorily for learners with visual impairment (Bhargava, 2004).

The teacher can use twine and string on a hard paper or Braille paper after having drawn whatever she wants to show the class. The teacher can work with the teacher from the special school until she is able to do such diagrams on her own. Thermoform can be used, which is a device that can produce a tactile diagram on a plastic sheet that has strings pasted on it after the diagram has been drawn by a pencil; another type of assistive technology is a computer with a Braille embosser that produces tactile diagrams, Tactile graphics and raised line drawings are also helpful for conveying information that is normally in illustrations, graphs, and drawings. Outline diagrams, graphs, and pictures with liquid glue in order to make simple raised line drawings (Kumar, Ramasamy and Stefanich, 2001).

It is important to remember not to rely solely on tactile graphics in teaching. Understanding and using tactile graphics is a special skill that most blind and low vision learners are not generally taught. It is a skill best taught by visually impaired specialists, and tactile graphics can only be adequate when produced by people familiar with methods for making them useable by blind and low vision learners.

3.5.2.7 Speed of working

The teacher must remember that most the information that comes to a blind learner is accessed through the hands or ears. This may be very slow and time-consuming. The teacher must allow the learner to work freely without undue pressure or intimidation. The other learners who are sighted are likely to complete the task in much less time. This must not put undue pressure to the visually impaired learner.

Providing a computer to produce reading material in Braille will not help a blind child to read at the same speed as a sighted peer or help in understanding visual concepts that are read about, say, in science or geography. Enlarging print or giving a desk lamp to a child with partial sight will not teach that child how to scan through texts for key points,

understand a diagram or graph which is only seen in part. Reading a character at a time or finding a place in a book or reading a part of a diagram at a time is time-consuming.

It is very important that teachers should realise that the incorporation of integration, equity and inclusivity constitute a package. They are the main ingredients for the foundation of inclusive schooling. We cannot talk of inclusive education unless we mean the three-pronged approach, which is a systemic approach of the incorporation of integration, equity and inclusivity. Just as OBE and inclusive education are interrelated and cannot be divided, so are integration, equity and inclusivity. OBE is a useful tool for implementing integration, equity and inclusivity: inclusive education. One of the most important features of OBE is that it is concerned with establishing the conditions and opportunities within the system that enable and encourage all learners to achieve those important outcomes. An inclusive curriculum is based on a view that learning takes place when learners are actively involved in making sense of their experiences – they have to find things out and understand things for themselves.

3.5.2.8 Adapting the classroom to accommodate the learner

Incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school begins by accommodating all learners in the classroom, through ensuring that the environment is accessible and comfortable for all children. This may mean putting in hand rails, clearing space for visually impaired learners, etc. It can also mean some small changes that do not involve any real change to the classroom infrastructure. Most of these changes are about good teaching practice.

The main reasons for making adaptations to the classroom are:

- Firstly, some children will not be able to participate or even enter a classroom if there are hurdles on the way. For example, if a child with low vision must use stairs that are not clearly marked with contrasting colours, such a child is in jeopardy. There should also be tactile markings in the classroom for a blind learner to use as reference point for his orientation and mobility.

- Secondly, if learners who are blind can realise that teachers and the school community are making an effort to include them, they will be given a psychological boost. They will feel included. This is good motivation for any child.

Obviously, the adaptations that you need to make are entirely dependent on the needs of each learner and there can be as many needs as there are learners. For this reason, we cannot discuss all the needs that exist. Instead, some ideas are presented as to the types of adaptations to the physical environment that can be made to accommodate the most common types of needs that you may encounter in your classroom. Let's begin by looking at some examples of how the learner work environment of some children can be adapted in ordinary schools.

The environment in which learners with visual impairment work requires careful attention and there are three aspects that need attention – the visual environment, the sound environment and the tactile environment.

Visual environment: The right visual environment can make an enormous difference for a learner with low vision creating ease with which the learners fit in and work at their best. In order to provide the best visual environment for a learner with low vision, both lighting and decoration need to be attended to in a classroom. These two factors are closely interrelated as the colour of walls, floors and ceilings will greatly affect the amount of light arriving at a working surface. These two concepts: lighting and decoration are discussed in depth in a separate section.

Sound environment: All learners with visual impairments, but particularly those who are blind, will need to use information from what they hear rather more than fully sighted children. Listening becomes very important for a visually impaired learner. He gathers much information by listening. It helps him follow classroom activities and obtain information from the teachers' presentation and classroom discussions. Listening is also essential for developing good orientation and mobility skills. The learner not only has to

be able to hear and follow what is being said, but he also has to be able to ignore distracting noises, identify activities-by their sound, and be able to locate the position of an object or person by their sounds.

Listening is a skill. Learners with visual impairment in the primary school should be assisted to master this skill since they will depend on it to a great extent. Some listening skills, like picking out the main points in a story being read, are difficult to learn and take time and practice to master. In a classroom, a visually impaired learner is confronted with two aspects of the sound environment: information sound and interest sound.

Information Sound: The sound environment can provide information to help a child understand what is happening and to help in orientating to the surroundings. A blind child in a classroom may hear a door open and want to find out who has entered or left the room; he may hear someone near him start speaking but, because the speaker did not make clear who he was going to speak to, the child must attend carefully to try to work this out. In some cases, he may be using a talking computer and need to listen carefully to hear when the synthesiser talks. These difficult tasks can be made easier if the relevant sounds such as speech or sounds from the activity -stand out well from a “plain” background. If a variety of sounds are reaching his ears, he will have to work hard to isolate the one which he must attend to and, inevitably, some of the others will appear more interesting.

This skill of selectively attending and interpreting sounds is partly acquired through training but much can be achieved through creating a good sound environment. However, visually impaired learners can be helped through training to understand what happens when sounds are made and the difference in the two sound sequences; so that they can know what is happening when they hear the sound associated with that particular activity. It is advisable that the environment be designed so that there are no confusing background noises which can mask useful sounds.

The other type of information that can be obtained through listening is concerned with orientation. This is likely to be of primary importance to the blind learner. Learners can

work out where they are within, a classroom by listening to fixed sounds in the classroom. Sounds can help a child by indicating the direction and the distance of a feature. Some of the sounds that may be of help will occur naturally but others, like a clock on the wall or any fixed sound that can be heard from a particular direction, can be introduced to make the sound environment more helpful for orientation.

The sound that comes to the classroom should be able to help a learner to be aware of sounds, identify, differentiate, localise and track sounds.

Interest sound: This is a disruptive sound like an echo or someone drilling a hole or the rumbling of engines or people talking noisily near the classroom. Someone may be watching a TV programme in the next room or playing music. This might draw the attention of a blind learner and cause them to lose focus on the teacher or classroom activities.

Something else that might need special consideration is a quiet area in which there is silence or at least the opportunity to think or converse without the presence of competing sounds. This is particularly important for Braille users in an inclusive school. They may make notes on a tape-recorder or a Brailier but in both cases, there needs to be an area in which this can be done without the feeling that other people may be disturbed.

Tactile environment: The working area for a blind learner should be free of distractions. The work area may be better for a blind learner if there is a clear edge to it. It is often helpful if the learner is allowed to explore what is on the working surface before commencing work. If necessary, a child's hands can be guided across and around the surface. This will ensure he is aware of what is in the area in front of him, something which might not happen if he is not directed to explore it.

A teacher from a mainstream school cannot be expected to know these facts by intuition. If some of them know, it is a blessing and privilege.

3.5.3 Incorporating equity when teaching life sciences to learners with visual impairment in the inclusive school using high technology

3.5.3.1 Assistive technology considerations

An extensive range of new technology is at present obtainable to enhance the success of learners with vision impairments in the classroom and laboratory. However, it cannot be assumed that every teacher has a comprehensive knowledge of the numerous assistive devices that might meet a vision-impaired learner's particular needs.

Visual impairment is the loss of visual function of such magnitude that special aids and use of other senses are necessary to achieve performance ordinarily directed by visual clues. Vision impairments range from having total absence of sight to varying degrees of useful vision. Because a learner is vision-impaired, it should not be assumed that he or she is unable to participate in educational activities. For learners who are blind or vision-impaired, a wide variety of special aids and/or accommodations are available that address equity, making learners with visual impairment equal to seeing fellow learners and thus facilitating learning in the classroom setting.

The academic success of learners who are blind or vision-impaired, whether in special, integrated or inclusive school settings, depends on a variety of factors. Among these is their ability to access the classroom curriculum. Curriculum access for blind and vision-impaired learners requires provision of the same books and resource materials as those provided for sighted learners. However, these need to be provided in an appropriate format, for example, Braille, large print, e-text and audio, at the same time and at the same level, including the same book edition (Kelley and Gale, 1998).

Kelley and Gale (1998) contend that literacy and numeracy acquisition, particularly through the medium of Braille, should involve instruction across all key learning areas, to the same level of proficiency expected of the learner's sighted peers. Learners should be

exposed to text in the full range of contexts, formats and genres, for example, environmental, factual and fictional.

Given the above constraint, appropriate adjustments can be made to the curriculum that render it more accessible and, as Casimir and Alchin (2001) have pointed out, thus enabling both teachers and learners with special needs to take advantage of the many rich learning opportunities available to them. For teachers, designing a classroom with assistive technology that is accessible for learners with significant vision impairment can appear a daunting task. Despite such initial apprehensions, curriculum accessibility can be increased with minimal disruption to others in the class using assistive technology.

The term assistive technology refers to items, or pieces of equipment, or products, whether acquired commercially, or off the shelf, modified or customised, that are used to increase, maintain or improve the functional capabilities of individuals with disabilities (Kochhar and West, 1996).

The effectiveness of a piece of equipment is dependent on its appropriateness to a variety of situational variables, such as user characteristics, setting demands, particular features of the technology itself, as well as a number of cultural factors (Lewis, 1998). These all require careful consideration prior to deciding whether and how to use assistive technology.

This study will outline some of the fundamental concepts that considerably enhance teacher and learner effectiveness in using technology. It is not possible to provide a fully comprehensive coverage of all aspects of assistive technology due to the vast number of devices and supports that can be classified as assistive technology. These include a widely diverse range of materials, services, systems and devices. It is useful to classify such devices into “low-tech” and “high tech” categories. Those commonly used in schools include positioning equipment, mobility aids, communication devices, computer applications, electronic interfaces that can be categorised into input and output devices, adaptive environments, an assorted array of medical equipment and prostheses (Parette,

Brotherson, Hourcade and Bradley (1996). This paper will, however, focus upon those forms of assistive technology that primarily help learners with vision impairments gain access to information, both print and electronic, and facilitate written communication. The key to taking advantage of the opportunity these tools offer, as Koenig and Holbrook (2000) have indicated, is to give learners access to the appropriate assistive devices when needed.

In this research, three points of consideration are proposed that teachers of learners with vision impairments must consider in the provision of technological supports to their learners. The first of these has to do with the importance to teachers and learners of adopting a protocol to guide them in selecting the appropriate equipment.

Selecting appropriate equipment at one time, as Bishop (1996) has pointed out, learners with vision impairments had only a typewriter, tape recorder, Talking Book Machine and/or a Braille writer as special equipment. Today, the available assistive technology has the potential to increase learner and teacher control over a variety of educational materials and can allow direct contact with classroom activities. There are systems and software to enlarge print spontaneously, software that enables computers to “talk”, self-contained electronic equipment to allow learners who are blind to take notes or read print; and software that will translate Braille to print and vice versa. The learner with vision impairment in the classroom is only limited by the availability of technology and the skills of the teacher in enabling him or her to use it.

The significant promise of technology for learners with vision impairments is accompanied by equally significant challenges for their teachers. It is critically important, for example, that learners are taught to operate efficiently in technological environments. This is because the inherent complexity of much assistive technology requires direct instruction from qualified and technologically competent teachers of learners with vision impairments (Kapperman, Heinze and Sticken, 1997). In this regard, Kelley et al, (2001) have reported that a key component of success in integrating technology for learners with

vision impairments into the curriculum is the collaboration between classroom and specialist teachers and technology instructors.

The arrival of a piece of complex assistive technology in a classroom will likely be greeted with excitement by the learner with vision impairment as well as by the specialist teacher. However, it might sometimes be regarded as a threat to the competence and an intrusion on the time of the class teacher. Some classroom teachers in fact do not view the teaching and supporting of assistive technology for the learner as part of their role. It is therefore essential that initial in-service training and on-going support is available to the learner, the classroom teacher, and the school staff generally and to the specialist teacher.

The efficiency with which a learner who is vision-impaired uses sensory information in the learning process is, as Koenig and Holbrook (2000) have indicated, essential to the construction of that learner's individual educational plan (IEP). Issues affecting curriculum access via assistive technology become additionally important to both teacher and learner. Any assistive technology device that enhances an individual's ability to access or engage in critical tasks must be selected systematically (Lueck, Dote-Kwan, Senge, and Clarke, 2001). The implications of assistive technology as a means of accessing the learner's instructional programme are best determined through specialised assessment processes that are, according to Koenig, Holbrook, Corn, DePriest, Erin and Presley (2000), unique to the needs of learners who are blind or vision-impaired. These specialised assessments in the school or classroom setting include the functional vision assessment, the learning media assessment, and the assistive technology assessment, aimed at determining the appropriate options for using adaptive technology to meet individual learner needs and the selection of access devices for computer input and output. There are of course, overlapping areas in these three types of assessment.

3.5.3.2 Vision assessor's role

Teachers of learners with vision impairments generally have primary responsibility for conducting specialised assessments. They take a leading role in conducting a functional vision assessment and a learning media assessment. In New South Wales for example, this role has also been assumed by the assistant principal or executive teacher (vision impairment). A teacher of learners with vision impairments may conduct an assistive technology assessment, or a specialist who has had specific training in the special technology needs of such learners may conduct it.

The specialist teacher gathers information from a number of specialised assessments and uses it to design, as part of a team, an appropriate IEP for the learner. The particular role of the specialist teacher is to do the following:

- Conduct the functional vision assessment.
- Conduct the learning media assessment.
- Conduct a screening of assistive technology needs.
- Ensure that a comprehensive technology assessment has been conducted.
- Collaborate with parents and other IEP preparation team members to gather objective information on learner strengths and weaknesses, related to use of the learner's sensory systems.
- Offer recommendations for instructional programming literacy media needs, and assistive technology needs based on the specific assessment results.
- Ensure on-going needs assessment using the specialised assessments to gather and synthesise information, at least annually.

The extensive and continuing development of a plethora of new equipment available for people who are vision-impaired means that specialist teachers are faced with the daunting task of trying to keep informed about not only the available equipment but also with the continuous developments in the field. Downie (1996) has stated that a major challenge for teachers of learners with vision impairments is that it is not possible for individuals to hope to keep abreast of all innovations. It is essential that teachers of learners with vision impairments have information and access to the range of available equipment. They also need access to the commercial producers of equipment as well as to individuals who are already using the equipment successfully. A teacher of learners with vision impairments requires time in her/his busy caseload to investigate, evaluate and select the most appropriate equipment for individual learners.

3.5.3.3 Assistive technology assessment

A comprehensive assistive technology assessment identifies the technology that a learner will need to complete a variety of tasks in his or her educational program. An effective assessment should be part of a team process. In addition to those who normally attend the learner's IEP meeting, it is advantageous to include an assistive technology specialist, should one be available, and possibly a vendor or product representative. These additional team members are crucial for successfully completing the assessment (Koenig and Holbrook, 2000). In this regard the time taken to complete the assessment is an important issue, with team and learner being encouraged to take as long as is necessary.

The comprehensive technology assessment includes a review of background information on the learner and an initial assessment by the specialist teacher; together with a follow-up assessment by an assistive technology specialist (should one be available). Once the recommended technology has been put in place, the specialist teacher and the other team members conduct on-going assessments and periodic re-evaluations to ensure continuity of support.

3.5.3.4 Teacher support

To implement and establish the system of inclusive schooling for learners with visual impairment, White Paper 6 acknowledges that schools will need continuous support. Within the schools themselves, this support will come from the institutional-level support team (school-based support team) from the side of the department, support will come from the district-based support teams (district-based support team). The chain of support for inclusive education will also be strengthened by special schools, which are to be restructured to act as resource centres. Selected schools will also be converted into full-service schools which can in turn provide support to neighbouring mainstream schools (Department of Education, 2001).

The implementation of inclusive schooling for learners with visual impairment necessitates a network of support, where everybody supports each other at all levels of the system. Special schools as resource centres directly support inclusive schools and these, in turn, support ordinary mainstream schools. This system of support has to be driven and supported and modelled at the district level and is formalised through the establishment of the school-based support team at school level, and the district-based support team at district level.

3.6 The role of the school support team to learners with visual impairment in the inclusive school

To turn the vision of inclusive schooling for learners with visual impairment into reality requires a lot of management and leadership. In the end, it can only be measured by the quality of learning and teaching that takes place in the classrooms. This is crucial and critical for creating enabling conditions for the teacher when teaching life sciences to learners with visual impairment in the inclusive school. This structure is school-based support that is linked to district support that is pivotal in the giving of support to teachers in the inclusive school especially to teachers when teaching life sciences to learners with

visual impairment in the inclusive school. This was discussed in greater detail in the previous chapter.

This task of making a school more inclusive is managed and supported by the school-based support team. According to Education White Paper 6 (2001), the general roles and functions of the school-based support team can be summarised as follows:

- Co-coordinating learner, teacher, curriculum and institutional development at the school.
- Identifying the barriers to learning at learner, teacher and institution level.
- Developing strategies to meet these needs.
- Drawing in resources.
- Building the capacity of the staff for inclusion.
- Ensuring sustainability of inclusion at the school.

Each of these will now be discussed in greater detail.

- **Co-ordination**

The main function of the school-based support team is to co-ordinate learner, teacher, curriculum and institutional development at the school. This includes linking up with any other management structures and processes at the school and integrating them. It also means liaising with the district-based support team and other relevant support providers.

The school-based support team could draw up a list of all the management structures and processes already at the school and to see how the school-based support team might link into them.

- **Identifying barriers to learning**

It is very important that a school comes to a common understanding of what is needed in terms of barriers to learning, so that all stakeholders can work together. This includes barriers to learning at learner, teacher, curriculum and institutional level.

The school-based support team will need to conduct a needs analysis, which looks at the barriers to learning at learner, teacher, curriculum and institutional level.

Learner needs:

Teachers submit a report to the school-based support team on barriers identified and the support provided to that point and the impact of the support. The school-based support team will then assess what support is needed and develop a programme for the teacher and parents. The school-based support team could also provide any additional training or support that the teacher may need to implement the program.

Teacher needs:

They could act as a support group for teachers to discuss issues of behaviour, discipline and conflict resolution. It could also become a safe place for teachers to share their problems and frustrations and a place to brainstorm ways to support the teacher to find non-violent ways to solve problems.

Institutional needs:

A situational analysis can be done by using the School Development Assessment form, or by doing a SWOT (strengths, weaknesses, opportunities and threats) analysis, or any other tool. However, it is important that the focus of the analysis is on barriers to learning. It is also important to find out the perceptions of parents and families of learners of the school. The district-based support team can be drawn in to facilitate the needs analysis and to help draw up a clear list of needs.

- **Develop strategies to meet the needs of inclusion**

Once the school-based support team has identified the needs of the school, it is important to make inclusion part of your strategic planning instruments such as your school development plan.

It must be remembered that a good strategic plan has the following qualities:

- It sets realistic and achievable goals which take into account other demands on the school and provide opportunities for new skills and ways of working.
- It deals with the frustrations that the change to inclusion can cause. In other words, a good strategic plan is challenging but kind; it carries the ethos of support.
- It maintains flexibility while firmly steering change.
- It ensures accountability.
- It has time built in for reflecting on successes and failures, so that the school can celebrate its successes and learn from the challenges.

Besides having a strategic and overall plan, it is also important that the School-Based Support Team meets frequently and regularly for check-in sessions with smaller groups of staff. These meeting must be supportive and give teachers the opportunity to share problems and successes. They could have a tone of mentorship.

- **Draw in resources**

Part of planning is knowing how to draw in the resources that are available to aid inclusion. While the district-based support team will be a major source of support to your school, it is important to be creative in accessing the resources around us. The school-based support team can do much to mobilise positive and creative attitudes towards the challenges that arise from inclusion.

Sometimes we think that having resources means having access to money and funding. As a result, schools often get overwhelmed by a feeling that they have so little anyway that they feel that there is nothing they can do to improve matters. As well as developing a positive attitude towards problems and challenges, it is also important to know where to look for resources.

- **Build capacity for inclusion**

As stated earlier, change often makes staff insecure and resistant. Training and professional development can help a lot towards changing attitudes and making staff feel empowered towards adapting the curriculum towards inclusion.

Training would include:

- Training senior staff and school management in their roles in supporting the development of an inclusive school. This would also include an understanding of the ethos of inclusion and the implications for the school.
- Training for teachers in the new skills needed in curriculum differentiation, curriculum assessment, collaborative planning and reflection.
- Training for all staff and various stakeholders. This would include caretakers, volunteers, admin staff, parents, learners, teachers, management, so that everybody at the school has a common understanding of inclusion.

While the district-based support team is in a key position to provide this training and support, the school-based support team are encouraged to develop their own plan for on-going staff development, based on the particular demands of your school. The school-based support team could be involved in offering staff support through guidance and direction, mentoring and monitoring the work of teachers, and also encouraging an atmosphere of collegiality and peer support among members of staff. This means that members of the school-based support team also need training in management and mentoring skills.

Professional development also has to take place on an informal, day-to-day basis. For example:

- A teacher from the school-based support team could invite colleagues to watch a lesson and afterwards they could discuss issues such as classroom management and differentiation.
- A parent is invited to share their experience with living with a visually impaired child.
- Teachers visit a special school and watch an occupational therapy session.

- Teachers meet once a month over a cup of tea and cake to discuss an article about inclusive education.
- Ensure the sustainability of inclusion at the school

Lastly, one of the main roles of the school-based support team is to make sure that inclusion is not just another passing “fad” that the school has to adapt to, but that it becomes entrenched and is sustained over time.

The implementation of new projects and ideas often fails because of weak leadership, over-ambitious goals, and poorly defined objectives, together with a strategy that has not been thought through properly. For example, when nobody is made accountable for its eventual success, people lose interest and start to focus on other issues.

It will probably be noticed that the main function of the school-based support team is to facilitate discussion and access to information. It is important that the school-based support team does not see itself as doing the work of teachers but as supporting the work that teachers do. The school-based support team also plays an important role in motivating teachers and driving the vision of inclusion at the school.

3.7 The role of the district-based support team in managing and supporting the incorporation of integration, equity and inclusivity

According to Education White Paper 6 (2001), the various roles that the district-based support team will play in incorporation of integration, inclusivity and equity can be broken down into the following categories:

- To play a central co-coordinating role. In this section we have described a complex network of support for inclusive schooling. The main role of the district-based support team is to provide the support to the incorporation of integration, inclusivity and equity. This means:
 - Co-coordinating with other departments and service providers.
 - Mobilising existing community resources such as NGOs and DPOs.

- Linking schools with formal and informal support systems in the community.
- To create and develop structures such as the school-based support team. It is the duty of the team to ensure that every school, including special schools and inclusive schools have a well-functioning and effective school-based support team.
- To assess the level of support needed by a learner. The district-based support team, in consultation with the parents or guardians and other stakeholders, will determine the levels of support that a learner will need, and what type of school she or she will go to.
- To monitor and make available the support needed in terms of curriculum and institutional development. The district-based support team will provide curricular and organisational development to schools and will help to plan and implement support programs for individual learners. They will offer this curricular support through training, consultation, mentoring and monitoring.
- To identify the resources that is required and available. For example, the district-based support team can organise the sharing of movable assistive devices.
- To facilitate the admissions of all learners to schools. The district-based support team will be responsible to ensure that all learners are admitted to school and that they receive the necessary support. It is accountable for tracking all learners who have applied for admission and has to control the waiting lists kept by schools. No learner should be out of school because an arrangement for providing support could not be made.

The district-based support team will:

- Prioritise the placement of learners who fall in the range of high and very high needs.
- Verify the initial screening done by the school-based support team of a school.
- Respond to applications within three weeks.
- Set in motion the provision of the necessary support.
- Play a role in capturing data from schools.

Inclusive schooling can only be implemented through a network of support, where everybody supports each other – special schools give direct support to full service schools and these, in turn, support ordinary schools. All of this has to be driven and supported by the district. This system of support is formalised through the establishment of the school-based support teams and the district-based support teams.

The emphasis on the reliance of all school leadership and management structures on the district-based support team for support is clear with the challenge of transforming all schools into inclusive schools, there is a very real need for leadership and management structures within all schools to be appropriately, effectively and meaningfully supported in their journey towards becoming the kind of institutions and support structures envisaged in the WP6. This is not a simple journey of transition. Schools cannot be expected to embrace and implement inclusion on their own, nor can this transition be accomplished overnight.

The encounter with teachers shows that schools are feeling the anxiety and pressure from being “bombarded” by a number of recent new policy initiatives with their corresponding expectations of change. Too often, priority has been placed on carrying out policy initiatives and implementation plans, at the expense of building strong relationships, and sound cognitive foundations, as effective scaffolds and support structures for new policies. Inclusive Education pilot projects have revealed that, with the challenge of having to incorporate new functions, roles and responsibilities in their transition to becoming more inclusive schools, school leadership and management structures may feel overwhelmed, anxious and even reluctant to embrace inclusion.

A fresh understanding of and insight into defining support is important on the part of all department personnel. There needs to be a paradigm shift from the understanding of management and support as separate and apart from one another, to the understanding that the two go hand in hand. It has been a realisation of the NCS that support should be given as much emphasis as delivery. We cannot expect school leadership and management structures to simply deliver on inclusion, if they are not adequately and

appropriately supported towards this end. The NCS emphasises the importance of the process (how we reach an outcome) as much as the outcome itself. Just as teachers are being encouraged to support learners towards certain outcomes, by facilitating, guiding, supporting and scaffolding, so the district-based support team needs to support school leadership and management towards inclusive outcomes. A priority of the district-based support team will necessarily be the need to give equal weight to delivery (of inclusive education practices) and appropriate support towards this end.

In the event that special and inclusive schools are feeling anxious and overwhelmed by the challenges of embracing new roles and responsibilities, it might be wise to allow the process of transition to be guided strongly by the principle of less is more. Rather than take on numerous tasks simultaneously, it may be wise to recommend that schools take on fewer, more realistic tasks, especially in the initial stages of transition. The district-based support team could support the leadership and management structures of these schools in focusing on one area of priority at a time, and setting realistic and achievable objectives. It might also be worth considering the choice of a smaller task as an initial objective (even if this is not a top priority issue), where the period from action plans to reaching the objective is shorter. This may help to build schools' confidence in their ability to problem solve, work collaboratively, and achieve an objective (however small) towards overall transformation.

Priority should be given to building strong personal relationships with teachers, school-based support team, school leadership and management, with emphasis on coming alongside them in a clearly supportive role, working with them and supporting them towards inclusion. Building a positive relationship with the resource centres and full-service schools is vital to the process of effective transition. Every endeavour on the part of the district-based support team needs to be made to foster and nurture healthy collaboration and cooperation among all stakeholders. A realisation of the shift in cultural ethos and power relations of new education policy needs to take place. The district-based support team needs to be aware at all times that their roles within the education system should be defined by support, not by levels of superiority and hierarchy. Traditional

power relations should no longer be characteristic of our present education system. In a cultural ethos where democratic management styles have replaced authoritarian and autocratic ones, dictating and prescription should have no place.

3.8 Conclusion

This chapter has dealt with, firstly, the index for inclusion and its indicators as framework for inclusive school. Secondly, it has dealt with the incorporation of integration, equity and inclusivity when teaching life sciences to learners with visual impairment in the inclusive school as foundations of the inclusive school. The researcher attempted to show that the three-pronged approach is a systemic approach aimed at creating conditions for a sense of belonging, being part of (incorporation of integration), full participation and active involvement (incorporation of inclusivity) and reasonable accommodation for access and accessibility (incorporation of equity). These three concepts are distinct yet inseparable. This has been demonstrated in the incorporation of these concepts following on the theoretical foundations. The next chapter will focus on the research design and how it was implemented in this study.

CHAPTER 4: Selection and application of the research methodology and data collection strategies

4.1 Introduction

This chapter discusses the research methodology used during the collection of data. The chapter also describes the processes followed as a response to the specific aim and objectives of the study. The collection of data for this investigation is based on qualitative data collection techniques and strategies. Emphasis is laid on the following aspects: the data collection techniques and strategies applied; the composition of the research sample and selection of the participants; data collection processes; the conducting of the individual interviews and the method of data analysis.

4.2 Data collection techniques and strategies applied

4.2.1 Reasons behind the conducting of a qualitative investigation

The purpose of qualitative research, Holloway (1997:79) maintains, is to uncover the essence of a phenomenon, not to generalise from a single case or a small number of cases in this respect qualitative research has specificity.

The researcher's intention to discover the views of both the teachers in the inclusive schools and the district subject advisers on integration, equity and inclusivity and the influences these have on the teaching of Life Sciences to blind and visually impaired learners in the inclusive schools prompted the research. The need to know also the views of the district subject advisers on how they provide support to these teachers in the inclusive schools prompted the research. The need to know how teachers and the district advisers were dealing with these issues prompted the selection of qualitative data

collection techniques and strategies. The merit of this method of data collection is that it provides insight into the challenges that confront the inclusive school teachers and the district subject advisers when incorporating integration, equity and inclusivity in the teaching of Life Sciences to the blind and visually impaired learners.

This research describes and analyzes the reality in the inclusive schools where the teaching of Life Sciences to learners with visual impairment. In this respect it is in line with the views expressed by Holloway (1997:79) when he pointed out that qualitative researchers often - if not always - produce a description and analysis of reality that is 'typical' for a particular setting by taking into account the conditions and the context under which the phenomena occur.

Holloway (1997:26) describes audit trail as the detailed record of the methods and decisions made by qualitative researchers before and during the research process. Audit trail comprises a description of the setting, events and activities as well as a rationale for the research. The audit trail seeks to give the readers of the research with the information that will enable them to judge its trustworthiness and authenticity.

Qualitative data collection techniques and strategies are significant because they are interpretive and constructivist in nature and they provide much insight into the experiences of the inclusive school teachers and the district subject advisers on the incorporation of integration, equity and inclusivity when teaching Life Sciences to the blind and visually impaired learners in the inclusive schools.

The researcher distinguishes three distinct characteristics of qualitative data collection techniques and strategies which are significant in conducting research. They relate to the researcher as an instrument, as a data collector and as a data processor.

Regarding quantitative methods, Smit (2001:56) argued that their assumptions about the world are based on a logical positivist philosophy. This implies that social evidence is a single objective reality which is separated from the feelings and beliefs of individuals. He

added that qualitative research is based on a naturalistic phenomenological philosophy. It is assumed that realities are socially constructed by the individual and by society.

Lichtman (2006) holds the view that qualitative research lends itself to many interpretations: many things to many people. Some researchers will view research pretty much in the same way they view the world. Others associate qualitative research with methodologies instead of realities. They will according to Lichtman identify ways to analyse data and will identify themes accordingly.

According to Swann and Pratt (2003) qualitative research can be defined as being concerned with the quality rather than the quantity of something. Qualitative research is often used in educational research to typify a particular paradigm.

Leedy, (1992:139) defines central phenomena as the key concept, idea or process studied in qualitative research. Qualitative research makes use of interviews, observations and document analysis to gather data. The data in this type of research is usually collected in the form of words.

Quantitative data is collected under controlled conditions in order to rule out the possibility that variables other than the ones under study account for the relationships among the variables. Qualitative data is collected within the context of their natural occurrences. This permits any variables that could naturally influence the data to operate without interference (Stainback and Stainback, 1988:316).

One of the most important advantages of qualitative method would be its emphasis on detail. It makes use of verbal and non-verbal behaviour in order to break down barriers in order to evoke meaning and highlight the complexity as well as subtlety of the phenomena under study. The data that is collected depicts perspectives, experience and views about the study. It also has the ability to highlight the feelings and experiences of participants about a particular issue or phenomena. Actions of participants in qualitative research are contextualized with regard to time and situations. The theory generated from

qualitative studies stems from empirical and becomes available to others in similar situations (Woods, 2006).

Creswell (2005) in the table below compares the opposing assumptions of quantitative and qualitative research:

Quantitative Research	Qualitative Research
Starts from a theoretical base.	Develops theory as the research proceeds.
Gathers quantifiable data.	Relies on descriptive data reports.
Makes generalizations about the research topic.	Aims to gather more specific data.
Has a clear idea of the research procedures to produce data.	Has a general idea of the research design. It is more flexible and emerges as the research proceeds.
Requires that the reliability and validity of the measuring instruments be established prior to the research being undertaken.	In qualitative research the researcher attempts to verify the data through various means such as the use of thick description.

4.2.2 Interviews

Cohen, Manion and Morrison (2001:267) define the term "interview" as an interchange of views between two or more people on a topic of mutual interest, which sees the centrality of human interaction for knowledge production and emphasizes the social situatedness for research data.

The researcher is of the opinion that the interview mode of data collection was ideal for

this research because of the following factors: It is unrestrictive. Therefore, it allowed the researcher to make use of supplementary modes of data collection like probing when the participant does not give enough information or the researcher needs to clarify a certain point in the response. Through it, one gains large amounts of information quickly. The researcher obtains a wide variety of information from a large number of subjects. It enables and enhances immediate follow-up questions and any necessary clarification. The researcher (interviewer) and participant (interviewee) always agree on follow-up interview sessions should the need arise. An interview that is supplemented by other modes of data collection (such as direct observation) allows the researcher to check and verify the descriptions given against other facts. It accords the researcher opportunities to describe and analyse the situation, event or process.

Holloway (1997) believes that credibility corresponds to internal validity in quantitative research. He says that it exists when the participants in a study recognise the truth of the findings in their own social context. There is no distortion in the reality and the situation of the participants. This means that the researcher's findings are compatible with the perceptions of the people under study.

Finally, the research methodology is successful because of its simple stages/phases of data collection, which comprise searching, collecting data, interviewing and interpreting. It is flexible, thus enabling the researcher to adjust strategies as he hears or sees unexpected data, which he then wishes to use in future.

4.2.3 The collection of data

According to Holloway, (1997:26) conformability is the equivalent of objectivity. It means that the findings are the result of the research and not an outcome of the biases, perversion and subjectivity of the researcher. One of the ways to achieve this is to be transparent in terms of processes and activities of the research. This means that the researchers uncover the decision trail for public scrutiny. It is imperative that the

researchers be reflexive and demonstrates that the data can be traced back to their origins.

Cohen, Manion and Morrison (2001:267) believe that questionnaires and inventories are of great use in collecting data because they mark move away from seeing human subjects as simply manipulable and data as somehow external to individuals and towards regarding knowledge as generated between humans, often through conversations through questionnaires and inventories, people exchange views on a topic of mutual interest; therefore, their interaction enhances a sense of social context.

According to the researcher, social interaction is essential in any learning situation, but especially in a situation involving the blind and visually impaired learners because interaction will accord them opportunities to communicate with fellow sighted learners and access information verbally.

The researcher used the semi structured interview. The purpose of using the semi-structured questionnaire in a qualitative research was to help the researcher to have questions organized and save valuable time of the participants as well as to protect him from deviating too much from issues investigated.

4.3 Interview schedules

4.3.1 Scheduling of interviews and related activities

Permission to conduct the research was granted in May 2009 and it was towards June holiday, the schools were about to close for holidays. The research was then conducted on the week of school closure.

Prior to the interviews, the researcher's role was that of: Preparing the interview schedule or inventory; Suggesting and scheduling dates for interviews; Notifying, participants (teachers and district subject advisers) about interview dates; Confirming with principals

the availability of participants during interview sessions; Furthermore, the researcher negotiated in advance with principals of targeted schools regarding suitable and convenient places for conducting interviews.

Before the commencement of the interview, the researcher: Checked the recording equipment so as to be aware of its current condition; gave a short explanation of the purpose/aim of the project and some general guidelines for the interview process.

During the interview, the researcher: Facilitated interview sessions as a means to avoid lack of direction; Triggered responses by asking direct and follow-up questions.

Finally, the researcher transcribed recorded information into a talking computer using MS-Word processor. A report was then compiled based on the responses of the participants.

4.3.2 The content validation of the inventories

According to Holloway (1997:28-9) bias occurs when research becomes perverted for a variety of reasons. However, according to Holloway (1997:28-9) qualitative researchers do not often employ the usage of the term bias as they try to make overt their own assumptions and tendencies from the start of the research. Holloway (1997:28-9) further believes that some qualitative researchers experience 'bias' is a misnomer.

Holloway (1997) argues that distortions or perversion may occur for a variety of reasons. These researcher biases are often disguised as prejudices of researchers of which they are not always aware. This bias may manifest as the result of the fact that researchers are affected by their culture, education, group membership, gender, personal disposition or other personal and environmental factors. It is often difficult for these researchers to recognise personal preferences. It does happen that sometimes these researchers may also be unconsciously influenced by the influential or elite groups or those who present

themselves as vulnerable participants. Value judgments that the researcher makes while writing field notes may creep in and as such could also bring about distortion.

Holloway (1997:29) believes that there is a way to address this phenomenon. He points out that researchers try to counteract bias by reflexivity and self-criticism and by converting subjectivity into a resource for the study. This appears to be important, according to Holloway (1997) because the researcher is the chief instrument in qualitative research.

Mouton (2001:108) argued that data come in different formats and have different properties, interview schedules or inventories, direct observations, notes, focus groups, educators, audiotapes, videotapes, questionnaires and photos were all not only methods but also techniques of triangulation. This was a way to verify or falsify the data collected.

Holloway, (1997) argued that triangulation is a process by which the same problem or phenomenon is investigated from different perspectives. It is sometimes believed that triangulation can improve validity and overcome the biases inherent in a single perspective.

Furthermore, the research's trustworthiness lies in the fact that the researcher provided evidence that is reliable in terms of the resources in which the data were collected. The findings of this research provided a foundation to work from in the improvement of the incorporation of integration, equity and inclusivity when teaching Life Sciences to the blind and visually impaired learners in the inclusive schools.

Holloway (1997:16) describes trustworthiness as the extent to which the researcher's findings truly reflect the purpose of the study and represent reality. Trustworthiness occurs when the research is systematic and evidence-based. As such, it cannot be described as merely impressionistic.

The research embarked on the quest for the possibility of inclusive schooling regardless of disability of the learners. This assumption is imbedded in the Education White Paper,

(Department of Education. 2001) that was discussed in details in chapter one of this research. Further, the National Curriculum Statement, (Department of Education. 2008) on Life Sciences, that education has the ability to improve the quality of life of all citizens and free the potential of each person. It further sought to establish whether everyone actually has the right to further education which the State through reasonable measures, must make progressively available and accessible White Paper 6 of the Department of Education (2001:30) argued that, central to the accommodation of diversity in our schools, is a flexible assessment policy that is accessible to all learners, irrespective of the nature of their learning needs. White Paper 6 attributes the problem of possible inaccessibility to the fact that the curriculum creates the most significant barrier to learning and exclusion for many learners.

4.3.3 Interview schedule or inventory for teachers

Holloway (1997:162) points out that value neutrality is a concept that means freedom from personal values. In order to achieve objectivity when conducting a qualitative research, it is important that a researcher remains value neutral and not let personal values, convictions and individual perspective on the matter under investigation influence their research.

researchers have the responsibility to make their value perspective less important and never depicted in the research. These personal values must not even creep in the writing up of the findings and interpretation of the research. Value neutrality must be clear to the readers of the study. It is imperative that the researcher avoids distortion by personal bias (Holloway, 1997:162).

The intention of the researcher was to uncover the experiences of the teachers and their challenges when they teach Life Sciences to the blind and visually impaired learners in the inclusive schools. The personal experiences and views of the researcher were not

important. The researcher wanted to hear and listen to the teachers and then write up the report which is the true reflection of the teachers' views and experiences.

The researcher is also aware of the caution raised by Holloway, (1997) that participants sometimes might try to impress the researcher by blowing out of proportion their information.

Each set of question is preceded by the objective of the research as stated in chapter one. Questions are then grouped together to achieve this objective.

1. To determine how the inclusive policy inform the teachers on inclusivity, equity and integration and to determine what the envisaged influences of these principles as foundations for inclusive schooling are on the quality of teaching and learning of the Life Sciences.

1.1 What is your understanding of Education White Paper no 6 which is a policy on inclusive education?

1.2 To what extent does Education White Paper no 6 inform you're planning?

1.3 What is your opinion on integrated classroom and? Give reasons for your view.

1.4 To what extent does integrated classroom influence your teaching?

1.5 What do you do to make your blind learners feel that they belong to your class?

1.6 What do you do to include blind learners in class activities?

1.7 How do you ensure that your blind learners are equal to other learners?

What is your opinion on blind learners attending inclusive schools? Give reasons for your view.

How do you promote acceptance of blind learners in your class?

2. To determine which variables restrict integration, equity and inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.
 - 2.1 To what extent do you allow blind learners participate in learning Life Sciences?
 - 2.2 What problems do you think blind learners experience in the learning of Life Sciences?
 - 2.3 To what extent do blind learners achieve Life Sciences outcomes?
 - 2.4 What is your opinion on blind learners taking Life Sciences? Give reasons for your view.
 - 2.5 What do you think it will take for the teacher to be effective in teaching Life Sciences to blind learners?
 - 2.6 What is your opinion on teaching Life Sciences to blind learners?
3. To determine what adaptations teachers are making to support visually impaired learners at the full service school so as to facilitate integration, equity and inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.
 - 3.1 What challenges do you experience when preparing material for teaching that will accommodate blind learners?
 - 3.2 What difficulties do you experience when you teach Life Sciences to blind learners?

- 3.3 What resources do you have that will make your blind learners equal to other sighted learners?
- 3.4 What resources do you think you still need?
- 3.5 What resources do blind learners have in learning Life Sciences?
- 3.6 What resources do you think blind learners still need?
- 4. To determine how the district officials help, support and monitor teachers in inclusive schools to be prepared to adapt their teaching and to apply the principles of integration, equity and inclusivity and thus achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.
 - 4.1 To what extent does the district help you in preparing for an inclusive class?
 - 4.2 What additional help you think you need from the district?
 - 4.3 What is your opinion on the support you get from the district?

4.3.4 Interview schedule or inventory for District Advisers

- 1. To determine how the inclusive policy inform the teachers on inclusivity, equity and integration and to determine what the envisaged influences of these principles as foundations for inclusive schooling are on the quality of teaching and learning of the Life Sciences.
 - 1.1 What is your understanding of Education White Paper no 6 which is a policy on inclusive education?

- 1.2 To what extent does Education White Paper no 6 inform your work?
- 1.3 What is your opinion on integrated classroom?
- 1.3 To what extent does integrated classroom influence your support to the teachers?
- 1.4 What do you do to enable the teachers make blind learners feel that they belong to same class as other learners?
- 1.5 What do you do to help teachers include blind learners in class activities?
- 1.6 How do you help teachers ensure that blind learners are equal to other learners?
- 1.7 What is your opinion on blind learners attending inclusive schools?
- 1.9 What support do you give to teachers that will ensure acceptance of blind learners in the class?
2. To determine which variables restrict integration, equity and inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.
 - 2.1 To what extent do you let teachers allow blind learners participate in learning Life Sciences?
 - 2.2 What problems do you think blind learners experience in the learning of Life Sciences?
 - 2.3 To what extent do blind learners achieve Life Sciences outcomes?
 - 2.4 What is your opinion on blind learners taking Life Sciences?

- 2.5 What do you think it will take for the teacher to be effective in teaching Life Sciences to blind learners?
- 2.6 What is your opinion on teaching Life Sciences to blind learners?
3. To determine what adaptations teachers are making to support visually impaired learners at the full service school so as to facilitate integration, equity and inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.
- 3.1 What challenges do you experience when preparing support material for teachers in teaching that will accommodate blind learners?
- 3.2 What difficulties do teachers experience when teaching Life Sciences to blind learners?
- 3.3 What resources do you have that will make your teachers make the blind learners equal to other learners?
- 3.4 What resources do you think teachers still need?
- 3.5 What resources do blind learners have in learning Life Sciences?
- 3.6 What resources do you think blind learners still need?
4. To determine how the district officials help, support and monitor teachers in inclusive schools to be prepared to adapt their teaching and to apply the principles of integration, equity and inclusivity and thus achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.
- 4.1 To what extent does the district help teachers in preparing for an inclusive class?

4.2 What additional help you think teachers need from the district?

4.3 What is your opinion on the support the district gives to teachers?

4.4 The composition of the research sample and selection of participants

This research was conducted in Mpumalanga province. Two inclusive schools: Kamagugu and Silindokuhle as well as the two districts responsible for these schools were the area of focus.

Six district officials were interviewed in order to explore how they understand inclusive education policy, with specific reference to Education White Paper no 6 and to what extent does this policy inform their practice to support, monitor and promote the incorporation of integration, inclusivity and equity when the teachers teach Life Sciences to learners with visual impairment.

Twenty teachers in Kamagugu and Silindokuhle were to be interviewed but because it was time towards schools' closure and teachers were expected to submit results schedules to the district, so the teachers work with district officials in the schools, six teachers were withdrawn. The interviews were conducted in order to explore how they understand inclusive education policy, with special reference to Education White Paper no 6 and to what extent does this policy inform their daily work. Also it was to determine how teachers incorporate integration, inclusivity and equity as foundation for inclusive schooling in their classes and what influences these have on their daily work.

Holloway (1997:28-9) thinks that in qualitative research Sampling bias may occur in the selection of the sample because researchers have adopted a particular stance or choose people who support their assumptions or preconceptions. Random sampling was used in this research and thus wards off bias. Bias can also take place in the selection and interpretation of data; only those data might be chosen which fit into the overall

framework of the researcher. It may happen that the researchers might not report the cases that do not support their ideas; this is sometimes done unintentionally and unconsciously, but if done deliberately it would be both unethical and 'bad research.

The first step taken in choosing the subjects is through sampling. The first step in sampling is to identify the population to be represented in the study. Since we are interested in exploring how the district officials support, monitor and promote integration, equity and inclusivity as foundation for inclusive schooling in their districts as well as how teachers incorporate integration, equity and inclusivity when teaching Life Sciences to the blind and visually impaired learners in their classes, all district officials in the involved district as well as all the teachers for the visually impaired learners in the inclusive Schools constituted the target population, i.e. all males and females, all races. However, since it is not possible to deal with the entire target population, the accessible population was identified. It is from this group that the sample for the study was taken. This comprised twenty teachers from 2 inclusive schools and six officials from two districts in Mpumalanga. The sample was then drawn from this accessible group. Sampling is done in such a way that the possible inclusion of each population element in the sampling occurs by chance, i.e. through randomization.

The first step in drawing a random sample from this population, is assigning each member of the population a distinct identification number, 001-100 since 100 subjects seem appropriate for our study. The district offices were requested to provide names of all available officials in the district and principal's offices were requested to supply lists of all teachers for visually impaired learners registered in their schools. A table of random numbers to obtain numbers of three digits each is entered. The corresponding element in the population falls in the sample.

The random sampling process compensates for Generalisability to a certain degree and thus ensuring that the findings are representative of the population from which the sample was drawn (Holloway, 1997:79).

In order to supplement the criteria discussed above regarding sampling, the researcher used the criteria when choosing participants: Whether educators merely offered life science subjects or specialised in life science subjects.

4.5 Data collection processes and the application of the interviews

Stage one

(1) District Officials

Having completed the selection procedures, the researcher assembled the district officials who have been selected to participate in the interview. Consent from the candidates, who in this case were the district officials, was obtained.

Upon arrival at the meeting place, the researcher explains to each candidate that his or her opinions were of utmost importance and each candidate was assured of confidentiality and anonymity.

It was explained to them that confidentiality means that the researcher, will keep the identity secret. Anonymity means that the participant can choose not to identify him or herself.

Interviews were carried out on the district premises at the appointed time and place. The researcher indicated to the candidates that it would take approximately forty-five minutes to complete the research proceedings. The candidates were informed that their involvement in the research project was free of charge and voluntary. The candidates were informed that they could withdraw anytime should they so wish and that there were no risks associated with participating in the research. However their co-operation, willingness, and eagerness on their part to participate were appreciated.

The district officials were informed about the purpose of the gathering: the research. The topic of the research was not disclosed in order to ward off sensitization to the topic.

A tape-recorder was turned on as the researcher interviewed each district official. The semi-structured interview question was in Braille for the researcher. Questions were asked as listed in appendix A.

This procedure was repeated until all selected district were interviewed. Data collected was summarized and coded in the computer for analysis.

(2) Teachers

Upon arrival at the meeting place, teachers were greeted. This he did in order to establish rapport. The researcher explained to each candidate that his or her opinions were of utmost importance and each candidate was assured of confidentiality and anonymity.

It was explained to them that confidentiality means that the researcher, will keep the identity secret. Anonymity means that the participant can choose not to identify him or herself.

The teachers were informed about the purpose of the gathering: the research. The topic of the research was not disclosed in order to ward off sensitization to the topic.

The candidates were informed that their involvement in the research project was free of charge and voluntary. The candidates were informed that they could withdraw anytime should they so wish and that there were no risks associated with participating in the research. However their co-operation, willingness, and eagerness on their part to participate were appreciated.

A tape-recorder was turned on as the researcher interviewed each teacher. The structured interview question was in Braille for the researcher. Questions were asked as listed in appendix A.

This procedure was repeated until all selected teachers were interviewed. Data collected was summarized and coded in the computer for analysis.

4.6 Method for analysing data

Ary, Jacobs and Razavieh (2002:465) indicated that the final activities in qualitative inquiries are analysing and interpreting the data collected and presenting the results. Data analysis is the heart of qualitative research and the process that most distinguishes qualitative from quantitative research.

After collecting data, researchers use several methods to analyze and interpret the information. The data collected must be assembled in some way other than by haphazardly recording bits and pieces to be fitted together at some time later. The researcher should have a plan for organizing the facts for interpretation. The planning should be directed by the type of information needed for the study and how the data will be analyzed. Coordination between data-gathering procedures and data treatment will then be directed by the procedures planned.

McMillan and Schumacher (2001:467) defined coding as the process of dividing into parts by a classification system. From the observations and findings, This is the most crucial and critical process for researchers. They systematically search, re-search, arrange and rearrange the data in order to understand the data clearly, so that they can present what they have learned to others. The process is intended to guarantee that field notes, interviews, transcripts, audiotapes, observer comments and other data are put into a readable form ready for analysis.

To achieve the expected outcomes, notes, photos, audio and videotapes were analysed or interpreted, recommendations were made. Data analysis involves coding, which authors such as Bogdan and Biklen (1992:166); McMillan and Schumacher (2001:467); and Ary et al., (2002:466) refer to as coding, classifications, topics or categories.

According to McMillan and Schumacher (2001:467), researchers develop a classification system through the use of one of the following three strategies: Segmenting the data into units of content called topics (less than 25-30) and grouping the topics in larger clusters to form categories; or Starting with predetermined categories of no more than 4-6 and breaking each category into smaller subcategories; or Combining the strategies, using some predetermined categories and adding discovered new categories. Ary et al., (2002:466) maintained that coding enables the researcher to physically separate material bearing on a given topic from other material and is a crucial step in organizing the data. According to Bogdan and Biklen (1992:166), in order for the researcher to develop each coding category, he/she has to search through his/her data for the regularities, patterns and topics his/her data covers, and then write down words and phrases to represent the topics and patterns perceived. These words and patterns are coding categories. They are a means of sorting the descriptive data collected so that the material bearing on a given topic can be physically separated from other data. The reason why the researcher, who is blind, decided to do the coding of the described information in the text and did not list it as a separate unit in the appendix is that it would have been very difficult for him to have worked across different documents (sections) and built his syntheses into a separate chapter. In this study, the researcher has used the constant comparative method because it combines inductive category coding with simultaneous comparison of all units of meaning obtained. The researcher's role was to examine each new unit of meaning (topics or concepts) and to determine its distinctive features.

4.7 Conclusion

In this chapter the researcher discussed the design of this research study. The two basic research approaches, the qualitative and the quantitative approach were discussed. It was pointed out that in this research, however, only the qualitative method would be used. The use of a variety of methods of collecting data in a study was discussed. The measuring instruments that will be employed to validate the results of this research study

were stated. The procedure by which the collected data will be interpreted and analyzed was explored.

In the following chapter the researcher will present the outcome of the study and observation. The results of the interviews and group interviews conducted will be interpreted and analyzed.

CHAPTER 5: Description and analysis of the data drawn from the empirical investigation

5.1 Introduction

This chapter deals with the data that came from the field work. Interviews were used to gather this data. A logical analysis method will be applied to extract the information for clarity and categorisation. Written permission was sought and granted by the Mpumalanga Department of Education (Inclusive Education) to the researcher to conduct interviews.

Fourteen (14) teachers were interviewed because they have both learners who are blind and those with low vision. Four (4) district officials who are responsible for these schools were also interviewed. Of the 14 teachers interviewed, eleven were females while three were males. Four (4) district officials from two districts were interviewed. Two were females and two were males.

This section comprises responses given by participants (teachers and district officials), and relates the findings arrived at as a result of the interviews. The researcher reported on the quality of the evidence gathered. The implications of these findings will be further explored in Chapter 6 and relevant recommendations will be made in Chapter 7 which will deal with human resource development and the establishment of support structures that would address the needs and challenges of teachers in the inclusive schools as shown by empirical evidence.

5.2 Classification and analysis of data

5.2.1 Secondary question one: Policy information

In this section the researcher endeavours to explore how the inclusive policy informs the teachers on inclusivity, equity and integration and to determine what

the envisaged influences are of these concepts when incorporating them in teaching as foundations for inclusive schooling on the quality of teaching and learning of the Life Sciences.

5.2.1.1 Responses to understanding of Education White Paper no 6 - Policy on inclusive education

Table 5.1: Understanding of Education White Paper no 6 as policy on inclusive education

Category	Code	Frequency
1. The work load does not allow teachers to study education policies.	WP1	E1; E2; E4;
2. It involves all learners irrespective of barriers in education.	WP2	E5; E6; E7; E8;
3. Not acquainted with Education White Paper 6.	WP3	E9; E10; E11; E12; E13; E14; E3

On understanding Education White Paper 6, teacher (E1) says there is no time to study policies because of work load teachers' experience. There is a lot of administrative paper work that involves lesson preparation and learners' work (WP1). The majority of teachers (E2; E4; E5; E6; E7; E8; E9; E10; E11; E12; E13; E14) say Education White Paper talks about involving all learners irrespective of barriers in education in the mainstream schools (WP2). Teacher (E3) says is not acquainted with policy (WP3).

This depicts some kind of exposure to Education White Paper 6. There is a common understanding of the main thrust of Education White Paper 6 that it is concerned with ensuring that all learners are given equal educational opportunities regardless of educational difficulties or challenges learners have and that learners cannot be

discriminated against on the basis of disability or because of their education special needs.

5.2.1.2 Responses to the extent to which Education White Paper no 6 informs teachers' planning

Table 5.2: The extent to which Education White Paper no 6 informs teachers' planning

Category	Code	Frequency
1. Do not use Education White Paper 6.	WPP1	E1; E3
2. Use Education White Paper 6 EWP with other policies.	WPP2	E2; E4; E5; E6; E7; E8; E9; E10; E11; E12; E13; E14

As regards policy informing planning, some teachers (E1; E3) do not use Education White Paper 6 for their daily work. In other words, Education White Paper has no bearing on their teaching and learning or in their working with learners (WPP1). The majority of teachers (E2; E4; E5; E6; E7; E8; E9; E10; E11; E12; E13; E14) use Education White Paper 6 with other policies in their work (WPP2).

The teachers who have been exposed to Education White Paper apply the knowledge and provisions as stipulated within the policy and this is implemented in conjunction with other policies. This means learners with educational special needs are catered for and such teachers have broader understanding of policies and the implication thereof or the bearing such policies have on their daily work and planning.

5.2.1.3 Responses to opinion on integrated classrooms

Table 5.3: Teachers' opinion on integrated classrooms

Category	Code	Frequency

1. Knowledge required on disability adds to the work load and thus the teacher cannot be perfect in her work.	ICR1	E1; E14
2. It is possible to include all learners except for blind and their culture which is difficult. Let us put blind together to give them skills and give them the foundation skills. The teacher must be trained. Not all teachers can use braille and they must be trained.	ICR2	E2; E3; E5; E11; E12
3. Teacher has to plan the different levels of teaching, the classroom must be adequate, proper furniture, enough stimulus material for learners available according to the disability and proper working equipment in the class, proper access to classes and not overcrowd a class.	ICR3	E4; E7
4. It is good provided that there is support for teachers and learners.	ICR4	E6
5. Integration in class is not good because the other learners make noise for the blind thus disturbing them.	ICR5	E8; E13
6. In accepting this integration, teachers need to have a clear understanding of the role of integration for writing their learning programmes. The teachers, therefore, must be aware of a Need for understanding role of integration.	ICR6	E9; E10

On integrated classroom, Teachers (E1; E14) view Education White Paper implementation as something extra that is additional work load to what they have as prescribed work in the classroom (ICR1). Some teachers (E2; E3; E5; E11; E12) think it

is possible to include all learners except for blind learners who are considered to have their culture which is difficult. In this regard, it is advised that blind learners must be put together to give them skills and give them the foundation skills. The teacher must be trained because Not all teachers can use braille and they must be trained to teach them (ICR2). Some teachers (E4; E7) say it needs well planning. The teacher has to plan for the different levels of teaching the classroom must be adequate, proper furniture, enough stimulus material for learners available according to the disability and proper working equipment in the class (ICR3). Teacher (E6) is of the opinion that it is good provided there is support in terms of accessible material for learners and the teacher is equipped to deal with these learners (ICR4). Some teachers (E8; E13) view integration of blind learners as something not good because, among other things, brailers are noisy and as such disturb other learners (ICR5). Other teachers (E9; E10) say teachers' needs understanding of the purpose and role of integration and the broad Education White Paper 6 framework for implementation in schools (ICR6).

Teachers who are of the opinion that allowing blind learners in the inclusive schools is possible on condition that there is support and accessible material. The issue of training for dealing with diversity of specific educational need is crucial. Conversely, blind learners should not be in the mainstream schools unless there is support, accessible material and trained teachers.

5.2.1.4 The extent to which integrated classroom influences teachers' teaching

Table 5.4: Responses to the extent to which integrated classroom influences teachers' teaching

Category	Code	Frequency
1. It has a negative effect on teaching and learning.	IIT1	E1; E4; E6; E8; E14
2. The teacher has to plan the different levels of teaching.	IIT2	E2; E12

3. Teachers must have positive attitude and come up with teaching strategies and individualise their teaching and separate the blind learners from other learners.	IIT3	E3; E5; E10
4. It works well with progress noted.	IIT4	E7
5. Integration must support conceptual development rather than being introduced for its own sake: Need to be seen within the framework of Education White Paper 6.	IIT5	E9
6. It provides a positive attitude for different types of challenges.	IIT6	E11
7. It influences the teaching in such a way that the duration counts, because some need more time and different assessment tasks. A blind teacher needs a personal assistant for marking the work of the sighted learners.	IIT7	E13

Regarding the influence of integration on teaching, some teachers (E1; E4; E6; E8; E14) consider this to have negative effect which is disruptive teaching and learning in class (IIT1). Some teachers (E2; E12) say the teacher must be able to adapt and differentiate in teaching in order to be able to accommodate all learners with different learning needs (IIT2). There are teachers (E3; E5; E10) view positive attitude as important. Due to the positive attitude of the teacher, then the teacher can come up with teaching strategies and individualise their teaching and adapt and differentiate to accommodate the blind learners and other learners (IIT3). Teacher (E7) says it works well because there is notable success in blind learners (IIT4). Teacher (E9) says this is the implementation of Education White Paper 6 on inclusive education and it needs to be seen within the framework of Education White Paper 6 (IIT5). Teacher (E11) says it brings about a positive attitude on the part of the teacher when seeing diversity and challenges that learners have in the class (IIT6). Teacher (E13) says it influences the teaching in such a way that it is time consuming because some need more time and different assessment tasks (IIT7).

The influence of integrated classroom is perceived in different ways by teachers. This poses a challenge for teachers because only those have the ability to adapt and differentiate their teaching cope with the diverse learner needs. This calls for teacher support and training in the implementation of Education White Paper 6 as the policy on inclusive education.

5.2.1.5 Making blind learners feel that they belong to same class

Table 5.5: Responses to making blind learners feel that they belong to the same classroom

Category	Code	Frequency
1. Prepare braille notes in advance so that learners can ask question during lesson presentation.	BLBC1	E1; E6; E11
2. We have a few of partially sighted and we put them in front of the class so that they can read. Their textbooks are readable to them. They do not feel marginalized because we use co-operative learning, setting up systems and when they are seen participating, then they are accepted.	BLBC2	E2
3. Give same treatment and differentiate when teaching.	BLBC3	E3; E14
4. It is not a problem with a partially sighted because he can see somehow, but for a blind learner it is difficult. A teacher must be trained first and the school must be ready to integrate them.	BLBC4	E4; E12
5. In every activity I include them. They participate in all activities. Firstly, give	BLBC5	E5; E8; E9; E10

them love and affection so that they can boost their self-esteem in the class. Leave the other group and attend to them make large print for the partially sighted learner so that they can learn. Now you give them also a chance to learn. Now they all learn in class and they are equal with the help I am giving them. This will make them part of the class.		
6. I talk to the blind learner and give him the support as a blind teacher and give him braille material. I talk to the sighted children and tell them how to treat the blind learner.	BLBC6	E6; E13
7. It is very difficult for blind learners to be in class with one teacher and no assistant.	BLBC7	E7

On making blind learners feel that they belong to the same class, some teachers (E1; E6; E11) suggest providing braille material in advance to blind learners so that they can be able to participate in class using their Braille material (BLBC1). Teacher (E2) thinks letting the partially sighted learner sit in front allows the learner to participate fully in class (BLBC2). Teachers (E3; E14) are of the opinion that applying same treatment with differentiation brings about full participation of blind learners in class and thus making them to be equal to other learners (BLBC3). Some teachers (E4; E12) suggest training teachers first so that they are able to ensure, through their training and skills acquired through training that blind learners are equal to other learners in class (BLBC4). Some teachers (E5; E8; E9; E10) suggest participation in all activities (BLBC5). Some teachers (E6; E13) say it is best to talk and support blind learners and provide for them Braille material (BLBC6). Teacher (E7) says it is difficult for the teacher who has blind learners in the class and be without class assistants to help the teacher (BLBC7).

There are those teachers who think letting a partially sighted learner sit in front is the way to make them participate. This is treating all partially sighted as having same problem of vision without knowing that there is the case of myopia and hyperopia. As far as low vision is concerned this is dealt with in greater detail in chapter one. This is a great challenge for teachers and they need to be supported and equipped.

5.2.1.6 Ways to include blind learners in class activities

Table 5.6: Responses to ways to include blind learners in class activities

Category	Code	Frequency
1. I give braille material and ask him questions. I bring objects that he can touch.	ICA1	E1; E6; E7; E14
2. The teacher creates the atmosphere for inclusion. We use contrast and differentiate and adapt work sheets for them to see.	ICA2	E2; E3; E4; E5; E7
3. The blind learners should have real objects and braille and feel or touch the objects.	ICA3	E6; E9; E10; E11
4. Blind learners participate in all class activities	ICA4	E8; E12; E13

On inclusion in class activities, some teachers (E1; E6; E7; E14) suggest providing Braille material and bringing in class some tactile objects for the lesson for blind learners as a way of having them included in class activities like all other learners (ICA1). Some teachers (E2; E3; E4; E5; E7) think the way to include blind learners is by way of differentiation in teaching and adaptation of material (ICA2). Other teachers (E6; E9; E10; E11) believe that providing Braille and tactile material for blind learners brings about equal participation in class (ICA3). Some teachers (E8; E12; E13) suggest that blind learners should participate in all class activities (ICA4).

Teachers apply different strategies when teaching in order to incorporate inclusivity that takes care of blind learners. The primary mode is tactile material and Braille material.

Once these are taken care of, then the rest seem to fall in place. Blind learners are allowed to participate in all activities in the class.

5.2.1.7 Ways to ensure that blind learners are equal to other learners

Table 5.7: Responses to ways that ensure that blind learners are equal to other learners

Category	Code	Frequency
1. Allow them to participate in all class activities, ensure availability of Braille material and let them achieve the same goals of the curriculum like other learners.	BEO1	E1; E2; E8; E9; E10; E13; E14
2. The intellect is the same the difference is in the planning for differentiation.	BEO2	E3
3. It is not difficult for a partially sighted learner because he can see somehow, I make sure that he has large fonts and all we teach in plants is made in a picture with large fonts. For the blind it is difficult.	BOE3	E4; E5; E6
4. By creating a warm environment in the class, where all learners acknowledge each other irrespective of their disabilities or challenges: Mutual acceptance.	BEO4	E7; E11; E12

On making blind learners equal to other learners, some teachers (E1; E2; E8; E9; E10; E13; E14) believe that the teacher must set same learning outcomes and all learners including the visually impaired learners, must have equal participation and same goals in terms of the curriculum (BEO1). One teacher (E3) holds the view that blind learners' intellect is the same the difference is in the teachers' planning for differentiation (BEO2). Some teachers (E4; E5; E6) say there are no challenges because partially sighted learners

can participate fully in the manner that is equal to other learners because they can see (BEO3). Other teachers (E7; E11; E12) encourage learners to acknowledge each other irrespective of their disabilities or challenges. In this way, the teacher promotes mutual acceptance among learners.

The National Curriculum Statement calls on all teachers to offer learning outcomes as prescribed. The differentiation and adaptation is in the teaching act. The curriculum that is single and unified for all South African schools. The inclusive schools are no exception to the rule.

5.2.1.8 Teachers' opinion on blind learners attending inclusive schools

Table 5.8: Responses to teachers' opinion on blind learners attending inclusive schools

Category	Code	Frequency
1. They should attend on condition that all learning support material is made available and necessary adjustment made in terms of furniture and reading on the board.	BIS1	E1; E2; E4; E5; E7; E13; E14
2. It is not easy from my experience. It wants a lot of support. Teachers' attitude is always a problem because some teachers do not want to work hard.	BIS2	E3; E6; E8; E11
3. It is good for them to socialize with other learners who have different disabilities. Teachers will put more effort on improving capacity of the education and training system to accommodate learners who experience the various forms of learning difficulties. Also	BIS3	E9; E10; E12;

they can feel accepted in the school and in society.		

On blind learners attending inclusive schools, some teachers (E1; E2; E4; E5; E7; E13; E14) say they should attend on condition that all learning support material is made available and necessary adjustment made in terms of furniture and accessible reading that accommodates blind learners (BIS1). Some teachers (E3; E6; E8; E11) are of the view that learning in the inclusive school is visually oriented and thus it is problematic because blind learners cannot see classroom activities that otherwise would make them part of the class (BIS2). Some teachers (E9; E10; E12) say it is good because it promotes social skills that will help blind learners live in their community and cope with life even in the tertiary institutions (BIS3).

Learning and participating in class activities in the inclusive school places a heavy demand on the teachers in terms of ensuring the availability of tactile and accessible teaching and learning material for blind learners. Those teachers who are aware of the heavy demand cannot allow blind learners to be in the inclusive school. They feel that blind learners are put at an enormous disadvantage. Unless there is support for blind learners at the inclusive school, it is not advisable for blind learners to be at the inclusive school.

5.2.1.9 Teachers' ways to promote acceptance of blind learners in the same class

Table 5.9: Responses to teachers' ways to promote acceptance of blind learners in the same class

Category	Code	Frequency
1. Create public awareness and information among learners.	ABL1	E1; E3; E6; E11
2. Give equal treatment to all learners.	ABL2	E2; E14

3. Make environmental adjustment and adaptation	ABL3	E4
4. Promote mutual acceptance and recognition of diversity	ABL4	E5; E13
5. Do not have the challenge as yet. I have partially sighted only.	ABL5	E7; E12
6. It is difficult because other learners are sighted (they can see) and the blind cannot see and thus cannot participate in all activities.	ABL6	E8
7. By allowing them to be in the inclusive school and being accepted by giving them teachers who know their culture and the braille system.	ABL7	E9; E10

Regarding acceptance of blind learners, some teachers (E1; E3; E6; E11) say they use public awareness and information among learners to promote acceptance of blind learners by the fellow learners (ABL1). Teachers (E2; E14) use equal treatment of learners to promote mutual acceptance among learners (ABL2). Another teacher (E4) uses environmental adjustment and adaptation to facilitate orientation and mobility of blind learners and full participation in order to bring about independence of blind learners and mutual acceptance by other learners (ABL3). Some teachers (E5; E13) promote acceptance and recognition of diversity (ABL4). Some teachers (E7; E12) say there is no challenge because they have partially sighted learners who are independent and can participate fully in all school activities (ABL5). Teacher (E8) points out that it is difficult because other learners are sighted (they can see) and the blind cannot see and thus cannot participate in all activities (ABL6). Other teachers (E9; E10) argue that facilitating and inculcating mutual acceptance that involves blind learners is a skill and competency that requires knowledgeable teachers and promoting of acceptance (ABL7).

Acceptance of blind learners at the inclusive school is not automatic. Teachers have different opinions as to how to achieve this crucial aspect because blind learners cannot attend the same class with learners who do not accept them. Blind learners will be intimidated and thus can never learn and will be inhibited from participating in any class activities that will result in their learning. A great detail of advocacy in the form of public knowledge, awareness and information is required.

5.2.2 Secondary question two: Variables restrict integration, equity and inclusivity

This section seeks to explore which variables restrict integration, equity and inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.

5.2.2.1 The extent to which the teacher allows blind learners to participate in learning Life Sciences

Table 5.10: Responses to the extent which teachers allow blind learners to participate in learning Life Sciences

Category	Code	Frequency
1. All material and notes must be made available in Braille in order to be on top not below average, provide extra readings in braille.	EPL1	E1
2. They should be involved and included in teaching especially the basics teaching them basic skills of good life and health. They can do their work as long as they can see and everything is clear. They must do the same subject but differentiate. When it comes to	EPL2	E2

plants and flowers the teacher must explain to the child and make sure that the learner understands. Give individual attention and adapt work sheets, create participation in class and not exclude him totally.		
3. I must allow participation and create things for them.	EPL3	E3
4. I allow them to participate and touch for experience. I make sure there is no danger or I come up with the alternative object or a picture for the partially sighted.	EPL4	E4; E5; E6; E14
5. Partially sighted learners participate fully and pose no challenge.	EPL5	E7; E12
6. It is a problem of preparing for learners whom you know they cannot see and the resources are difficult to have for them for example chemicals that they cannot see.	EPL6	E8
7. We have partially sighted so they can see when you enlarge the print and make them sit in front and make big diagrams. For the smallest parts, I make pictures big for them to see. So they participate with accommodation. (partially sighted)	EPL7	E9
8. Blind learners participate like other learners.	EPL8	E10; 11; E13

On the extent to which blind learners participate in Life Sciences activities, teacher (E1) limits blind learners' participation to the availability of braille notes and extra reading that is provided (EPL1). Another teacher (E2) says differentiation and description is used. Blind learners should be involved and included in teaching especially the basics, teaching them basic skills of good life and health. They can do their work as long as they can see and everything is clear to them. The teacher must have empathy with the child and must do the same subject but differentiate. When it comes to plants and flowers the

teacher must explain to the child and make sure that the learner understands. The teacher must be aware of the previous experience of the child because in the inclusive environment that is important. You cannot work with children if you do not know their background. Give individual attention and adapt work sheets, create participation in class and not exclude him totally (EPL2). The other teacher (E3) thinks creating tactile objects and being innovative is the extent that will allow blind learners participate (EPL3). Some teachers (E4; E5; E6; E14) say the children experience through touch and this will determine the extent of their participation (EPL4). Some teachers (E7; E12) say there are no challenges because they have partially sighted learners (EPL5). One teacher (E8) argued that it is problematic because there are no resources for blind learners that will allow them to participate and achieve extensively like seeing learners (EPL6). Teacher (E9) finds it best to let the partially sighted learner sit in front and be given material with big fonts is adequate to facilitate optimal participation in all class activities (EPL7). Some teachers (E10; E11; E13) say blind learners participate like other learners at the inclusive school in all class activities (EPL8).

Participation of blind learners is limited to both the availability of tactile material as well as the nature of tactile material because sometimes hands cannot give adequate information that is equal to information provided by vision. This then can sometimes put blind learners to the enormous disadvantage or to be misconstrued or adversely perceived.

5.2.2.2 Problems what teachers think blind learners experience in the learning of Life Sciences

Table 5.11: Responses to problems what teachers think blind learners experience in the learning of Life Sciences

Category	Code	Frequency
1. The problem is the lack of tactile material	PEL1	E1; E2; E3; E4; E5; E6; E8; E9; E10; E11; E13; E14

2. Partially sighted learners participate fully and pose no challenge	PEL2	E7; E12

On problems experienced in Life Sciences, the majority of teachers (E1; E2; E3; E4; E5; E6; E8; E9; E10; E11; E13; E14) point to lack of tactile material (PEL1). Some teachers (E7; E12) say there are no problems because they do not have blind learners, only the partially sighted (PEL2).

Teachers hold the view that provision of tactile material is the solution to inaccessibility. Accessibility is far beyond the tactile factor only in Life Sciences. This holds true to shapes, sizes forms and textures, but it does not hold true to colour changes. There are assistive devices that can deal with these factors.

5.2.2.3 The extent to which blind learners achieve Life Sciences outcomes

Table 5.12: Responses to the extent to which blind learners achieve Life Sciences outcomes

Category	Code	Frequency
1. To the extent that the teacher is able to provide and apply strategies appropriate to the learner needs, then blind learners can achieve like other learners. It fundamental for learners to internalise and visualise. Being able to convey knowledge by the teacher.	ALS1	E1; E2; E3; E6; E8; E9
2. They achieve like other children and they are on the same level. Like others	ALS2	E4; E5; E14
3. Partially sighted participate fully and thus pose no challenges.	ALS3	E7

4. They achieve well and sometimes they struggle a bit with things they cannot see.	ALS4	E10
5. I think it is difficult for them because it wants sight and they are blind. Even those with little sight struggle.	ALS5	E11; E13
6. They do not do well because of the lack of resources) They achieve only the basic skills	ALS6	E12

On whether blind learners are able to achieve the outcomes specified, some teachers (E1; E2; E3; E6; E8; E9) say it depends on teachers' strategies. This means blind learners can achieve to the extent that the teacher is able to provide and apply strategies appropriate to the learner needs, then blind learners can achieve like other learners. It fundamental for learners to internalise and visualise being able to convey knowledge by the teacher (ALS1).Some teachers (E4; E5; E14) say they achieve like other learners (ALS2). One teacher (E7) say there is no challenges because they are partially sighted (ALS3). One teacher (E10) believes that they achieve well and sometimes they struggle a bit with things they cannot see. This teacher thinks it is difficult for them because class activities in the inclusive school demand vision and the fact that they are blind is putting them at the disadvantage. Even those with little sight are said to struggle (ALS4).Some teachers (E11; E13) say they do not do well because of lack of resources (ALS5).Another teacher (E12) says blind learners achieve basic skills in Life Sciences (ALS6).

Life Sciences demands vision in order to participate in class activities. The lack of availability of tactile resources and the nature of tactile material available compounds the inhibition. Blind learners struggle and teachers are experiencing difficulty in terms of both finding adequate resources or tactile resources for their blind learners.

5.2.2.4 Teachers' opinion on blind learners taking Life Sciences

Table 5.13: Responses to teachers' opinion on blind learners taking Life Sciences in inclusive schools

Category	Code	Frequency
1. They must take it in order for them to understand systems and concepts used in Life Sciences.	OLS1	E1; E3; E8; E11; E12
2. They can take it dependent on teachers' creativity	OLS2	E2; E9
3. They can take it dependent on teachers' training and attitude.	OLS3	E4
4. They can take it because they are intelligent	OLS4	E5; E14
5. They can take it though not helpful to them unless they intend becoming teachers for the same subject.	OLS5	E6; E13
6. I think Life Science is difficult for them because it needs sight and they are blind. Even those with little sight they have a problem.	OLS6	E7; E10

Regarding teachers' opinion on blind learners taking Life Sciences, some teachers (E1; E3; E8; E11; E12) say blind learners must take it to understand life system and concepts used in Life Sciences (OLS1). Some teachers (E2; E9) taking of Life Sciences by blind learners depends on teachers' creativity to accommodate blind learners (OLS2). One teacher (E4) says taking of this subject depends on teachers' training and attitude (OLS3). Other teachers (E5; E14) say Blind learners must do Life Sciences because they are intelligent (OLS4). Some teachers (E6; E13) say it does not help blind learners in anyway other than for becoming a teacher of the same subject (OLS5). Other teachers (E7; E10) argue that this is the difficult subject for blind learners because it demands vision and blind learners are put at the enormous disadvantage because of sight deprivation (OLS6).

Life Sciences does not seem to hold much benefit for blind learners in view of the heavy demand it places on both the learner with visual impairment and the teacher who must acquire training and skills then find tactile and accessible material for them. On the other hand, blind learners are put at the enormous disadvantage because then they are deprived of the knowledge that Life Sciences offer to other learners. This is not making them equal to other learners as demanded by Education White Paper 6.

5.2.2.5 What teachers think it will take for the teacher to be effective in teaching Life Sciences to blind learners

Table 5.14: Responses to what teachers think it will take for the teacher to be effective in teaching Life Sciences to blind learners

Category	Code	Frequency
1. Creativity and innovation: Learn from experienced teachers about how teach life sciences to the blind, being creative and innovative improvisation, what else can I bring to a class, I always had this think of thinking what can I do in spite of life specimen not to scare caution them about the specimen, I one time brought a frog to see gaseous exchange other touched it and others were scared but I explained the concept telling about the moisture breathing through the skin, the fact I told them the frog dead, using plastic filled ice cold water tight up not let water escape then condensation with water vapour being touched, thus explaining	ETL1	E1; E2; E6
2. It will take a well-educated and trained teacher.	ETL2	E3; E7; E9; E10; E11;
3. All it takes is the availability of equipment	ETL3	E12; E13;

4. Teachers need to give chance to blind learners.	ETL4	E14 E4; E8; E11 E5

On what it will take to be effective in teaching Life Sciences to blind learners, some teachers (E1; E2; E6) say creativity and innovation on the part of the teacher and teachers can do with the advice from experienced teachers in the special schools (ETL1). The majority of teachers (E3; E7; E9; E10; E11; E12; E13) argue that good education and training will take care of the challenges experienced by both teachers and blind learners (ETL2). Some teachers (E12; E13; E14) think it is the equipment that will address the question of inaccessible material and visual demands of the subject Life Sciences (ETL3). Some teachers (E4; E5; E8; E11) think it is worth giving blind learners a chance (ETL4).

The demands that Life Sciences places on teachers impels teachers to call for support and training in order to be creative and innovative when teaching blind learners Life Sciences. The teaching and the taking of Life Sciences stands and falls on the ability of the teachers to face and meet a wide range of demands posed by compensatory measures for vision. The attitude and willingness seems not adequate at the face of implementation of Education White Paper 6.

5.2.2.6 Teachers' opinion on teaching Life Sciences to blind learners

Table 5.15: Responses to teachers' opinion on teaching Life Sciences to blind learners

Category	Code	Frequency
1. It requires teachers' creativity and innovation	LSB1	E1
2. It requires that teachers be trained and exposed to technology	LSB2	E2; E3; E7; E14
3. It benefits blind learners to gain knowledge of concepts used in Life Sciences and to understand life system	LSB3	E4; E5; E8; E11; E12; E13

4. It is difficult to teach the blind and I think it is difficult for them too because they cannot see everything in activities.	LSB4	E6; E9; E10

In terms of opinion expressed regarding teaching Life Sciences to blind learners, one teacher (E1) says it requires innovation and creativity on the part of the teacher (LSB1). Some teachers (E2; E3; E7; E14) say it requires exposure to training and technology (LSB2). Other teachers (E4; E5; E8; E11; E12; E13) think it benefits blind learners to know life system and concepts found in Life Sciences (LSB3). Some teachers (E6; E9; E10) find it difficult both to teach and to learn by blind learners because of vision demanding aspect as the prerequisite for learning (LSB4).

Teaching Life Sciences to blind learners demands more than the current education system can offer. Teachers are expected to meet a wide range of blind learner needs. Teachers count on no support from the education system other than the provisions of Education White Paper 6. There is no certainty on variables as ingredients for ensuring conditions for success and conducive environment for blind learners that will address the demands of vision placed on the teachers by Life Sciences. Effective and efficient teaching is dependent on either the teachers' ability to be creative and innovative or technology to address the education in imbalances caused by lack of material and human resources.

5.2.3 Secondary question three: Adaptations and Differentiations

In this section, the researcher attempted to explore what adaptations and differentiations teachers are making to support visually impaired learners at the inclusive school by incorporating in their teaching inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.

5.2.3.1 Challenges teachers experience when preparing material for teaching that will accommodate blind learners

Table 5.16: Responses to challenges teachers experience when preparing material for teaching that will accommodate blind learners

Category	Code	Frequency
1. Finding tactile material poses a challenge because there is not much for the blind learners in Life Sciences.	CPM1	E1; E2; E3; E6; E8;
2. Lack of teacher training in the education of the blind creates a problem.	CPM2	E9; E10; E11; E12; E13; E14
3. The teachers' lack of knowledge of type of learners with visual impairment.	CPM3	E4; E7; E5

The findings of this study reveal that finding tactile material poses a challenge because there is not much for the blind learners in Life Sciences. On challenges when preparing teaching material, some teachers have difficulty in finding accessible teaching material that will accommodate blind learners in Life Sciences. Some teachers point to lack of teacher training that hampers adequate and effective lesson planning and preparation. Other teachers point to the difficulty caused by not knowing the type of learners they are teaching a factor that renders them not to be able to address their education special needs.

5.2.3.2 Difficulties teachers experience when they teach Life Sciences to blind learners

Table 5.17: Responses to difficulties teachers experience when they teach Life Sciences to blind learners

Category	Code	Frequency
1. Making them visualize abstracts concepts when teaching without tactile material.	DTL1	E1; E8; E9; E10; E13

2. The lack of tactile when teaching material	DTL2	E2; E5; E6; E7; E10; E14
3. They experience difficulty with practicals because they cannot observe classroom activities.	DTL3	E3; E11
4. There is lack of teacher training.		
5. Partially sighted learners participate fully in all class activities and thus pose no challenges	DTL4 DTL5	E4 E12

Regarding challenges experienced by teachers when teaching Life Sciences to the blind learners, the majority of teachers (E1; E8; E9; E10; E13) have difficulty in making their learners visualize abstract concepts or concepts of things accessible through seeing when making them visualize abstracts concepts when teaching without tactile material (DTL1). Some teachers (E2; E5; E6; E7; E10; E14) point to the lack of tactile material (DTL2). Some teachers (E3; E11) have difficulty when learners must do practical things that require vision (DTL3). One teacher (E4) points to lack of training that hinders participation and teaching of Life Sciences to blind learners (DTL4). Another teacher (E12) experiences no challenges because partially sighted are seen participating fully in all class activities (DTL5).

The fact that teachers require adequate training and tactile resources cannot be over accentuated. The support for teachers from education system is yet to be seen and felt by the teachers in their daily work. The call upon teachers to be creative and innovative in noval didactical situation raises an alarm for intervention.

5.2.3.3 Resources teachers have that will make their blind learners equal to other learners

Table 5.18: Responses to resources teachers have that will make their blind learners equal to other learners

Category	Code	Frequency
1. The availability of tactile material for blind learners.	RAB1	E1; E5; E6; E8
2. Blind learners have adapted computers with speech or magnification and brailers.	RAB2	E2; E3; E4; E6; E11; E12; E13; E14
3. There is nothing when teaching Life Sciences.	RAB3	E7; E9
4. There are large print pictures for partially sighted learners.	RAB4	E10

Regarding the resources that are available to blind learners, some teachers (E1; E5; 6; E8) have tactile material for their blind learners (RAB1). Some teachers (E2; E3; E4; E6; E11; E12; E13; E14) have computers with speech synthesizers and magnification for low vision learners as well as brailers (RAB2). Some teachers (E7; E9) say there is nothing for blind learners for teaching Life Sciences (RAB3). One teacher (E10) has large print pictures for low vision learners (RAB4).

The teaching of Life Sciences requires more than the currently available resources for blind learners. Not much is available in the form of tactile Life Sciences material for blind learners.

5.2.3.4 Resources teachers think they still need

Table 5.19: Responses to resources teachers think they still need

Category	Code	Frequency
1. Teachers feel they still need recorded material for blind learners.	AR1	E1; E12
2. Teachers need adapted software for blind learners.	AR2	E2

3. Teachers still need more Braille books for blind learners.	AR3	E3; E5
4. Teachers need markings in buildings for orientation and mobility of partially sighted learners.	AR4	E4
5. Teachers need tactile material	AR5	E6; E7; E8; E10;
6. Teachers would like to have magnifiers for partially sighted learners.	AR6	E11; E13; E14 E9

In terms of additional resources, some teachers, (E1; E12) need recorded material for blind learners (AR1). One teacher (E2) needs computer software with speech synthesizer for blind learners and magnification for low vision learners (AR2). Two teachers (E3; E5) need more braille books (AR3). One teacher (E4) needs some building markings for orientation and mobility for learners (AR4). Some teachers, (E6; E7; E8; E10; E11; E13; E14) require tactile material (AR5). One teacher (E9) needs magnifiers for low vision learners (AR6).

Teachers still need more in the form of tactile material and adapted software for blind learners. How much of these can address the demands of Life Sciences teaching and learning that involves blind learners remains to be seen.

5.2.4 Secondary question four: Helping, Supporting and Monitoring Teachers

In the following section, the researcher explores how the district officials help, support and monitor teachers in inclusive schools to be prepared to adapt and differentiate their teaching and to incorporate integration, equity and inclusivity in their teaching and thus achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.

5.2.4.1 The extent to which the district helps teachers in preparing for an inclusive class

Table 5.20: Responses to the extent which the district helps teachers in preparing for an inclusive class

Category	Code	Frequency
1. The district officials need help from us teachers.	DHP1	E1; E4; E5; E6; E7; E10; E14
2. They are not well equipped and thus they cannot help us teachers.	DHP2	E2; E8; E9
3. They organize workshops and training on diversity for teachers.	DHP3	E3; E11; E12; E13

On district help regarding class work preparation, (DHP1) some teachers point out that the opposite happens, the district requires help from teachers, (E1; E4; E5; E6; E7; E10; E14). Some teachers (E2; E8; E9) say the district is not well equipped to render support to teachers who need it the most (DHP2). However, there are teachers, (E3; E11; E12; E13) who say district offers workshops and training as a way of support to teachers (DHP3).

The system of inclusive education under the auspices of Education White Paper 6 stands and falls on the ability of district support team. This is the core support for teachers whose survival depends on them. Without district support team there is not much about inclusive schooling in general for blind learners in particular.

5.2.4.2 Additional help teachers think they need from the district

Table 5.21: Responses to additional help teachers think they need from the district officials

Category	Code	Frequency
1. The district must provide knowledge that will help teachers address diversity issues in class.	AHD1	E1; E2; E3; E5; E6; E7; E9; E10; E14

2. We need their active participation in addressing classroom challenges.	AHD2	E4; E8; E11; E13

An additional district support, (AHD1) the majority of teachers need to be equipped with knowledge that will equip them in the execution of their task in the inclusive schools particularly (E1; E2; E3; E5; E6; E7; E9; E10; E14). Some teachers, (E4; E8; E11; E13) require active participation, (AHD2) from the district.

Teachers call upon district support to land a helping hand and support to teachers. In the absence of district support, inclusive schooling will be a sinking ship.

5.2.4.3 Teachers' opinion on the support they get from the district

Table 5.22: Responses to teachers' opinion on the support they get from the district officials

Category	Code	Frequency
1. There is no support from the district for teachers.	ODS1	E1; E2; E3; E4; E5; E6; E7; E8; E9; E10; E11; E12; E13; E14

Regarding district support, (ODS1) teachers point out that there is no district support, (E1; E2; E3; E4; E5; E6; E7; E8; E9; E10; E11; E12; E13; E14).

Central to this integrated support system is the District-based Support Teams. This team refers to Education support personnel within district support services who are orientated to and trained in their roles of providing support to all teachers and other teachers. The team has been trained on: supporting all learners, teachers and the system as a whole so that the full range of learning needs can be met. The focus is on teaching and learning

factors, and emphasis is placed on the development of good teaching strategies that will be of benefit to all learners; on overcoming barriers in the system that prevent it from meeting the full range of learning needs; and on adaptation of support systems available in the classroom (Department of Education, 2001:19).

5.2.5 District Responses

5.2.5.1 Understanding of Education White Paper 6

Table 5.23: District officials understanding of Education White Paper 6

Category	Code	Frequency
1. It talks about giving an opportunity for learners with special needs in the mainstream education.	Ewp1	D1; D2; D3; D4

On understanding Education White Paper 6, all district officials (D1; D2; D3; D4) tell us that it talks about giving an opportunity for learners with special needs in the mainstream education (EWP1).

5.2.5.2 Policy informing planning

Table 5.24: District officials' responses to the way policy informs planning

Category	Code	Frequency
1. Use policy to inform planning	PIP1	D1; D2; D3; D4

All district officials (D1; D2; D3; D4) say as an employee who works for the Department of Education all activities are guided by this policy (PIP1).

5.2.5.3 Opinion on integrated classes

Table 5.25: Responses of district officials on integrated classes

Category	Code	Frequency
1. It is good because it addresses diversity	OIC1	D1; D2; D3; D4

When voicing their opinions on integrated classes, district officials (D1; D2; D3; D4) say it is good because in the inclusive classroom lies diversity (OIC1).

5.2.5.4 Influence of integration on planning

Table 5.26: Responses of district officials regarding the influence of integration on planning

Category	Code	Frequency
1. Integration challenges officials to prepare their support accordingly	IIC1	D1; D2; D3; D4

The influence of integration on district officials (D1; D2; D3; D4) is that officials prepare in such a way the teachers are influenced to change their attitude. Teachers learn to deal with diversity and that all learners are equal (IIC1).

5.2.5.5 Blind learners' sense of belonging

Table 5.27: Responses of district officials' opinions regarding blind learners' sense of belonging

Category	Code	Frequency

1. Equip teachers for curriculum adaptation and differentiation	BBC1	D1; D2; D3; D4

Regarding the way of making blind learners feel that they belong to the same class, district officials (D1; D2; D3; D4) use what we call curriculum adaptation, curriculum differentiation and curriculum accommodation. In this way learners' style of learning and teaching style is taken care of (BBC1).

5.2.5.6 Ways of including blind learners in class activities

Table 5.28: Responses of district officials on the ways of including blind learners in class activities

Category	Code	Frequency
1. Equip teachers with skills and competencies to address diversity	IBL1	D1; D2; D3; D4

District officials (D1; D2; D3; D4) show that Workshops and seminars would be tool to ensure that teachers are acquainted with the latest ways of including all learners in the classroom activity (IBL1).

5.2.5.7 Making blind learners equal to other learners

Table 5.29: Responses of district officials on making blind learners equal to other learners

Category	Code	Frequency
1. Conduct teacher training to address diversity	BLE1	D1; D2; D3; D4

District officials (D1; D2; D3; D4) conduct workshops where teachers are trained and equipped to address a wide range of learner needs (BLE1).

5.2.5.8 Blind learners' attending inclusive school

Table 5.30: Responses of district officials on the issue of blind learners attending inclusive school

Category	Code	Frequency
1. Inclusive schooling promotes social inclusion	BAI1	D1; D2; D3; D4

District officials (D1; D2; D3; D4) say inclusive schooling offers chances for learning about each other's limitations and sighted learners can know learners with disabilities. We must not discriminate because these learners are going to live in the same community (BAI1).

5.2.5.9 Support to teachers

Table 5.31: Responses of district officials on the support to teachers

Category	Code	Frequency
1. Support through teacher training	ST1	D1; D2; D3; D4

On support that the district officials give to teachers, officials (D1; D2; D3; D4) offer training to teachers as a way of enabling them to deal with different learner needs (ST1).

5.2.5.10 Extent of blind participation

Table 5.32: Responses of district officials on the extent of blind participation

Category	Code	Frequency
1. Encourage the use of tactile objects	EP1	D1; D2; D3; D4

All participants (D1; D2; D3; D4) tell us that making accessible resources available in class is encouraged (EP1) Participant (D2) says:

“I bring models to school for the teacher to use like the board for braille that my husband made for me. I encourage teachers to involve blind learners and show them by touch the learning model.”

5.2.5.11 Problems experienced by blind learners

Table 5.33: Responses of district officials on the problems experienced by blind learners

Category	Code	Frequency
1. Lack of accessible material	PB1	D1; D2; D3; D4

All participants (D1; D2; D3; D4) point to lack of accessible material for blind learners as being problematic. Participant (D1) says:

“The problem is that they cannot have the models for everything. The blind learners cannot see some of the learning material.”

5.2.5.12 Opinion on blind learners’ taking Life Science

Table 5.34: Responses of district officials on their opinion on blind learners’ taking Life Sciences

Category	Code	Frequency
1. They can take Life Sciences	OL1	D1;D2;D3;D4

All participants (D1; D2; D3; D4) are of the opinion that blind learners must do Life Sciences because there are models, there is braille and the teacher can explain to the blind

learner. Participants don't think it should be a problem as long as there is a way of teaching and learning it because it needs sight (OL1).

5.2.5.13 Effective teacher

Table 5.35: Responses of district officials on an effective teacher

Category	Code	Frequency
1. Positive attitude and hard work	ET1	D1
2. Training and resources	ET2	D4

Participants (D1; D2; D3) believe that the teacher must have positive attitude and be willing to work hard (ET1). While participant (D4) is Not sure but he/she thinks training maybe and other resources that learners can use and touch (ET2).

5.2.5.14 Preparation challenges

Table 5.36: Responses of district officials on the issue of preparation challenges

Category	Code	Frequency
1. Lack of suitable material	PC1	D1

Participants (D1; D2; D3; D4) have a responsibility of making sure that there are objects and models and enough material. They say that they know that teachers depend on them for information and support. However, they concede that it is not always easy to help them all.

5.2.5.15 Problems experienced by blind learners

Table 5.37: Responses of district officials on problems experienced by blind learners in an inclusive school

Category	Code	Frequency
1. Problem of accessible material	PB1	D1;D2;D3;D4

Participants (D1; D2; D3; D4) tell us that Life Sciences involves experiences and practicals. They deal with what they can see there and observe. In most cases those blind learners when they conduct experiments they cannot see what is happening, they can only feel (PB1).

5.2.5.16 Available resources

Table 5.38: Responses of district officials on the available resources

Category	Code	Frequency
1. Limited resources	AR1	D1;D2;D3;D4

Participants (D1; D2; D3; D4) point to limited resources which include brailers, models and Braille material (AR1)

5.2.5.17 District help

Table 5.39: Responses of district officials to help from district office

Category	Code	Frequency
1. District conducts teacher training and school visits	DH1	D1;D2;D3;D4

Participants (D1; D2; D3; D4) say they conduct workshops and train teachers; they give teachers materials and visit schools (DH1).

5.2.5.18 Additional help

Table 5.40: Responses of district officials to additional help from district office

Category	Code	Frequency
1. Capacity building	AH1	D1;D2;D3;D4

Participants (D1; D2; D3; D4) need additional training or empowerment so that they can address all the challenges they meet in their daily work (AH1).

5.2.5.19 Opinion on district help

Table 5.41: Response of district officials opinion regarding district office help

Category	Code	Frequency
1. Additional resource required	OH1	D1;D2;D3;D4

Participants (D1; D2; D3; D4) believe that additional resources are required to meet the challenges in the field. They say that there are no enough resources out there and they are very few and the schools are many (OH1).

5.3 Accumulative Summary

There is common understanding of the main thrust of Education White Paper 6 that it is concerned with ensuring that all learners are given equal educational opportunities regardless of educational difficulties or challenges learners have and that learners cannot be discriminated against on the basis of disability or because of their education special needs.

The teachers who have been exposed to Education White Paper apply the knowledge and provisions as stipulated within the policy and this is implemented in conjunction with other policies. This means learners with educational special needs are catered for and

such teachers have broader understanding of policies and the implication thereof or the bearing such policies have on their daily work and planning.

Teachers who are of the opinion that allowing blind learners in the inclusive schools is possible on condition that there is support and accessible material. The issue of training for dealing with diversity of specific educational need is crucial. Conversely, blind learners should not be in the mainstream schools unless there is support, accessible material and trained teachers.

The influence of integrated classroom is perceived in different ways by teachers. This poses a challenge for teachers because only those have the ability to adapt and differentiate their teaching cope with the diverse learner needs. This calls for teacher support and training in the implementation of Education White Paper 6 as the policy on inclusive education.

There are those teachers who think letting a partially sighted learner sit in front is the way to make them participate. This is treating all partially sighted as having same problem of vision without knowing that there is the case of myopia and hyperopia as far as low vision is concerned. This is dealt with in greater detail in chapter one. This is a great challenge for teachers and they need to be supported and equipped.

Teachers apply different strategies when teaching in order to incorporate inclusivity that takes care of blind learners. The primary mode is tactile material and Braille material. Once these are taken care of, then the rest seem to fall in place. Blind learners are allowed to participate in all activities in the class.

The National Curriculum Statement calls on all teachers to offer learning outcomes as prescribed. The differentiation and adaptation is in the teaching act. The curriculum that is single and unified for all South African schools. The inclusive schools are no exception to the rule.

Learning and participating in class activities in the inclusive school places a heavy demand on the teachers in terms of ensuring the availability of tactile and accessible teaching and learning material for blind learners. Those teachers who are aware of the heavy demand cannot allow blind learners to be in the inclusive school. They feel that blind learners are put at an enormous disadvantage. Unless there is support for blind learners at the inclusive school, it is not advisable for blind learners to be at the inclusive school.

Acceptance of blind learners at the inclusive school is not automatic. Teachers have different opinions as to how to achieve this crucial aspect because blind learners cannot attend the same class with learners who do not accept them. Blind learners will be intimidated and thus can never learn and will be inhibited from participating in any class activities that will result in their learning. A great deal of advocacy in the form of public knowledge, awareness and information is required.

CHAPTER 6: Discussion of the findings of the empirical investigation

6.1 Introduction

The researcher explained in the previous chapter how the data collected during the field work was coded, classified and logically analysed. The data was then tabled and described briefly. This chapter discusses the findings of the study, based on the incorporation of integration, equity and inclusivity when teaching Life Sciences to learners with visual impairment in the inclusive school as well as the implication of district support for these teachers in the inclusive schools.

6.2 How district and teachers deal with integration, equity and inclusivity in Life Sciences to blind and visually impaired learners

This chapter discusses the data analysis, based on learning outcomes prescribed by the National Curriculum Statement (Grade 10-12 schools for Life Sciences), to consider whether they are attainable by learners with visual impairment in the inclusive school or not.

The chapter deals with the significance of the analysis and its implications, and also provides important patterns regarding themes based on three-pronged approach, attainment of Life Sciences learning outcomes and district support for teachers who are incorporating integration, equity and inclusivity when teaching Life Sciences to learners with visual impairment in the inclusive schools, as indicated in the previous chapter. Additional district support to Life Sciences teachers in the inclusive schools.

In instances where the actual words of participants are quoted, they are presented in quotes. Data analysis and interpretations regarding challenges experienced by teachers and district officials in the incorporation of integration, equity and inclusivity are presented below. Sub-themes of these three concepts are discussed independently though

some questions are treated together in order to make them more significant, coherent and extensive.

6.2.1 Discussion of the findings of the empirical investigation

Written permission was sought and granted by the Mpumalanga Department of Education (Inclusive Education) to the researcher to conduct interviews with teachers and district officials on June 2009.

6.2.2 Teachers and District Officials' Profiles

It was indicated in the previous chapter that 14 teachers were interviewed because they have both learners who are blind and learners with low vision and 4 district officials responsible for these schools were interviewed. Of 14 teachers interviewed, eleven were females while three were males. Four district officials from two districts were interviewed. Two were females and two were males.

6.2.3 Feedback and Report on the Interviews

Teachers and district officials were interviewed separately. Therefore, the first section below will pay attention to teachers' responses and the latter part to district officials' responses in order to avoid confusion.

6.3 How integration, equity and inclusivity manifest themselves as being foundational in terms of the influences they have on the teaching and learning of Life Sciences to blind and visually impaired learners in the inclusive schools

6.3.1 Incorporating inclusivity when teaching Life Sciences to blind and visually impaired learners as foundation in the inclusive school

The first sets of questions are based on the learning outcome 1 and the incorporation of inclusivity when teaching Life Sciences. The researcher seeks to explore strategies of adaptations and differentiations that teachers employ in the classroom to accommodate their learners with visual impairment.

6.3.1.1 Ways of including blind learners in class activities

From the interviews with the Life Sciences teachers it appears that blind learners relied mainly on verbalism and theory and not on real practicals, like observation for learning experience as revealed by literature and discussed in chapter three. One participant (E3) stated the following words: “I must Create separate activities because the blind cannot do all things that seeing children can do in Life Sciences like seeing the change of a solid to liquid when heated .”

This seems to support the idea that certain teachers lacked competences and skills to accommodate learners with visual impairment during the incorporation of inclusivity when teaching Life Sciences. Those teachers did not improvise. The interviews suggested that blind learners relied on theory and not on good scientific practices only. Teacher (E10) says:

“It is difficult to teach the blind because they cannot participate in Life Sciences activities or survey or conduct a simple test. Sometimes you do not know what to do now because they cannot see all these experiments.”

Teachers resort to theory and verbalism as the method of teaching. Learners with visual impairment lose out on investigation and inquiry experiences as demanded by Life Sciences.

These interviews with teachers revealed that little practical work is done in the Life Sciences classrooms. Teacher (E10) puts this view thus:

“Blind learners cannot see and they cannot see and observe things happening like changing

of colour when we use chemicals. Even those who have a little sight (partially sighted) they struggle. Sometimes I explain to them without them seeing what is happening.”

Ways of including a blind learner in Life Sciences pose a real challenge. The practical observation is a drawback for a blind learner, for example when linear programming is being done. Learners with visual impairment cannot perceive the whole picture in totality at one glance or touch because it is very visual and there are certain things that the teacher normally can't even try and describe for such learners to get a complete picture. In such cases, the teacher tries to teach them the basic principles because is part of the curriculum.

This view is supported by teacher (E3) this way:

“It is difficult because the blind cannot see and cannot do other things like taking part in observation or experimentation of chemical reaction.”

Learner-centered approach to observation demands that learners are expected to analyze their observations. The absence of visual ability deprives learners with visual impairment of the advantage of observation (Borg, 1987:157-158). Such deprivation causes blind learners to be less competitive during Life Sciences class.

This is endorsing literature that teachers express uncertainty about their abilities to cope successfully and to provide the best educational opportunities for those children in their classes who have special needs (Wade, 1987:13)

In many instances where observation is involved, blind learners rely on their sense of touch. As one way to include them in learning is to use the sense of touch. Learners with visual impairment then learn to use their hands to manipulate the skeleton of the body or tactile embossed diagram of a cell division for observation in class without fear or being intimidated. Sighted learners learn to bring Life Sciences objects for observation to learners with visual impairment without inhibition or feeling like they are intruding or embarrassing learners with visual impairment. Teacher (E10) supports this view this way:

“They take turns to touch the model of an animal. We allow them to touch. They also have Braille and they use their hands to read.”

One of the most important features of outcomes-based education is that it is concerned with establishing the conditions and opportunities within the system that enable and encourage all learners to achieve those important outcomes. An inclusive curriculum is based on a view that learning takes place when learners are actively involved in making sense of their experiences – they have to find things out and understand things for themselves (Da Costa, 2003:56).

Some teachers suggest providing Braille material and bringing to class some tactile objects for the lesson for blind learners as a way of having them included in class activities like all other learners, or sometimes take them outside the classroom and try to make them feel the texture of different kinds of soil. Teacher (E1) says this to add:

“In rural areas it can be easy. I just take the blind learners outside during special occasion where a goat or sheep is to be slaughtered. During slaughter dissecting a goat I then show parts of the washed and cleaned internal organs e.g. lungs and windpipe.”

Another teacher (E1) sees the way of including blind learners thus:

“I make sure that all material and notes on Life Sciences must be made available in braille in order for the blind learners to be on top of the situation not below average, provide extra readings like tactile diagrams where possible.”

Regarding the way to include partially sighted learners in Life Sciences activities, this teacher (E2) said:

"The teacher creates the ways and atmosphere for including the learners. We use contrasting colours like black for the branches and yellow for the leaves. We differentiate and adapt work sheets for them to see by reducing activities on the diagram or show the main points only."

Another teacher (E6) raised a concern on this state of affairs:

“It is a problem of preparing for learners whom you know they cannot see and the resources are difficult to have for them for example chemicals that they cannot see.”

Some teachers also expressed frustrations about experiments because the majority of their learners need visual ability to perform and observe. It is for this reason teachers adopt to the collaborative learning approach. This is discussed in details in chapter three. This happens where blind learners are working collaboratively with a learner with low vision. In this case, a learner with low vision can describe the experiment under observation then the blind learner can then record in braille. Teacher (E3) endorsing co-operative learning says:

“I let the partially sighted read the barometer for the blind”. The sighted fellow learner then explains and describes the activity. A learner with visual impairment can then record in Braille or use a talking computer, then formulate possible answer. The possible underlying principles are discussed together.”

6.3.1.2 The extent to which teachers allow blind learners to participate in Life Sciences

The interviews with Life Sciences teachers revealed that most educators working at the inclusive schools received a general education training qualification. They were not trained in the education for the blind and visually impaired learners. As the result, these teachers show a lack of ideas to adapt the curriculum and accommodate blind and visually impaired learners in the life sciences' environment. Some teachers express the view that blind and visually impaired learners cannot cope with the demands and challenges of life sciences, including observation, exploration and experimentation.

In the interview this teacher (E2) said this about the extent of involving her blind learners:

“Blind learners can do their work as long as they can see and everything is clear. The teacher must have empathy with the child and must allow the blind learner to do the same subject but the teacher must differentiate the Life Sciences activities. When it comes to

plants and flowers the teacher must explain to the child and make sure that the child understands.”

In another interview, teacher (E3) said this about participation in Life Sciences by the blind and visually impaired learners:

“Blind learners depend on me. I must allow them to touch and I must create things (Life Sciences teaching objects) for them.”

Teacher (E5) said this during the interview:

“I allow them to participate and touch Life Sciences objects for experience. I make sure there is no danger or I come up with the alternative object or a picture for the partially sighted.”

The research conducted by Maguvhe (2005) points out that according to evidence, Maguvhe argues that, access to the learning mediation of biology including experimentation and exploration is limited. In his view, he argues that this state of affairs endorses the argument that the learning mediation of biology depends on one’s visual ability, thus making it difficult for blind learners to access information

Echoing this limitation, one teacher (E6) argued: “I give him the things he can touch. I bring real flowers but some of the things he cannot see and there is nothing I can do.”

Maguvhe (2005) citing Borg (1987:157-158) argues that observational processes are important in enabling individuals to collect direct information. Such lack depicts blind learners’ deprivation of opportunities to study specific aspects because they cannot observe. This deprivation puts blind learners at an enormous disadvantage making them to be less competitive during the process of learning biology. Blind learners will only be made equal and on the same par in order to be able to be competitive when they are fully exposed to all biology phenomena.

Maguvhe (2005) further alludes to Nagel and Stobbs (2003:47) who argued that

“...benchmarking against the regular curriculum is extremely important because we’ve got to foot it with this competitive world that we live in. Like it, or not. And if you

want a job you have to compete, you have to be there, you have to develop skills and talents. Part of this is having the ability to know and to deal with others, and to live in the real world. You have to learn to take the knocks and have the ability to deal with prejudices.”

Maguvhe (2005) established that there is evidence showing that even if blind learners are not able to observe experiments visually, they still benefit from explanations given by partially sighted classmates and teachers particularly with practicals, because of their complexities and challenges that they may pose to blind learners, teamwork between blind and partially sighted learners is encouraged so that they could assist one another.

Supporting the findings in the study conducted by Maguvhe (2005) teachers experience many problems with learners who are blind and think the learners with low vision have no problem; hence they help the blind learners. Teacher (E4) said:

“We let the child experience. We let them feel. It is not a problem with the partially sighted learner.”

This is what teacher (E3) said:

“I must allow them to participate and create things for them,” this is how teacher (E3) facilitates participation for blind learners.

Another teacher (E1) said:

“All material and notes must be made available in order to be on top not below average, provide extra readings.”

Supporting, but a part of literature some teachers argue that it depends on the ability and intellect of the child. It also depends on the support. If they are given enough support they pass well.

However, caution was raised by Horton (1988:9) that placing either a blind or low vision learner in an inclusive class at an inclusive school and not providing such a learner with access to learning material, learning environment and learning equipment does not

constitute inclusive school. The role of the teacher is to provide the needed accessibility so that the blind learner can successfully be educated in an inclusive classroom

These teachers might not be aware of the essential factor that there are a number of other things, among which is both the availability of tactile material as well as the nature of tactile material which determine accessibility for blind learners. This view is endorsed by literature that the teacher in the inclusive school must bear in mind that learners with visual impairments need assistance in making the connection between vocabulary, and real objects, body movements and abstract ideas. Important vocabulary and concepts should be pre-taught using concrete, multi-sensory experiences combined with verbal explanations (Barghava, 2004).

Learning experience is important in for learners. Learners with visual impairment cannot be deprived of this opportunity by verbalism in teaching. The teacher must allow first-hand experience where possible. A learner must not be exposed to verbal cues only. This is discussed in detail in chapter three of this study. For this experience to occur, learning material must be accessible and or tactile for blind learners to manipulate with their hands in case it is visual presentation or vision perceived. New vocabulary should be spelled out verbally (Barghava, 2004).

This view is further supported by literature that when exploring new objects or in helping direct the learner's attention, use the hand-under-hand technique, in which the teacher places his/her hand under the learner's and guides their hand (Sewell, 2005).

As shown by literature, the combination of techniques and strategies must be used when teaching the blind learner. The fact that learning material is tactile might not be adequate the nature of the tactile material is critical. This is compounded by the fact that these learners have been exposed or not exposed to such material before and or during their learning experience. This implies teachers' intervention in promoting learning new objects through the experience of touch-to-see. This is discussed in detail in chapter three of this study.

The teachers believe that partially sighted learners do not have problems and they perform well and they are able to deal with classroom activities with relative ease. This view is expressed by one teacher (E7) thus “We let the child experience. We let them feel. It is not a problem with the partially sighted learner.” However, literature shows that the nature of low vision determines vision and that adaptations or some form of techniques need to be used to assist such learners. It is advisable in literature that for learners with low vision, the teacher must use chalk or markers that contrast well with the blackboard or dry erase board (Barghava. 2004). For older learners, the teacher should ask which colour combinations they prefer. The teacher should be aware of glare on the board (Barghava. 2004). Allow the learner to move flexibly in order to gain the best view of the board.

Participation of blind learners cannot be limited to both the availability of tactile material as well as the nature of tactile material because sometimes hands cannot give adequate information that is equal to information provided by vision. Such limitation then can sometimes put blind learners to the enormous disadvantage or to be misconstrued or adversely perceived. In case of verbal description, verbal descriptions and directions should be clear and specific. Visual Information needs to be described auditory for learners with visual impairment (Barghava, 2004).

6.3.1.3 Problems Blind Learners Experience in the Learning of Life Sciences

The majority of teachers – Twelve of the fourteen educators who participated in the study pointed to the lack of accessible material as a critical problem blind learners had to face. One teacher (E1) said:

"Availability of tactile material and that some finer details of organs like lungs, heart and animals cannot be touched."

In the observation done by Maguvhe (2005) he expresses the related frustrations experienced by teachers regarding experiments since most of their learners need visual

ability to perform and observe. Hence, educators resorted to the teamwork approach (pairing blind and partially sighted learners together) so that the partially sighted learners could supply blind learners with visual experiences.

Another teacher (E10) explained this problem as follows:

"Blind learners cannot see and they cannot see and observe things happening like changing of colour when we use chemicals. Even those who can see a little, they struggle. Sometimes I explain to them without them seeing what is happening."

The main problem is the one about support material and skilled educators specializing with visual impairment. They experience problems in diagrams, dangerous chemicals and labelling.

"They have problems when it comes to more complicated science structures, particularly high school, the diagrams cannot be seen and thus impossible," so teacher (E2) thinks.

Yet teacher (E3) thought that:

"Support material is a problem and seeing things."

"We let (make) a lot of description in teaching," teacher (E4) added.

In line with the findings of this research, Fraser (1996:68) maintains that from a teaching and learning point of view the ability to observe remains a crucial aspect applicable to teaching and learning in general. Observation is foundation al to the science processes and without observation; learning will be restricted and easily become less meaningful. Twelve of the teachers who participated in this study show that lack of tactile material are the main problem of blind learners in Life Sciences. If tactile material is not available for such learners, learning experience is a problem. In this way, teachers hold the view that provision of tactile material is the solution to inaccessibility.

Accessibility to learning experiences opportunities is crucial and critical and it serves as the determining factor for success or failure. The lack of accessibility and availability of tactile resources and the nature of tactile material available compounds the inhibition. Blind learners struggle and teachers are experiencing difficulty in terms of both finding accessible resources and tactile material for their blind learners. In this regard, according to the research findings then, visual impairment presents challenges in learning Life Science

Regarding this problem revealed by the findings of this study, literature say this is so because, at its core, Science and Biology are founded on observation: watching things, measuring them, analysing their properties, figuring out how they work, making analysis of relationships and properties (Kumagai, 1995:82).

6.3.2 Challenges teachers experience when preparing for blind learners

In the study done by Maguvhe, (2005) points out that the teaching and learning of biology is susceptible to some kind of debate, particularly concerning observation, teaching and learning strategies, resources, creativeness, innovativeness, and the like.

“If teachers are not creative, they are defeating one of the objectives of Outcomes-based Education and Training, which is to eliminate rote learning and promote critical thinking and creative teaching. Feelings of ineffectiveness, hopelessness, discouragement and/or incompetence in educators may bring about ineffectiveness in practical adaptations (e.g. of experiments). On the other hand, if educators find themselves in supportive work conditions, they gain a sense of achievement and accomplishment.”

Teacher (E2) expressed this challenge thus:

“Lack of enough material on the subject for the blind. The other thing it is expensive. Sometimes you want to teach something and there is no material available. Teachers make do with the technology available. Teachers then do research.”

In this regard, the findings of this study are in line with the findings in the study done by Maguvhe (2005) who revealed that finding accessible material poses a challenge because there is not much for the blind learners in Life Sciences. On challenges when preparing teaching material, some teachers have difficulty in finding accessible teaching material that will accommodate blind learners in Life Sciences. Some teachers point to lack of teacher training that hampers adequate and effective lesson planning and preparation. Other teachers point to the difficulty caused by not knowing the type of learners they are teaching a factor that renders them not to be able to address their education special needs.

Teacher (E1) expressed this challenge as follows:

"Looking for tactile objects, specimen and organization of learning which is different from ordinary, looking for things that can be touched or tasted: all these need a dedicated teacher otherwise the teacher won't try much. Such a teacher should ask help from other teachers from other schools."

Another teacher (E6) said: "The challenge is to get material. There is no material. Even if you prepare you wonder what to do now." Yet another teacher (E1) said: "I experience shortage of suitable material for blind learners."

"Shortage of material is making my work difficult," it is yet another voice (E3) to the challenge. "No proper training or support from the department," it is pointed out by the teacher (E2). Expressing less of a challenge, one teacher (E9) listed the following observation:

"There is not much difficult in preparing. The important thing is to know the type of children you have in your class and prepare accordingly. You do not discriminate against those who are blind but you differentiate in terms of adaptations. I move around them as I teach or give them work so that I can monitor and support. I encourage them to ask questions. I must answer freely and put them at ease."

Yet another teacher (E1) experienced a challenge and said: "Availability of braille material is always a problem and the models are not available. I must look for what I can find to use in class." Pointing to the cause of a challenge, one teacher (E14) says: "There

is no training to deal with challenges that will equip teachers." Adding to the chorus of challenge, another teacher (E7) says: "When preparing material for blind we find difficult because there are no resource as such for them. This is because they cannot see and this is a problem." "The lack of material. It is not easy to find the material to be used in class," another teacher supported the voice on challenge.

The evidence from the study conducted by Maguvhe (2005) suggests that should schools be resourced, blind learners will practically and theoretically be equipped with science process skills. In addition, observations will be possible and meaningful to them.

The interviews with Life Sciences teachers revealed that these teachers are not taking an advantage of the flexibility features in the National Curriculum Statement. The National Curriculum Statement depicts that there are a number of options that a teacher who teaches visually impaired learners can adopt. These relate mainly to the features of flexibility of the National Curriculum Statement that teachers use daily in their work. These include among other things, that learning outcomes do not prescribe content or method. Content and methodology in particular should be appropriate for a learner's needs (DOE, 2003: Overview of Revised National Curriculum Statement, p. 14.).

A teacher who knows that she has a learner who is visually impaired in her class must, when writing on the board for other learners who can see, verbalize or speak as she writes or read afterwards for her learners. If a learner has low vision hints discussed in the other section are quite appropriate (DOE, 2003: Overview of Revised National Curriculum Statement, p. 14.).

Activities can be flexible. In this regard, if learners have to collect objects, pictures, etc., as a teacher, ensure that they are in a position to do so or else provide a variety for them to select and collect.

The use of real objects or representations of such objects would facilitate learning example e.g. having real flowers instead of pictures or using a globe instead of just

explaining certain aspects of earth and beyond. Should the learners be unable to have access to real objects or natural phenomena it should be made available to them. When exploring new objects or in helping direct the learner's attention, use the hand-under-hand technique, in which the teacher places his/her hand under the learner's and guides their hand (DOE, 2003: Teacher's Guide for the development of Learning Programmes, p.10).

Further, literature points out that, according to Forlin (2004:4), inclusivity can be achieved through adaptation of material and curriculum differentiation. This strategy will cater for all learners with differing needs. In this regard, inclusivity means teachers must reformulate their traditional methods of teaching to include or accommodate learners who are visually impaired (Booth and Amscow, 1998:7).

Problematic is the fact that seeing objects as a whole and as well as in parts is critical. Far off objects need to be observed, their structures analysed and some of these objects and structures cannot be touched or manipulated by means of hands. In this case, one could search for a solution to the problem in the view that concrete-empirical proposition serves to enhance the transition from concrete to abstract cognitive functioning (English, 1985).

Accessibility is far beyond the tactile factor only. More so in Life Sciences. This holds true to shapes, sizes forms and textures, but it does not hold true to colour changes. There are assistive devices that can deal with these factors not only tactile objects or devices. The factor of three-dimensional diagrams is yet another factor in accessibility for blind learners.

Rarely has sufficient resources learners accompanied them to the paradise of inclusivity. Instead diminished resources have followed learners with visual impairment to Inclusive schools.

Literature eliminates this picture by revealing that what is of essence in this process of inclusivity, is the perfected art of blending the diversities in terms of limitations with the commonalities in terms of equalisation of educational opportunities. It is an inevitable

logical that the greater the degree of functional impairment, the greater the degree of modification or differentiation needed in the common and flexible curriculum (Mittler, 1993:83).

In supporting this view, Sapon-Shevin (2001:2), states that by definition, inclusivity relates to making changes in the nature and quality of the general education classroom. Furthermore, according to Sapon-Shevin, the instructional strategies and adaptations provided for learners in special schools can be provided in ordinary classrooms on condition that classrooms are reconceptualised.

6.3.2.1 Challenges experienced by teachers in class

Interviews with Life Sciences teachers showed that the main challenge in the teaching of Life Sciences to blind and visually impaired learners is imbedded in the nature of the National Curriculum Statement. The nature of National Curriculum Statement is that it is visually oriented and this curriculum is implemented in the inclusive school which is the ordinary school converted to become the inclusive school, that is it is made to take learners who, otherwise, according to the previous education dispensation (prior 1994) would go to a special school for specific special education needs. The nature of such school is visually oriented and must be adapted and adjusted to cater for learners with visual impairment. The teachers in such schools have taught from visual perspective material. Their pre-service training, (Initial professional education training) has prepared them for the ordinary schools. Now because of education paradigm shift, the education landscape has changed. These teachers must address a wide range of diverse learner needs with special education needs. They do not have an inkling of what happens in the special schools for the visually impaired.

In the interviews with Life Sciences teachers, teacher (E1) expressed this challenge when teaching Life Sciences to blind and visually impaired learners in class thus:

"The main challenge is in gathering suitable Life Sciences material and making them visualizes and understands some Life Sciences abstract concepts like nervous system,

conveying and interpreting stimulus collecting material that will explain (what you are teaching)."

Talking about the challenges, in the interview with teacher (E2) this was said:

"Blind learners have problems when it comes to more complicated science structures, particularly at the high school. Remember the diagrams cannot be seen by the blind and this makes Life Sciences impossible for them."

Another teacher (E6) expressed this challenge thus:

"Remember they cannot see objects in detail. They cannot see all the things that other learner can see and there must be the equipment to help make tactile diagrams and we are not all allowed to use it."

Some teachers they find that there is no material and they do not know how to make the blind learners see in their minds; or sometimes they do not have large print and learners with low vision cannot read on their own. So, the teacher must leave others and go to them and help.

Another teacher (E5) depicting team spirit said this:

"If during preparation I cannot find a particular object, I go to my head of the department ask as to what to do then. Teachers also support one another we talk giving information (to one another)."

This research found that teachers have difficulty in making their learners visualize abstract concepts or concepts of things accessible through seeing when making them visualize abstracts concepts when teaching without accessible and tactile material. This is indicative of lack of accessible resources. Teachers have difficulty when blind learners are supposed to do practical things that require vision. This includes observation when doing experiments with chemicals or changing of colour in the experiment.

Teachers express this challenge this way (E5): “The difficulty is that they cannot see sometimes you think they can see but they do not and you explain and hope they understand”. Another teacher (E1) echoes this challenge thus: “Gathering and making them visualize and understand some abstract concepts like nervous system, conveying and interpreting stimulus and collecting material that will explain.”

The fact that teachers require competences, skills and exposure to novel assistive technology and tactile resources cannot be over accentuated. The support for teachers from education system through the district support team is yet to be seen and felt by the teachers in their daily work. The call upon teachers to be creative and innovative in novel didactical situation raises an alarm for intervention.

Teachers are thrown in the deep end by the education system under the auspices of Education White Paper 6 that stipulates that all learners can learn and that they can learn at an ordinary school near their home. Further, according to the stipulations of Education White Paper 6, the district support teams created to render support services to teachers in class in order to be able to deal with issues of diversity and wide range of learner needs with specific reference to those with special education needs. On the other hand, demands are placed on the teachers to address a wide range of learner needs in the absence of district support. This calls for competencies and skills coupled with knowledge of the education for visual impairment.

According to the findings of this research, all teachers show that achievement of outcomes in Life Sciences by learners with visual impairment is limited.

This limitation is confined mainly to availability or lack thereof tactile material for blind learners. Life Sciences demands vision in order to participate in class activities. Accessibility to learning experiences opportunities is crucial and critical and it serves as the determining factor for success or failure. The lack of accessibility and availability of tactile resources and the nature of tactile material available compounds the inhibition. Blind learners struggle and teachers are experiencing difficulty in terms of both finding accessible resources and tactile material for their blind learners.

In line with the findings of this research, Fraser (1996:68) maintains that from a teaching and learning point of view the ability to observe remains a crucial aspect applicable to teaching and learning in general. Observation is foundation al to the science processes and without observation; learning will be restricted and easily become less meaningful (Fraser et al, 1996:68). Teachers are not take advantage of science process skills to equip their learners with visual impairment as discussed in chapter three. They use co-operative learning to a limited scale. In this way they miss out a great deal of opportunities as discussed in chapter three of this study.

In this regard, according to the research findings then, visual impairment presents challenges in learning Life Science. Many science processes are linked to outcomes and activities that are visually connected or dependent. For example, processes that are linked to changes in colour, size, shape, dispositioning and repositioning, movement, changes in direction, and speed or patterns, require the careful observation of the changes. Where observation by means of visual perception as skill is found lacking, the execution of the integrated (advanced) science process skills will be poorly performed.

6.3.2.2 Teachers' views on Life Sciences to the blind

Interviews with teachers showed that it is good for blind learners to do Life Sciences. However, this does not seem to be easy for both the teacher to teach Life Sciences and the blind learners to learn Life Sciences. Teacher (E3) said:

“Blind learners must do the subject Life Sciences like others to gain knowledge. Teaching Life Sciences to blind learners needs well educated, supportive and good trained teacher. It is good for blind learners to do Life Sciences because it brings about knowledge and competency in life, society and science in general.”

In another interview, teacher (E4) said this about blind learners taking Life Sciences:

“Teaching Life Sciences to blind learners needs training and dedication with positive attitude. But Life Sciences are difficult for them. It needs a lot of description. We don't have the equipment. However, I think they must take life sciences they need to know ecology.”

Another teacher (E5) said this about her blind learners and Life Sciences:

“They must take Life Sciences because they have the intellect and they just cannot see. We must give them chance and let not blindness restrict them. It could be a way to a career in technology. Later this knowledge might help him see these things (experiences).”

According to the interviews, Life Sciences do not create opportunities for equality with other learners who are not visually impaired. Life Sciences, in this sense, does not seem to hold much benefit in terms of experiences afforded by the subject for blind learners in view of the heavy demand it places on both the learner with visual impairment and the teacher who must acquire training and skills then find tactile and accessible material for them.

Regarding this problem revealed by the interviews, literature say this is so because, at its core, Science is founded on observation: watching things, measuring them, analysing their properties, figuring out how they work, making analysis of relationships and properties (Kumagai, 1995:82).

Taking the various degrees of visually impairment into consideration one could assume that the teaching of the life sciences to these learners is complicated by requirements put forward by the subject and learning area on teachers and learners. It has therefore become necessary to discover, develop and promote new approaches, strategies, tools, techniques, ET cetera, that are essential for the enhancement of the full and active participation of visually impaired learners in special and inclusive schools (Abantwana-Phambili, 2001:2).

On the other hand, blind learners are put at the enormous disadvantage because then they are deprived of the knowledge and experiences that Life Sciences offer to other learners. This is not making them equal to other learners as demanded by Education White Paper 6.

This research shows that teachers all agree that blind learners must do Life Sciences. However, they all have different reasons as to why blind learners must take it as a

subject. The reasons given amounts to acquisition of basic life skills because blind learners have the ability to acquire those skills.

6.3.2.3 Understanding Education White Paper 6

Inclusive schooling is defined in the Education White Paper 6 as ‘maximising the participation of all learners in the culture and the curricula of educational institutions and uncovering and minimizing barriers to learning (Department of Education, 2001:16).

The interviews with teachers showed that their understanding of Education White Paper centres on involving learners in the mainstream schools. Their understanding does not reveal their challenge and the enormity of the task that they are expected to perform as the result of this policy.

In the interview, teacher (E4) said this about understanding EWP #6:

“It is a policy that talks about teaching and learning in the mainstream schools.”

The majority of teachers who participated in the study indicated that Education White Paper talks about involving all learners irrespective of barriers in education in the mainstream schools. Supporting this view, teacher (E6) told us that: “It talks about special needs of blind learning in the mainstream school.”

Teacher (E14) said this in the interview about understanding EWP #6:

“Learners must be in the same school regardless of disabilities or not.”

The interview with teacher (E5) revealed some additional information on the understanding of EWP #6:

“It is the kind of education that includes all types of learners that have different types of needs according to their abilities I know there are learners with different abilities so they need to be helped according to their abilities. We must differentiate their needs when we are teaching. We must differentiate their work to suit their abilities. I learnt on my own

including sign language.”

Teachers are expected to know the provisions and stipulations found in this policy. These provisions have direct bearing on their daily work and their understanding of such policy is crucial.

According to the findings of this study, twelve teachers depict some kind of exposure to Education White Paper 6. Some teachers were exposed through their studies at the tertiary level and others through the workshop conducted by the district. There is common understanding of the main thrust of Education White Paper 6 that it is concerned with ensuring that all learners are given equal educational opportunities regardless of educational difficulties or challenges learners have and understanding that learners cannot be discriminated against on the basis of disability or because of their education special needs.

Teachers do not give much information from their understanding of Education White Paper 6 on how it impacts on their work. One would think teachers would talk also about inclusive Schools.

It is the Education White Paper 6 that establishes inclusive schools and spells out how it will function. This is discussed in details in chapter one and chapter three of this study.

Teachers are expected to function within the provisions of Education White Paper and in this regard one would expect teachers to be well informed because it is about their role in the new kind of school: the inclusive school.

In the interview, teacher (E1) indicated that there was no time for studying policy:

“The work load does not allow teachers to study education policies.”

Echoing the same view, teacher (E3) said this:

“It does not help me in my daily work because I don’t know the policy.”

One would also expect teachers to be familiar with the concept of ‘special school’ and ‘resource centre’ because according to the provisions of Education White Paper 6, special

school will be converted to become resource centres. This means special schools are expected to provide necessary support to the neighbouring school and form part of the newly established District Support Team. In this way, Life Sciences teachers could go to special schools ask for help on teaching blind and visually impaired learners.

It can be safely concluded, according to the findings of this study, that a majority of teachers depict limited understanding of Education White Paper 6 which is a policy on inclusive education.

6.3.2.4 Policy Informing Planning

Education White Paper #6 (2001) tells us that the provision of Inclusive educational opportunities to learners with visual impairment in the inclusive schools is designed to equalize the opportunity to develop their abilities to think and do educational activities together with their sighted peers (Department of Education. 2001) .

The twelve teachers who participated in the study and who had been exposed to Education White Paper 6 said they apply the knowledge and provisions as stipulated within the policy and this is implemented in conjunction with other policies. In this regard, one would expect that learners with educational special needs are catered for and such teachers have broader understanding of policies and the implication thereof or the bearing such policies have on their daily work and planning. This knowledge must translate into classroom activities where diversity is addressed. This means teachers must be able to teach Life Sciences to blind and visually impaired learners.

Teacher (E2) said this in the interview:

“Education White Paper #6 informs us to involve all learners with different barriers. We use it together with learning area policy. We teach basics and apply EWP policy.”

This teacher (E2) gave this picture to show how the policy informs her daily work:

“The teacher has to plan for the different levels of teaching. The classroom must be adequate. There must be proper furniture. I must make enough stimulus material for learners available according to the disability and ensure proper working equipment in the class. There must be proper access to classes and not overcrowd a class. Partially sighted must use contrast and bigger fonts.”

The interviews showed in the later questions that teachers do not have adequate skills to teach Life Sciences to the blind and visually impaired learners, for example teacher (E4) said: “It is difficult to teach a blind learner. A teacher must be trained first and the school is ready.”

The interviews showed that having a blind learner in the Life Sciences class poses a challenge for the teachers in the inclusive schools. Although they have been exposed to Education White Paper #6, this exposure does not translate into knowledge and expertise to deal with the teaching of Life Sciences to the blind and visually impaired learners in the inclusive schools.

6.3.2.5 The extent to which teachers allow blind learners to participate

Kokot et al, (1997:26), point out that learning implies the outcome or results achieved by means of a completed process. This implies that when learners with visual impairment learn Life Sciences, they must attain the prescribed learning outcomes of Life Sciences in the inclusive school.

According to Fraser et al., (1996:50) learners should be made conscious of all demands relating to their tasks, and this implies knowing exactly what is expected of them as learners.

The interviews with teachers revealed that participation is limited. This limitation is caused by the nature of Life Sciences that it requires vision. Teacher (E10) says this:

“They achieve well in Life Sciences because we describe and they write down afterwards. But, sometimes they struggle a bit with things they

cannot see when we do tabulation or I put a picture on the wall for the class to see and analyze.”

The teacher in the inclusive school must bear in mind that learners with visual impairments need assistance in making the connection between vocabulary, and real objects, body movements and abstract ideas (Bhargava, 2004:12). Important vocabulary and concepts should be pre-taught using concrete, multi-sensory experiences combined with verbal explanations. The teacher must review material by asking the learner to describe what s/he understands about the term or concept in order to verify and consolidate understanding of the concept (Bhargava, 2004). New vocabulary should be spelled out verbally and be accompanied by concrete object or experience where possible (Bhargava, 2004).

Learners need to be active agents in their own learning. Suffice it to say verbal teaching only because the learners are blind or have low vision is less than adequate and is putting such learners to an enormous disadvantage. The disadvantage resulting from such imbalance will not help them achieve learning outcomes like other fellow sighted learners.

The researcher wants to draw the attention to the important fact of orientating a blind learner when new Life Sciences concepts are demonstrated. This was not revealed by the interviews and yet it is also crucial. There is a helpful method of teaching new concept to the learner with visual impairment. It is just not enough to place the object for learning on his/her desk or right in front of him/her. This view is further supported by literature that when exploring new objects or in helping direct the learner's attention, use the hand-under-hand technique, in which the teacher places his/her hand under the learner's and guides their hand (Sewell, 2005).

As shown by literature, the combination of techniques and strategies must be used when teaching the blind learner. The fact that learning material is tactile might not be adequate the nature of the tactile material is critical. This is compounded by the fact that these learners have been exposed or not exposed to such material before and or during their

learning experience. This implies teachers' intervention in promoting learning new objects through the experience of touch-to-see. This is discussed in detail in chapter three of this study.

The teachers believe that partially sighted learners do not have problems and they perform well and they are able to deal with classroom activities with relative ease. This view is expressed by one teacher (E7) thus: "We let the child experience. We let them feel. It is not a problem with the partially sighted learner." However, literature shows that the nature of low vision determines vision and that adaptations or some form of techniques need to be used to assist such learners. It is advisable in literature that for learners with low vision, the teacher must use chalk or markers that contrast well with the blackboard or dry erase board (Bhargava, 2004). For older learners, the teacher should ask which colour combinations they prefer. The teacher should be aware of glare on the board (Bhargava, 2004). Allow the learner to move flexibly in order to gain the best view of the board.

Participation of blind learners cannot be limited to both the availability of tactile material as well as the nature of tactile material because sometimes hands cannot give adequate information that is equal to information provided by vision. Such limitation then can sometimes put blind learners to the enormous disadvantage or to be misconstrued or adversely perceived. In case of verbal description, verbal descriptions and directions should be clear and specific. Visual Information needs to be described auditory for learners with visual impairment (Bhargava, 2004).

6.4 Incorporating integration when teaching Life Sciences to blind as foundation to inclusive schools

6.4.1 Influence of integration on teachers

Life Sciences require co-operation and collaborative learning especially for learners with visual impairment. By co-operative learning as means of incorporating integration when teaching Life sciences to learners with visual impairment in the inclusive school, the teacher creates conditions for integration. The strategy of co-operative learning when

teaching Life sciences to learners with visual impairment in the inclusive school will create and promote the situation where a learner with visual impairment becomes an integral part of the inclusive school.

One of the teachers (E10) interviewed put the influence of integration thus:

“We must understand the role of integration that it must support conceptual development of both blind and sighted learners in Life Sciences and as part of the learning programme. I must tell you it affects teaching negatively”.

The interviews with teachers showed that influences of integrated classrooms are quite a challenge to many teachers. Teachers express their concerns and fear of mainstream dumping: a term meaning simply placing learners with visual impairment in the inclusive school that does not have conducive and accessible environment that caters for a wide range of visually impaired learner needs. Teacher (E3) put it thus:

“Integration is difficult because the blind cannot see and cannot do other things like taking part in the experiments with sighted learners.”

Another teacher (E1) raised concerns during the interview that the quality of teaching is compromised. This is how it was put:

“Knowledge required on disability more so the blind to teach Life Sciences adds to the work load and thus the teacher cannot be perfect in her work.”

Interviews with teachers showed that some teachers are not trained and equipped to deal with blind and sighted learners in the same class. Teacher (E5) said:

“You see I am from the mainstream school where we work with specific outcomes even if we integrate classes we use specific outcomes but here you have learners with different needs and this makes it difficult to work in that way because some of these learners are limited according to their disabilities. What can I say, yes! It is not quite good to put learners who are blind with those who can see. At least with the partially sighted it is better because they can see unlike the blind.”

In the interview with teacher (E2), it appears as if he/she is less supportive of integrated classes. This is what was said:

“It is possible to integrate to include all learners except for the blind learners. Blind have their culture which is difficult. Let us put blind together to give them skills and give them the foundation skills. The teacher for the blind learners must be trained. Not all teachers can use brailler and they must be trained.”

Another teacher (E6) said this in the interview about integrated classes:

“Integrated classes need tactile objects for the blind learners and needing differentiation and a lot of work for the teachers.”

This issue of integrated classrooms perceived and addressed in different ways by teachers. This poses a challenge for teachers because only those have the ability to adapt and differentiate their teaching cope with the diverse learner needs. During the interview, teacher (E6) said: “It is not easy. I use my experience because I know how hard it is for a blind child not to have material and not being able to write and read.”

Teachers seem to be thrown in the deep end. It is like the law of the jungle: the survival of the fittest. This calls for teacher support and training in the implementation of Education White Paper 6 as the policy on inclusive education.

6.5 Incorporating equity when teaching Life Sciences to blind learners as foundation in the inclusive schools

Equity goes beyond just making blind and visually impaired learners equal to their fellow sighted learners by being in the same school. It means creating reasonable accommodation for blind and visually impaired learners in the inclusive schools. It includes support and assistive technology as a resource that creates access and accessibility in the learning of Life Sciences.

6.5.1 Ways to ensure that blind learners are equal to other learners

The meta-approach adoption as framework that underpins this research and teachers' practices in the inclusive schools to deal with issues of equity is crucial because it addresses the issue of empowerment and the enhancement of blind and low vision learners potential to learn and become equal and of value (Florian, et al 2006).

This ultimate value in terms of equity that of becoming equal is supported as the objects of value (Burchardt, 2004).

The interviews with Life Sciences teachers indicated that the way to make blind and visually impaired learners equal to their fellow sighted learners is by bringing to class basic resources for learning. Teacher (E5) says:

"I bring braille material and other things like models that he needs and like braille machine to be like other sighted fellow learners." Yet another teacher (E12) holds the view that: "The blind learners are equal to sighted learners because they do same Life Sciences activities and the blind learners must show that they are equal with resources given to them like Braille machine and Braille books."

Yet another teacher (E9) indicated in the interview that equality is done in her school thus: "They do all Life Sciences activities like other learners, the difference is that they are blind, they also take part in other extramural activities. We do not separate them from other learners because this is an inclusive school."

Interviews with teachers showed that integration, availability of Braille material and doing same activities in the same class will make blind and visually impaired learners equal to their fellow sighted learners.

The interview with teacher (E2) showed that placement in the same class and providing material will make blind and visually impaired learners equal to their sighted fellow learners. This is what was said:

"Blind learners are treated like all other children. They are given material. We assess to monitor the progress."

The interviews with teachers showed that teachers think common learning outcomes with Braille material and mutual acceptance among learners brings about equality in classroom. There is more still that is more demanding than just setting of learning outcomes because the means to this end is critical and crucial as shown by Kokot et al, (1997:26), point out that learning implies the outcome or results achieved by means of a completed process. This implies that when learners with visual impairment learn Life Sciences, they must attain the prescribed learning outcomes of Life Sciences in the inclusive school.

The National Curriculum Statement calls on all teachers to offer learning outcomes as prescribed. The differentiation and adaptation is in the teaching strategies and achievement standards and how the teachers adapt the worksheet for blind learners. The curriculum that is single and unified for all South African schools is prescriptive with flexibility as discussed in chapter three of this study. The inclusive schools are no exception to the rule.

6.5.2 Resources available for the blind

Maguvhe (2005) citing Smit (2001:142) holds the view that lack of appropriate resources and lack of materials exasperates the possibilities of effective teaching and learning in the classroom.

Echoing this problem, teacher (E3) says:

“Shortage of suitable Life sciences material for the blind learners makes my work difficult.”

This is what teacher (E2) says:

“There is no suitable Life Sciences material for the blind and parents cannot help either with money because Life Sciences that are tactile are very expensive.”

The interviews with teachers showed that there are limited Life sciences resources in the schools. It is the teacher's ability to be creative and innovative that helps in teaching Life Sciences to the blind and visually impaired learners. Teacher (E3) tells us this:

“There are no resources to teach Life Sciences. Nothing other than words to describe when the simple test is done. Teachers create Life Science models for blind learners. My daughter brings me some small models because she knows I struggle.”

An issue not given full or adequate consideration by those in authority is the high cost of support services necessary for learners such as the visually impaired. They need, among other things and resources not readily available in these inclusive schools. In some cases learners with visual impairment need extra tutorial hours.

Learning experience is important for learners. Learners with visual impairment cannot be deprived of this opportunity by verbalism in teaching. The teacher must allow first-hand experience where possible. A learner must not be exposed to verbal cues only.

This is discussed in detail in chapter three of this study. For this experience to occur, learning material must be accessible and or tactile for blind learners to manipulate with their hands in case it is visual presentation or vision perceived.

Regarding the resources that are available to blind learners, teacher (E2) said:

“We need more hardware and software, classrooms and furniture. We have thermoform, embossers, we have a tiger-pro (producing tactile diagrams). The thing it is only me working on it. There is no other person in the school who knows how to use it.”

Teacher (E3) tells us what equipment is in the school:

“We have resources like tactile atlas, braille machine, close-circuit TV (CCTV), thermoform for duplicating tactile material, braille printer, but teachers don't know how to use them.”

Showing some kind of networking resources, teacher (E5) told us that:

“There are Life Sciences objects and some of the Life Sciences teaching

aids we get from our sister special school.”

Telling us about resources available and related to Life Sciences, teacher (E6) said:

“Braille machines and braille books and some objects that are available like fruits, plants and flowers we use in teaching Life Sciences to our blind learners.”

The evidence coming from the study conducted by Maguvhe (2005) support these findings in this way that there is limited resources With the little that teachers have, they try their best to make science process skills known to blind learners. The unavailability of resources in the form of laboratory equipment, classroom equipment and library equipment obliges blind learners to depend on friends, educators, relatives, and others.

6.5.3 Teachers’ views on district advisers

According to the interviews with Life Sciences teachers, there is limited support from the district and as such teachers need more training and help with their daily challenging task of teaching Life Sciences to the blind and visually impaired learners in the inclusive schools.

Literature clearly shows us that teachers must be prepared for such task in the inclusive schools. English (1985) accentuates this crucial aspect that there is need to prepare inclusive schools classroom teachers, through in-service programmes, if inclusive schooling, through inclusivity, is to be effective.

The interview with teacher (E2) showed that they expect much help from the district officials as subject advisers. This is how it was said:

“District officials are not well equipped and so they are cautious to do something they do not know very well. District must give guidance and it is difficult because they do not know what is like to be in class.”

Teacher (E3) said this about the district officials:

“District officials need to improve their training. We must let them learn from special schools.”

The interview with teacher (E4) showed somewhat less confidence in district subject advisers: This is what was said:

“To date, we have supported ourselves and our learners. District advisers come and observe. I think we are more of help to them. I don't mean it in the negative way. We need their active participation. They come once in a year yet there aren't many inclusive schools. I can't express it because we are presently supporting the district.”

The interviews with teachers revealed that teachers still need to be prepared for inclusive schooling through proper exposure to strategies and technological modalities that will equip teachers to address diversity and blind learner needs in particular in their classrooms. This is expressed this way by one teacher (E7):

“We have no support from the district. We support learners ourselves. We are supporting the district. There is nothing that they do for us. We need active participation from the district to help.”

There is no institutional support team or school based support team in both schools. Teachers call upon district support to land a helping hand and support to teachers. In the absence of district support, inclusive schooling will be a sinking ship.

6.6 Responses from District subject advisers

Some questions are treated together in order to make them more significant, coherent and extensive.

On whether learners with visual impairment should take Life Sciences or not, district officials believe that it needs a teacher who is more innovative, who is more motivated, and who can do more practicals and let learners feel. Endorsing this view, participant D1 said:

“They must do it. There are models, there is braille and the teacher can explain to the blind learner.”

Another participant (D4) had the following to say:

“I don’t think it should be a problem but there must be a way of teaching and learning it because it needs sight.”

Participant D3 endorsed the opinions of the other participant in the following manner:

“A very good idea. Blind learners should do any subject that they wish you to do irrespective of their disabilities. Government should provide appropriate resources.”

District officials think the teacher must have positive attitude and be willing to work hard.

Participants thought it to be good because it gives knowledge and information like any subject at school. The blind learners must not be deprived of this.

Participant (D4) confirmed this:

“It gives them the other type of knowledge and experience but teachers must be able to teach it.”

Participant (D3) supported this view further thus:

“Life Sciences are one of the critical subjects which are a pre-requisite for many careers in SA and therefore if the Education System wants to produce learners who will be able to have good career prospects, it should therefore be taught to blind learners as well.”

District officials concede that there are Preparation challenges because they must make sure that there are objects and models and enough material.

Participant (D4) confirmed it this way:

“I know that teachers depend on me for information and support. It is not always easy to help them all.”

District officials think blind learners experience Problems posed by the nature of Life Sciences. Participant (D2) reported as follows:

“Life Sciences involve experiences and practicals. They deal with what they can see there and observe. In most cases those blind learners when they conduct experiments they cannot see what is happening, they can only feel. For instance when you put salt in the water it dissolves he cannot see that.”

Participant (D1) listed the problem as follows:

“It is the lack of material and proper training in the adapting material for the blind. Others do not know braille and cannot read and write in braille.”

To address this situation, district officials (D1) conduct workshops and train teachers:

“We give them materials and visit schools.”

Participant (D1) exposed the district main challenge as follows:

“There are no enough resources here. We are very few and the schools are many.”

6.7 Synopsis of the findings

6.7.1 Ways of including blind learners in class activities

From the interviews with the Life Sciences teachers it appears that blind learners relied mainly on verbalism and theory and not on real practical's, like observation for learning experience as revealed by literature and discussed in chapter three.

This seems to support the idea that certain teachers lacked competences and skills to accommodate learners with visual impairment during the incorporation of inclusivity when teaching Life Sciences. Those teachers did not improvise. The interviews suggested that blind learners relied on theory and not on good scientific practices only.

Teachers resort to theory and verbalism as the method of teaching.

Learners with visual impairment lose out on investigation and inquiry experiences as demanded by Life Sciences.

These interviews with teachers revealed that little practical work is done in the Life Sciences classrooms without them seeing what is happening.

Ways of including a blind learner in Life Sciences pose a real challenge. The practical observation is a drawback for a blind learner, for example when linear programming is being done. Learners with visual impairment cannot perceive the whole picture in totality at one glance or touch because it is very visual and there are certain things that the teacher normally can't even try and describe for such learners to get a complete picture. In such cases, the teacher tries to teach them the basic principles because is part of the curriculum.

Some teachers suggest providing Braille material and bringing to class some tactile objects for the lesson for blind learners as a way of having them included in class activities like all other learners, or sometimes take them outside the classroom and try to make them feel the texture of different kinds of soil.

Some teachers also expressed frustrations about experiments because the majority of their learners need visual ability to perform and observe. It is for this reason teachers adopt to the collaborative learning approach. This is discussed in details in chapter three. This happens where blind learners are working collaboratively with a learner with low vision. In this case, a learner with low vision can describe the experiment under observation then the blind learner can then record in braille.

6.7.2 The extent to which teachers allow blind learners to participate in Life Sciences

The interviews with Life Sciences teachers revealed that most educators working at the inclusive schools received a general education training qualification. They were not trained in the education for the blind and visually impaired learners. As the result, these teachers show a lack of ideas to adapt the curriculum and accommodate blind and visually impaired learners in the life sciences' environment. Some teachers express the view that blind and visually impaired learners cannot cope with the demands and challenges of life sciences, including observation, exploration and experimentation.

The teachers believe that partially sighted learners do not have problems and they perform well and they are able to deal with classroom activities with relative ease. This view is expressed by teachers during the interviews.

6.7.3 Problems Blind Learners Experience in the Learning of Life Sciences

The majority of teachers – Twelve of the fourteen educators who participated in the study -pointed to the lack of accessible material as a critical problem blind learners had to face.

Twelve of the teachers who participated in this study show that lack of tactile material are the main problem of blind learners in Life Sciences. If tactile material is not available for such learners, learning experience is a problem. In this way, teachers hold the view that provision of tactile material is the solution to inaccessibility.

6.7.4 Challenges teachers experience when preparing for blind learners

Interviews with teachers revealed that when preparing material for teaching Life Sciences to the blind and visually impaired learners the challenge is enormous. Finding accessible material poses a challenge because there is not much for the blind learners in Life Sciences. On challenges when preparing teaching material, some teachers have difficulty in finding accessible teaching material that will accommodate blind learners in Life Sciences. Some teachers point to lack of teacher training that hampers adequate and effective lesson planning and preparation. Other teachers point to the difficulty caused by

not knowing the type of learners they are teaching a factor that renders them not to be able to address their education special needs.

The interviews with Life Sciences teachers revealed that these teachers are not taking an advantage of the flexibility features in the National Curriculum Statement. The National Curriculum Statement depicts that there are a number of options that a teacher who teaches visually impaired learners can adopt. These relate mainly to the features of flexibility of the National Curriculum Statement that teachers use daily in their work.

6.7.5 Challenges experienced by teachers in class

Interviews with Life Sciences teachers showed that the main challenge in the teaching of Life Sciences to blind and visually impaired learners is imbedded in the nature of the National Curriculum Statement. The nature of National Curriculum Statement is that it is visually oriented and this curriculum is implemented in the inclusive school which is the ordinary school converted to become the inclusive school, that is it is made to take learners who, otherwise, according to the previous education dispensation (prior 1994) would go to a special school for specific special education needs. The nature of such school is visually oriented and must be adapted and adjusted to cater for learners with visual impairment. The teachers in such schools have taught from visual perspective material. Their pre-service training, (Initial professional education training) has prepared them for the ordinary schools.

Now because of education paradigm shift, the education landscape has changed. These teachers must address a wide range of diverse learner needs with special education needs. They do not have an inkling of what happens in the special schools for the visually impaired.

This research revealed that teachers have difficulty in making their learners visualize abstract concepts or concepts of things accessible through seeing when making them visualize abstracts concepts when teaching without accessible and tactile material. This is indicative of lack of accessible resources. Teachers have difficulty when blind learners

are supposed to do practical things that require vision. This includes observation when doing experiments with chemicals or changing of colour in the experiment.

The findings of this research revealed that the fact that teachers require competences, skills and exposure to noval assistive technology and tactile resources cannot be over accentuated. The support for teachers from education system through the district support team is yet to be seen and felt by the teachers in their daily work. The call upon teachers to be creative and innovative in noval didactical situation raises an alarm for intervention.

It is the findings of this research through the interviews with teachers that teachers are thrown in the deep end by the education system under the auspices of Education White Paper 6 that stipulates that all learners can learn and that they can learn at an ordinary school near their home. Further, according to the stipulations of Education White Paper 6, the district support teams created to render support services to teachers in class in order to be able to deal with issues of diversity and wide range of learner needs with specific reference to those with special education needs. On the other hand, demands are placed on the teachers to address a wide range of learner needs in the absence of district support. This calls for competencies and skills coupled with knowledge of the education for visual impairment.

According to the findings of this research, all teachers show that achievement of outcomes in Life Sciences by learners with visual impairment is limited. This limitation is confined mainly to availability or lack thereof tactile material for blind learners.

In this regard, according to the research findings then, visual impairment presents challenges in learning Life Sciences. Many science processes are linked to outcomes and activities that are visually connected or dependent. For example, processes that are linked to changes in colour, size, shape, dispositioning and repositioning, movement, changes in direction, and speed or patterns, require the careful observation of the changes.

Where observation by means of visual perception as skill is found lacking, the execution of the integrated (advanced) science process skills will be poorly performed.

6.7.6 Teachers' views on Life Sciences to the blind

Interviews with teachers showed that it is good for blind learners to do Life Sciences. However, this does not seem to be easy for both the teacher to teach Life Sciences and the blind learners to learn Life Sciences. Teaching Life Sciences to blind learners needs training and dedication with positive attitude. But Life Sciences are difficult for them. It needs a lot of description. We don't have the equipment. However, teachers think they must take life sciences they need to have the knowledge accorded by the subject Life Sciences.

According to the interviews, Life Sciences do not create opportunities for equality with other learners who are not visually impaired. Life Sciences, in this sense, does not seem to hold much benefit in terms of experiences afforded by the subject for blind learners in view of the heavy demand it places on both the learner with visual impairment and the teacher who must acquire training and skills then find tactile and accessible material for them.

Teachers are expected to know the provisions and stipulations found in this policy. These provisions have direct bearing on their daily work and their understanding of such policy is crucial.

According to the findings of this study, twelve teachers depict some kind of exposure to Education White Paper 6. Some teachers were exposed through their studies at the tertiary level and others through the workshop conducted by the district. There is common understanding of the main thrust of Education White Paper 6 that it is concerned with ensuring that all learners are given equal educational opportunities regardless of educational difficulties or challenges learners have and understanding that learners cannot be discriminated against on the basis of disability or because of their education special needs.

Teachers do not give much information from their understanding of Education White Paper 6 on how it impacts on their work. One would think teachers would talk also about inclusive Schools. It is the Education White Paper 6 that establishes inclusive schools and

spells out how it will function. This is discussed in details in chapter one and chapter three of this study.

Teachers are expected to function within the provisions of Education White Paper and in this regard one would expect teachers to be well informed because it is about their role in the new kind of school: the inclusive school.

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6.7.7 Policy informing planning

The twelve teachers who participated in the study and who had been exposed to Education White Paper 6 said they apply the knowledge and provisions as stipulated within the policy and this is implemented in conjunction with other policies. In this regard, one would expect that learners with educational special needs are catered for and such teachers have broader understanding of policies and the implication there of or the bearing such policies have on their daily work and planning. This knowledge must translate into classroom activities where diversity is addressed. This means teachers must be able to teach Life Sciences to blind and visually impaired learners.

The interviews showed in the later questions that teachers do not have adequate skills to teach Life Sciences to the blind and visually impaired learners, for example teacher (E4) said:

“It is difficult to teach a blind learner. A teacher must be trained first and the school is ready.”

The interviews showed that having a blind learner in the Life Sciences class poses a challenge for the teachers in the inclusive schools. Although they have been exposed to Education White Paper #6, this exposure does not translate into knowledge and expertise to deal with the teaching of Life Sciences to the blind and visually impaired learners in the inclusive schools.

6.7.8 The extent to which teachers allow blind learners to participate

The interviews with teachers revealed that participation is limited. This limitation is caused by the nature of Life Sciences that it requires vision. Teacher (E10) says this:

“They achieve well in Life Sciences because we describe and they write down afterwards. But, sometimes they struggle a bit with things they cannot see when we do tabulation or I put a picture on the wall for the class to see and analyse.”

6.7.9 Influences of integration on the teachers

The interviews with teachers showed that influences of integrated classrooms are quite a challenge to many teachers. Teachers express their concerns and fear of mainstream dumping: a term meaning simply placing learners with visual impairment in the inclusive school that does not have conducive and accessible environment that caters for a wide range of visually impaired learner needs. Teacher (E3) put it thus:

“Integration is difficult because the blind cannot see and cannot do other things like taking part in the experiments with sighted learners.”

Teachers raised concerns during the interview that the quality of teaching is compromised. Knowledge required on disability more so the blind to teach Life Sciences adds to the work load and thus the teacher cannot be perfect in her work.

This issue of integrated classrooms perceived and addressed in different ways by teachers. This poses a challenge for teachers because only those have the ability to adapt and differentiate their teaching cope with the diverse learner needs.

6.7.10 Ways of ensuring blind learners are equal to other learners

Interviews with teachers showed that integration, availability of Braille material and doing same activities in the same class will make blind and visually impaired learners equal to their fellow sighted learners.

The interviews with teachers showed that teachers think common learning outcomes with Braille material and mutual acceptance among learners brings about equality in classroom. There is more still that is more demanding than just setting of learning outcomes because the means to this end is critical and crucial as shown by Kokot et al, (1997:26), point out that learning implies the outcome or results achieved by means of a completed process. This implies that when learners with visual impairment learn Life Sciences, they must attain the prescribed learning outcomes of Life Sciences in the inclusive school.

6.7.11 Resources available for blind learners

The interviews with teachers showed that there are limited Life sciences resources in the schools. It is the teacher's ability to be creative and innovative that helps in teaching Life Sciences to the blind and visually impaired learners.

An issue not given full or adequate consideration by those in authority is the high cost of support services necessary for learners such as the visually impaired. They need, among other things and resources not readily available in these inclusive schools. In some cases learners with visual impairment need extra tutorial hours.

6.7.12 Teachers' views on district subject advisers

According to the interviews with Life Sciences teachers, there is limited support from the district and as such teachers need more training and help with their daily challenging task of teaching Life Sciences to the blind and visually impaired learners in the inclusive schools. Teachers feel that they are of help to the district not the other way round. Teachers also feel that district advisers are less qualified to offer help in teaching Life Sciences to the blind and visually impaired learners.

6.7.13 Responses from district subject advisers

On whether learners with visual impairment should take Life Sciences or not, district officials believe that it needs a teacher who is more innovative, who is more motivated, and who can do more practicals and let learners feel. Subject advisers said that they don't think Life Sciences should be a problem but there must be a way of teaching and learning it because it needs sight.

District officials think the teacher must have positive attitude and be willing to work hard. Participants thought it to be good because it gives knowledge and information like any subject at school. The blind learners must not be deprived of this.

Another district official (D4) says that, subject advisers believe that Life Sciences is one of the critical subjects which is a pre-requisite for many careers in SA and therefore if the Education System wants to produce learners who will be able to have good career prospects, it should therefore be taught to blind learners as well.

District officials concede that there are Preparation challenges because they must make sure that there are objects and models and enough material. District officials think blind learners experience Problems posed by the nature of Life Sciences plus the fact that is the lack of material and proper training in the adapting material for the blind that exacerbates the situation.

To address this situation, district subject advisers said that they conduct workshops and train teachers. They give them materials and visit their schools.

Subject advisers revealed the district main challenge to be lack of enough resources and they are very few and the schools are many.

6.8 Conclusion

It is very important that educators discover that integration, equity and inclusivity constitute a package. They are the main ingredients for the foundation of inclusive schooling. We cannot talk of inclusive education unless we mean integration, equity and inclusivity. Just as outcomes-based education and inclusive education are interrelated and cannot be divided, so are integration, equity and inclusivity. Outcomes-based education is a useful tool for implementing integration, equity and inclusivity: inclusive education. One of the most important features of outcomes-based education is that it is concerned with establishing the conditions and opportunities within the system that enable and encourage all learners to achieve those important outcomes. An inclusive curriculum is based on a view that learning takes place when learners are actively involved in making sense of their experiences - they have to find things out and assign meaning to them.

This study has brought to light the fact that the three-pronged faceted strategy is critical and decisive in the implementation of the inclusive schools. Integration which incorporates virtues of mutual acceptance and acknowledgement of diversity cannot be left out of the equation because learners with visual impairment need to feel and be made part of the equation in the inclusive school, and yet this crucial aspect is not the stand-alone and independent factor of ensuring success.

The second aspect in the triune strategy is the inclusivity. This relates mainly to the adaptation and differentiation in teaching. It creates educational opportunities and learning experiences for learners with visual impairment. It brings about the equilibrium in the equation by addressing the issues of accessible teaching and learning setup. This can never be the stand-alone concept. It is the indispensable part in the equation of inclusive schooling.

The third part is equity. This encompasses issues of access and accessibility under the auspices of reasonable accommodation at school. It is this part that brings about, among other things, issues of resources. It addresses the availability of accessible resources that will put a learner with visual impairment on the same footing as his sighted peers. It is not a stand-alone concept because it constitutes the elemental ingredient in the building of the foundation of the inclusive school. This three-faceted strategy is calculated at creating conditions for success at the inclusive school that will address the issues that have direct bearing on the teaching and learning of learners with visual impairment.

Simply placing either a blind or learner with low vision learner in an inclusive class at an inclusive school and not providing such a learner with access to learning material, learning environment and learning equipment does not constitute inclusive school. The role of the teacher is to address the issue of inclusivity, integration and equity by providing the needed conducive environment so that the blind learner and a learner with low vision can successfully be educated in an inclusive classroom.

The proposed three-pronged strategy presupposes a two-pronged systemic approach. This two-pronged systemic approach comprises human resource development and support structures. These two entities together they form a system. Human resource development

is the content and the support structures the delivery structures. The two tributaries meet in the educator corpse. This then becomes the agent of impact where the tyre hits the road.

The education paradigm shift changes the education landscape by overhauling the education system. Now we are confronted with the novelty. It is not business as usual in the education sector. This change or shift calls for appropriate response. Therefore, it is imperative for the education system to be responsive and address these challenges of novelty.

The system ought not to be labelling rather enabling its learner fraternity. The tapestry of each individual is unique. No two visually impaired learners are homogeneous. The content of human resource development ought to comprise a tool for learner special education needs and multi-skilling for addressing these needs. The support structures are indispensable to mediate support.

Chapter seven deals in details about the proposed two- pronged systemic approach.

CHAPTER 7: Summary of the results of the empirical investigation, conclusions, recommendations and implications

7.1 Introduction

The main aim of this research was to determine how integration, equity and inclusivity when teaching Life Sciences is incorporated in inclusive schools with visually impaired learners and to establish how the lessons learnt from this experience could be implemented to the advantage of such learners in the other inclusive settings and in Outcomes-based education settings. The purpose of this chapter is in the first instance to summarise the main findings that emerged from the review of the literature and from the empirical investigation. This is followed by the recommendations which apply to the research as well as the implication of such recommendations to theory and practice. The establishment of support structures is discussed and the new role of the itinerant teacher is discussed as part of the recommendations. The limitations of the study are given pointing to future research. The conclusion of the study provides the main thought of the research and gives the conclusion of the research study.

7.2 Summary of the main aim and objectives of the investigation

To achieve the aim listed above, the following objectives were envisaged for the study, as outlined in chapter 1, paragraph 1.6 of this research:

- To determine how the inclusive policy informs us on inclusivity, equity and integration and to determine what the envisaged influences of these concepts as foundation for inclusive schooling are on the quality of teaching and learning of the Life Sciences in Inclusive) school.
- To determine which variables restrict the incorporation of integration, equity and inclusivity when teaching Life Sciences to learners with visual impairment in the

inclusive school in order to achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.

- To determine what adaptations will be required to support visually impaired learners at the inclusive school so as to incorporate integration, equity and inclusivity when teaching Life Sciences to learners with visual impairment in the inclusive school in order to achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.
- To determine how teachers in the inclusive schools should be prepared by the district officials to adapt their teaching to incorporate integration, equity and inclusivity when teaching Life Sciences to learners with visual impairment in the inclusive school and thus achieve the learning outcomes (highest possible learning quality) specified for the Life Sciences.

7.3 Summary of the main and secondary research questions

In a quest to address the research problem and in an attempt to achieve the aim of the investigation, the researcher formulated the following research question and accompanying sub-questions.

7.3.1 Primary Research Question

How do district officials and teachers deal with integration, inclusivity and equity in the teaching of Life Sciences to blind and visually impaired learners and how do these concepts manifest themselves as being foundational for schooling and what influences do these concepts have on the teaching and learning of Life Sciences to blind and visually impaired learners in Inclusive schools?

The first focuses on incorporating integration when teaching Life Sciences emanating from the implementation of Education White Paper 6 that promotes integrated classes in terms of disability or otherwise. The understanding of this Education White Paper 6 is

crucial and critical because it has direct bearing on incorporating Integration when teaching Life Sciences where vision, experimentation, observation, etc. is a core to learners with visual impairment: that is creating co-operative learning and conducive friendly environment in class where all learners regardless of disability are equal class mates learning side by side in the same class.

The second and the third questions deal with the incorporation of equity when teaching Life Sciences to learners with visual impairment, with specific reference to resources: assistive technology in Life Sciences like colour detector for the blind, access and accessibility in terms of teaching and learning support material) and

Incorporating inclusivity: learning strategies, science process skills, curriculum adaptation and curriculum modification).

The fourth secondary questions deals with district support that is given to the teachers in the inclusive schools per the provisions of Education White Paper 6.

7.3.2 Secondary questions

The following secondary questions were addressed during the course of the investigation:

- How does the inclusive policy inform us on inclusivity, equity and integration and what are the envisaged influences of these concepts on the quality of teaching and learning of the Life Sciences?
- Which variables restrict inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the life sciences?
- What adaptations will be required to support visually impaired learners at the inclusive school so as to facilitate inclusivity in order to achieve the learning outcomes (highest possible learning quality) specified for the life sciences?

- How should teachers in the full service schools be prepared by the districts to adapt their teaching to incorporate integration, equity and inclusivity in their teaching so as to achieve the learning outcomes (highest possible learning quality) specified for the life sciences?

7.4 The Main Findings of the Empirical Investigation

7.4.1 Ways of including blind learners in class activities

From the interviews with the Life Sciences teachers it appears that blind learners relied mainly on verbalism and theory and not on real practical's, like observation for learning experience as revealed by literature and discussed in chapter three.

This seems to support the idea that certain teachers lacked competences and skills to accommodate learners with visual impairment during the incorporation of inclusivity when teaching Life Sciences. Those teachers did not improvise. The interviews suggested that blind learners relied on theory and not on good scientific practices only.

Teachers resort to theory and verbalism as the method of teaching.

Learners with visual impairment lose out on investigation and inquiry experiences as demanded by Life Sciences.

These interviews with teachers revealed that little practical work is done in the Life Sciences classrooms without them seeing what is happening.

Ways of including a blind learner in Life Sciences pose a real challenge. The practical observation is a drawback for a blind learner, for example when linear programming is being done. Learners with visual impairment cannot perceive the whole picture in totality at one glance or touch because it is very visual and there are certain things that the teacher normally can't even try and describe for such learners to get a complete picture.

In such cases, the teacher tries to teach them the basic principles because is part of the curriculum.

Some teachers suggest providing Braille material and bringing to class some tactile objects for the lesson for blind learners as a way of having them included in class activities like all other learners, or sometimes take them outside the classroom and try to make them feel the texture of different kinds of soil.

Some teachers also expressed frustrations about experiments because the majority of their learners need visual ability to perform and observe. It is for this reason teachers adopt to the collaborative learning approach. This is discussed in details in chapter three. This happens where blind learners are working collaboratively with a learner with low vision. In this case, a learner with low vision can describe the experiment under observation then the blind learner can then record in braille.

7.4.2 The extent to which teachers allow blind learners to participate in Life Sciences

The interviews with Life Sciences teachers revealed that most educators working at the inclusive schools received a general education training qualification. They were not trained in the education for the blind and visually impaired learners. As the result, these teachers show a lack of ideas to adapt the curriculum and accommodate blind and visually impaired learners in the life sciences' environment. Some teachers express the view that blind and visually impaired learners cannot cope with the demands and challenges of life sciences, including observation, exploration and experimentation. The teachers believe that partially sighted learners do not have problems and they perform well and they are able to deal with classroom activities with relative ease. This view is expressed by teachers during the interviews.

7.4.3 Problems blind learners experience in the learning of Life Sciences

The majority of teachers – Twelve of the fourteen educators who participated in the study – pointed to the lack of accessible material as a critical problem blind learners had to face.

Twelve of the teachers who participated in this study show that lack of tactile material are the main problem of blind learners in Life Sciences. If tactile material is not available for such learners, learning experience is a problem. In this way, teachers hold the view that provision of tactile material is the solution to inaccessibility.

7.4.4 Challenges teachers experience when preparing for blind learners

Interviews with teachers revealed that when preparing material for teaching Life Sciences to the blind and visually impaired learners the challenge is enormous finding accessible material poses a challenge because there is not much for the blind learners in Life Sciences. On challenges when preparing teaching material, some teachers have difficulty in finding accessible teaching material that will accommodate blind learners in Life Sciences. Some teachers point to lack of teacher training that hampers adequate and effective lesson planning and preparation. Other teachers point to the difficulty caused by not knowing the type of learners they are teaching a factor that renders them not to be able to address their education special needs.

The interviews with Life Sciences teachers revealed that these teachers are not taking an advantage of the flexibility features in the National Curriculum Statement. The National Curriculum Statement depicts that there are a number of options that a teacher who teaches visually impaired learners can adopt. These relate mainly to the features of flexibility of the National Curriculum Statement that teachers use daily in their work.

7.4.5 Challenges experienced by teachers in class

Interviews with Life Sciences teachers showed that the main challenge in the teaching of Life Sciences to blind and visually impaired learners is imbedded in the nature of the

National Curriculum Statement. The nature of National Curriculum Statement is that it is visually oriented and this curriculum is implemented in the inclusive school which is the ordinary school converted to become the inclusive school, that is it is made to take learners who, otherwise, according to the previous education dispensation (prior 1994) would go to a special school for specific special education needs. The nature of such school is visually oriented and must be adapted and adjusted to cater for learners with visual impairment. The teachers in such schools have taught from visual perspective material. Their pre-service training, (Initial professional education training) has prepared them for the ordinary schools. Now because of education paradigm shift, the education landscape has changed. These teachers must address a wide range of diverse learner needs with special education needs. They do not have an inkling of what happens in the special schools for the visually impaired.

This research revealed that teachers have difficulty in making their learners visualize abstract concepts or concepts of things accessible through seeing when making them visualize abstracts concepts when teaching without accessible and tactile material. This is indicative of lack of accessible resources. Teachers have difficulty when blind learners are supposed to do practical things that require vision. This includes observation when doing experiments with chemicals or changing of colour in the experiment.

The findings of this research revealed that the fact that teachers require competences, skills and exposure to noval assistive technology and tactile resources cannot be over accentuated. The support for teachers from education system through the district support team is yet to be seen and felt by the teachers in their daily work. The call upon teachers to be creative and innovative in noval didactical situation raises an alarm for intervention. It is the findings of this research through the interviews with teachers that teachers are thrown in the deep end by the education system under the auspices of Education White Paper 6 that stipulates that all learners can learn and that they can learn at an ordinary school near their home. Further, according to the stipulations of Education White Paper 6, the district support teams created to render support services to teachers in class in order to be able to deal with issues of diversity and wide range of learner needs with specific

reference to those with special education needs. On the other hand, demands are placed on the teachers to address a wide range of learner needs in the absence of district support. This calls for competencies and skills coupled with knowledge of the education for visual impairment.

According to the findings of this research, all teachers show that achievement of outcomes in Life Sciences by learners with visual impairment is limited.

This limitation is confined mainly to availability or lack thereof tactile material for blind learners.

In this regard, according to the research findings then, visual impairment presents challenges in learning Life Science.

Many science processes are linked to outcomes and activities that are visually connected or dependent. For example, processes that are linked to changes in colour, size, shape, dispositioning and repositioning, movement, changes in direction, and speed or patterns, require the careful observation of the changes. Where observation by means of visual perception as skill is found lacking, the execution of the integrated (advanced) science process skills will be poorly performed.

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The interviews showed in the later questions that teachers do not have adequate skills to teach Life Sciences to the blind and visually impaired learners, for example teacher (E4) said: “It is difficult to teach a blind learner. A teacher must be trained first and the school is ready.”

The interviews showed that having a blind learner in the Life Sciences class poses a challenge for the teachers in the inclusive schools. Although they have been exposed to Education White Paper #6, this exposure does not translate into knowledge and expertise to deal with the teaching of Life Sciences to the blind and visually impaired learners in the inclusive schools.

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The interviews with teachers revealed that participation is limited. This limitation is caused by the nature of Life Sciences that it requires vision. Teacher (E10) says this:

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The interviews with teachers showed that there are limited Life sciences resources in the schools. It is the teacher's ability to be creative and innovative that helps in teaching Life Sciences to the blind and visually impaired learners.

An issue not given full or adequate consideration by those in authority is the high cost of support services necessary for learners such as the visually impaired. They need, among other things and resources not readily available in these inclusive schools. In some cases learners with visual impairment need extra tutorial hours.

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To address this situation, district subject advisers said that they conduct workshops and train teachers. They give them materials and visit their schools.

Subject advisers revealed the district main challenge to be lack of enough resources and they are very few and the schools are many.

7.5 Findings from the literature

7.5.1 Ways to include blind learners in Life Sciences

Literature informs us that learner-centered approach to observation demands that learners are expected to analyse their observations. The absence of visual ability deprives learners

with visual impairment of the advantage of observation (Borg 1987:157-158). Such deprivation causes blind learners to be less competitive during Life Sciences class.

One of the most important features of outcomes-based education is that it is concerned with establishing the conditions and opportunities within the system that enable and encourage all learners to achieve those important outcomes. An inclusive curriculum is based on a view that learning takes place when learners are actively involved in making sense of their experiences – they have to find things out and understand things for themselves (Da Costa, 2003:56).

Literature tells us that for blind and visually impaired learners, it is essential that they acquire science processing skills. The acquisition of basic science process skills serve as a prerequisite for advanced science skills that comes once the learner has mastered the basic process skills.

The threshold of the learning of basic science skills occurs through sensorimotor and cognitive skills, as of great significance because this leads to the development and enhancement of other advanced science skills as specified by the Life sciences learning outcome above. These include: discovery, observation, inquiry, investigation, experimentation, analysis, measurements, prediction, problem-solving and evaluation.

Erwin et al., (2001:339) argue that learners who have acquired basic science process skills have positive, consistent and successful experiences in science that will enable them to explore, discover and ask questions about the world in which they live.

Van Aswegen et al., (1993:15) point out that the concept “process” encompasses what is in line with what scientists do: the processes they carry out in their own scientific activities. Through this process, scientists gain valuable information through observing, classifying, inferring, measuring, using space or time relationships, using numbers, communicating, hypothesizing, and performing experiments.

7.5.2 The extent to which teachers allow blind learners to participate in Life Sciences

The interviews with Life Sciences teachers revealed that most educators working at the inclusive schools received a general education training qualification. They were not trained in the education for the blind and visually impaired learners.

As the result, these teachers show a lack of ideas to adapt the curriculum and accommodate blind and visually impaired learners in the life sciences' environment. Some teachers express the view that blind and visually impaired learners cannot cope with the demands and challenges of life sciences, including observation, exploration and experimentation.

The research conducted by Maguvhe (2005) points out that according to evidence, Maguvhe argues that, access to the learning mediation of biology including experimentation and exploration is limited. In his view, he argues that this state of affairs endorses the argument that the learning mediation of biology depends on one's visual ability, thus making it difficult for blind learners to access information

Maguvhe (2005) citing Borg (1987:157-158) argues that observational processes are important in enabling individuals to collect direct information. Such lack depicts blind learners' deprivation of opportunities to study specific aspects because they cannot observe. This deprivation puts blind learners at an enormous disadvantage making them to be less competitive during the process of learning biology. Blind learners will only be made equal and on the same par in order to be able to be competitive when they are fully exposed to all biology phenomena.

Maguvhe (2005) established that there is evidence showing that even if blind learners are not able to observe experiments visually, they still benefit from explanations given by partially sighted classmates and teachers particularly with practicals, because of their complexities and challenges that they may pose to blind learners, teamwork between blind and partially sighted learners is encouraged so that they could assist one another.

Literature informs us that for participatory experience to occur, learning material must be accessible and or tactile for blind learners to manipulate with their hands in case it is visual presentation or vision perceived. New vocabulary should be spelled out verbally (Barghava, 2004).

This view is further supported by literature that when exploring new objects or in helping direct the learner's attention, use the hand-under-hand technique, in which the teacher places his/her hand under the learner's and guides their hand (Sewell, 2005).

7.5.3 Problems Blind Learners Experience in the Learning of Life Sciences

Interviews with teachers supported literature by pointing to the lack of accessible material as a critical the problem for blind learners had to face.

In the observation done by Maguvhe (2005) he expresses the related frustrations experienced by teachers regarding experiments since most of their learners need visual ability to perform and observe. Hence, educators resorted to the teamwork approach (pairing blind and partially sighted learners together) so that the partially sighted learners could supply blind learners with visual experiences.

In line with the findings of this research, Fraser (1996:68) maintains that from a teaching and learning point of view the ability to observe remains a crucial aspect applicable to teaching and learning in general. Observation is foundation al to the science processes and without observation; learning will be restricted and easily become less meaningful Regarding this problem revealed by the findings of this study, literature say this is so because, at its core, Science and Biology are founded on observation: watching things, measuring them, analysing their properties, figuring out how they work, making analysis of relationships and properties (Kumagai, 1995:82).

7.5.4 Challenges teachers experience when preparing for blind learners

Maguvhe (2005) revealed that finding accessible material poses a challenge because there is not much for the blind learners in Life Sciences.

Maguvhe, (2005) points out that the teaching and learning of Life Sciences is susceptible to some kind of debate, particularly concerning observation, teaching and learning strategies, resources, creativeness, innovativeness, and the like.

“If teachers are not creative, they are defeating one of the objectives of Outcomes-based Education and Training, which is to eliminate rote learning and promote critical thinking and creative teaching. Feelings of ineffectiveness, hopelessness, discouragement and/or incompetence in educators may bring about ineffectiveness in practical adaptations (e.g. of experiments). On the other hand, if educators find themselves in supportive work conditions, they gain a sense of achievement and accomplishment.”

The findings from the study conducted by Maguvhe (2005) suggests that should schools be resourced, blind learners will practically and theoretically be equipped with science process skills. In addition, observations will be possible and meaningful to them.

Further, literature points out that, according to Forlin (2004:4), inclusivity can be achieved through adaptation of material and curriculum differentiation. This strategy will cater for all learners with differing needs. In this regard, inclusivity means teachers must reformulate their traditional methods of teaching to include or accommodate learners who are visually impaired (Booth and Amscow, 1998:7).

In supporting this view, Sapon-Shevin (2001:2), states that by definition, inclusivity relates to making changes in the nature and quality of the general education classroom. Furthermore, according to Sapon-Shevin, the instructional strategies and adaptations provided for learners in special schools can be provided in ordinary classrooms on condition that classrooms are reconceptualised.

7.5.5 Challenges experienced by teachers in class

The main challenge for Life Sciences teachers is that Life Sciences teaching and learning depends largely on vision. The teachers here deal with blind and visually impaired learners. In support of this argument, Arentz and Sterkenburg (2002:1) argue that the most important part of learning is observation.

Regarding this problem revealed by the interviews, literature say this is so because, at its core, Science is founded on observation: watching things, measuring them, analysing their properties, figuring out how they work, making analysis of relationships and properties (Kumagai, 1995:82).

Fraser et al., (1996:48) point out that learning involves intellectual ability, which will make it possible for learners to link new concepts to relevant concepts.

7.5.6 The extent to which teachers allow blind learners to participate

Literature informs us that participation in didactic situation must result in learning. Kokot et al, (1997:26), point out that learning implies the outcome or results achieved by means of a completed process. This implies that when learners with visual impairment learn Life Sciences, they must attain the prescribed learning outcomes of Life Sciences in the inclusive school. According to Fraser et al., (1996:50) learners should be made conscious of all demands relating to their tasks, and this implies knowing exactly what is expected of them as learners.

According to Fraser et al., (1996:51) these educators' immense contributions should:

- Motivate learners to become aware of their own, existing way of learning.
- Assist and encourage learners to develop a deep approach to learning.
- Encourage learners to develop skills with which to exploit their existing knowledge in order to solve future problems.

- Make all experiences, with specific reference to the learning experiences, content related.
- Encourage cooperative learning in the classroom to give learners the opportunity to reflect their own learning and that of others.

Van Der Horst and McDonald (1997:124) defined learning strategies as a broad plan of action for teaching activities with a view to achieving an aim.

Pauw (1990b:31) considered learning strategies as processes through which an individual develops or acquires knowledge, skills or attitudes.

The teacher in the inclusive school must bear in mind that Learners with visual impairments need assistance in making the connection between vocabulary, and real objects, body movements and abstract ideas (Bhargava, 2004:12). Important vocabulary and concepts should be pre-taught using concrete, multi-sensory experiences combined with verbal explanations. The teacher must review material by asking the learner to describe what s/he understands about the term or concept in order to verify and consolidate understanding of the concept (Bhargava, 2004). New vocabulary should be spelled out verbally and be accompanied by concrete object or experience where possible (Bhargava, 2004).

According to Fraser et al., (1996:51) blind and visually impaired learners will learn Life Sciences only if facts of reality are placed within the reach of the learner. This must, however, be done in such a way that details to be observed and perceived by the learners are converted into concrete facts of reality.

Learners learn by being exposed to various ways of knowing. Such ways include creativity (imagination) and innovation.

Participation of blind learners cannot be limited to both the availability of tactile material as well as the nature of tactile material because sometimes hands cannot give adequate information that is equal to information provided by vision. Such limitation then can

sometimes put blind learners to the enormous disadvantage or to be misconstrued or adversely perceived. In case of verbal description, verbal descriptions and directions should be clear and specific. Visual Information needs to be described auditory for learners with visual impairment (Bhargava, 2004).

7.5.7 Influence of integration on teachers

Fraser et al., (1996:38) are of the view that learners learn when one or more stimuli are reinforced by social interactions and linked to one or more responses (relations). In addition, learners learn best when they regard learning as the formation of associations between physical stimuli and observable reactions.

In addition, Holdstock (1987:107) argued that the appropriate attitude on the part of the teacher is necessary for the establishment of a climate in which learning can take place.

Clark (1982:57) argued that regardless of the disability, personal and professional acceptance of the disabled is the ultimate key to success.

7.5.8 Ways to ensure blind learners are equal to others

The meta-approach adoption as framework that underpins this research and teachers' practices in the inclusive schools to deal with issues of equity is crucial because it addresses the issue of empowerment and the enhancement of blind and low vision learners potential to learn and become equal and of value (Florian, et al 2006).

This ultimate value in terms of equity that of becoming equal is supported as the objects of value (Burchardt, 2004).

One of the most important features of outcomes-based education is that it is concerned with establishing the conditions and opportunities within the system that enable and encourage all learners to achieve those important outcomes. An inclusive curriculum is

based on a view that learning takes place when learners are actively involved in making sense of their experiences – they have to find things out and understand things for themselves (Da Costa, 2003: 56).

Given the above constraint, appropriate adjustments can be made to the curriculum that render it more accessible and, as Casimir and Alchin, (2001) have pointed out, thus enabling both teachers and learners with special needs to take advantage of the many rich learning opportunities available to them. For teachers, designing a classroom with assistive technology that is accessible for learners with significant vision impairment can appear a daunting task. Despite such initial apprehensions, curriculum accessibility can be increased with minimal disruption to others in the class through the use of assistive technology.

Kelley and Gale (1998) have contended that literacy and numeracy acquisition, particularly through the medium of Braille should involve instruction across all key-learning areas, to the same level of proficiency expected of the learner's sighted peers. Learners should be exposed to text in the full range of contexts, formats and genres, as for example, environmental, factual and fictional.

Trief and Feeney (2003:137) argued that, among other things, blind and visually impaired learners learn if they have acquired study and note taking skills using Braille machine, talking computer or braille frame and stylus. These learners should know how to handle the stress of the inclusive classed.

Literature show us that assistive technology is one of the ways of ensuring that blind and visually impaired learners are equal to their fellow sighted learners. Assistive technology is a powerful tool more than ever before, in the current technological epoch. It has power to revolutionize lives of learners with visual impairment.

In this regard, we employ the words of Dr Mike Steer (2008):

“A wide variety of new technology is currently available to enhance the success of learners with vision impairments in the classroom, laboratory, and workshop or at home. Since it should not automatically be assumed that every tertiary setting, or teacher, nor every

disability specialist teacher has a thorough knowledge of the many devices that might meet a vision impaired learner's particular need, the focus of this paper is upon fundamental concepts that considerably enhance teacher and learner effectiveness in using specialised technology.”

The term assistive technology refers to items, or pieces of equipment, or products, whether acquired commercially, or off the shelf, modified or customized, that are used to increase, maintain or improve the functional capabilities of individuals with disabilities (Kochhar and West, 1996).

In ensuring that blind and visually impaired learners are not marginalized and excluded from equal learning opportunities and learning outcomes, National Curriculum Statement calls on all teachers to offer learning outcomes as prescribed. The differentiation and adaptation is in the teaching strategies and achievement standards and how the teachers adapt the worksheet for blind learners. The curriculum that is single and unified for all South African schools is prescriptive with flexibility as discussed in chapter three of this study. The inclusive schools are no exception to the rule (Department of Education, 2008).

7.5.9 Resources available for the blind

Visual impairment is the loss of visual function of such magnitude that special aids and use of other senses are necessary to achieve performance ordinarily directed by visual clues. Learners who have vision impairments range from having total absence of sight to varying degrees of useful vision. Because a learner is vision impaired, it should not be assumed that he or she is unable to participate in educational activities. There is for learners who are blind or vision impaired a wide variety of special aids and/or accommodations that address equity, making learners with visual impairment equal to seeing fellow learners and thus facilitate learning in the classroom setting.

The academic success of learners who are blind or vision impaired, whether in special, integrated or inclusive school settings depends on a variety of factors? Among these is their ability to access the classroom curriculum.

Curriculum access for blind and vision-impaired learners requires provision of the same books and resource materials as those provided for sighted learners. However, these need to be provided in an appropriate format, for example, Braille, large print, e-text and audio), at the same time and at the same level, including the same book edition (Kelley and Gale, 1998).

Maguvhe (2005) citing Smit (2001:142) holds the view that lack of appropriate resources and lack of materials exasperates the possibilities of effective teaching and learning in the classroom.

7.6 Recommendations

The researcher wishes to make the following recommendations based on the following factors:

- (i) Interviews with Life Sciences teachers from inclusive schools in the Mpumalanga province tabled in chapter five and discussed in chapter six of this research;
- (ii) Interviews with district subject advisers in the Mpumalanga province tabled in chapter five and discussed in chapter six of this research;
- (iii) Analysis of the empirical investigation discussed in chapter six of this research; and
- (iv) Findings of the empirical investigation discussed in chapter six of this research.

7.6.1 Human resource development

Interviews with teachers showed that it is good for blind learners to do Life Sciences. However, this does not seem to be easy for both the teacher to teach Life Sciences and the blind learners to learn Life Sciences. Teacher (E3) said:

“Blind learners must do the subject Life Sciences like others to gain knowledge. Teaching Life Sciences to blind learners needs well educated, supportive and good trained teacher. It is good for blind learners to do Life Sciences because it brings about knowledge and competency in life, society and science in general.”

In another interview, teacher (E4) said this about blind learners taking Life Sciences:

“Teaching Life Sciences to blind learners needs training and dedication with positive attitude. But Life Sciences are difficult for them. It needs a lot of description. We don’t have the equipment. However, I think they must take life sciences they need to know ecology.”

Another teacher (E5) said this about her blind learners and Life Sciences:

“They must take Life Sciences because they have the intellect and they just cannot see. We must give them chance and let not blindness restrict them. It could be a way to a career in technology. Later this knowledge might help him see these things (experiences).”

Interviews with district subject advisers showed that their help to teachers is limited and more training for teachers is required. Participant (D1) listed the problem as follows:

“It is the lack of material and proper training in the adapting material for the blind. Others do not know braille and cannot read and write in braille.”

Participant (D4) confirmed it this way:

“I know that teachers depend on me for information and support. It is not always easy to help them all.”

Literature support human resource development, Council of Administrators of Special Education (2008) by asserting that inclusive schooling cannot work for any learners with visual impairment that are "dumped" into ordinary classes with an untrained teacher and without on-going support.

7.6.1.1 Training in basic Life Sciences skills, curriculum adaptation and modification

The interviews with teachers revealed that training is a prerequisite for teaching Life Sciences to the blind and visually impaired learners. One teacher (E4) put it thus:

“I’m not being negative. This is my honest opinion. Adequate training, infrastructure like buildings must be prepared before a blind learner is admitted to the school.”

Most educators working at schools for the blind and visually impaired received a general education training qualification. They lack ideas to adapt the curriculum and accommodate blind and visually impaired learners in the life sciences' environment. This implies that they will not encourage learners to do a difficult subject while they cannot teach it properly.

Erwin et al., (2001:339) argue that learners who have acquired basic science process skills have positive, consistent and successful experiences in science that will enable them to explore, discover and ask questions about the world in which they live.

The acquisition of basic science process skills serve as a prerequisite for advanced science skills that comes once the learner has mastered the basic process skills.

The threshold of the learning of basic science skills occurs through sensorimotor and cognitive skills, as of great significance because this leads to the development and enhancement of other advanced science skills as specified by the Life sciences learning outcome above. These include: discovery, observation, inquiry, investigation, experimentation, analysis, measurements, prediction, problem-solving and evaluation.

Outcomes-based Education and Training (2008) aims at increasing the general knowledge of the learners as well as developing their skills, critical thinking, attitudes and understanding.

If learners with visual impairment do not acquire basic science process skills they will only acquire superficial knowledge instead of a knowledge that is scientific and

profound. Deprivation of the science process skills depicts learners with visual impairment lacking scientific experiences and data gathered through observations, predictions, experimentation, measurement, problem-solving, communicating, inferring, evaluating, et cetera. Lack of basic science process skills will deprive blind learners of the stimulation and motivation which are crucial during learning. Lack of these skills will deprive blind learners of the enhancement afforded by the provision of inquiry activities that are crucial for helping all learners to develop problem-solving skills. Problem-solving skills are crucial in science because learners become creative, initiative and innovative.

Taking the various degrees of visually impairment into consideration one could assume that the teaching of the life sciences to these learners is complicated by requirements put forward by the subject and learning area on educators and trainers. It has therefore become necessary to discover, develop and promote new approaches, strategies, tools, techniques, et cetera, that are essential for the enhancement of the full and active participation of visually impaired learners in special and inclusive schools (Abantwana-Phambili, 2001:2).

7.6.1.2 Adapting Learning Outcomes and Assessment Standards

The interviews with teachers revealed that participation is limited. This limitation is caused by the nature of Life Sciences that it requires vision. Teachers do not know where to start with the curriculum in order to increase participation of blind and visually impaired learners other than the theory only. Teacher (E10) says this:

“They achieve well in Life Sciences because we describe and they write down afterwards. But, sometimes they struggle a bit with things they cannot see when we do tabulation or I put a picture on the wall for the class to see and analyze.”

The researcher recommends that the starting point is to select learning outcomes with its assessment standards. Choose a learning activity: learning about the flower. Draw up a flower as a teacher for the class using a pencil. Make a picture big and not clustered with many details. Take a string and paste it along the pencil drawing. Wait till it dries up.

Place the drawing on the thermoform machine (heating machine that exposes and impacts on the brailion to produce tactile drawing) and then place a brailion paper on the stringed drawing on the thermoform. A tactile drawing has now been produced. Almost all required tactile material can be produced in this manner.

A teacher can use any flat material that will not burn instead of making a drawing. For example a dry leaf of a tree. When teaching the blind learner a new concept or picture, the teacher must use the "hand under hand" method that was discussed in greater detail in

7.6.1.3 Observation relayed through verbal description

This research found that teachers have difficulty in making their learners visualize abstract concepts or concepts of things accessible through seeing when making them visualize abstracts concepts when teaching without accessible and tactile material. This is indicative of lack of accessible resources. Teachers have difficulty when blind learners are supposed to do practical things that require vision. This includes observation when doing experiments with chemicals or changing of colour in the experiment.

Teachers express this challenge this way (E5): “The difficulty is that they cannot see sometimes you think they can see but they do not and you explain and hope they understand”.: Another teacher (E1) echoes this challenge thus: “Gathering and making them visualize and understand some abstract concepts like nervous system, conveying and interpreting stimulus and collecting material that will explain.”

The researcher recommends that activities which are vision based like observation can be done as long as there is a sighted person who will always describe and explain the activity to a blind learner. A blind learner must not be deprived of the knowledge and information accorded by Life Sciences just because such a learner is blind. Collaborative learning must be encouraged where sighted or partially sighted learners help and describe the visual phenomenon or activity. This is the primary responsibility of the teacher; however social skills through this activity are developed and enhanced as well.

Maguvhe (2005) established that there is evidence showing that even if blind learners are not able to observe experiments visually, they still benefit from explanations given by partially sighted classmates and teachers particularly with practicals, because of their complexities and challenges that they may pose to blind learners, teamwork between blind and partially sighted learners is encouraged so that they could assist one another.

As regards to teaching and learning, the ability to observe remains a crucial aspect applicable to teaching and learning in general. Observation, in this case, is foundational to the science processes and without observation; learning will be restricted and easily become less meaningful (Fraser, 2005:1).

The teachers believe that partially sighted learners do not have problems and they perform well and they are able to deal with classroom activities with relative ease. This view is expressed by one teacher (E7) thus: “We let the child experience. We let them feel. It is not a problem with the partially sighted learner.” However, literature shows that the nature of low vision determines vision and that adaptations or some form of techniques need to be used to assist such learners. It is advisable in literature that for learners with low vision, the teacher must use chalk or markers that contrast well with the blackboard or dry erase board (Bhargava, 2004). For older learners, the teacher should ask which colour combinations they prefer. The teacher should be aware of glare on the board (Bhargava, 2004). Allow the learner to move flexibly in order to gain the best view of the board.

This notion of visual impairment refers to those with residual eyesight commonly referred to as partially sighted, and those who depend, for information, on other senses excluding visual experience, commonly referred to as blind. The partially sighted learner has an educational advantage. This means residual eyesight can be of great use in the learning of Life Sciences. The blind learner has absolute limitations regarding visual experiences. The absence of sight poses educational challenges. This means all learning activities that require vision remain a challenge facing both the teacher and the learner because an alternative must be found to compensate for vision and thus facilitate

participation and involvement in vision-based activities.

7.6.1.4 Compensation as equalizing factor in achieving equity

Visual impairment is the loss of visual function of such magnitude that special aids and use of other senses are necessary to achieve performance ordinarily directed by visual clues. Learners who have vision impairments range from having total absence of sight to varying degrees of useful vision. Because a learner is vision impaired, it should not be assumed that he or she is unable to participate in educational activities. There is for learners who are blind or vision impaired a wide variety of special aids and/or accommodations that address equity, making learners with visual impairment equal to seeing fellow learners and thus facilitate learning in the classroom setting.

The academic success of learners who are blind or vision impaired, whether in special, integrated or inclusive school settings depends on a variety of factors? Among these is their ability to access the classroom curriculum.

Curriculum access for blind and vision-impaired learners requires provision of the same books and resource materials as those provided for sighted learners. However, these need to be provided in an appropriate format, for example, Braille, large print, e-text and audio), at the same time and at the same level, including the same book edition (Kelley and Gale, 1998).

Therefore, a learner who cannot see colour must use colour detector. This is an assistive device that has a synthesized voice and talks back to the user telling the colour or combination of colour. This is very useful in laboratory or experimentations where colour or colour change is significant and conveys the message or results of the experiment. This is discussed and demonstrated in details in chapter three of this research.

7.6.1.5 Training on Inclusion and Education White Paper 6

The interviews with teachers showed that their understanding of Education White Paper centres on involving learners in the mainstream schools. Their understanding does not

reveal their challenge and the enormity of the task that they are expected to perform as the result of this policy.

In the interview, teacher (E4) said this about understanding EWP #6:

“It is a policy that talks about teaching and learning in the mainstream schools.”

In the interview, teacher (E1) indicated that there was no time for studying policy:

“The work load does not allow teachers to study education policies.”

Echoing the same view, teacher (E3) said this:

“It does not help me in my daily work because I don’t know the policy.”

Education White Paper #6 (2001) tells us that the provision of Inclusive educational opportunities to learners with visual impairment in the inclusive schools is designed to equalize the opportunity to develop their abilities to think and do educational activities together with their sighted peers (Department of Education. 2001) .

Teacher (E2) said this in the interview:

“Education White Paper #6 informs us to involve all learners with different barriers. We use it together with learning area policy. We teach basics and apply EWP policy.”

The interviews showed in the later questions that teachers do not have adequate skills to teach Life Sciences to the blind and visually impaired learners, for example teacher (E4) said:

“It is difficult to teach a blind learner. A teacher must be trained first and the school is ready.”

The findings of this study have revealed a great need for capacity building on the part of the teachers in the inclusive schools. Human resource development strategy must embark on Education White Paper 6 teacher education dedicating focus on the roles and functions of teachers in terms of new education dispensation in South Africa. In addition, it must embark on developing university (tertiary institution) linkages in consultation and in

collaboration with the Department of Education in developing a credited modular curriculum qualifications on and around Education White Paper 6 and global agenda on the philosophy of inclusive education issues. These courses must target education students while at the university as part of initial professional education training because some of these prospective teachers will be employed in the inclusive and even in the special school. These prospective teachers will stand ready being thoroughly prepared for demands placed by education system on teachers in the inclusive schools. These modules should be accessible even to parents and members of civil society. This development is in line with the concept of continued professional teacher development for those teachers in employment already. This view serves as a precursor for professional career-pathing for teachers.

Linked to this is the need for people to understand the inclusive education model that is adopted by the White Paper. This will serve as a good starting point for all as they plunge into their roles in implementing inclusive education. It will also assist them in changing attitudes and behaviour.

7.6.1.6 Training on developing individual education plan

I fervently believe that the education and training of learners with education special needs in general and learners with visual impairment in particular requires teachers with special training, positive attitude and skills. Teachers need to be knowledgeable about assessing learner education special needs so that he can be able to make individual education planning. The teacher must further be able to assist a learner with visual impairment in the inclusive school to adopt strategies for analysing tasks, sequencing learning materials and using assistive technology devices.

7.6.1.7 Training on Human Rights

Crucial to all teachers involved in inclusive schooling is the need for them to understand the values and attitudes as well as the kind of behaviour expected of them. In terms of

values, teachers will have to be educated on the values of human rights, social justice and integration put forward in our new Constitution.

Fraser et al., (1996:38) are of the view that learners learn when one or more stimuli are reinforced by social interactions and linked to one or more responses (relations). In addition, learners learn best when they regard learning as the formation of associations between physical stimuli and observable reactions.

In addition, Holdstock (1987:107) argued that the appropriate attitude on the part of the teacher is necessary for the establishment of a climate in which learning can take place.

In an inclusive school self-esteem for a learner with visual impairment is very important. The loss of vision in general, have an impact upon relationships with sighted learners and affect self-esteem and the development of positive, healthy emotions. In order to cope in an inclusive environment, a learner in general, more so a learner with visual impairment needs at least three things: Attention, Affection, and Approval from others, in order to feel acknowledged and a sense of belonging to a group and to enjoy the wonderful relationships that inclusive school accords for all. Yet, rarely intentionally, many learners with visual losses are doubly isolated, and therefore doubly disabled. The very nature of visual impairment restricts their joining in conversations or group activities, and they may also receive a major part of their school instruction in separate classes or schools, away from ordinary, everyday sighted communities. However, visual impairment should not be the basis for exclusionary practices or a lifetime sentence of exclusion. Many learners with visual impairment require early intervention by teachers and families who worked together.

Teachers will have to start by changing their attitudes to differences to be able to teach in an inclusive way. This could be done through activities designed to help people reflect on their attitudes towards difference, that is, impairment, intellectual ability, and so on. Role-plays and other activities that allow people to place themselves in the shoes of those who are different is one way. An example of this could be to blindfold people being

trained and let them use Braille. Arranging visits to sites that practise inclusive education could provide participants with the knowledge and skills they need to be able to accommodate learners that are different.

It is generally agreed that inclusive schooling involves the optimal integration of learners with impairment into ordinary classrooms or learners who receive intense support while attending mainstream classes (McCoy, 1995; Putnam, 1993).

7.6.1.8 Training in orientation and mobility

Conversations with teachers revealed that there are no mobility instructors in the inclusive schools. Blind and visually impaired learners are expected to be led by hand by the fellow learners. In the interview with teacher (E6) about her view on blind and visually impaired learners attending at the inclusive school, this is what she said:

“It is good provided there is support. I attend for a year in mainstream school as a blind child. I had to memorize work, I could not read and write. During breaks I depended on other children to lead me wherever I wanted to go. Teachers gave instructions without considering that I am blind. I could not participate in sports.”

Inclusive school means, a school where learners with visual impairment are educated in the ordinary classroom for the majority or totality of their day and as such they should receive support such as orientation and mobility training conducted in that school wherever possible.

Inclusive schooling, in this regard, assures that learners with visual impairment will be able to move around the school campus with ease where they are educated daily with their non-disabled peers, allowing the enhanced development of social and academic skills that are so important to their happiness and success as adults.

This view is supported by Wilson (1992:287) who claims that mobility represents the avenue through which a person who is born blind or becomes blind at a later age reaches out into his social, educational, vocational, and economic environment.

7.6.1.9 Developing innovation and creativity in Life Sciences education

(a) Practical hints on material adaptation

The guiding factor is that the point of departure is being blind not the absence of sight only. The teacher sometimes must leave out some information if she is adapting a picture or diagram. Sometimes she must add some information to provide or compensate for visual perspective.

It is imperative for the teacher to see and experience the learning material for her blind learner through the vision and eyes of her blind learner.

- (1) The task should be adapted only when it requires visual skills and/or understanding that a visually impaired learner cannot reasonably be expected to possess.
- (2) Adapted task should be of the same level of difficulty as the original.
- (3) The same skills, knowledge and concepts should be assessed as in the original question.
- (4) Adaptations should not change the balance of the original task in terms of content and weighting. (Some tasks will inevitably become easier and others more difficult. Keep the balance).
- (5) See to it that adaptations do not require a disproportionately large amount of time for very few marks.
- (6) Replacement Tasks should only be used when adaptation is not possible for meeting the same task objective.

7.6.2 Training in Graphics and Diagrams

The golden rule in this regard is that teachers need to be trained on how to design this material and present it to the blind learner. A blind learner must be exposed to tactile picture, map or diagram at an early age of schooling. There are reasons for this early intervention. There are different types of paper used to emboss tactile graphic and diagrams. These types of have different textures and have different effects in the fingers. A blind learner needs to get used or adapt or acclimatize his fingers to a particular type of paper. If all types of paper are used frequently, a blind learner will be at an advantage because he gets to know all types.

Now what happens is that the school uses one type of paper, mostly in cases where teachers do not have computers they tend to use the type of paper where a teacher uses a black pen to draw on it and then put braille letters and numbers as required by the picture or diagram. This is easy for most schools, but the disadvantage is that this type of paper is imported and it is very costly.

The braille printing houses who transcribe braille and tactile material for the blind use computers which use a different type of paper. Other school might decide to use yet another type of paper called braillon which is like plastic and it is usually not comfortable in the fingers but readily available in the country.

Another reason is that people with sight (because of their vision) see many different images, forms and shapes of different things in everyday life. A blind learner does not have this kind of luxury. The absence of sight and vision means absence of these images in everyday life. Simply taking a tactile picture or diagram and present it to a blind learner because we want to make them equal is null and void from the start, such defeats the purpose of making a blind learner equal to his fellow sighted learner.

Using fingers to read either braille or tactile graphic or diagram is a skill that needs to be perfected through a long period of time. Practice makes perfect holds true in this sense.

7.6.3 Establishment of Support Structures

7.6.3.1 School-Based Support Teams

During interviews, it appears that certain teachers lacked competences and skills to accommodate learners with visual impairment during teaching Life Sciences and they have nobody to consult for help or advice at the school level. Teacher (E10) says:

“It is difficult to teach the blind because they cannot participate in Life Sciences activities or survey or conduct a simple test. Sometimes you do not know what to do now because they cannot see all these experiments.”

The researcher wishes to suggest that a school support team or institutional support team must be established at the school level. It is primarily concerned with both learner and teacher support at the institutional level. This structure cannot just be left unequipped for their role. It will require training on the following, in addition to the core training referred to earlier:

- 1) How to support the learning and teaching process by identifying and addressing learner, teacher and institutional needs
- 2) Managing curriculum differentiation to accommodate diversity
- 3) Team problem-solving
- 4) Teacher capacity building through classroom observation, mentoring, consultation and sharing of knowledge and skills
- 5) Community networking
- 6) Coordinating the assessment, support and identification practice within an inclusive school.
- 7) Co-ordinate district support and district referrals.

7.6.3.2 External Support Teams

The Education White Paper 6 calls for an integrated approach supporting learners within the system. It advocates a systemic model which encourages the learner to be included in his/her local inclusive school, with support being accessed. More intensive support packages will be made available through the District level where District-Based Support Teams will access, supply and coordinate the provisioning of support across each local district.

This research has revealed (see chapter 5 and 6) that this role of the district support is yet to come to the teachers. This research has further revealed that there are district officials attached to schools in terms of their responsibilities and functions. The dilemma plaguing the district support lies in the district support team being less effective as implied and expressed by teachers. Teachers need the active participation of the district. This active participation can be met by fulfilling the role and function of the itinerant teacher by the district.

The researcher makes the following recommendations:

- 1) The district support team needs to be established and constituted as such.
- 2) The roles and functions of the district support team needs to be spelt out clearly and concisely.
- 3) The integrated support system within the district needs to be established. This means the participation and contribution of each section of the district as the integrated support service.
- 4) Establish the centralization of co-ordination of functions and service delivery. This means it must be established which section performs the function of co-ordinating the activities of the district support team.
- 5) There needs to be an allocation of resources. The personnel rendering the service must have the ear-marked budget to perform these tasks.

- 6) There needs to be post provisioning establishment dedicated to this specific task. An organogram needs to be established showing the structure and relation within the various structures to ease co-ordination and orderly rendering of services.
- 7) A programme of action needs to be drawn up. This must indicate clear deliverables and objectives of integrated support.
- 8) Support and monitoring mechanism needs to be developed. The personnel must design tools or instruments that will provide feedback and serve as radar for detecting where the greatest need is in the system.
- 9) The active role played by the district needs to translate into teacher activities. Teacher must experience the meaningful contribution made by the district in their daily teaching and classroom activities. The first task, among others, would be to establish the school based support team. This is crucial and critical as the co-ordinating structure at the school level that addresses all issues of support for both teachers and learners. This is the structure that will liaise with the district support team directly on all issues pertaining to support.
- 10) There is a need to establish a national support team. This view is not farfetched because there are other structures in the Department of Education that correspond to provincial structures. These structures are able to collaborate and consult each other on issues of common interest.

This is one structure that does not exist in the Department of Education. The creation and establishment of such structure is seen to be crucial and critical in the provision of support to provinces that in turn must support the district, which, in turn must support the schools. This is a chain of support that is decisive in as leverage for support in the integrated support system.

Support within district should be defined as all activities that increase the capacity of schools to respond to diversity and to the challenges faced by its learners and teachers. This support should therefore become the responsibility of all officials working within the education system.

7.6.3.3 Identifying a learner who experiences visual barriers in class

Sometimes vision problems develop over time or they are so subtle that they have gone previously undiagnosed. Often a learner can have vision impairment, but it may have gone unnoticed. The learner is often the last one to recognize or report a loss in vision unless it has deteriorated. If the vision impairment remains undetected, it can result in the learner facing a substantial educational disadvantage because of adverse effects on the learner's academic, communication, and social development. This can interfere with a learner's ability to reach full potential. On a medical note, if the vision problem is left undetected and untreated, it can cause permanent loss of vision and the long-term consequences can be serious in terms of quality of life.

Teachers need to be aware of the indicators that signal that a learner has vision impairment. Below is a guide that you can use to identify whether a child in your class experiences visual barriers.

The following hints are adapted from UNESCO (2001).

Appearance of Eyes

- One eye turns in or out at any time
- Reddened eyes or lids
- Eyes tear excessively
- Encrusted eyelids
- Frequent styles on lids

Complaints when Using Eyes at Desk

- Headaches in forehead or temples
- Burning or itching after reading or desk work
- Nausea or dizziness
- Print blurs after reading a short time

Behavioural Signs of Visual Problems

- Eye Movement Abilities (Ocular Motility)
- Head turns as reads across page
- Loses place often during reading
- Needs finger or marker to keep place
- Displays short attention span in reading or copying
- Too frequently omits words
- Repeatedly omits "small" words
- Writes up or down hill on paper
- Rereads or skips lines unknowingly
- Orients drawings poorly on page
- Eye Learning Abilities (Binocularity)
- Complains of seeing double (diplopia)
- Repeats letters within words
- Omits letters, numbers or phrases
- Misaligns digits in number columns
- Squints, closes or covers one eye
- Tilts head extremely while working at desk
- Consistently shows gross postural deviations at all desk activities
- Eye-Hand Coordination Abilities
- Must feel things to assist in any interpretation required
- Eyes not used to "steer" hand movements (extreme lack of orientation, placement of words or drawings on page)
- Writes crookedly, poorly spaced: cannot stay on ruled lines
- Misaligns both horizontal and vertical series of numbers
- Uses hand or fingers to keep his place on the page
- Uses other hand as "spacer" to control spacing and alignment on page
- Repeatedly confuses left-right directions

- Visual Form Perception (Visual Comparison, Visual Imagery, Visualization) Mistakes words with same or similar beginnings
- Fails to recognize same word in next sentence
- Reverses letters and/or words in writing and copying
- Confuses likenesses and minor differences
- Confuses same word in same sentence
- Repeatedly confuses similar beginnings and endings of words
- Fails to visualize what is read either silently or orally
- Whispers to self for reinforcement while reading silently
- Returns to "drawing with fingers" to decide likes and differences
- Refractive Status (Nearsightedness, Farsightedness, Focus Problems, etc.) Comprehension reduces as reading continued; loses interest too quickly
- Mispronounces similar words as continues reading
- Blinks excessively at desk tasks and/or reading; not elsewhere
- Holds book too closely; face too close to desk surface
- Avoids all possible near-centered tasks
- Complains of discomfort in tasks that demand visual interpretation
- Closes or covers one eye when reading or doing desk work
- Makes errors in copying from chalkboard to paper on desk
- Makes errors in copying from reference book to notebook
- Squints to see chalkboard, or requests to move nearer
- Rubs eyes during or after short periods of visual activity
- Fatigues easily; blinks to make chalkboard clear up after desk task

7.7 The Limitation of the Study

The researcher regards the following issues as being limitations to the study. Further research is suggested to probe the matters further.

7.7.1 Blind Learner Population

Many inclusive schools in the province do not have blind learners. The research was confined to two schools that cater for blind learners. Even in one school, kaMagugu, mostly learners with low vision are catered for and, according to the findings, are regarded having no problem other than requiring large printed material.

7.7.2 Provincial Differences

The research was done in one province. The fact that provinces are at different levels of development as well as different in terms of provision, this matter is discussed in chapter 1. Maybe a comparative study can yield some light on whether all provinces have the same or experience the same challenges.

7.8 Conclusion

This research was focusing on how integration, equity and inclusivity manifest themselves as being foundational in terms of the influences they have on the teaching and learning of Life Sciences to blind and visually impaired learners in the inclusive schools

This research was conducted against the background of socio-educational transformation. South Africa wants to record in the annals of Education that it can be demonstrated that a single, uniform and monolithic school structure is able to minister to the varied educational, psychological and emotional requirements of children with a baffling and demanding array of learning and other difficulties.

Of equal concern is the implied assumption that teachers working in inclusive schools are sufficiently qualified to attend to the needs of all learners presenting a variety of subtle education special needs.

Today, South Africa is witnessing the alarming spectacle of educational policy and reform being fashioned by political and social justice notions. This research serves as alarm bell for the battle cry for total inclusion of all children with disabilities that have reached a crescendo that need not silence the voice of reason and good judgment borne by academic quest.

These socio-political views are being peddled by the Inclusive Movement. Not long, teachers might be wary of marching under the "Inclusive Schooling" banner unless carefully blended through the art of research. This gargantuan wagon has the potential to cause immense mischief to the entire special and general education enterprise (Kauffman and Hallahan, 1995).

To actualize and realize the provisions of Education White Paper 6 that have eventuated in the popularity of this bandwagon is that it should not be an imaginative rhapsody based upon a false promise to its devotees to weave a seamless garment with special and mainstream education. It should not pledge to confer untold benefits upon disabled children because this is unredeemable. This kind of assurance is a cruel deception. Inclusive schooling ought not to claim to emancipate learners with visual impairment or any other learner with education special needs and facilitate their survival in the promised land of inclusive schools with an enormous unbridled facility to dupe the unsuspecting visually impaired. Otherwise this is fraudulent.

The researcher believes learners with visual impairment are entitled to appropriate education, training and care, and that formal education should take place, wherever possible, in their local school in the company of non-disabled peers, as proposed by Education White Paper 6.

As it has been unravelled by this study, much of the discomfort which non-disabled people feel in the presence of a disabled person stems from their lack of experience of disability, a lack which denies opportunities to learn the virtues of simple respect for, and acceptance of, differences.

The assumption of responsibility by education authorities for the education of all children is embedded in the principle that all children including disabled children have the capacity to learn.

The educational opportunities and learning experiences for learners with visual impairment in the inclusive schools were poor and this mishap resulted in relegating them to inferior and inadequate educational settings. Today the provisions of Education White Paper 6 that encourage both education implementers and parents to educate learners with education special needs in an ordinary school are widely acknowledged. However the proviso to such a right is the need to ensure that appropriate resources accompany the child to the integrated setting.

In South Africa integration, mainstreaming and more recently inclusive schooling is a contemporary development. It was not within the scope of this research to explore the merits and demerits of inclusive school and as such there has never been any dispute as to whether learners with visual impairment should receive their education side by side with their sighted peers. The real concern has always been how best to achieve this highly desirable goal by proposing the three-pronged facet teaching where inclusivity, integration and equity are incorporated, whilst respecting the child's needs and parents' aspirations. This research argues that attempts to place learners with visual impairment into inclusive schools with poorly prepared non-disabled peers, inadequately trained teachers and poorly resourced settings, is a cruel and unjustified experiment by social engineers.

Having a learner with visual impairment in the inclusive schools ought not to be heralded as a modern day miracle that such a child is not abandoned at home but able to savour the joys of "Inclusive Schooling" with his sighted peers. To even the most sympathetic observer this depiction of Inclusive Schooling is a poignant caricature.

The account of the inclusive education movement might well illustrate the way in which societies can easily deceive themselves about their own institutions because of an insufficient and inconstant scrutiny of the reasoning and evidence which is supposed to

support them. Once such institutions, (the inclusive schools) have been launched, howsoever adequate or inadequate it is first justification, and then follows the danger that the original political exertion will adopt a momentum of its own and grow beyond all proportion. For instance, the devotees, the employees, the administrators of the new institution become a vested interest of significant political influence.

Furthermore, the inclusive movement itself may condition successive generations into accepting it simply by habitual dependence upon it. The institution itself becomes so precious and ingrained that when an inquirer like myself has the audacity to question it, he is received with stunned astonishment as if one has questioned the necessity of human rights entitlement.

Full inclusion, the philosophy underpinning the movement to include learners with disabilities as full-time members of general education classrooms, has come under severe criticism of late, and has been blamed for a host of problems-overworked teachers, policy overload, falling academic standards, lack of resources, and poor teacher morale (Willis, 1994).

Although some of these criticisms resonates with the often less than adequate and half-hearted ways in which inclusion has been implemented, negative responses to planning and implementing full inclusion tell us as much (or more) about the quality and responsiveness of the schools as it does about the challenges presented by the learners themselves.

Sapon-Shevin (2001:1) paints the following picture about the issues that plague inclusive schooling:

“When children are being taught proper dental hygiene, the dentist sometimes gives them a little red pill to chew after they have brushed. The red dye sticks to any areas that have been inadequately brushed, thus making it obvious where problems remain. These pills are called "disclosing tablets" because they disclose the areas that require further attention. It is possible to look at full inclusion as a disclosing tablet. Attempting to integrate students with

significant educational and behavioural challenges tells us a lot about the ways in which our schools are unimaginative, under-resourced, unresponsive, and simply inadequate. Full inclusion did not create these problems, but it shows us where the problems are. Children who stretch the limits of the system make it painfully clear how constricting and narrow those limits are. Full inclusion reveals the manner in which our educational system must grow and improve in order to meet the needs of all children.”

Thorough work must be done in preparing for inclusive schooling. A lot of things need to be put in place to make an inclusion system work smoothly and effectively for learners with visual impairment (Sapon-Shevin, 2007:143).

It would be naive to assert that this study is the absolute answer to the problem in the education of the visual impaired in the inclusive schools; nevertheless, stupefying mist has been cleared. The horizon has been widened and broadened. Through acquired knowledge and skills, more researchers ought to perpetuate the quest to alleviate a burden that has been plaguing the education for people with visual impairment.

The enthusiasm that characterised the assistive technological epoch signifies a call for pedagogic intervention. The positive attitude towards venturing into the unknown: the world of the computers must be taken to educational fruition. All this must be done for the improvement of the visually impaired person.

The experience gained at Kamagugu and Silindokuhle schools and the knowledge acquired at Mpumalanga district office is invaluable. It is indicative of the need to remove prejudice and racial barriers built around the visually impaired people. This is a minority group, but it comprises the citizens of South Africa like any able bodied.

Carrying out this study has not been void of limitations. Facilities and finances have been the limiting factors in terms of a number of participants. It is anticipated that the divested misconceptions achieved by this study will serve as a safe and firm base to venture into the future. The success of this quest must be harnessed and be taken a step further through

academic quest in order to equalize the educational opportunities for people with visual impairment.

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