

# **VALIDATION OF AN AFRICAN PICTURE TYPES CHART FOR VISION TESTING OF PRELITERATE CHILDREN IN RURAL BOTSWANA**

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## ABSTRACT

**Background:** Children's ability to see greatly impacts their ability to learn. Screening for vision problems is an appropriate and important part of school health services. The use of the Snellen chart (composed of letters), commonly used for visual acuity, is not suitable for pre-school children. Instead, eye care health workers use kindergarten charts composed of pictures for the child to identify. It is not known if African children can recognize the pictures in these charts.

**Research question:** What is the most valid and reliable Picture Types Chart for vision screening of preliterate rural Botswana children?

**Aim:** To establish whether the Dr Beale Collin's Picture Types Chart or the Powell Picture Types Chart is the most valid for eye screening of preliterate children in rural Botswana.

**Method:**

**Design:** A descriptive cross-sectional comparative design was employed in this study that tested the validity of the Dr Beale Collins's Picture Types Chart and the Powell Picture Types Chart against the Snellen E (illiterate) chart as the gold standard for visual acuity testing of 102 Standard One learners in Mahotshwane, Sekoma and Khonkhwa Primary Schools in rural villages in Botswana.

**Findings:** There was no statistically significant difference between the Dr Beale Collin's Picture Types Chart and the Powell Picture Types Chart although the results did show that the participants recognized more pictures on the Powell Picture Types Chart.

**Conclusion:** It is important to screen children's eyes as early as possible when treatment is likely to be successful. Eye screening charts should be valid and reliable to achieve the best results. In this small study both the Western Dr Beale Collin's Picture Types Chart and the Powell Picture Types Chart are sufficiently valid to achieve good visual acuity results in preliterate children in rural Botswana. Reliability of the Powell Picture Types Chart was established to some extent. It is recommended that the pictures used in Picture Types Charts such as the Powell chart should be culturally relevant for improved recognition of items. Interestingly though, non-recognition of items did not influence visual acuity testing negatively.

## Definition of Terms

Visual Acuity (VA) - "a measure of the ability of the eye to see that closely positioned objects are separate" (Batterbury & Bowling, 2005 p. 9).

Snellen E Chart (gold Standard) - A chart composed of an E facing different directions (up, down, left and right) arranged from 6/60 to 6/6.

Dr Beale Collin's Picture Types Chart - A chart originating in the United Kingdom composed of 16 different pictures arranged from 6/60 to 6/6.

Powell Picture Types Chart - a chart originating in Cape Town, South Africa composed of 13 different pictures arranged from 6/60 to 6/6.

Standard One in Botswana - Grade One in South Africa.

Amblyopia - "Reduced vision usually due to interference with the eye's development" (Stollery, Shaw & Lee, 2005, p. 248).

Strabismus - "Both eyes cannot be directed at the same point at the same time" (Eperjesi, Bartlett & Dunne, 2007, p. 200).

Refractive errors - "An optical defect that prevents light rays from being brought to a single focus on the retina (Vaughan, Asbury & Riordan-Eva, 1999, p. 408).

## Operational Definitions

Validity (specificity) of the eye screening tool – is defined as the number of pictures on the chart correctly identified by participants, for example a ball.

Reliability (sensitivity) of the eye screening tool – is defined as the consistent interpretation of visual acuity, that is, if only the first two of three pictures on a line on the chart can be seen, the visual acuity is recorded as, for example,

6/9<sup>-1</sup>.

## ABBREVIATIONS

FEW - Family Welfare Educator

MOH - Ministry of Health

UNICEF - United Nations Children's Emergency Fund

VA - Visual acuity

WHO - World Health Organisation

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# CHAPTER 1

## INTRODUCTION

### 1.0 Introduction to the study

Children's ability to see greatly impacts their ability to learn. Screening for vision problems is an appropriate and important part of school health services and is mostly carried out by Registered School Nurses. Eye screening is important in the early identification and diagnosis of disease and functional disorders (Colorado Department of Education, 2006). It is an easy and relatively inexpensive way to identify eye problems amongst a large number of apparently healthy students, that is, those who might be at risk of having potentially blinding conditions.

The Colorado Department of Education, (2006) points out that the measurement of visual acuity is probably the most important aspect of a complete eye examination. This test is completed by asking the person to read a visual acuity chart at a distance of 6 meters. The length of the room need not be 6 meters, as the use of mirrors to bounce the image simulates visualization at 6 meters in a 3 meter room. The use of the Snellen letters chart which is commonly used for visual acuity is not possible for pre-school children as most do not read. Instead, eye care health workers use kindergarten charts which are composed of pictures for the child to identify such as the Sheridan Gardner and the Lea Playing Cards. Students who are found to have possible problems are referred to an ophthalmologist for further evaluation and treatment.

The main purpose of preschool vision screening is to detect those sight-threatening eye conditions that treatment is most likely to be effective for. Identification of and treatment for vision concerns as early as possible in a child's life prevents vision defects that could result in later restrictions in educational and occupational opportunities (Gustafson, Kinne, Little, Strawhacker & Doyle, 2000, p. 241). The most prevalent concerns are amblyopia, strabismus, congenital conditions, and a notable discrepancy in

refraction between eyes. It is the researcher's assumption that it is difficult for preliterate rural Botswana children to recognize some of the pictures on the Westernized charts. If so, then using such charts for visual acuity testing may give inaccurate results. "The success of any screening depends upon securing the cooperation of the school personnel, the child, the parents, the eye practitioner and others who are participating" (Colorado Department of Education, 2006).

## **1.1 Background**

Botswana is a landlocked country sharing a border with Namibia in the west, Zambia and Zimbabwe in the north and South Africa in the south and eastern part. The Central Statistics Office (2002) estimated the population of Botswana to be 1.7 million in August 2001 and that is the latest as the next population census has not yet been conducted.

Botswana has adopted the primary health care approach. Primary health care (integrated preventative, curative and promotive) is available at health posts, clinics and primary hospitals. A health post is the smallest unit and serves an area containing around 500 people. Botswana is a member of the United Nations International Children's Emergency Fund (UNICEF) and the World Health Organization (WHO) to mention a few. Botswana is striving to reach the goals of building an Informed and educated nation and building a just and caring society which is one of the Vision 2016 goals. No studies appear to have been done in respect of eye problems in young children in the rural areas of Botswana. It is therefore important to screen children's eyes with a reliable eye testing chart to promote the above goals.

## **1.2 Relevance of the study**

The conclusion of a Cochrane review by the Eyes and Vision Group that aimed to find studies that evaluated the effectiveness of school vision screening programmes in first identifying children with reduced vision was that no eligible

randomized studies were found and that there is a clear need for reliable evidence to measure the effectiveness of vision screening (Powell, Wedner & Hatt, 2004). In the present study by comparing the visual acuity results as well as the recognition of pictures for the Dr Beale Collin's Picture Types Chart and the Powell Picture Types Chart, the sensitivity, specificity and therefore the reliability and validity of each chart can be established. This will help to diagnose refractive errors of preliterate children accurately. By screening children for refractive errors, the Millennium Development Goal of 'achieving universal primary education' (United Nations, 2000) will be promoted.

### **1.3 Research question**

What is the most valid and reliable Picture Types Chart for vision screening of preliterate children in rural Botswana?

### **1.4 Aim of the study**

The aim of the study was to determine the validity and reliability of the African (Powell) Picture Types Chart for vision screening of preliterate children in rural Botswana to diagnose refractive errors.

### **1.5 Specific objectives**

- 1.5.1 To establish the extent to which preliterate children in rural Botswana are able to recognize pictures on the Westernized Dr Beale Collin's Picture Types Chart.
- 1.5.2 To establish the extent to which preliterate children in rural Botswana are able to recognize pictures on the Africanized Powell Picture Types Chart.
- 1.5.3 To compare the number of items correctly identified by preliterate children in rural Botswana on the Dr Beale Collin's and Powell Picture Types charts.
- 1.5.4 To compare the number of items recognized on the Dr Beale Collin's and the Powell Picture Types Charts according to gender.

- 1.5.5 To compare the number of items recognized on the Dr Beale Collin's and the Powell Picture Types Charts according to age.
- 1.5.6 To establish the visual acuity of preliterate children in rural Botswana using the Dr Beale Collin's and the Powell Picture Types charts against the gold standard Snellen E Chart.
- 1.5.7 To compare the visual acuity results of preliterate children in rural Botswana for the Dr Beale Collin's and the Powell Picture Types Charts against the gold standard Snellen E Chart to establish which chart is the most sensitive for visual acuity testing.
- 1.5.8 To establish the validity and reliability of the Powell Picture Types Chart.

## **1.6 Hypothesis**

- 1.6.1. There is no difference between the number of items correctly identified for the Dr Beale Collin's Picture Types Chart and the Powell Picture Types Chart.
- 1.6.2 There is no difference between visual acuity results for the Dr Beale Collin's Picture Types Chart, the Powell Picture Types Chart and the Snellen E chart.

## **1.7 Assumptions**

The researcher assumed that preliterate children in rural Botswana may not recognize some of the pictures on the Dr Beale Collin's Picture Types Chart such as the sailing boat and the rocking horse that urbanised children would recognize. It was also assumed that there may be a relationship between non-recognition of items and visual acuity scoring. It was further assumed that African contextualized Picture Types charts which include culturally relevant pictures that children see daily, may facilitate accurate diagnosis of refractive errors so that referrals can be made to ophthalmologists before it is too late to treat conditions such as amblyopia.

# CHAPTER 2

## LITERATURE REVIEW

### 2.0 Introduction

Researchers usually conduct their studies within the context of existing knowledge base as it was done in this study (Polit & Beck, 2004, p. 88). According to Polit and Hungler (1999 p. 80) one of the major functions of a research literature review is to ascertain what is already known in relation to a problem of interest. The researcher can also discover what is known and what can be learned in the field. The researcher may identify a study that can be replicated or whose findings may be compared and contrasted with the proposed study. The researcher may become aware of difficulties experienced by others, which may save time, money and error after identified ethical problems. The researcher may find a research report that is well structured and easy to read that will be useful as a guide in writing the research report.

Researchers undertake a literature review to familiarize themselves with the knowledge base. A literature review can serve a number of important functions in research as reported by Polit and Beck (2004, p. 88):

- “Identification of a research problem and development or refinement of research questions or hypotheses,
- Orientation to what is known and not known about an area of inquiry, to ascertain what research can best make a contribution to the existing base of evidence,
- Determining of any gaps or inconsistencies in a body of research,
- Determining of a need to replicate a prior study in a different setting or with a different study population,
- Identification or development of new or refined clinical interventions to test through empirical research,
- Identification of relevant theoretical or conceptual frameworks for a research problem,
- Identification of suitable designs and data collection methods for a study,

- For those developing research proposals for funding, identification of experts in the field who could be used as consultants and
- Assistance in interpreting study findings and in developing implications and recommendations”.

Polit and Hungler (1999, p. 79) state that a literature review refers to activities involved in identifying and searching for information on a topic and developing an understanding of the state of knowledge on that topic. Familiarizing oneself with the practical or theoretical issues relating to a problem area often helps the researcher to generate ideas or focus on a research topic. According to Polit and Beck (2004 p. 88) a literature review helps to lay the foundation for a study and can inspire new research ideas. A literature review early in the report provides readers with a background for understanding current knowledge on a topic. It also plays a role at the end of the study when the researchers are trying to make sense of their findings.

Readings in areas of general interest can be extremely useful in alerting the researcher to unresolved research problems or to new applications suitable for the project. When a general topic has been selected, readings on that topic help to bring the problem into sharper focus and to aid in the formulation of appropriate research questions (Polit & Hungler, 1999, p. 79). Wilson (1989, p. 234) argues that after the researcher has written the question the next step is to conduct a systematic search to find out more precisely what is known about the topic as the level of the question may change after you do an extensive review of literature. Although in this study a systematic review has not been conducted a literature review was conducted to familiarise the researcher with the topic. Literature reviews helps support and clarify why you are doing your particular study. Cooper (1989, p. 12) states that literature reviews typically appear as introductions to reports of new primary data or as more detailed independent works and that the scope of a literature review that introduces new data is quite narrow.

When a literature review appears independent of new data, it can serve decidedly broader purposes. According to Cooper (1989, p. 12) a literature

review can have numerous different focuses, goals, perspectives, coverage strategies, organizations and audience. For instance, reviews can focus on research outcomes, research methods, theories, and or applications. Reviews can attempt to integrate what others have done and said, to criticize previous scholarly works, to build bridges between related topic areas and or to identify the central issues in the field. Acquaintance with the current state of knowledge enables those engaged in doing research to avoid unintentional duplication of a study and to focus on aspects of the problem about which there is relatively little knowledge. This comparison of the Westernized charts and African Charts for testing preliterate children has not been done before, therefore the study is not duplicated. When a study is linked with other research, the findings can be better understood within the existence base of knowledge.

The review also serves the essential function of providing you, as a researcher with a perspective on the problem necessary for interpreting the results of your study. The comparison of the results of a study with earlier findings is often a good point for suggesting new research either to resolve conflicts or to extend the base of knowledge. An important role of a literature review, particularly for students engaged in their first research project, is to suggest ways of going above the business of conducting a study on a topic of interest. This helped the researcher as a new researcher to know how others conducted their studies on the related topics.

The researcher has conducted a literature review on the comparison of picture types chart in the screening of preliterate children. Due to the limited information found the discussion will be done under the following headings: prevalence of vision problems among children, reasons for screening, when to test children, gold standard evaluation, standardized charts, the Dr Beale Collin's Picture Types Chart and the Powell Picture Types Chart.

## 2.1 Prevalence of vision problems among children

The prevalence of preschool vision problems in the United States of America is estimated at 5 to 10% (Gustafson *et al.* 2000, p. 240). Vision plays an important part in early life of learning, therefore children who are found to have eye problems should be referred to an eye care specialist. Hartmann, Bradford, Chaplin, Johnson, Kemper, Kim and Marsh-Tootle (2006, p. 226) report that although vision disorders among pre-school aged children are common, there is inadequate screening going on in the communities. "Vision threatening eye problems, which include amblyopia, strabismus, and significant refractive error are estimated to occur in 2% to 5% of preschool children" (Hartmann *et al.* 2006, p. 227). Ager (1998, p. 38) reports that an estimated 1 in 250 children are visually impaired as a result of eye disease.

A population-based Australian study found that an enormous amount of money was spent on spectacles that were wrongly prescribed (Hard, 2006 p. 416). The above author therefore suggested that it is necessary to define healthy eyes and eyes with refractive errors in different age groups of children to avoid misuse of public funds. When spectacles are wrongly prescribed one has to consider the possible effect on emmetropization, the burden for some children of having to wear unwanted glasses and the costs to health care resources. The economic consequences for parents who have to take time off work to accompany their children to the clinics for repeated visits should also be considered.

Jones, Westall, Averbeck and Abedolell (2003, p. 546) state that during the first 45 years of life amblyopia is responsible for loss of vision in more people than all other ocular disease and trauma combined. Those aged under 20 years the incidence of amblyopia is 10 times more frequent than all other diseases and trauma. People with amblyopia are at a greater risk of blindness as a result of injury or disease in the non amblyopic eye than those with two good eyes (Snowdon & Steward-Brown, 1997). Mocan, Najera-Covarrubias & Wright (2005 p.48) state that amblyopia prevails as the cause of visual loss worldwide.

Williams, Northstone, Harrad, Sparrow and Harvey (2003, p. 989) reported in their study of Amblyopia treatment outcomes after preschool screening versus school entry screening: observational data from a prospective cohort study that amblyopia was less common among children who had received preschool screening. The results for their study supports the hypothesis that preschool screening for amblyopia leads to better visual acuity after the treatment for the affected eye.

## 2.2 Reasons for screening

It is important to develop picture charts that can be understood better by African children so that eye problems could be easily screened. Newman, Hitchcock, McCarthy, Keast-Butler, & Moore (1996, p. 1081) argue that the main aim for preschool screening is to uncover unsuspected amblyopia at an age where treatment is effective. Jones *et al.* (2003, p. 546) state that visual acuity is the most detector for amblyopia and is considered the most effective screening test. Bishop (1991) argues that screening tests for children should be simple, quick to administer and should be easily interpreted by other personnel. Bishop (1991) listed 10 guidelines by World Health Organization (WHO) for effective screening problem:

1. "The condition sought should be an important health problem.
2. There should be an accepted treatment for patients with recognized disease.
3. Facilities for diagnosis and treatment should be available.
4. There should be acceptable to the population.
5. There should be a suitable test or examination
6. The test should be acceptable to the population.
7. The natural history of the condition, including development from latent to declared disease, should be adequately understood.
8. There should be an agreed policy on whom to treat as patients.
9. The cost of case finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible Case finding should be a continuing process and not 'once and for all' project".

Kurt (1996, p. 4) argues that under these criteria the justification for preschool screening would appear to be detection of amblyopia or amblyopic refractive, strabismic or ocular disease conditions. However the above recommendations are not easily fulfilled in screening for children with eye problems (Bishop, 1991).

Newman and East (1999, p. 676) reports that preschool vision screening should be performed to detect unsuspected amblyopia during the sensitive period when treatment is likely to be successful. Eye examination and vision assessment are important to eliminate avoidable blindness and eliminate conditions that can jeopardize the child's life (American Academy of Paediatrics, 2003, p. 902). Bishop (1991) reports that the risk of amblyopic patient becoming blind is high and that is why early detection and treatment of amblyopia is significant. The American Academy of Paediatrics (2003, p. 902) argues that early detection and immediate treatment of vision problems in children can avoid permanent visual impairment. Bishop (1991) argues that although amblyopia, strabismus and ametropia are not life threatening disorders, children should grow up with two good eyes.

The American Academy of Paediatrics (2003, p. 902) reports that children never complain of eye problems that is why visual acuity measurement should always be carried out and should be started at the age of three years. Drover, Felius, Cheng, Morale, Wyatt and Birch (2007) state that accurate and reliable measurement of visual acuity in children is essential for the detection and management of paediatric eye diseases. Refractive errors may strain ocular muscles causing squints although they can occur on their own. Both are thought to be associated with amblyopia because vision in one eye may be suppressed to prevent diplopia (Snowdon & Steward-Brown, 1997).

Adults suffering from amblyopia may have a problem with a number of activities such as driving or doing jobs requiring fine motor coordination. Those people could be refused entry in forces or pilot training programmes. According to Williams *et al.* (2003, p. 992) effective detection and treatment for amblyopia prevents incapacitating visual impairments especially if the unilateral amblyopic

looses the better eye. Newman *et. al.* (1996, p. 1077) observe that although preschool screening detects amblyopia, little is known about their results of treatment. Newman *et al.* (1996, p. 1077) report that preschool vision screening can lead to detecting visual defects like amblyopia, strabismus and refractive errors.

Campbell and Mani (2007, p. 21) state that the importance of visual assessment can help alter the educational interventions a child will require. They report that eye health care professionals and educators should be working together in the assessment of eye problems among school children. Ager (1998, p. 38) points out that sight is a key stimulus during a child's development therefore young children should be motivated to use their residual vision. Barry and Konig (2003, p. 911) report that screening for eye conditions guarantees that eye problems will be diagnosed in time so that early treatment will be commenced. It is therefore necessary to identify children for whom reduced vision is a significant problem while avoiding unnecessary referrals of normal children. Obtaining a current and past visual history is critical to identifying children who pose a high risk for vision anomalies. According to Rahi (1998, p. 37) visual acuity testing should be carried out at the appropriate distance and if possible using linear optotypes to ensure the effect of crowding is not overlooked in children with amblyopia.

Rahi (1998, p. 36) reports that ophthalmic examinations of a child with visual loss aims to confirm the impairment, establish diagnosis, identify the treatment required and describe the prognosis for the disorder causing visual loss. Barry and Konig (2003, p. 911) observe that the ability of children to co-operate can affect the results of vision screening. It is therefore desirable that the screening process should be able to differentiate between those who actually have reduced vision and those who fail screening because of other factors related to ability to co-operate. Visual acuity testing is the most important single screening item in detecting refractive errors. It depends more on cooperation and age than cover testing does. That is why it is almost impossible to test young children for visual acuity. Orthoptic screening in populations with a greater proportion of

strabismic amblyopias may be even more sensitive and specific, with less "inconclusive" results (Barry & Konig, 2003, p. 912).

Barry and Konig (2003, p. 913) argue that the underlying motive of vision screening is to identify and treat amblyopia as early as possible in the critical development stage by correctly identifying Snellen-equivalent resolvable visual loss. Since the successful treatment of amblyopia rests on early diagnosis and treatment, it is essential to get reliable visual acuity readings as soon as the child is able to cooperate with visual testing. Most children who are found to have good visual acuity are unlikely to have refractive errors and therefore benefit from glasses is very minimal. Rahi (1998, p. 36) argues that the examination by ophthalmic professionals is important in the assessment of visual function and educational needs of the child, which form the plan for management of that child.

### **2.3 When to test children**

Mocan *et al.* (2005, p. 49) point out that visual screening for young children is possible by age 2[1/2] years although routine visual testing has been recommended at 3 years by the American Academy of Paediatrics (AAP), the American Association for Paediatric Ophthalmology and Strabismus (AAPOS) and American Academy Of Ophthalmology (AAO). Barry and Konig (2003, p. 910) suggest that the fourth year of life is considered best for vision screening as from this age onwards most children are more likely to co-operate and therefore visual acuity can reliably be assessed by simple screening methods. Rahi (1998, p. 38) states that with young children and those unable to read matching tests like Sheridan Gardner charts can be used.

“In a joint policy statement with the AAO, AAPOS and the American Association of Certified Orthoptists (AACO), the AAP recommended that physical inspection of eye functioning and overall eye health should begin at birth and that objective

evaluation of acuity should be initiated by 3 years of age”  
(Hartmann, *et al.* 2006, p. 226).

Formal visual acuity in adults and literate children according to Mocan *et al.* (2005, p.48) is usually tested with a Snellen chart which presents letter optotypes with certain physical characteristics designed to evaluate two-point discrimination. However, due to the abstract nature of this chart it cannot be used in the young preliterate paediatric population and various visual acuity charts have been developed for this purpose. Moutakis, Stigmar and Hall-Lindberg (2004, p. 548) observe that the diagnosis of amblyopia can easily be missed if visual acuity (VA) is tested with single optotypes. Therefore, it is generally accepted that VA testing in young children should be performed with the optotypes in rows (line acuity measures) as soon as the child is mature enough to co-operate. In Germany about 50% of children enter kindergarten at age 3 and more than 80% attend kindergarten at age 4, therefore kindergarten offers easy access to large numbers of children without efforts from the parents (Barry & Konig, 2003, p. 911). Rahi (1998, p. 37) observes that in cooperative children aged 18-24 months it is possible to use picture optotype tests such as Kay's pictures at a short distance.

Hard (2006, p. 418) states that in Sweden after the introduction of a preschool year for 6-year-olds, eye testing was introduced at 6 years rather than 7 years of age. Regardless of testing children early, some cases of amblyopia can be missed resulting in them developing myopia and other conditions that need to be corrected during the preschool years. Testing at 6 rather than 7 years of age as was done previously may be advantageous in that it allows for earlier amblyopia treatment (Hard, 2006, p. 417). Rahi (1998, p. 36) points out that the ophthalmic examination of a child is basically the same as that of an adult although different techniques may be used according to the child's age, personality, ability to cooperate and level of responsiveness. Furthermore measuring visual functions in children is not straight forward as the visual system is immature at birth and development is rapid in the first year of life, continuing into late adulthood. Based on the above it is evident that it can be

difficult to predict the final visual acuity outcome in infants and very young children.

Rahi (1998, p. 37) reports that standard optotype tests such as the Snellen E chart can be used in children 3 years and older. Barry and Konig (2003, p. 910) argue that the re-testing of preschool children who fail the first screening test is important in reducing the number of over-referrals and it is thus cost-effective. It is necessary to test children with VA of 0.65 (logMAR 0.2) after an extra year of maturation in the first grade at school avoiding unnecessary referral (Barry & Konig, 2003, p. 911). Lynch and McCall (2007, p. 27) suggest that in a situation of older preschool children teachers can perform a preliminary functional visual assessment using an E chart. Rahi (1998, p. 37) states that despite using different and appropriate methods at different ages measuring visual acuity in infants and preschool children remains difficult and it is important to assess the eyes separately as well as together whenever possible.

Newman *et al.* (1996, p. 1077) observe that amblyopia develops during the sensitive period of visual maturation which continues until about eight years of age. Newman *et al.* (1996, p. 1077) report that amblyopia responds to treatment provided it is treated during the sensitive period. The American Academy of Paediatrics (2003, p. 902) recommends that, to achieve the best results the most sophisticated test that the child is capable of performing should be used. Newman *et al.* (1996, p. 1077) argue that for the majority of amblyopic children early detection depends on vision screening.

Newman *et al.* (1996, p. 1077) state that it has been suggested that 3 1/2 years of age detection for amblyopia might be too late to allow effective treatment for amblyopia. However, Newman *et al.* (1996, p. 1081) in their study of "Preschool vision screening: outcome of children referred to the hospital service" the results showed that most amblyopic children detected at 3 1/2 years of age achieve a good visual outcome with treatment. The extent to which preschool children benefit from early correction of their refractive error is uncertain (Newman *et al.*, 1996, p. 1082).

## 2.4 Gold standard evaluation

Barry and Konig (2003, p. 912) observe that the evaluation of screening tests performed in a community is prone to be affected by examination or verification bias. This bias is introduced if the diagnosis for patients with different screening test results is not equally likely to be confirmed by a gold standard evaluation. Watt (n.d.) reports that a standard eye chart is necessary to make comparisons and to record people's visual acuity. "Verification bias has been shown to be frequent in paediatric studies" (Barry & Konig, 2003, p. 910). Watt (n.d.) points out that the tumbling E chart with the capital letter E facing different directions is used as a standard chart for illiterate people including children.

Hussain, Saleh, Sivaprasada and Hammond (2006, p. 6) point out that although the Snellen chart is the universally used tool for visual acuity it has poor reliability and reproducibility. The Snellen E chart has letters or optotypes of different sizes that are read one at a time from a distance of 6 meters and each line has a different number of letters/optotypes so, for example, people with normal vision are able to read the 6 meter line at 6 meters and it is recorded as 6/6. Kemper, Margolis, Downs and Bordley (1999, p. 1220) in their systematic review of vision screening tests for the detection of amblyopia found that the Snellen E has a sensitivity of 9%-12.5% and a specificity of 99%. Although the Snellen chart has poor reliability Hussain *et al.* (2006, p. 7) report that since its introduction in 1862 it has been adopted as the standard for measuring visual acuity.

## 2.5 Standardized charts for children

Simons (1983, p. 84) and Drover *et al.* (2007) state that although visual acuity tests in young children is both important in clinical and screening settings there are no universally standardized visual acuity protocols for young children. Becker, Hubsch, Graf and Kaufmann (2002, p. 514) observe that picture charts for items known to children are hardly standardized. McGraw and Winn (1993) observe that problems with the use of the Snellen chart have led to alternative

charts for measuring visual acuity in adults but advances in chart design for preschool children have not been developed. Drover *et al.* (2007) observe that visual acuity is also a desirable outcome measure for paediatric eye research. Simons (1996, p. 16) reports that single optotypes mostly used for visual acuity tests in preschool children suffer from false negatives in amblyopia detection. Simons (1996, p. 16) states that crowded single optotypes have been reported to be more reliable although performance of this type of screening has not been reported yet.

Santamaria, Brown and Story (1998, p. 4) observe that for the screening to be more efficient, it must have a high attendance rate so that a lot of results could be achieved. Amblyopia, refractive errors and non-cosmetically obvious squints are associated with one another although the relationship is complex. Snowdon and Steward-Brown (1997) argue that if visual acuity screening is done appropriately all the children failing could be regarded as disabled. These authors state that refractive errors create a blurred image on the retina resulting in a reduced visual acuity. The American Academy of Paediatrics (2003, p. 903) recommended that paediatricians should use picture cards and wall charts as young children have some difficulties in using vision testing machines.

Current methods of eye screening for preschool children are successful when conducted by well trained personnel (Newman *et al.* 1996, p. 1077). Simons (1983, p. 84) suggests that a standard test should meet the following criteria: it should utilize a letter optotype and a single optotype with contour interaction bar surround, it should permit non-verbal pointing responses in young children and verbal responses in older children. If an orientation specifying optotype is followed as an E or C, the test should use three alternative choices (up, down and sideways). Simmers *et al.* in Jones, *et al.* (1998, p. 4) argue that the reliability of the screening test depends on those who do the test, that is why the test should not be done by everyone but it should be performed by qualified staff at the clinic. Bishop (1991) observes that screening preschool children in their homes can produce 100% attendance even though the conditions are not conducive for screening.

# CHAPTER 3

## METHODOLOGY

### 3.0 Introduction

The methodology discussed in this chapter covers aspects of quantitative research design, the measures taken to ensure scientific rigor and the ethical issues that impact on the study.

### 3.1 Research Design

A descriptive cross-sectional, comparative design was used for this study. Cross-sectional designs are used to examine groups of subjects in various stages of development simultaneously (Burns & Grove, 1993, p. 297). The aspect of development as it relates to the present study is the age of the Standard One learners, position in the educational system, growth pattern or stages of maturation and personal growth (Burns & Grove, 1993, p. 297). Subjects are then categorized by group and data on the selected variables are collected at a single point in time.

Polit and Beck (2004, p. 166) state that cross-sectional designs involve the collection of data at one point in time. In this study data was collected at one point in time. Cross-sectional studies are appropriate for describing status of phenomena or for describing relationships among phenomena at a fixed point in time (Polit & Beck, 2004, p. 166; LoBiondo-Wood & Haber, 1986, p. 134). Polit and Beck (2004, p. 166) argue that cross-sectional designs are easy to do and very economical even though there are problems in inferring changes over time.

Comparative designs examine the relationships between variables as they exist without manipulating them (Wood & Brink, 1998, p. 143) as was done in this study. Descriptive comparative designs are used to define and describe the relationships between concepts and variables (Routio, 2007). Catanzaro (1988)

defines comparative studies as a design involving comparing and contrasting two or more samples on one or more variables at a single point in time. In this study the researcher compared a Western picture types chart and an African picture types chart against the gold standard illiterate E chart. Polit and Beck (2004, p. 192) define the purpose of descriptive research as to observe, describe and document aspects of situations as it naturally occurs.

“The word design implies the organization of elements into a masterful work of art” (LoBiondo-Wood & Haber, 1986, p. 101). The purpose of the research design is to provide the plan for answering specific research questions. A descriptive cross-sectional, comparative design was used for this study to compare the validity of the Western Dr Beale Collin’s Picture Types Chart (Appendix K) with that of an African (Powell) Picture Types Chart (Appendix L) against the Snellen E chart (Appendix J) used as the gold standard for determining resolvable visual acuity.

### **3.2 Research setting**

According to Polit and Beck (2004, p. 164) research sites are locations for the research and are more specific places where data collection will take place. Sites and settings should be selected so as to maximize the validity and reliability of the data. Research can be conducted in a wide variety of locales including health care facilities, in people’s homes, in classrooms and so on. Researchers make decisions about where to conduct a study based on the nature of the research question and the type of information needed to address it. The researcher decided to use the Standard Ones in rural primary schools as there are no preschools in those rural areas. The Standard Ones were thought to be appropriate as they were still new in the school and the researcher assumed that they were still preliterate. “Researchers sometimes engage in multi-site studies because the use of multiple sites usually offers a large or more diverse sample of study participants” (Polit & Beck, 2004, p. 28). It is important to select an appropriate setting because the nature of the setting can influence the way the people behave or feel and how they respond to questions.

The study was conducted in three primary schools in rural Botswana determined by the number of Standard One learners to satisfy the sample size requirement. The rural areas selected for the study were Mahotshwane, Khokhwa and Sekoma Villages. Population figures for Mahotshwane, Sekoma and Khokhwa are 775, 1327 and 525 respectively (Central Statistics Office, 2002). They are rural villages on the western side of Botswana. The villages of Mahotshwane, Sekoma and Khonkhwa are 70km, 80km and 90km west of Jwaneng town respectively. Jwaneng town is commonly known for diamond mining.

These villages each have a health post, run by a nurse, Family Welfare Educators (FEW) and lay counsellors. The schools were Mahotshwane, Sekoma and Khonkhwa Primary Schools. Mahotshwane Village was selected as the first research setting for the researcher's convenience as the researcher comes from this Village and data were collected during the University of Cape Town vacation. Sekoma and Khonkhwa villages are nearby and were included to reach the required number of participants for the sample size.

### **3.3 Study Population**

There are no preschool facilities in the rural parts of Botswana so it would have not been easy to locate preschoolers. The researcher then decided to use Standard One Learners as participants as it was assumed that they would be preliterate. Polit and Beck (2006 p. 56) define population as all the individuals or objects with common, defining characteristics. Fraenkel and Wallen (1993, p. 80) define population as the group of interest to the researcher, the group to whom the researcher would like to generalize the results of the study. Polit and Beck (2004, p. 290) state that populations are not restricted to human subjects only but it could consist of all the hospital records on file in a particular hospital. According to Wilson (1989, p. 256) population is the total group that meets the criteria for the study. The total population consisted of all Standard One learners (children of 5-7 years of age) in Botswana.

### **3.3.1 Sampling and Sample size**

One of the most important steps in the research process is to select the sample of individuals who will participate (be observed or questioned) in the study. "Sampling refers to the process of selecting representative subjects for the study" (Fraenkel & Wallen, 1993, p. 79; LoBiondo-Wood & Haber, 1986, p. 101). Sampling is the process of selecting a portion of the designated population to represent the entire population (LoBiondo-Wood & Haber 1986, p. 206; Polit & Beck 2004, p. 291). The study was conducted with Standard One learners in the selected primary schools. Cluster sampling was used in this study. According to Fraenkel and Wallen (1993, p. 84) cluster sampling is the selection of groups or clusters of subjects rather than individuals. They define a sample in a research study as any group on which information is obtained. Researchers work with samples rather than populations because it is more cost effective to do so. Wilson (1989, p. 263) states that the following guidelines may help in determining the sample size:

- "If the population is homogeneous, you can use a smaller sample than if it is heterogeneous [and this study utilizes a homogeneous sample],
- If you use a research design that requires numerous treatment groups (experimental design), then you must determine the number of subjects needed for the smaller groups (called cells) and not just for the larger group heading,
- Survey designs frequently use many more subjects than observational or experimental designs, because telephoning or mailing questionnaires to a large number of people is feasible, whereas observing large numbers of people may not be,
- A thorough review of literature will give you ideas about what size sample is typical for certain types of research questions and designs used in nursing research and
- The statistical analyses you choose to use may impose certain requirements regarding sample size".

The sample size for the study was a minimum of ninety six (96) Standard One learners, determined with the help of a statistician. The statistician was given the two percentages estimated by the researcher to be that at which the learners can recognize pictures. For the Dr Beale Collin's Picture Types Chart this was estimated to be 80 % and for the Powell Picture Types Chart it was estimated to be 90%. The statistician calculated the sample size using the following formula:

$$n = \frac{p(1-p) 1.96^2}{d^2}$$

where p = 0.50 (50% expected)

d = 0.10 (in precision of 10%)

based on the above formula

$$n = 96$$

Mahotshwane Primary School had forty-two (42) Standard One learners, Sekoma Primary School had thirty-five (35) Standard One learners and Khonkhwa Primary School had twenty-five (25) Standard One learners. The researcher therefore used all three primary schools in the study. In view of the small numbers in each class, the researcher sampled all learners in each Standard One class in each school which added up to hundred and two (102) learners.

### **3.3.1.1 Inclusion Criteria**

According to Polit and Beck (2004, p. 290) researches should be specific about the criteria that define who is to be included in the population. All the pupils in each school, that is, boys and girls aged between 5-7 years of age, were included in the study whether or not they were repeating the year after failing the previous year. The researcher anticipated that the majority of the learners would be preliterate with the exception of the repeaters. According to Polit and Beck (2004, p. 290) eligibility criteria may reflect one or more of the following issues:

- "Costs - Some criteria result from cost constraints,
- Practical concerns - Sometimes there are other practical constraints such as difficulty in including people who are hearing impaired. [Although the

researcher did not encounter this situation it would have been difficult to test such a child as the researcher is not competent in the use of sign language],

- People's ability to participate in a study - The health condition of some people may preclude their participation [In this study all the selected children were healthy enough to participate] and
- Design considerations - It is sometimes advantageous to define a fairly homogenous population as a means of controlling extraneous variables". The selected participants in this study were all in Standard One making it a homogeneous population.

The criteria used to define a population for a research project have implications for both the interpretation of the results and the generalizability of the findings (Polit & Beck, 2004, p. 290).

### **3.4 Data collection**

#### **3.4.1 Data collection method and process**

The study was designed to compare the effectiveness of the Western Dr Beale Collin's Picture Types Chart (Appendix K) with an African Picture Types Chart (Appendix L) against the Snellen E chart (Appendix J) as the gold standard for determining resolvable visual acuity.

Data are pieces of information obtained in the course of the investigation (Polit and Beck, 2004, p. 32). In quantitative studies researchers identify the variable of interest, develop operational definitions of those variables and collect relevant data from subjects. The variables in the present study are gender, age, visual acuity for the three charts and recognition of pictures for both the Dr Beale Collin's Picture Types Chart and the Powell Picture Types Chart. Decisions about data collection methods should be guided by ethical considerations, cost considerations, time pressures and anticipated burden to participants. Data collection is the costliest and most time consuming portion of

the study (Polit & Beck, 2004 p. 326). During data collection, any child who would be found to have any eye problems, their parents and the village nurse will be notified so that appropriate measures could be taken to help the child.

### **3.4.2 Data collection tools**

A distinction was made between the researcher designed data collection tool (Appendix H) and the three eye screening tools (Dr Beale Collins Picture Types Chart, the Powell (African) Picture Types Chart and the Snellen's Chart) used for testing the participants' vision. Polit and Beck (2004, p. 326) point out that data collection instruments should be assessed to determine their appropriateness after they have been identified. This will confirm whether the instrument is conceptually relevant, that is, if it captures the conceptual definition of the variable and whether it will yield data of sufficiently high quality. The researcher designed data collection tool (Appendix H) captured the following data when the participants' vision was tested:

- Participant code number,
- Gender,
- Age in years,
- Visual acuity for E Chart (Appendix J),
- Visual acuity for the Dr Beale Collin's Picture Types Chart (Appendix K),
- Visual acuity for the Powell Picture Types Chart (Appendix L),
- Number of items recognized on the Powell Picture Types Chart and
- Number of items recognized on the Dr Beale Collin's Picture Types Chart.

There was no intention to amend the three eye screening tools. For measurement of sensitivity, the charts are intended to identify children who have a refractive error, that is, a child who has a visual acuity of 6/18 and worse. The specificity of each chart depends on the number of pictures correctly recognized on each chart. The final column on the data collection tool was for capturing visual acuity result with the Powell Picture Types Chart specifically to confirm the earlier data as it was the first time that the chart would have been

used. The fact that there are thirteen (13) items on the Powell Picture Types Chart and sixteen (16) on the Dr Beale Collin's Picture Types Chart was of concern but the charts were not changed.

The Dr Beale Collin's Picture Types Chart (Appendix K) was developed in the United Kingdom but has been, and may well still be used in South Africa. The African Picture Types Chart (Appendix L) was developed by Dianna Powell, an ophthalmic trained professional nurse in Cape Town, South Africa in 2006 but has not yet been implemented.

An ophthalmologist at the Red Cross War Memorial Children's Hospital was contacted to confirm the explanation of specificity and sensitivity in relation to the picture charts. "Sensitivity refers to the ability of an instrument to detect true instances of the phenomenon (true positives) whereas specificity refers to the ability of the instrument to detect instances in which the phenomenon is not present (true negatives)" (Catanzaro, 1988, p. 257).

### ***3.4.3 Pilot test of data collection tool***

Before the study was undertaken the data collection tool (Appendix H) was pre-tested on 8 children aged between 5 and 7 years (Appendix C) at the Red Cross Children's Hospital in Cape Town. Polit and Beck (2006, p. 506) report that a pilot study is a small scale version or trial run undertaken in preparation for a major study. The pilot study was undertaken to test the validity and reliability of the data collection tool so that any changes could be made well ahead of time before the main study was commenced. Research cannot contribute evidence to guide clinical practice if the findings are inaccurate or biased. Consumers of research need to assess the quality offered in a study by evaluating the conceptual and methodological decisions the researcher made. Therefore producers of research need to strive to make good decisions to produce evidence of the highest possible quality by conducting a pilot study before embarking on the main study.

### **3.4.3.1 Reliability**

Reliability is concerned with how accurately and consistently the measurement technique measures the concept of interest (Burns & Grove, 1993, p. 339; Polit & Beck 2004, p. 35; Wilson, p. 358). Reliability refers to the proportion of accuracy in measurement (LoBiondo-Wood & Haber 1986 p. 188). For example when each learner is tested by two evaluators at the same time for visual acuity using the three charts sequentially, each evaluator should score each learner the same. This is inter-rater reliability (Burns & Grove, 1993, p. 339). Catanzaro (1988, p. 251) states that inter-rater reliability relates to the level of accuracy when two or more individuals apply the same measuring instruments, then ending up with the same findings. It reflects the accuracy of those doing the rating rather than the accuracy of the instrument itself. The same score should be given by each evaluator for picture recognition in each chart. A limitation of the pilot study is that there was no inter-rater reliability testing of the data collection tool. The participants were therefore only tested once with each eye screening chart. Nevertheless, during the pilot testing phase the data collection tool and the eye screening tools were administered in the same way (consistently) for each participant.

### **3.4.3.2 Validity**

Validity of an instrument is the determination of the extent to which the instrument actually reflects the abstract construct being examined (Burns & Grove, 1993, p. 342; Catanzaro, 1988, p. 251; LoBiondo-Wood & Haber, 1986, p. 101). Two nurse researchers and two ophthalmic nurses were consulted to check the data collection tool (Appendix H) for face and construct validity. Burns and Grove (1987, p. 295) state that face validity ensures that the instrument gives the appearance of measuring the content. Colleagues were asked to check the instrument for flow, layout, design and content. Construct validity according to Burns and Grove (1987, p. 296) is the extent to which a measurement strategy measures the construct it was designed to measure. Wilson (1989, p. 357) states that the goal of contrast validity is to demonstrate the extent to which the instrument will discriminate between those who possess

and those who do not possess the characteristics of interest. Polit and Hungler (1999, p. 231) and Polit and Beck (2004, p. 217) define external validity as the generalization of the research findings to other settings or samples.

Polit and Beck (2004, p. 328) state that pre-tests can serve many other purposes including the following:

- "Identifying parts of the instrument package that are difficult for pre-test subjects to read or understand or may have been misinterpreted by them. [The pre-test confirmed that the participants understood what they have to do during the testing.],
- Identifying any instruments or questions that participants find objectionable or offensive. [The pre-test confirmed the questions and the way the researcher should approach the participants.],
- Determining whether the sequencing of instruments is sensible. [The pre-test helped the researcher to change the process of data collection. Before the pre-test the researcher wanted to test visual acuity of the picture charts before recognition of pictures which proved to be inappropriate.],
- Determining needs for training data collection staff. [The researcher alone collected data therefore there was no need to train other staff.] and
- Determining if the measures yield data with sufficient variability". The pre-test confirmed that the data collection tool captured the required variables sufficiently.

Data from the pilot study is presented in Table 3.1.

**Table 3.1: Pilot study data on the data collection tool (Appendix H)**

Participant No.	Gender	Age	VA E chart in log MAR		VA Powell Chart in log MAR		VA Beale chart in log MAR		Recognition Powell Chart %	Recognition Dr Beale Chart %
			R	L	R	L	R	L		
1	M	5	0.00	0.00	0.00	0.00	0.00	0.00	84.6	93.8
2	M	6	0.00	0.00	0.00	0.00	0.00	0.00	84.6	87.5
3	F	6	0.00	0.00	0.00	0.00	0.00	0.00	76.9	62.5
4	M	5	0.00	0.00	0.00	0.00	0.00	0.00	84.6	93.8
5	M	6	0.00	0.00	0.00	0.00	0.00	0.00	92.3	93.8
6	M	5	0.00	0.00	0.00	0.00	0.00	0.00	84.6	93.8
7	M	6	0.00	0.00	0.00	0.00	0.00	0.00	92.3	68.8
8	F	5	0.00	0.00	0.00	0.00	0.00	0.00	92.3	93.8
Mean	m-6 f-2	5.5	0.00	0.00	0.00	0.00	0.00	0.00	86.525	85.975

The visual acuity of each child was 6/6 (0.00 in Log MAR) for the E Chart, Powell and the Dr Beale Collin's Picture Types Charts. The data in Table 3.1 show no difference in the visual acuity of each participant and between the three charts. Only one child was able to recognize all thirteen (13) pictures on the Powell Picture Types Chart. Not one child was able to recognize all sixteen pictures on the Dr Beale Collin's Picture Types Chart. The picture not identified by any child on the Dr Beale Collin's Picture Types Chart was the rocking horse. There is a 0.55% difference in the recognition of the pictures between the Powell and the Dr Beale Collin's Picture Types Charts with the Powell Picture Types Chart scoring highest (86.53%). The mean for the Powell Picture Types Chart for recognition of pictures was 86.53% while it was 85.98% for the Dr

Beale Collin's Picture Types chart. The results show that more pictures were recognized on the Powell Picture Types chart than on the Dr Beale Collin's Picture Types chart.

The pilot test helped the researcher to rearrange the steps of the data collection process (Appendix I). The researcher realized that it would be better if he tested the children for recognition of pictures for both charts before testing for the visual acuity. Doing the tests in this order would eliminate doubt about the visual acuity result being influenced by non-recognition of the picture. The pilot test helped the researcher to estimate the time that it will take for one learner to complete the test which was between 10 and 15 minutes. A retest with the Powell Picture Types Chart for visual acuity was not possible as the participants were out patients therefore they were not available the following day.

#### ***3.4.4.1 Preparation for access to research sites***

After the approval of the research proposal by the University of Cape Town Faculty of Health Sciences Research and Ethics Committee (Appendix D), permission to conduct the study was obtained from the Botswana Ministry of Education and the Ministry of Health's Department of Research (Appendices E and G). The researcher was asked by the Ministry of Education headquarters to inform the Regional education officer in Kanye village and the Education officer in Jwaneng town about the study as the selected schools (Mahotshwane and Sekoma Primary Schools) were under their jurisdiction. The Principals of the two schools (Mahotshwane and Sekoma) were notified of the Department of Education's permission for the researcher to conduct the study at their schools (Appendix E).

The researcher gave a consent form to the learners to give to their parents (Appendix B) a few days before the actual data collection started. On the day of data collection learners were briefed about the aim of the study and told that they are free to participate if they are willing, that is assenting to participate. An assent form in Setswana (Appendix N) for learners was read to each learner

before the commencement of the study and they were asked to put a thumb print on it before the study commenced if they were willing to participate.

#### **3.4.4.2 Data collection process**

The data collection process is summarised in Appendix I.

##### **Day 1: Mahotshwane Primary School**

The principals and the class teachers of the selected primary schools were asked about the most convenient time for conducting the study to avoid interference with the learners' studies. At the first school, Mahotshwane Primary, on the first day, the class teacher allowed the researcher to use her classroom for testing. The school had forty-two (42) Standard One learners including five repeaters. After securing a suitable place for the test the three charts (Appendices J, K & L) were hung on the wall. A distance of 6 meters was measured from the charts and marked. A chair was put at the marked spot for learners to sit on during the test. Learners were then called one by one into the room according to the list given by the class teacher. The class list included the gender and age of each learner and these were noted on the data collection form before the testing began. Learners were tested one at a time in the absence of the others to avoid other learners memorizing and repeating what was said.

1. Each learner was tested by the researcher for visual acuity using the E chart (Appendix H).to establishes a baseline visual acuity for each child and the results were recorded.
2. Each learner was then asked to come near the charts and asked to identify pictures on the Powell Picture Types Chart after which they repeated the process using the Dr Beale Collin's Picture Types Chart, and the results were recorded (Appendix H).
3. Each learner was tested for visual acuity using the Dr Beale Collin's Picture Types and the Powell Picture Types Chart when sitting 6 metres away and the results were recorded (Appendix H).

## **Day 2: Mahotshwane Primary School**

4. The following day the researcher re-tested the learners who were tested the day before for visual acuity with the Powell Picture Types Chart only. The Powell Picture Types Chart was used twice to check for reliability as it had never been tested for reliability before. Burns and Grove (1987 p. 291) report that reliability is how consistently the measurement technique measures the concept of interest. These authors state that reliability testing is a measure of random error in the measurement technique.

When testing for visual acuity using the three charts learners were given an occluder to cover the eye not tested. Learners were assessed for fatigue during the test. They all looked fine during and at the end of the testing. They were then given a packet of potato chips as a snack to thank them and to encourage others coming after them to cooperate. After testing twenty pupils on day one the class teacher thought it was taking her time and decided that the researcher should conduct the study in the afternoons during the learners' self study time. The remaining children were tested for the next three days repeating the test for visual acuity using the Powell Picture Types Chart the day following the full screening.

The two Primary Schools (Mahotshwane and Sekoma) were selected as the research sites during proposal writing and the numbers of learners for both schools were adequate for the sample size at that stage. However, when the study commenced, the researcher checked the number of the Standard One learners in each school and then realized that the sample size was not going to be reached from the Mahotshwane and Sekoma Primary Schools. This occurred while still collecting data from the first school. The researcher then went to the Jwaneng Education Officer to ask for access to more schools. Permission was given to include the Khonkhwa and the Keng Primary schools (Appendix F). These primary schools are in the same region as the Mahotshwane and Sekoma villages.

In the second school, Sekoma Primary, after asking permission from the principal, the researcher gave learners consent forms (Appendix B) to take to

their parents. Sekoma Primary school had thirty five (35) Standard One learners including 3 repeats. The following day the class teacher advised the researcher to conduct the study outside her classroom so that she could continue teaching at the same time. The three charts were hung on the outside wall of the Standard One class and 6 meters were measured from the wall and marked by putting a chair at the spot. Learners were called one at a time and the assent (Appendix N) read to them before the testing commenced. After the testing each learner was given a packet of potato chips. Learners in this school were tested in the same way as those in the first school, that is testing for everything and repeating the visual acuity testing with the Powell Picture Types chart the following day.

The third school, Khonkhwa Primary School, had twenty five (25) Standard One learners including 3 repeats. After contacting the principal of the school in person to ask for permission, the Principal called the class teacher so that the researcher could explain the study to them. After the explanation of the research to the Principal and the class teacher the researcher then gave the class teacher the consent forms (Appendix B) to give to learners to take them home to their parents before the researcher came to conduct the study. When the researcher arrived for the study almost all the consent forms had been returned signed and approved. It was noted in the consent form that if parents did not return the consent forms it was taken as consent for participation.

No parent prevented their child from participating. Only one parent came during the collection of data as she wanted further clarification from the researcher. She told the researcher that she thought he was going to do surgery on the children's eyes but her concerns were dispelled after the explanation was given. The data collection process followed at this school was the same as for the other two schools. Data collection took place outside the classroom while the teacher continued teaching. Learners at this school were also given the snacks after the test. The researcher decided to stop after completing the two day study at the Khonkhwa Primary Schools as the required sample size had been reached. The total number of participants was hundred and two (102).

### **3.6 Data Analysis**

LoBiondo-Wood & Haber (1986, p. 101) argue that no matter how careful data are collected they are meaningless without organization and interpretation. Data from all the learners were captured on the data collection form (Appendix H) and kept in a safe place. The results of the Dr Beale Picture Types Chart test and the Powell Picture Types Chart test were compared with the results of the E chart individually. Data collected were put into the Excel spread sheets and analysed using Stata 10 statistical software. Statistics can be used for a variety of purposes: to summarize, explore the meaning in the deviation of data, compare or contrast descriptively or infer that the findings from the sample are indicative of the entire population. Statistics for the present study include frequency distributions, shapes of distributions, and Pearson's correlation tests which can be used to test if more items are recognized on one instrument than on another.

### **3.6 Ethical considerations**

The research proposal to conduct the study was submitted to the following for approval and permission was granted;

- Research and Postgraduate Committees in the School of Health and Rehabilitation Sciences,
- Faculty of Health Sciences Research and Ethics Committee (Appendix D),
- The Botswana Ministry of Health to include children in the study (Appendix G),
- The Botswana Ministry of Education to include the selected primary schools in the study (Appendices E & F),
- The principals of the schools where the study was conducted (Appendix E).

Consent was obtained from each child's parents (Appendix B) prior to data collection. On the day of data collection each child was asked to assent to participation by thumb print (Appendix N).

Blanche, Durheim and Painter (2006, p. 78) state that in ethics it is essential to protect the welfare of research participants. Research ethics however involves more than a focus on the welfare of research participants and extends into areas such as scientific misconduct and plagiarism. Polit and Beck (2004, p. 142) argue that research that violates ethical principles is rarely done specifically to be cruel but more because that knowledge is important and potentially life saving in the long run. Thompson, Melia and Boyd (1995, p. 118) point out that research which is not conducted according to the proper scientific procedure is valueless and research which is not conducted with proper respect of rights of participants may become inhumane. That is why when humans are used as study participants care must be exercised in ensuring that rights of those humans are protected (Polit & Beck, 2004 p. 141). Following are some of the ethical issues that were considered during the study.

### ***3.6.1 Principle of Autonomy and Dignity***

Schwirian (1998, p. 294) states that autonomy is the right to independence and personal freedom, which leads to privacy of self-determination. Polit and Beck (2004, p. 147) point out that humans should be treated as autonomous agents capable of controlling what happens in their lives which is why children were asked to assent before they could be enrolled in the study. Pera (2002, p. 45) has argued that autonomy expresses respect for the unconditional worth of an individual and respect for an individual's thought and action. Respect for individual thought and action means allowing people to make choices according to their convictions as long as the choices made do not limit the freedom of choice of others and do not harm others. People should never be forced to participate in studies if they do not want to. Polit and Beck (2004, p. 147) argue that coercion involves threats of penalty for failing to participate in the study or providing excessive rewards for agreeing to participate. The obligation to protect people from coercion requires careful thought when the researcher is in a position of authority.

Van der Wal (2002, p. 159) states that autonomous individuals are capable of being informed about the implications of research studies. It is the responsibility of the researcher to respect the autonomy of vulnerable individuals and individuals with diminished autonomy and where necessary to locate the legal guardians or suitably responsible persons from whom consent to include these individuals in research will have to be obtained. Parents were given the consent form as the participants were minor and considered vulnerable. Human beings should be treated as autonomous agents, capable of controlling their own activities and destinies. The researcher had designed the study to ensure that the research participants although minor children have the right to decide voluntarily whether to participate in the study (Appendix N), without the risk of incurring any penalties or prejudicial treatment. Learners had the right to decide at any point to terminate their participation, to refuse to give information or to ask for clarification about the purpose of the study or specific study procedure. None of the participants refused to participate, and none asked for clarification of the purpose of the study or the study procedure which the researcher took as a sign of understanding.

According to Polit and Beck (2004, p. 151) informed consent means that participants have adequate information regarding the research, are competent to understand the information and have the power of free choice enabling them to consent to or decline participation voluntarily. Informed consent ensured that the parents of the participants had a choice to allow or disallow their children to participate without any punishment if they refused to participate (Appendices A & B). Legally and ethically, children do not have the competence to give their informed consent. Generally the informed consent of children's parents or legal guardians should be obtained. Gerrish and Lacey (2006, p. 34) state that the ability to act and decide autonomously develops with maturity, but even very young children of primary school age are capable of holding reasoned, well-informed views on issues that affect them.

Schenk and Williamson (2005, p. 4) argue that children must be given the opportunity to express their views about activities that affect their welfare and these views should be respected. In this study assent was obtained verbally

and by thumb print (Appendix N) from each child. An informed consent form for parents was designed by the researcher in English (Appendix A) and in Setswana (Appendix B). The Setswana consent form was read and edited by a Setswana-speaking researcher. Parents were asked to respond by coming to the researcher if they did not want their children to participate in the study. If children did not return a signed consent form refusing permission, their children were included in the study. No parent restricted their child's participation. A Setswana assent consent form for the children (Appendix N) was read to all the children as all children were Setswana speaking and they were allowed to ask questions if they needed any clarification but none of the children asked for clarification. They were also told that they are free to choose whether to participate or not to participate without any punishment. All the participants put their thumb prints on the assent form as most may have not known how to write their names. The researcher used Setswana to introduce himself and to explain the study.

Polit and Beck (2004, p. 149-151) state that a fully informed consent involves communicating the following information to participants:

- "Participant status - Prospective participants need to understand clearly the distinction between research and treatment. They should be told which health care activities are routine and which are implemented specifically for the study. They also should be informed that data they provide will be used for research purposes,
- Study goals - The overall goals of the research should be stated, in lay rather than technical terms. The use of which the data will be put should be described,
- Type of data - Prospective participants should be told the type of data that will be collected,
- Procedures- Prospective participants should be given a description of the data procedures and of the procedures to be used in an innovative treatment,
- Nature of the commitment - Information should be provided regarding participants' estimated time commitment at each point of contact

Sponsorship- Information on who is sponsoring or funding the study should be noted; if the study is of an academic requirement, this information should be shared,

- Participant selection - Researchers should explain how prospective participants were selected for recruitment and how many people will be participating,
- Potential risks - Prospective participants should be informed of any foreseeable risks (physical, psychological, social or economic) or discomforts that might be incurred as a result of participation and any efforts that will be taken to minimize risks. The possibility of unforeseeable risks should also be discussed if appropriate. If injury or damage is possible, treatments that will be made available to participants should be described. When risks are more than minimal, prospective participants should be encouraged to seek advice of others before consenting,
- Potential benefits - Specific benefits to participants, if any, should be described, as well as information on possible benefits to others,
- Alternatives - If appropriate, researchers should provide information about alternative procedures or treatments that might be advantageous to participants,
- Compensation - If stipends or reimbursements are to be paid (or if treatments are offered without fee), these arrangements should be discussed,
- Confidentiality pledge - Prospective participants should be assured that their privacy will at all times be protected.
- If anonymity can be guaranteed, this should be noted,
- Voluntary consent - Researchers should indicate that participation is strictly voluntary and failure to volunteer will not result in any penalty or loss of benefits,
- Rights to withdraw and withhold information - Prospective participants should be told that even after consenting they have the right to withdraw from the study and to refuse to provide any specific piece of information. Researchers may in some cases need to provide participants with a

description of circumstances under which researchers would terminate the overall study and

- Contact information - The researcher should provide information on whom participants could contact in the event of further questions, comments or complaints”.

Consent is normally presented to participants while they are being recruited either orally or in writing. In this study the consent was presented in writing. It is important for participants to fully understand the consent as it is based on the participant's evaluation of potential risks and benefits (Polit & Beck, 2004, p. 152). Researchers should use simple language and avoid jargon and technical terms whenever possible. They should also avoid biased language that might influence the person's decision to participate.

#### ***3.6.1.1 Confidentiality and anonymity***

Researchers need to ensure that their research is not more intrusive than it needs to be and that the participants' privacy is maintained throughout the study (Van der Wal, 2002, p. 160). Study participants have the right to expect that any information collected during the study will be kept in the strictest confidence. The identity of participants was known to the researcher but anonymity was protected by using code numbers for each participant and data was published in the dissertation using code numbers only. Code numbers also protected the confidentiality of the data so that participants' identity could not be linked to the data. The researcher regarded his promise of confidentiality to participants as a pledge that any information that the participant provides will not be publicly reported in a manner that identifies the participant or made accessible to parties other than those involved in the research. Data were kept in a locked drawer and the key was kept safe.

### **3.6.2 Principle of Beneficence**

The ethical principle of beneficence in research imposes a duty on researchers to minimize harm and to maximize benefits (Polit & Beck, 2006, p. 87). Polit and Hungler (1999, p. 134) argue that beneficence is one of the most ethical principles in research which includes freedom from exploitation, benefits from research and the risk/benefit ratio. Involvement in a research study should not place people at a disadvantage or expose them to situations for which they have not been explicitly prepared. Polit and Beck (2004, p. 143) point out that exposing study participants to procedures that can result in serious or permanent harm is not allowed. Protecting study participants from physical harm may be straightforward but the psychological consequences may be unnoticed and thus require close attention and sensitivity (Polit & Beck, 2004, p. 145). Involvement in the study should not place participants at disadvantage or expose them to situations for which they have not been prepared. Ethical researchers should be prepared to terminate the research if they suspect that continuation would result in injury, death or disability or undue stress to participants.

Polit and Beck (2004, p. 46) state that it is important to share risks and benefits that participants might experience so that they can evaluate whether it is in their best interests to participate. One learner who was found to have a refractive error was referred to the village nurse who had to make the necessary arrangements for referral of the child to the ophthalmologists in the nearby hospital as there was no hospital in any of the research sites. Minimal risks were expected and if risks were identified they would have been addressed.

### **3.6.3 Principle of Nonmaleficence**

This principle involves avoiding doing harm or causing no harm to be done. Polit and Beck (2006, p. 87) state that it is the researcher's duty to avoid, prevent and minimize harm to study participants. Participants should not be subjected to any unnecessary risks of harm or discomfort and their participation in research

must be voluntary to achieve important scientific and societal values that could not otherwise be realized. Polit and Hungler (1999, p.134) caution that exposing research participants to experiences that result in serious or permanent harm is unacceptable. Research should only be conducted by qualified people, especially if potentially dangerous technical equipment or specialized procedures are used. The researcher was a novice but was supervised as far as possible by the supervisor. No potentially dangerous technical equipment or specialized procedures were used in this study.

The study the researcher conducted was quite safe. The researcher was prepared at any time to terminate the study if there was reason to suspect that continuation would result in injury, exhaustion, disability or undue distress to study participants. If a learner had started to cry for no reason before or during the time that data was collected and could not be consoled, then the study participant would have been eliminated from the study. It was explained that there were no risks involved in the study as they only had to identify pictures on a chart from a distance without anything being put into their eyes.

#### ***3.6.4 Principle of Justice***

Polit and Beck (2004, p. 149) point out that the principle of justice is the third broad principle articulated in the Belmont report concerning justice. Participants for the present study were selected based on age and grade and not social background. Any child in the school who was in Standard One, aged between five (5) and seven (7) was eligible to participate provided their parents did not restrict their participation. Schwirian (1998, p. 294) defines justice as a professional obligation to be fair to all people. All people have the right to be treated equally, no matter what their age, sex, social class or religious beliefs. This principle includes the participants' right to fair treatment and the right to privacy (Polit & Hungler, 1999, p. 138). Study participants had the right to fair and equal treatment before, during and after their participation in the study.

Polit and Beck (2004, p. 149) state that fair treatment includes the following features:

- “The fair and non-discriminatory selection of participants such that any risks and benefits will be equally shared; participants should be selected based on research requirements and not on the vulnerability in compromised position of certain people,
- Respect for cultural and other forms of human diversity,
- The non-prejudicial treatment of those who decline to participate or withdraw from the study after agreeing to participate,
- The honouring of all agreements between researchers and participants, including adhering to procedures described to them and payment of any promised stipends,
- Participants’ access to research personnel at any point in the study to clarify information,
- Participants’ access to appropriate professional assistance if there is any physical or psychological damage.
- Debriefing, if necessary to divulge information withheld before the study or to clarify issues that arose during the study and
- Courteous and tactful treatment at all times”.

All research with humans involves intruding into personal lives. Therefore researchers should ensure that their research is not more intrusive than it needs to be (Polit & Beck, 2004, p. 149). Researchers should make sure that privacy of their participants is maintained throughout the study. According to Polit and Beck (2004, p. 149) participants have the right to expect that any data they provide will be kept in the strictest confidence. Anonymity occurs when even the researcher is not able to link participants to their data. A promise of confidentiality is a pledge that any information participants provide will not be publicly reported in a manner that identifies them and will not be made accessible to others. Research information should not be shared with strangers nor with people known to the participants (Polit & Beck, 2004, p. 150).

Polit and Beck (2004, p. 150) state that researchers can take a number of steps to ensure that breaches of confidentiality do not occur including the following:

- “Obtain identifying information from participants only when essential,

- Assign an identification (ID) number to each participant and attach the ID number rather than other identifiers of the actual data,
- Maintain identifying information in a locked file,
- Restrict access to identifying information to a small number of people on a need-to-know basis,
- Enter no identifying information onto computer files,
- Destroy identifying information as quickly as practical,
- Make research personnel sign confidentiality pledges if they have access to data or identifying information and
- Report research information in the aggregate; if information for a specific participant is reported, takes steps to disguise the person's identity such as through the use of a fictitious name".

### **3.6.5 Vulnerable Participants**

Vulnerable participants are those people that are capable of being physically or emotionally wounded or hurt. Van der Wal (2002, p. 157) states that though health care professionals are alert to vulnerability, some groups of potential research respondents and informants may feel particularly vulnerable when pressure is put on them to participate in health research. Both vulnerability and the potential for exploitation increase when autonomy is diminished, as in case of a child or someone who is mentally incapacitated. Circumstances can also render individuals who are quite competent vulnerable.

According to Polit and Hungler (1999, p. 143) vulnerable communities are characterized by one or more of the following:

- "Limited economic development,
- Inadequate protection to human rights,
- Discrimination on the basis of health status,
- Inadequate understanding of scientific research,
- Limited availability of health care treatment options and
- Impaired ability of individuals in the community to provide informed consent".

Vulnerable participants may be incapable of fully giving consent for example mentally retarded persons or they may be at risk of unintended side effects because of their circumstances for example pregnant women (Polit & Hungler, 1999, p. 143). Researchers interested in studying high risk groups should become acquainted with laws and guidelines governing informed consent, risk/benefit ratio assessment, and acceptable procedures for research involving the group of interest. In general, research with vulnerable groups should be undertaken only when the researcher has determined that the risk/benefit ratio is low or when there is no alternative.

Among the groups that the researchers should consider as being especially vulnerable are the following:

- Children: Legally and ethically, children do not have the competence to give their informed consent. Generally the informed consent of children's parents or legal guardian should be obtained. If the child is developmentally mature enough to understand the basic information involved in the informed consent it is advisable to obtain a written consent from the child as well. Gerrish and Lacey (2006, p. 34) state that the ability to act and decide autonomously develops with maturity, but even very young children of primary school age can be capable of holding reasoned, well-informed views on issues that affect them. Schenk and Williamson (2005 p. 4) argue that children must be given the opportunity to express their views about activities that affect their welfare and these views should be respected. Investigators have a responsibility to identify appropriate opportunities and roles for young people to express their views about information gathering activity in ways that are appropriate to their age. Children and adolescents can provide crucial information about their needs and how to respond to them. Promoting the participation of children and adolescents recognizes their potential to enrich decision making processes, to share perspectives and to participate as active citizens,
- Mentally or emotionally disabled people: Individuals whose disability makes it impossible for them to weigh the risks and benefits of

participation and make an informed decision also cannot legally or ethically be expected to provide informed consent. In such cases the researcher should obtain the written consent of each person's legal guardian. However the researcher should be sensitive to the fact that the legal guardian may not necessarily have the person's best interest in mind. In such cases informed consent should be obtained from a person whose primary interest is the person's welfare,

- Physically disabled people: For certain physical disabilities, special procedures for obtaining consent maybe required. For example for people who have a physical impairment preventing them from writing or for participants who can not read nor write alternative procedures for documenting informed consent (such as audio taping or videotaping the consent proceedings) should be used,
- The terminally ill: Researchers who use the terminally ill as their participants must take steps to ensure that their health care and comfort are not compromised. Special procedures may be required for obtaining informed consent if they are physically or mentally incapacitated. Health researchers need to be aware that personal autonomy can become limited from both pathological and social reasons rendering the individual more vulnerable and less autonomous (Gerrish & Lacey 2006, p. 33),
- Institutionalized people: Researchers often conduct studies using hospitalized or institutionalized people as participants. Special care may be required in recruiting such people because they often depend on health care personnel and may feel pressurized into participating or may feel that their treatment would be jeopardized by their failure to participate. Inmates of prisons and other correctional facilities who have lost their autonomy in many sphere of activity may also feel constrained in their ability to give free consent. The government has issued special regulations for the additional protection of prisoners as participants,

- Pregnant women: The government has issued stringent additional requirements governing research with pregnant women. These requirements reflect a desire to safeguard both the pregnant mother who may be at heightened physical or psychological risk and the foetus who cannot give informed consent. The regulations stipulate that a pregnant woman cannot be involved in a study unless the purpose of the study is to meet the healthy needs of the pregnant woman and the risks to her and her foetus are minimized or there is only a minimal risk to the foetus,
- Gerrish and Lacey (2006, p. 34) state that it is equally tempting to assume that older people are automatically vulnerable to inappropriate clinical or research interventions. On the other hand, the majority of health care recipients are older people and this trend will continue. Therefore special considerations should be kept in mind when doing a study involving old people for example if the researcher feels that the participant is too old to make an informed consent, the legal guardian should give consent on their behalf and
- Minority ethnic populations are sometimes difficult to involve in research especially where there are language and cultural differences. For this reason, sensitive efforts should be made to include people with such backgrounds where possible since everyone has the opportunity to take part in and potentially benefit from research. This applies to individuals and to whole groups defined by ethnicity, age or gender (Gerrish & Lacey, 2006, p. 34).

### **3.7 Summary**

A quantitative research design was appropriate for validating the African Picture Types Chart for vision testing of preliterate children in three primary schools in rural Botswana. The pilot test validated the data collection tool (Appendix H) and lead to a rearranging of the steps of the data collection process (Appendix I), first testing the children for recognition of pictures for both charts before testing for the visual acuity. In this way doubt about the visual acuity result

being influenced by non-recognition of the picture was eliminated. Ethical principles were adhered to during the study and measures to ensure scientific rigour were taken.

University of Cape Town

# CHAPTER 4

## RESULTS

### 4.0 Introduction

In this chapter the results are presented for each of the objectives of the study, that is:

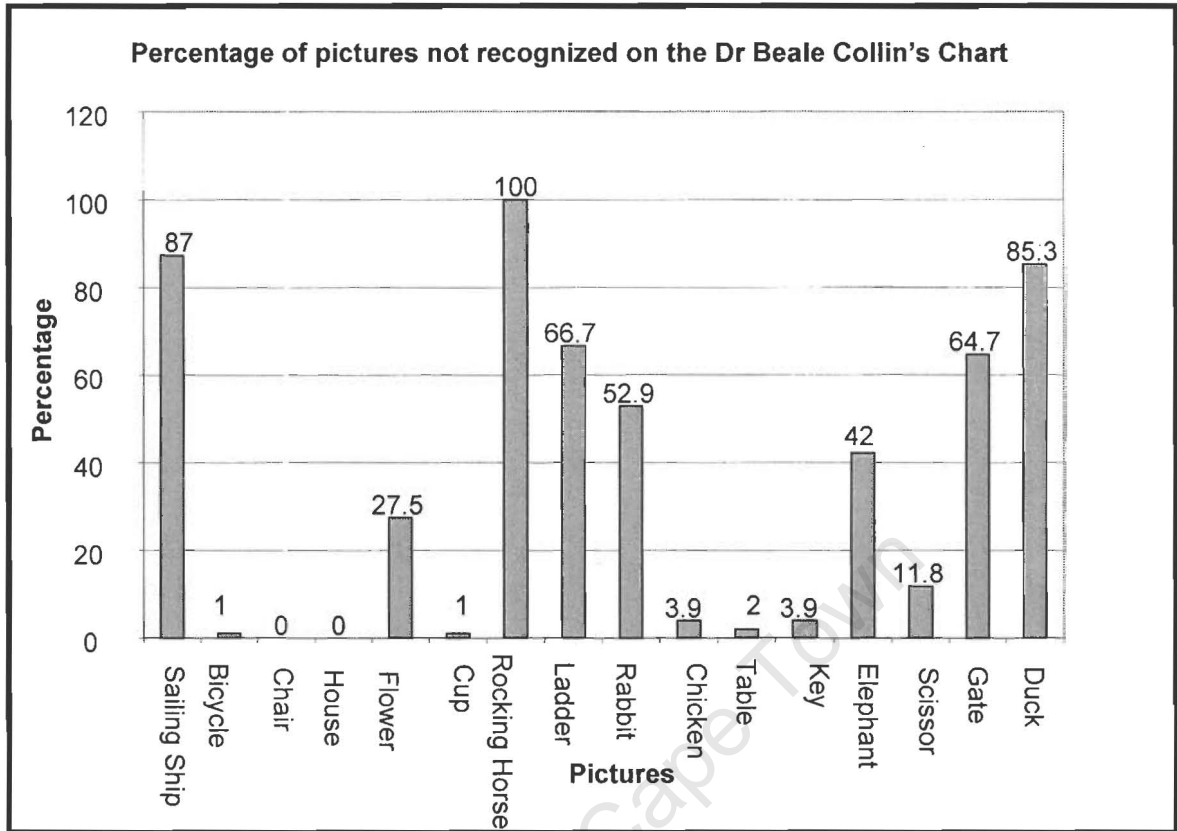
- the extent to which preliterate children in rural Botswana are able to recognize pictures on the Westernized Dr Beale Collin's Picture Types Chart and on the Africanized Powell Picture Types Chart;
- a comparison of the number of items correctly identified on the Dr Beale Collin's and Powell Picture Types charts;
- a comparison of the number of items recognized on the Dr Beale Collin's and the Powell Picture Types Charts according to gender;
- a comparison of the number of items recognized on the Dr Beale Collin's and the Powell Picture Types Charts according to age;
- visual acuity using the Dr Beale Collin's and the Powell Picture Types charts against the gold standard Snellen E Chart;
- a comparison of the visual acuity results for the Dr Beale Collin's and the Powell Picture Types Charts against the gold standard Snellen E Chart to establish which chart is the most reliable (sensitive) for visual acuity testing;
- and to establish the validity (specificity) and reliability (sensitivity) of the Powell Picture Types Chart.

The researcher used descriptive and inferential statistical methods to analyze the data.

### 4.1 Presentation of findings

#### ***4.1.1 Objective One: Recognition on the Dr Beale Collin's Picture Types Chart***

The first objective was to establish the extent to which children in rural Botswana were able to recognize pictures on the Western Dr Beale Collin's Picture Types Chart (Figure 4.1).



**Figure 4.1: Percentage of pictures not recognized on the Dr Beale Collin's Picture Types Chart**

The Dr Beale Collin's Picture Types Chart has sixteen items. Data in figure 4.1 indicate that all the participants (102) recognized the chair and the house. All, except one (1%) participant, recognized the bicycle and the cup and all but two (2%) participants, recognized the table. Four (3.9%) participants did not recognize the pictures of the chicken (cockrel) and the key. Twelve (11.8%) participants did not recognize the scissor; twenty-eight (27.5%) participants did not recognize the flower; and forty-three (42%) participants did not recognize the elephant. That accounts for the majority (10/16; 62.5%) of the pictures having been recognized, scoring less than 50% for non-recognition. Of the pictures recognized least often on the Dr Beale Collin's Picture Types Chart the rocking horse (all participants; 100%); the ship (89; 87%); the duck (87; 85.3%); the ladder (68; 66.7%), the gate (66; 64.7%) and the rabbit (54; 52.9%) all scored above 50%.

#### 4.1.2 Objective Two: Recognition of items of the Powell Picture Types Chart

The second objective of the study was to establish the extent to which children in rural Botswana were able to recognize pictures on the Africanized (Powell) version of the Picture Types eye chart (Figure 4.2).

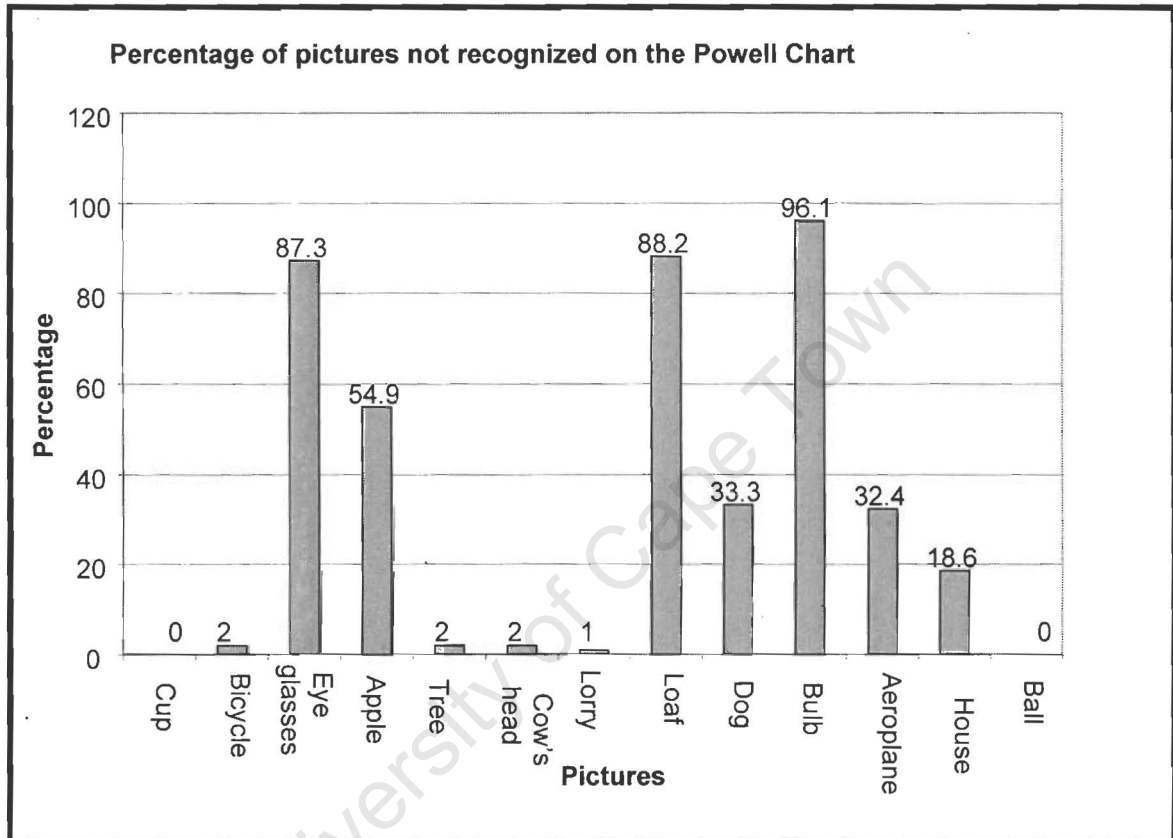


Figure 4.2: Percentage of pictures not recognized on the Powell Picture Types Chart

The Powell Picture Types Chart has thirteen (13) items. Data in Figure 4.2 indicate that all the participants (102) recognized the cup and the ball. All, except one (1%) participant recognized the lorry, and all but two (2%) participants recognized the bicycle, the tree and the cow's head. The pictures recognized least often on the Powell Picture Types Chart were the light bulb (98 participants; 96.1%), eye glasses (89 participants; 87.3%), loaf of bread (90 participants; 88.2%), and the apple (56 participants; 54.9%) as these items all scored above 50%. Thirty-four (34; 33.3%) participants did not recognize the picture of the dog; thirty-three (33; 32.4%) did not recognize the picture of an aeroplane; and nineteen (19; 18.6%) participants did not recognize the picture

of a house. The majority of the pictures (9/13; 69.23%) were recognized, scoring less than 50% for non-recognition.

#### **4.1.3 Objective Three: Comparison of correctly identified items on the two charts**

The third objective was to compare the number of items correctly identified by rural Botswana children on the Powell and the Dr Beale Collin's Picture Types charts (Table 4.1).

**Table 4.1: Data representing a comparison of recognition of shared pictures on the Powell and the Dr Beale Collin's Picture Types Charts.**

	Powell Chart	Dr Beale Collin's Chart
Cup	100%	99%
Bicycle	98%	99%
House	81.4%	100%

Data in Table 4.1 indicate that all the participants (102; 100%) recognized the cup on the Powell Picture Types Chart compared to 99% of recognition on the Dr Beale Collin's Picture Types Chart. The bicycle had 98% recognition on the Powell Picture Types Chart while it had 99% recognition on the Dr Beale Collin's Picture Types Chart. The house was recognized by 81.4% on the Powell Picture Types Chart compared to 100% recognition on the Dr Beale Collin's Picture Types Chart.

**Table 4.2: Pearson correlation table**

	Recognition Powell chart	Recognition Dr Beale chart
Recognition Powell chart	1.0000	0.6336
Recognition Dr Beale chart	0.6336	1.0000

Table 4.2 for Pearson correlation shows that the relationship between the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart is 0.6. This shows that there is a strong relationship between the two charts as the 0.6 is nearer to 1 than 0. The results show that there is no statistically significant difference between the two picture charts.

**Table 4.3: Data representing the level of recognition (%) of items on the African (Powell) and the Western Dr Beale Collin's Picture Types Charts and a comparison between the number of items correctly identified by participants on the Powell and the Dr Beale Collins's Picture Types Charts and the degree of validity of the Powell Picture Types Charts**

	Powell	Beale	p-value	% Difference
%recognition	880/1326 (66.37%)	1042/1632 (63.85%)	0.165	2.52

Data in table 4.3 show that there is no statistically significant difference in recognition of pictures between the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart ( $p= 0.165$ ). However the Powell Picture Types Chart showed a slightly higher level of recognition of pictures by the participants than for the Dr Beale Collin's Picture Types Chart.

#### **4.1.4 Objective four: Comparison of visual acuity using the two charts**

The fourth objective was to compare the visual acuity of rural Botswana children using the Powell and the Dr Beale Collin's Picture Types charts against the gold standard Snellen E Chart (Table 4.4).

**Table 4.4: Data representing the mean differences in the visual acuity readings for the African (Powell) Picture Types Chart and the Dr Beale Collin's Picture Types Chart respectively against the gold standard E-Chart**

VA of E Chart in Log MAR		VA of Powell Chart in Log MAR		VA of Dr Beale Chart in Log MAR	
R Eye	L Eye	R Eye	L Eye	R Eye	L Eye
0.001765	0.011569	0.00	0.009804	0.00	0.009804

Data on table 4.4 show that there was no statistically significant difference between the Snellen chart, the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart. However the Snellen chart showed the greatest sensitivity and specificity.

The right to privacy was maintained and the name of one learner, six years of age, who had a converging squint of the left eye and who had a visual acuity of 6/60 was not identified in the results. Only the parents of the child concerned and the school nurse were notified so that they could take further measures to help the child.

#### **4.1.5 Objective five: Comparison of recognition according to gender**

The fifth objective was to compare the extent of recognition of items for the Powell and the Dr Beale Collin's Picture Types Charts according to gender (Table 4.5; Figure 4.3).

**Table 4.5: Data representing the extent of recognition of items for the African (Powell) Picture Types Chart and the Dr Beale Collin's Picture Types Chart by gender**

% recognition	Male (N=60)	Female (N=42)	p-value
Powell	66.43	66.09	0.9648
Beale	63.86	64.02	0.9967

Sixty (60) males and forty-two (42) females were involved in the study. The p value between the males and females for the Powell picture types chart is 0.9648 showing no statistically significant difference between the genders. The p value between the males and females for the Dr Beale Collin's picture types chart is 0.9967 showing no statistically significant difference between the genders.

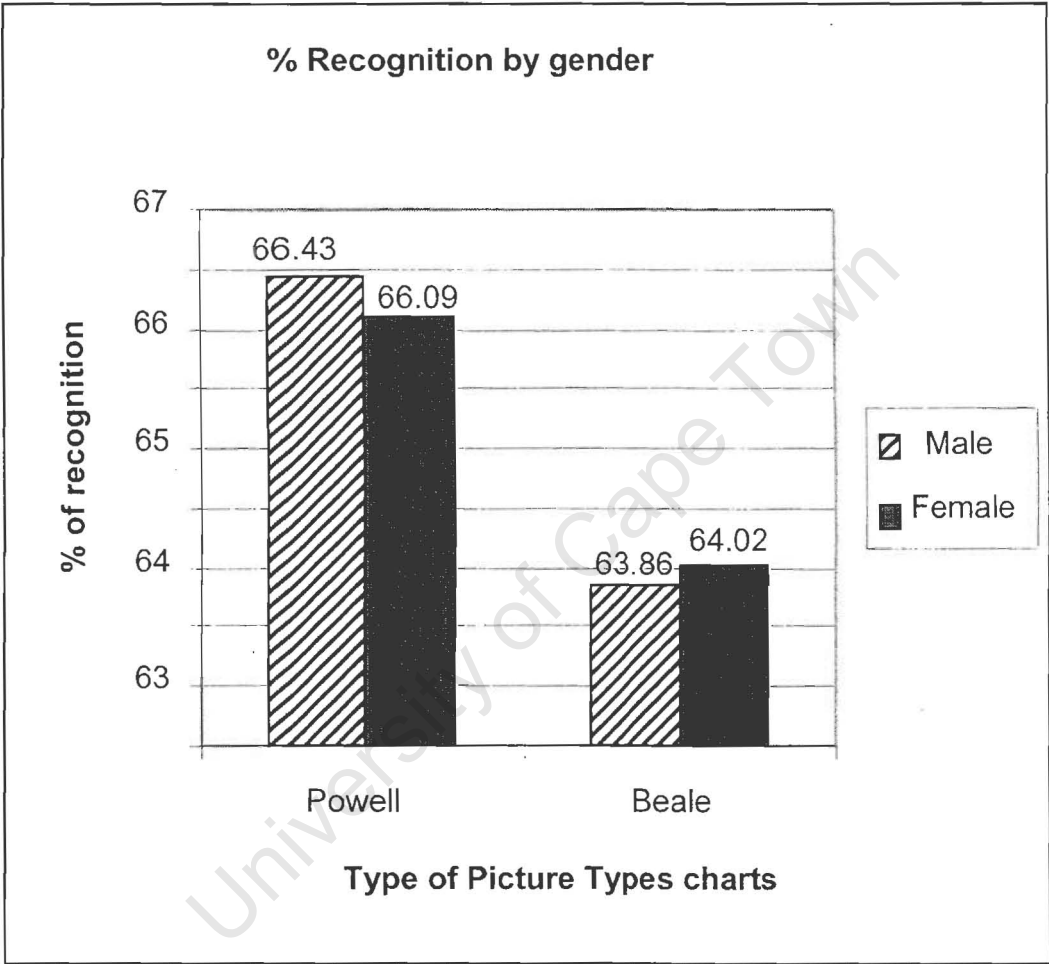


Figure 4.3: Comparison of % recognition of gender

Data in Figure 4.3 show that males and females recognized more pictures on the Powell Picture Types Chart than on the Dr Beale Collin's Picture Types Chart. Marginally more males (66.43%) than females (66.09%) recognized more pictures on the Powell Picture Types Chart while more females (64.02%) than males (63.86%) recognized more pictures on the Dr Beale Collin's Picture Types Chart.

#### 4.1.6 Objective six : Comparison of recognition according to age

The sixth objective was to compare the extent of recognition of items for the Powell and the Dr Beale Collin's Picture Types Charts according to age (Figure 4.4; Table 4.6).

Table 4.6: Data representing the extent of recognition of items for the African (Powell) Picture Types Chart and the Dr Beale Collin's Picture Types Chart by age.

% recognition	Age 5 (n=2)	Age 6 (n=67)	Age 7 (n=33)	p-value (age 6 vs. age 7)
Powell	69.20	66.79	65.25	0.8775
Beale	53.15	65.60	61.39	0.6796

The age range of participants was from five to seven years. Two (2; 1.96%) participants were aged 5 years of age, the majority, sixty-seven (67; 65.69%) were six years of age and thirty-three (33; 32.35%) were seven years old. The p value for the level of recognition of optotypes on the Powell Picture Types Chart for the six and seven year old participants was 0.8920 showing no statistically significant difference. The p value between the age six and age seven for the level of recognition of optotypes on the Dr Beale Collin's picture types chart was 0.7158 showing no statistically significant difference.

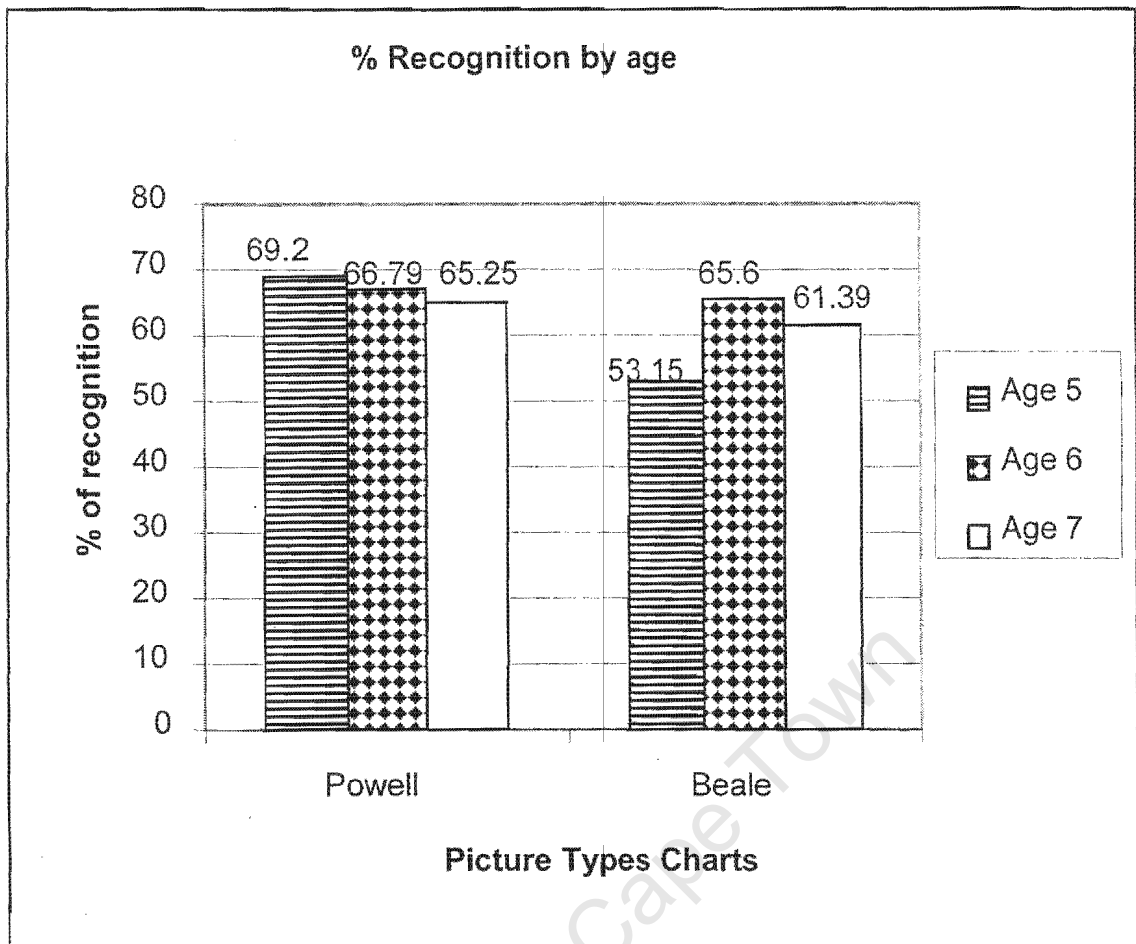


Figure 4.4: Data showing a comparison of recognition by age

Data in Figure 4.4 show that participants from all age categories recognized more pictures on the Powell Picture Types Chart than on the Dr Beale Collin's Picture Types Chart. The participants aged 5 years recognized the greatest numbers of pictures on the Powell Picture Types Chart; whereas those six years of age recognized the greatest number of pictures on the Dr Beale Collin's Picture Types Chart.

#### 4.1.7 Objective seven: Validity of the Powell Picture Types Chart

It was decided to only consider validity testing of the screening tool and not reliability testing as well because the intention was to establish the extent of recognition of picture (specificity) and not sensitivity. The Powell Picture Types Chart had more validity (66.4%) than the Dr Beale Collin's Picture Types Chart (63.9%). The pictures on this chart were better recognized by both males and females of all ages compared to the Dr Beale Collin's Picture Types Chart.

## **4.2. Summary**

This chapter presented the results in terms of the study objectives. The first objective was to establish the extent to which children in rural Botswana were able to recognize pictures on the Western Dr Beale Collin's Picture Types Chart. All participants recognized the chair and the house, but no one recognized the rocking horse. The second objective of the study was to establish the extent to which children in rural Botswana were able to recognize pictures on the Africanized (Powell) version of the Picture Types eye. All participants recognised the cup and the ball but the light bulb was recognised the least often. The third objective was to compare the number of items correctly identified by rural Botswana children on the Powell and the Dr Beale Collin's Picture Types charts. Interestingly, of the shared pictures, the house on the Beale chart was recognised by more participants than the house on the Powell chart. The fourth objective was to compare the visual acuity of rural Botswana children using the Powell and the Dr Beale Collin's Picture Types charts against the gold standard Snellen E Chart which showed no statistically significance.

The fifth objective was to compare the extent of recognition of items for the Powell and the Dr Beale Collin's Picture Types Charts according to gender and there was no statistical difference. The sixth objective was to compare the extent of recognition of items for the Powell and the Dr Beale Collin's Picture Types Charts according to age and again, there was no statistical difference. Lastly the seventh objective was to establish the validity of the Powell Picture Types Chart but, although both male and female participants recognised more pictures on the Powell chart than on the Beale chart, this was not statistically significant.

# CHAPTER 5

## DISCUSSION OF FINDINGS

### 5.0 Introduction

In this chapter the findings of the study are discussed and interpreted in relation to the literature review. Topics discussed include a description of picture charts, recognition of Picture Optotypes, a comparison between the level of recognition of optotypes on the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart, visual acuity, recognition of pictures by gender, recognition of pictures by age, validity of the Powell Picture Types Chart and a comparison of findings from the pilot study and the main study.

### 5.1 Description of picture charts

The Powell Picture Types Chart (Appendix L) is composed of thirteen (13) different optotypes. On line 6/60 there is a single optotype, a cup. The number of optotypes increase on the subsequent lines as follows; at 6/36 there is a bicycle and eye glasses, at 6/24 an apple and a tree, at 6/18 a cup and a ball, at 6/12 there is a cow's head, a dog, a light bulb and aeroplane, at 6/9 a lorry, a loaf of bread and a cup and lastly at 6/6 there is a bicycle, a dog, a house and a ball. A cup is repeated twice, after line 6/60: at lines 6/18 and 6/9. A bicycle is repeated once after line 6/36 it is at line 6/6. A ball is repeated once after line 6/18: at line 6/6. A dog is repeated once, after line 6/12 it is at line 6/6.

The Dr Beale Picture Types Chart (Appendix K) has sixteen (16) different types of optotypes. There is a sailing ship at 6/60, a bicycle and a chair at 6/36, a house and a flower at 6/24, a cup and a sailing ship at 6/18, a rocking horse, a ladder, a rabbit and a chicken (cockerel) at 6/12, a table, a key and an elephant at 6/9 and lastly a sailing ship, a chair, a scissor, a gate and a duck at 6/6. A sailing boat is repeated twice, after line 6/60: at lines 6/18 and line 6/6. A chair is repeated once after line 6/36: at line 6/6.

Both picture types charts have a high contrast background. The charts have a white background while the optotypes are black to make them visible enough for children to see. Both picture types charts present many optotypes in rows to avoid the risk of missing amblyopia which could happen when testing children's eyes with single optotypes. Moutakis *et al.* (2004, p. 548) observe that the diagnosis of amblyopia can easily be missed if visual acuity (VA) is tested with single optotypes. According to Rahi (1998, p. 37) visual acuity testing should be carried out at the appropriate distance and if possible using linear optotypes to ensure the effect of crowding is not overlooked in children with amblyopia.

## **5.2 Recognition of Picture Optotypes**

### **5.2.1 The Powell Picture Types Chart**

Participants were asked to identify the picture optotypes on this chart by name. Individual items not recognized on each chart were also recorded. Basic items such as a cup and a ball were identified by all participants. Other items familiar to these preliterate rural children were a lorry (99%), a bicycle (98%), a cow's head (98%), a house (81.4%). Less familiar but still recognized by more than 50% of the children were the following optotypes: a dog (66.7%) and an aeroplane (67.6%). Interestingly, an aeroplane (67.6%) presumably a less familiar picture, was recognized by more children than the picture of a dog (66.7%).

Although no items were not recognized at all, it was a surprise to find that more than half of the children (54.9%) did not recognize the apple optotype. The picture of the apple should perhaps have been a line item rather than a solid structure. Some of the children thought it was a water-melon while others said they did not know what it was. Also surprising is the finding that the majority of the children (88.2%) did not recognize a loaf of bread. In the villages where these children live a loaf of bread is purchased at the grocery store and it is the same shape as in the picture..

The researcher is unable to explain why these rural children were more familiar with the shape of an aeroplane (67.6% recognition) than with that of an apple (54.9% non-recognition). There was 96.1% non-recognition of the picture of a light bulb. The researcher was not surprised at this finding because there is no electricity in any of the selected villages. The Majority of the children thought the light bulb was an umbrella and some said it was a hat. The majority of the children thought a loaf of bread was a bag for clothes.

### **5.2.2 The Dr Beale Collin's Picture Types Chart**

Participants were asked to identify the picture optotypes on this chart by name. Individual items not recognized on each chart were also recorded. Basic items such as the chair and house were identified by all participants. Other items familiar to these preliterate rural children were a bicycle (99%), a cup (99%), a table (98%), a chicken (cockerel) (96.1%), a key (96.1%) and a scissor (88.2%). Less familiar but still recognized by more than 50% of the children was the elephant (58%) and a flower (72.5%).

From the Dr Beale Collin's Picture Types Chart the researcher did not expect to find that these rural children did not recognize a chicken (cockerel) (3.9% non-recognition) of and a basic item such as a table (2% non-recognition) as most of their families or their neighbours keep poultry in their yards.. They used tables at school unless they had not yet been told what it was as.

The item that was not recognized at all by any of these rural children was the rocking horse. They all thought that the rocking horse was just a horse. In the rural areas children do not seem to have a rocking horse for a toy. The majority of the children did not recognize the duck (85.3% non-recognition) and the sailing ship (87.3% non-recognition). Most of the children thought the duck was a dove as they are more familiar with doves in their villages. Non-recognition of the sailing ship could be explained as Botswana is a landlocked country and it is most likely that these children have not travelled beyond their rural areas. Some thought the sailing ship was thunder and lightning and some said they did not

know what it was. The few children who identified the sailing ship may have seen pictures of ships in books.

### **5.3 Comparison between the level of recognition of optotypes on the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart**

The data in Table 4.2 and Table 4.3 show that there was no statistically significant difference between the level of recognition of optotypes for the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart. However the results in Table 4.3 shows that the Powell Picture Types Chart had achieved a higher level of recognition of optotypes with an average of 66.37% compared to the Dr Beale Collin's Picture Types Chart with an average of 63.85% recognition. The P-value for the comparison of recognition of both picture charts is 0.165 showing that there is no statistically significant difference.

Data in Table 4.1 reflecting recognition of shared optotypes on the two charts, indicate that all the participants (102; 100%) recognized the cup on the Powell Picture Types Chart compared to 99% of recognition on the Dr Beale Collin's Picture Types Chart. The bicycle was recognized by 98% of the participants on the Powell Picture Types Chart compared to 99% recognition on the Dr Beale Collin's Picture Types Chart. The house was recognized by 81.4% on the Powell Picture Types Chart compared to 100% recognition on the Dr Beale Collin's Picture Types Chart. Two of the shared optotypes were recognized by the majority of the children on the Dr Beale Collin's Picture Types Chart.

What was not anticipated was the extent to which exposure to Western, urbanized items, while residents in rural villages, would contribute to increased recognition of items equal to that of urbanized children. This was exemplified by one 6 year old boy from Khonkhwa Primary School who had 100% recognition from the Powell Picture Types Chart and 87.5% recognition of items from the Dr Beale Collin's Picture Types Chart. On asking him where he came from the

researcher realized that he was one of the teachers' children and that he was from a village that is not rural.

## 5.4 Visual Acuity

Out of one hundred and two (102) study participants one learner (0.98%) scored 6/9 visual acuity on the Snellen E chart (Appendix J) for both eyes. He scored 6/6 for both the Powell Picture Types Chart (Appendix L) and the Dr Beale Collin's Picture Types Chart (Appendix K) for both eyes. Although 6/9 is a good visual acuity the best is 6/6. Pictures type optotypes at 6/6 for both picture charts are larger than the E letters on the Snellen E chart at 6/6. That may be the reason that the learner scored best on the picture charts than on the E chart. One learner, six years of age, had a converging squint of the left eye with a visual acuity score of 6/60 for that eye for all the charts. The results concurs with Hartmann et al. (2006, p. 227) when they report that vision threatening eye problems, which include amblyopia, strabismus, and significant refractive error are estimated to occur in 2% to 5% of preschool children. Children should be treated of all the vision threatening eye problems to avoid blindness as Bishop (1991) reports that the risk of amblyopic patient becoming blind is high and that is why early detection and treatment of amblyopia is significant. The American Academy of Paediatrics (2003, p. 902) argues that early detection and immediate treatment of vision problems in children can avoid permanent visual impairment.

Apart from the two learners mentioned above there was no difference in the visual acuity from the Gold standard Snellen E chart, the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart. Visual acuity as stated by Westall, *et al.* (2003, p. 546) is the most detector for amblyopia and is considered the most effective eye screening test. The first hypothesis, that is there is no difference between the numbers of items correctly identified for the Dr Beale Collin's Picture and the Powell Picture Types Charts, therefore is rejected. However, the difference in number is not statistically significant. The second hypothesis, that is there is no difference between visual acuity results

for the Dr Beale Collin's Picture Types Chart, the Powell Picture Types Chart and the Snellen E chart is therefore accepted.

#### **5.4.1 A comparison between the visual acuity results for the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart against the gold standard E Chart**

There is no statistically significant difference between the visual acuity results for the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart against the gold standard E Chart. Data in Table 4.4 show that the mean for the gold standard E Chart for the right eye was 0.001765 and 0.011569 for the left eye and the mean for both the Dr Beale Collin's and the Powell Picture Types Charts for the right eye was 0.00 and for the left eye was 0.009804 showing that both picture charts were less sensitive in testing the visual acuity than the gold standard E Chart. Apart from the two children who performed less than 6/6 in all the three charts, they all achieved the results of 6/6 in both eyes which makes them reliable as Watt (n.d.) points out that the tumbling E chart is used as a standard chart for illiterate people including children. The E chart used as a standard chart is also confirmed by Hussain *et al.* (2006, p. 7) when they report that since 1862 the E chart has been adopted as the standard for measuring visual acuity.

#### **5.5 Recognition of charts by gender**

Recognition of items was compared by gender for both picture types charts (Table 4.5 & Figure 4.3). For the Powell Picture Types Chart 66.4% of the males had correctly recognized the optotypes and this was very similar for the females (66.1%). This shows only a slightly better average for the males for the Powell Picture Types Chart. For the Dr Beale Collin's Picture Types Chart 64.0% of the females had correctly identified the optotypes which was slightly better than for the males (63.9%).

## **5.6 Recognition by age**

Recognition of items for both picture charts was also compared by age category (Figure 4.3 & Table 4.6). Participants in this study ranged from five (5) years to seven (7) years of age. Hard (2006, p. 418) states that in Sweden eye testing was introduced at 6 years rather than 7 years of age. Recognition of optotypes on the Powell Picture Types Chart by the five year olds had achieved a mean recognition of 69.2% while this was 53.2% for the Dr Beale Collin's Picture Types Chart. The six year olds achieved a mean recognition of 66.8% for the Powell Picture Types Chart and a mean recognition of 65.6% for the Dr Beale Collin's Picture Types Chart. The American Academy of Paediatrics (2003, p. 902) reports that children never complain of eye problems that is why visual acuity measurement should always be carried out when something odd about the child's eyes is suspected.

The seven year olds achieved a mean recognition of 66.3% for the Powell Picture Types Chart and a mean recognition of 61.4% for the Dr Beale Collin's Picture Types Chart. Overall, optotypes on the Powell Picture Types Chart were better recognized amongst all the age categories. All the participants were taking the test seriously and they looked relaxed. Konig (2003, p. 911) observed that the ability of children to co-operate can affect the results of vision screening. It is therefore desirable that the screening process should be able to differentiate between those who actually have reduced vision and those who fail screening because of other factors related to ability to co-operate. The eye screening for children should not be complicated to avoid intimidating them which could yield in poor results. This is confirmed by Bishop (1991) when he states that screening tests for children should be simple and quick to administer.

## **5.7 Validity of the Powell Picture Types Chart**

The Powell Picture Types Chart had more validity (66.4%) than the Dr Beale Collin's Picture Types Chart (63.9%). The Powell Picture Types Chart also showed better recognition by gender (66.4% male) compared to 63.9% recognition by male learners for the Dr Beale Collin's Picture Types Chart. More

females (66.1%) recognized optotypes on the Powell Picture Types Chart compared to 64.0% for the Dr Beale Collin's Picture Types Chart. The Powell Picture Types Chart also showed better recognition by age category: age five (69.2% recognition of optotypes for the Powell Picture Types Chart compared to 53.2% recognition for the Dr Beale Collin's Picture Types Chart); age six (66.8% recognition of optotypes for the Powell Picture Types Chart compared to 65.6% recognition for the Dr Beale Collin's Picture Types Chart); and age seven (65.3% recognition of optotypes for the Powell Picture Types Chart compared to 61.4% recognition of the Dr Beale Collin's Picture Types Chart).

The validity of the Powell Picture Types Chart has been confirmed, therefore the wrongly prescription of spectacles or medication can be avoided reducing the unnecessary spending of money by the parents. This is supported by a population-based Australian study conducted by Hard (2006 p. 416) that found that an enormous amount of money was spent on spectacles that were wrongly prescribed. It is therefore necessary to define healthy eyes to avoid misuse of public funds and the burden of some children to wear unwanted glasses. Hard, 2006 (p. 416) states that economic consequences for parents who have to take time off work to accompany their children to the clinics for repeated visit should also be considered. Bishop (1991) argues that the test should be a suitable one for the children in order to get the desired results.

It is important to confirm the validity of the Powell Picture Types Chart so that preschool screening could be done effectively. Newman *et al.* (1996, p. 1081) argue that the aim for preschool screening is to uncover unsuspected amblyopia at an age where treatment is effective. The seventh specific objective was to establish the validity of the Powell Picture Types Chart and this was confirmed when compared to the Dr Beale Collin's Picture Types Chart. The research question has been answered as the most valid picture types chart for eye screening of preliterate children in rural Botswana was found to be the Powell Picture Types Chart.

## **5.8 Comparison of findings from pilot study and the main study**

On comparing the results of the pilot study conducted at a public tertiary level hospital in Cape Town and the main study conducted in rural areas in Botswana, the level of recognition of optotypes was 86.53% and 85.98% respectively for the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart for the pilot study while it was 66.37% and 63.85% respectively for the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart for the main study. The researcher made the assumption that, if this study was to be conducted in an urban area, more children would recognize more optotypes on both charts than their counter-parts in rural areas and this assumption was proved to be correct.

On the other hand, a girl aged seven years from Khonkhwa primary school scored the lowest mark of 30.8% recognition of pictures on the Powell Picture Types Chart and 43.8% on the Dr Beale Collin's Picture Types Chart. On asking about the girl the researcher was told that she was from Khonkhwa village. She was not frightened or tired as the researcher gave her a few opportunities to confirm what she had said earlier, but she did not change her mind. The researcher had also made the assumptions that children from rural areas are less able to recognize pictures compared to urbanized children because in towns children are exposed to televisions and computers which are rarely seen in rural areas that are not electrified.

## **5.9 Summary**

The results of this small study to some extent reveal that the Africanized Picture Types Chart for vision testing of preliterate children in rural Botswana has more specificity than the Beale chart, but this is not statistically significant by gender or age. Out of 102 learners all, except one who scored 6/60, had a good visual acuity. Recognition of pictures by gender showed that there was a slightly better average for the males for the Powell Picture Types Chart (66.4% of the males and 66.1% females). For the Dr Beale Collin's Picture Types Chart 64.0% of the females had correctly identified the optotypes which was slightly better than for

the males (63.9%). On comparing the results of the pilot study and the main study the level of recognition of optotypes was 86.53% and 85.98% respectively for the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart for the pilot study while it was 66.37% and 63.85% respectively for the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart for the main study.

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# CHAPTER 6

## IMPLICATIONS, LIMITATIONS, RECOMMENDATIONS AND CONCLUSIONS OF THE STUDY

### 6.0 INTRODUCTION

Nursing research is designed to generate knowledge to guide nursing practice and to improve the health and the quality of life of health clients (Polit & Beck, 2004, p. 1). The purpose of nursing research is to answer questions or solve problems relevant to the nursing profession. Catanzaro (1988, p. 14) points out that nursing research contributes to the nursing profession by the accumulation of new knowledge, the testing of old knowledge, and by identifying professional accountability and autonomy. This study showed that, although there was no statistically significant difference between the Powell and the Dr Beale Collin's Picture Types Charts preference should be given to the former as it had a slightly better score for recognition of items than the latter and therefore it may be an appropriate chart for vision testing of preliterate children in rural Botswana.

### 6.1 Implications of the study

#### *6.1.1 Implications for Nursing Practice*

The results of the present study have identified characteristics about the type of chart that should be used for testing the eyes of preliterate children in rural areas. This study will help the ophthalmology staff to which chart is best to be used when screening children. These findings should assist eye health care professionals in Botswana to train general nurses, auxiliaries and community workers on how to conduct a visual acuity test. This will facilitate learning of visual acuity testing by other health care providers and prevent visual impairment by correcting visual refraction errors. The Powell Picture Types

Chart has pictures that maybe more familiar to preliterate children in rural areas and therefore it may be the most suitable for eye screening in these areas. American Academy of Paediatrics (2003, p. 902) observes that children never complain of eye problems and that is why visual acuity measurement should always be carried out. This could be achieved by community workers going house to house to test preliterate children's eyes regardless of history of eye problems.

### ***6.1.2 Implications for Nursing Education***

Incorporating the findings of this study on preschool eye screening into the curriculum of pre-registration nursing programs and in-service education programmes for clinic and outpatient staff is important. Specifically nurse educators should be aware that the Powell Picture Types Chart may be more suitable for vision testing of preliterate children in rural Botswana than Western charts. It is recommended that health workers are well trained in understanding the importance of preschool screening to reduce avoidable blindness in school age children.

### ***6.1.3 Implications for Nursing Research***

The current study generates research opportunities that need to be researched in order to have a picture chart that can be used by all children in Africa. The study needs to be extended and replicated in different contexts within African continent both in rural and urban areas.

### ***6.1.4 Implications for Nursing Management***

The findings of the present study suggest that health management should provide manpower for clinical staff to screen preliterate children in the community. The staff should be provided with the necessary equipment and transport. School screening should take place as soon as the children enter the school and every year to prevent avoidable blindness.

## **6.2 Limitations of the study**

The study was done in only three rural areas so the results should be applied with caution and data cannot be generalized to Botswana or the continent of Africa. The study selected children five years and above which excluded some of the preliterate children under five years.

## **6.3 Recommendations**

A larger comparative study should be done in both urban and rural settings. Even though the African (Powell) Picture Types Chart had more recognizable pictures than the Dr Beale Collin's Picture Types Chart the African version can be improved as the shared pictures on both charts were not all recognized. Such a chart should include better drawn and more common items known by African children before embarking on such a study.

## **6.4 Conclusions**

Eyes are the light of the body therefore they must be cared for to prevent avoidable blindness. Children's ability to see greatly impacts on their learning which can in turn affect their planning career. It is important to screen children's eyes as early as possible when treatment is likely to be successful. Eye screening equipment used for children should be simple to use. The study shows that there was no difference in the visual acuity results for the three charts involved and only a slight difference in the recognition of pictures on the Powell Picture Types Chart and the Dr Beale Collin's Picture Types Chart.

## REFERENCES

- Ager, L. 1998. Optical services for visually impaired children. *Community Eye Health Journal*. 11(27): 38.
- American Academy of Paediatrics. 2003. Eye examination in infants, children and young adults by paediatricians. *Journal of Paediatrics*. 110(4): 860-865. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Barry, J. C. & Konig, H.H. 2003. Test characteristics of orthoptic screening examination in 3 year old kindergarten children. *British Journal of Ophthalmology*. 87: 909-916. [Online]. Available: <http://bjo.bmj.com/cgi/content/full/87/7/909>. [2007, May, 20].
- Batterbury, M. & Bowling, B. 2005. *Ophthalmology: an illustrated colour text*. 2nd ed. Edinburgh : Elsevier Limited.
- Becker, R. Hubsch, S. Graf, M.H. & Kaufmann, H. 2002. Examination of young children with Lea symbols. *British Journal of Ophthalmology*. 86(5): 513-516. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Bishop, A.M. 1991. Vision of children: a review of methods and personnel involved within the UK. *Ophthalmology, Physiology and Optometrists*. 11(1): 3-9. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Blanche, M.T, Durheim, K. & Painter, D. 2006. *Research in practice*. 2nd ed. Cape Town: UCT Press.
- Burns, N. & Grove, S. K. 1987. *The practice of nursing research: conduct, critique and utilization*. Philadelphia: W.B Saunders Company.

- Burns, N. & Grove, S. K. 1993. The practice of nursing research: conduct, critique and utilization. 2nd ed. Philadelphia: W.B Saunders Company.
- Campbell, L. & Mani, M.N.G. 2007. Providing educational services. *Community Eye Health Journal*. 20(62): 22.
- Catanzaro, W. 1988. Nursing research: theory and practice. Missouri: The C.V. Mosby Company.
- Central Statistics Office. 2002. Republic of Botswana Health Statistics Report. Gaborone, Botswana: Government Printers.
- Colorado Department of Education. 2006. Guidelines for school vision screening programs: Kindergarten through Grade 12. [Online]. Available: <http://www.cde.state.co.us/cdesped/download/pdf/nurVisionGuidelines.pdf> [2007, July, 25].
- Cooper, H.M. 1989. Integrating research: a guide for literature review. 2nd ed. California: Sage Publications Inc.
- Drover, J.R, Feliuss, J, Cheng, C.S, Morale, S.E, Wyatt, L & Birch, E.E. 2007. Normative paediatric visual acuity using single surrounded HOTV optotypes on the electronic visual acuity tester following the amblyopia treatment study protocol. [In Press]. *Journal of American Association for Paediatric Ophthalmology and Strabismus*. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Eperjesi, F, Bartlett, H & Dunne, Mark. 2007. *Ophthalmic clinical Procedure*, Edinburgh, Elsevier Limited.
- Fraenkel, J.R. & Wallen, N.E. 1993. How to design and evaluate research in education. 2nd edition. New York: McGraw-Hill INC.

Gerrish, K. & Lacey, A. 2006. The research process in nursing. 5th ed. Oxford: Blackwell Publishing Ltd.

Gustafson, J, Kinne M, Little D, Strawhacker, M. & Doyle, J. 2000. Heartland AEA 11 Vision Survey Spring. Journal of School Nursing. 17(5): 239-245. [Online]. Available: <http://www.aea11.k12.ia.us/NurseWeb/vision.htm>. [2007, May, 20].

Hard, A.L 2006. Results for vision screening of 6 year olds at school: a population based study with emphasis on screening limits. Acta Ophthalmologica Scandinavica. 85(4): 415-418 [Online]. Available from Blackwell-Synergy at <http://www.lib.uct.ac.za/datahosts.htm> [2007, July, 25].

Hartmann, E.E., Bradford, G.E., Chaplin, P.K.N., Johnson, T., Kemper, A.R., Kim, S & Marsh-Tootle, W. 2006. Project universal preschool vision screening: a demonstration project. Official Journal of the American Academy of Pediatrics. 117 (2): 226-237. [Online]. Available: <http://pediatrics.aappublications.org/cgi/content/abstract/117/2/e226>. [2007, May, 25].

Hussain, B., Saleh, G. M., Sivaprasada, S. & Hammond, C. J. 2006. Changing from Snellen to LogMAR: debate or delay. Clinical and Experimental Ophthalmology. 34: 6-8.

Jones, D, Westall, C, Averbek, K. & Abdoell, M. 2003. Visual acuity assessment: a comparison of two tests for measuring children's vision. The Journal of the College of Optometrists. 23(6): 541-546. [ Online]. Available from Blackwell-Synergy at <http://www.lib.uct.ac.za/datahosts.htm> [2007, July, 25].

- Kemper, A.R., Margolis, P.A., Downs, S.M. & Bordley, W.C. 1999. A systematic review of vision screening tests for the detection of amblyopia. *Official Journal of the American Academy of Pediatrics*. 10(104): 1220-1222.
- LoBiondo-Wood, G. & Haber, J. 1986. *Nursing research: critical appraisal and utilization*. St.Louis. The C.V. Mosby Company.
- Lynch, P. & McCall, S. 2007. The role of itinerant teachers. *Community Eye Health Journal*. 20(62): 27.
- McGraw, P.V. & Winn, B. 1993. Glasgow Acuity Cards: a new test for measurement of the letter acuity in children. *The Journal of Ophthalmology, Physiology and Optometry*. 13(4): 400-403. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Mocan, M.C., Najera-Covarrubias, M. & Wright, K.W. 2005. Comparison of visual acuity levels in podiatric patients with amblyopia using Wright figures, Allen Optotypes and Snellen Letters. *Journal of American Association for Paediatric Ophthalmology and Strabismus*. 9(1): 48-52. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Moutakis, K., Stigmar, G & Hall-Lindberg, J. 2004. Using the KM visual acuity chart for more reliable evaluation of amblyopia compared to the HVOT method. *Acta Ophthalmologica Scandinavica*. 82: 547-551. [Online]. Available from Blackwell-Synergy at <http://www.lib.uct.ac.za/datahosts.htm> [2007, July, 25].
- Newman, D.K. & East, M.M. 1999. Preschool vision screening: negative predictive value for amblyopia. *British Journal of Ophthalmology*. 83: 676-679. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].

- Newman, D.K., Hitchcock, A., McCarthy, H., Keast-Butler, J. & Moore, T. 1996. Preschool vision screening: outcome of children referred to the hospital service. *British Journal of Ophthalmology*. 80: 1077-1082. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Pera, S. 2002. Ethical theory and decision making in nursing and health care. In: *Ethics in health care*. 2nd ed. S.A. Pera and S. van Tonder. Eds. Lansdowne, South Africa: Juta. 27-55.
- Polit, D.F. & Hungler, B.P. 1999. *Nursing research, principles and methods*. 6th ed. Philadelphia: Lippincott Williams and Wilkins.
- Polit, D.F. & Beck, C.T. 2004. *Nursing research, principles and methods*. 7th ed. Philadelphia: Lippincott Williams and Wilkins.
- Polit, D.F. & Beck, C.T. 2006. *Essentials of nursing research, methods, appraisal and utilization*. 6th ed. Philadelphia: Lippincott Williams and Wilkins.
- Powell, C. Wedner, S. & Hatt, S. 2004. Vision screening for correctable visual acuity deficits in school-age children and adolescents. [Online]. Available: [http://www.cochrane.org/reviews/en/topics/63\\_reviews.html](http://www.cochrane.org/reviews/en/topics/63_reviews.html) [2007, August, 22].
- Rahi, J.S. 1998. Examination of a child with visual loss. *Community Eye Health Journal*. 11(27): 36-38.
- Routio, P. 2007. Comparative study. [Online]. Available: <http://www2.uiah.fi/projects/metodi/172.htm> [2008, February, 04].
- Santamaria, L. Brown, S. & Story, I. 1998. MIST (Melbourne Initial Screening Test) evaluation studies. February, 1-30. [Online]. Available from

- Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Schenk, K. & Williamson, J. 2005. Ethical approaches to gathering information from children and adolescents in international settings: guidelines and resources. Washington, DC: The Population Council Inc.
- Schwirian, P.M. 1998. Professionalization of nursing. 3rd ed. Philadelphia: Lippincott-Raven.
- Simons, K. 1996. Preschool vision screening: rationale, methodology and outcome. *Survey of Ophthalmology*. 41(1): 3-30. [Online]. Available from Sciedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Simons, K. 1983. Visual norms in young children. *Survey of Ophthalmology*. 28(2): 84-92. [Online]. Available from Sciedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 19].
- Snowdon, S.K. & Steward-Brown, S.L. 1997. Preschool screening. *Health Technology Assessment*. 1(8): 1-83. [Online]. Available: <http://www.york.ac.uk/inst/crd/projects/visioncreening.htm> [2008, March, 19].
- Stollery, R, Shaw, M & Lee, A. 2005. *Ophthalmic Nursing*, 3rd ed. Oxford. Blackwell Publishing Ltd.
- Thompson, I. E. Melia, K.M. & Boyd, K.M. 1995. *Nursing ethics*. 3rd ed. London: Churchill Livingstone.
- United Nations. 2000. Millennium Development Goals. [Online]. Available: URL: [http://en.wikipedia.org/wiki/Millennium\\_Development\\_Goals](http://en.wikipedia.org/wiki/Millennium_Development_Goals).

- Vaughan, D, Asbury, T & Riordan-Eva, P. 1999. *General Ophthalmology*. 15th ed. Stamford. Appleton & Lange.
- Van der Wal, D. 2002. Ethics in research. In: *Ethics in health care*. 2nd ed. S. A. Pera and Van Tonder. Eds. Lansdowne, South Africa: Juta. 147-163.
- Watt, W.S. (n.d.). How visual acuity is measured. [Online]. Available: URL: <http://www.mdsupport.org/library/acuity.html> [2008, April 14].
- Williams, C. Northstone, K. Harrad, R.A. Sparrow, J.M. & Harvey, I. 2003. Amblyopia treatment outcomes after preschool screening versus school entry screening: observational data from a prospective cohort study. *British Journal of Ophthalmology*. 87(8): 988-993. [Online]. Available from Sciencedirect at <http://www.lib.uct.ac.za/datahosts.htm> [2008, March, 18].
- Wilson, H.S. 1989. *Research in nursing*. 2nd ed. California: Addison-Wesley Publishing Company, Inc.
- Wood, M.J. & Brink, P.J. 1998. Comparative designs. In: *Advanced design in nursing research*. 2nd e.d. M.J. Wood and P.J. Brink. Eds. California: SAGE Inc.89-103.

## Appendix A

### **PARTICIPANT'S INFORMATION AND CONSENT FORM FOR PARENTS UNIVERSITY OF CAPE TOWN - DIVISION OF NURSING AND MIDWIFERY**

**NAME OF THE RESEARCHER:** Mr Oageng Edrick Lesowa

**STUDENT NUMBER:** LSWOAG001

**NAME OF SUPERVISOR:** Mrs Una Kyriacos

**Researcher's contact details:** 027833626880/0026771613939 (mobile) email- olesowa@yahoo.com

**Supervisor's contact details:** 027761422676 (mobile)

**Dear Parent**

**Proposed research:**

**A comparison of the Westernized Dr Beale Collin's Picture Types Chart and the Africanized Powell Picture Types Chart for testing Rural Botswana children's eyes**

My name is Mr Oageng Edrick Lesowa and I am studying for a Master's degree at the University of Cape Town, South Africa. I am in the process of conducting a study on the comparison of the Westernized Dr Beale Collin's Picture Types chart and the Powell Picture Types Chart for testing rural Botswana children's eyes. The purpose of this study is to establish whether the Dr Beale Collin's Picture Types Chart or the Powell Picture Types Chart is the most effective for eye screening of children in rural Botswana. The study has been approved by the University of Cape Town.

Children will be asked name the pictures in each chart and their visual acuities tested using three charts. The study will take approximately 10 minutes for each child. The study might be conducted during school hours or after school depending on the agreement with the principal and the class teacher. I therefore ask for your permission to allow your child, a Standard One learner, to take part in my study. You are to decide whether to let your child participate or not. If you agree the child will be tested at the school and the results will be recorded on a sheet of paper. Please note that the results for the test will be kept anonymous and the name of the child is not written anywhere. Your child's participation in the study is voluntary and there is no penalty for refusing your child to take part at any time. The study involves no risks.

Thank you for your cooperation.

**Parent's Name:**

**Signature:** \_\_\_\_\_

**Date:**

**PARENT CONSENT (SETSWANA)**

**KITSISO YA MOTSA YA KAROLO KA TSAMAISO YA PATLISISO LE TUMALANO YA MOTSADI**

**UNIVESITI YA CAPE TOWN –LEPHATA LA BOOKI**

**LEINALAMOTSAMAISA PATLISISO:** Mr Oageng Edrick Lesowa

**LEINA LA MOETELEDIPELE WA PATLISISO:** Mrs Una Kyriacos

**MEGALA YA MOTSAMAIISA PATLISISO:** 027833626880/0026771613939 (mogala wa letheke) email-olesowa@yahoo.com

**MOGALA WA MOETELEDIPELE:** 027761422676 (mogala wa letheke)

**TSHEKATSHEKO YAGO TSHWANTSHANYA SETLHATHOBA MATLHO SESE DIRILWENG KO MAFATSHENG A BOPHIRIMA (DR BEALE COLLINS PICTURE TYPYES) LE SESE DIRILWENG MO AFRICA (POWELL PICTURE TYPES CHART) GO TLHATLOBA MATLHO A BANA BA BOTSWANA BA DIKGAOLO**

Go motsadi

Leina lame ke Oageng Edrick Lesowa, ke moithuti wa Mmadikolo wa Cape Town (South Africa). Ke ithutela booki jwa matlho. Ke sekaseka gore a setlathoba matlho sese dirilweng ko mafatsheng a bophirima (Dr Beale Collin's Picture Types) se tshwantshangwa le se se dirilweng mo Africa (Powell Picture Types Chart) kesefe se se siametseng bana ba dikgaolo mo Botswana.

Bana batla kopiwa go bala setlathoba matlho go bona gore baka kgona go bala gole kae. Batla bua gore ditshwantsho tse di dirisiwang ke dife. Patlisiso etla tsaya metsotsoele eka nna lesome. Patlisiso etla dirwa ka nako ya dithuto kgotsa morago ga sekole go setswe morago tumalano ya mogokgo le morutabana wa mophato. Ke kopa olettelele ngwana wagago go tsaya karolo ka ke sekaseka mo baneng ba mophato wa ntlha. O letlelelwa go tihopha gore a o batla ngwana wagago a tsenelela patlisiso kana nnyaa. Ga ke tsee maina a bana ketlabe keba file dinomore Gagona katlholo e ngwana wagago atlaa fiwang fa osa rate a tsenelela patlisiso.

Ke lebogela tirisano ya gago

Maina a motsadi:

Setlanyo/monwana:

Letsatsi/ngwaga:

## Letter of permission to conduct a pilot study at the Red Cross War memorial Children's Hospital



Departement van Gesondheid  
Department of Health  
iSebe lezewMpilo



Verwysing:  
Reference: RESEARCH  
Isalathiso:

Navrae:  
Enquiries: Dr. T. Blake

Datum:  
Date: 7 December 2007

Telefoon:  
Telephone: (021) 658 5383  
Ifowuni:

Fax: (021) 658 5166

Email: Tblake@pgwc.gov.za

Mr. Oageng Lesowa  
UCT Student

Dear Mr. Lesowa

Approval is hereby granted to see children in the Ophthalmology Clinic, subject to the agreement by the staff in the clinic. This clearance is valid until the end of next week.

Yours faithfully

**Dr. T. Blake**  
Senior Medical Superintendent

## Letter of permission from the University of Cape Town Ethics Committee



UNIVERSITY OF CAPE TOWN

Health Sciences Faculty  
Research Ethics Committee  
Room E52-24 Grootte Schuur Hospital Old Main Building  
Observatory 7925  
Telephone: (021) 650 6222 • Facsimile: (021) 650 6111  
e-mail: [ethics@uct.ac.za](mailto:ethics@uct.ac.za)

12 December 2007

REC REF: 470/2007

Mr O Lesowa  
C/o Mrs U Kyrianos  
Health & Rehabilitation Sciences

Dear Mr Lesowa

**PROJECT TITLE: A COMPARISON OF THE WESTERNIZED DR BEALE COLLIN'S PICTURE TYPES CHART AND AN AFRICANIZED POWELL PICTURE TYPES CHART FOR TESTING RURAL BOTSWANA CHILDREN'S EYES.**

Thank you for submitting your study to the Research Ethics Committee for review.

It is a pleasure to inform you that the Ethics Committee has **formally approved** the above mentioned study.

This serves to confirm that the University of Cape Town Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines I36: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

**Please quote the REC. REF in all your correspondence.**

Yours sincerely

**PROF M BLOCKMAN**  
**CHAIRPERSON, HSE HUMAN ETHICS**

lemjedi

Letter of permission from the Ministry of Education

TELEPHONE: 00 (267) 3655300  
TELEFAX 2944 THUTO  
FAX: 00 (267) 3911746



REPUBLIC OF BOTSWANA

MINISTRY OF EDUCATION  
DEPARTMENT OF PRIMARY EDUCATION  
PRIVATE BAG 119  
GABORONE  
BOTSWANA

REF NO: PE 1/19/17 II (43)

December 28, 2007

Mr Oageng Edrick Lesowa  
PO Box 80  
Jwaneng

Dear Sir

**PERMISSION TO CARRY OUT STUDY AT MAHOTSWANE  
AND SEKOMA PRIMARY SCHOOLS: YOURSELF**

Reference is made to your write up dated November 14, 2007 on the above subject matter.

You are by this letter granted permission to carry out the study between 01–29 February 2008 at the above schools. You are advised to make the necessary consultations with the Regional Education Officer – (Kanye), Principal Education Officer II of affected schools and the School Heads of affected schools before kickstarting your study

This office believes that you will share with it the report of your study's findings and recommendations.

By copy of this letter, the Regional Education Officer – South Region, Principal Education Officer II – Jwaneng and School Heads of affected schools are accordingly informed about the permission granted to you to carry out your study at Mahotshwane and Sekoma Primary Schools.

Bcst wishes in your endeavour.

Yours faithfully

  
KK Matlhape  
for/DPE

cc: Principal Education Officer – South  
Principal Education Officer II – Jwaneng  
School heads – Mahotshwane and Sekoma Primary Schools

Letter of permission from Jwaneng Education Officer to conduct research Khonkhwa Primary School



(267) 5880737  
(267) 5802300  
(267) 5883807

FAX: (267) 5882663



Republic of Botswana

DEPARTMENT OF PRIMARY EDUCATION  
PO BOX 29  
JWANENG  
BOTSWANA

REF NO: ED/SW/21 IV

16 January 2008

Mr. Oageng Edrick Lesowa  
P O Box 80  
Jwaneng

Dear Sir

EXTENTION FOR STUDY COVERAGE TO KENG AND KHONKHWA PRIMARY SCHOOLS: YOURSELF

You are by this communiqué given permission to carry out your study at the above named schools from 01-29 February 2008. This office will make some arrangements for you with the School Heads of the affected schools.

Good luck.

Thank you

Lucy Mphahlele  
For/ PEO II

cc School Head- Keng  
School Head- Khonkhwa

Letter of permission from the Ministry Of Health Botswana

TELEPHONE: 3632000  
FAX: 3914467  
TELEGRAMS: RABONGAKA  
TELEX: 2818 CARB BH



MINISTRY OF HEALTH  
PRIVATE BAG 0038  
GABORONE  
BOTSWANA

REPUBLIC OF BOTSWANA

REFERENCE No: PPME-13/18 PS Vol II (70) January 9, 2008

Oageng Edrick Lesowa  
P.O. Box 722  
Jwaneng

**Permit : A COMPARISON OF THE WESTERNIZED DR BEALE COLLIN'S PICTURE TYPES CHART AND AN AFRICANIZED POWELL PICTURE TYPES CHART FOR TESTING MAHOTSHWANE AND SEKOMA PRIMARY SCHOOL STANDARD ONE LEARNERS**

Your application for a research permit for the above stated research protocol refers. We note that you have satisfactory revised the protocol as per our suggestions.

**Permission is therefore granted to conduct the above mentioned study.** This approval is valid for a period of 1 year effective January 9, 2008.

The following conditions apply:  
Permission should also be obtained from the Ministry of Education to conduct this study.

This permit does not however give you authority to collect data from the selected institutions without prior approval from the management of the institutions. Parental consent for the selected students should be obtained at all times as well as individual assent from the selected students.

The research should be conducted as outlined in the approved proposal. Any changes to the approved proposal will need to be resubmitted to the Health Research Unit in the Ministry of Health.

1

Furthermore, you are requested to submit at least one hardcopy and an electronic copy of the report to the Health Research Unit, Ministry of Health within 3 months of completion of the study.  
**Approval is for academic fulfillment only.**

Thank you,

  
S. E. H. J. M. M. M.  
For/Permanent Secretary Ministry of Health

2

DATA COLLECTION FORM

Subject	Gender	Age (yrs)	VA E Chart in Log MAR		VA Powell chart in Log MAR		VA Beale chart in Log MAR		Recognition Powell chart/13	Recognition Beale chart/16	VA Powell chart in Log MAR	
			R eye	L eye	R eye	L eye	R eye	L eye			R eye	L eye
1												
2												
3												
4												
5												
6												
...												
96+												

University of Cape Town

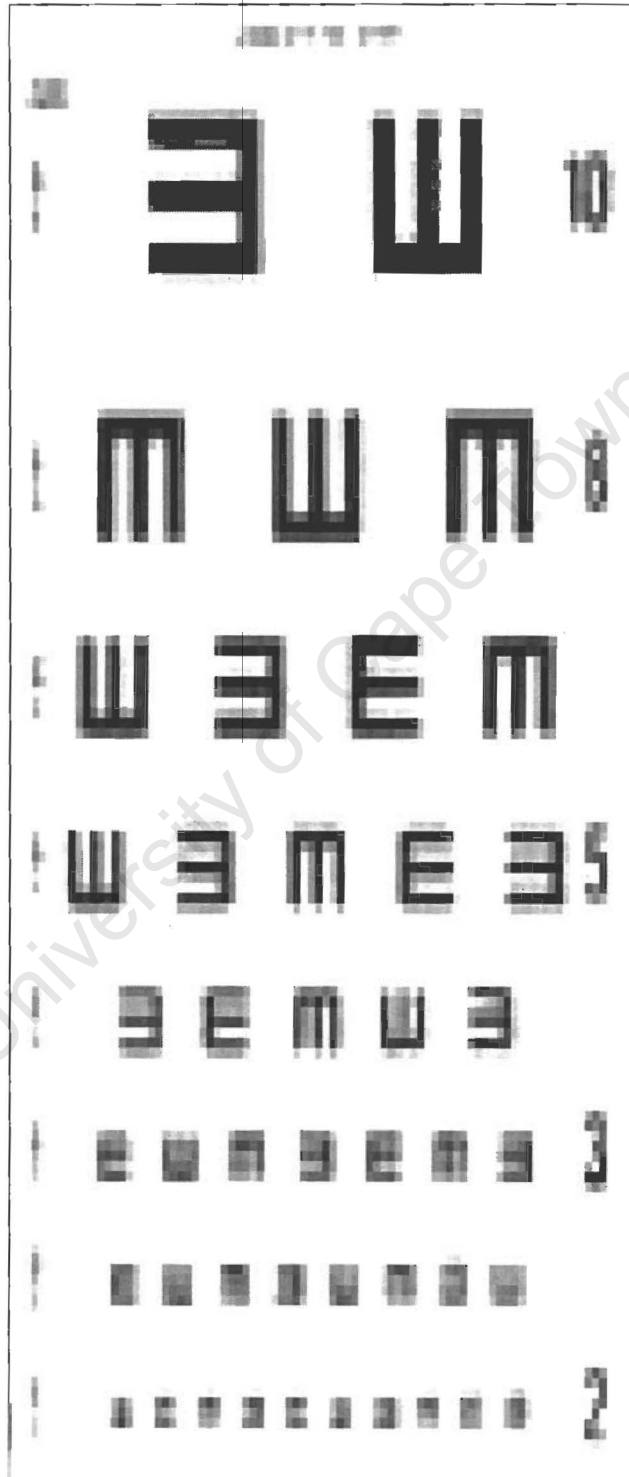
### DATA COLLECTION PROCESS

Study subject No.1

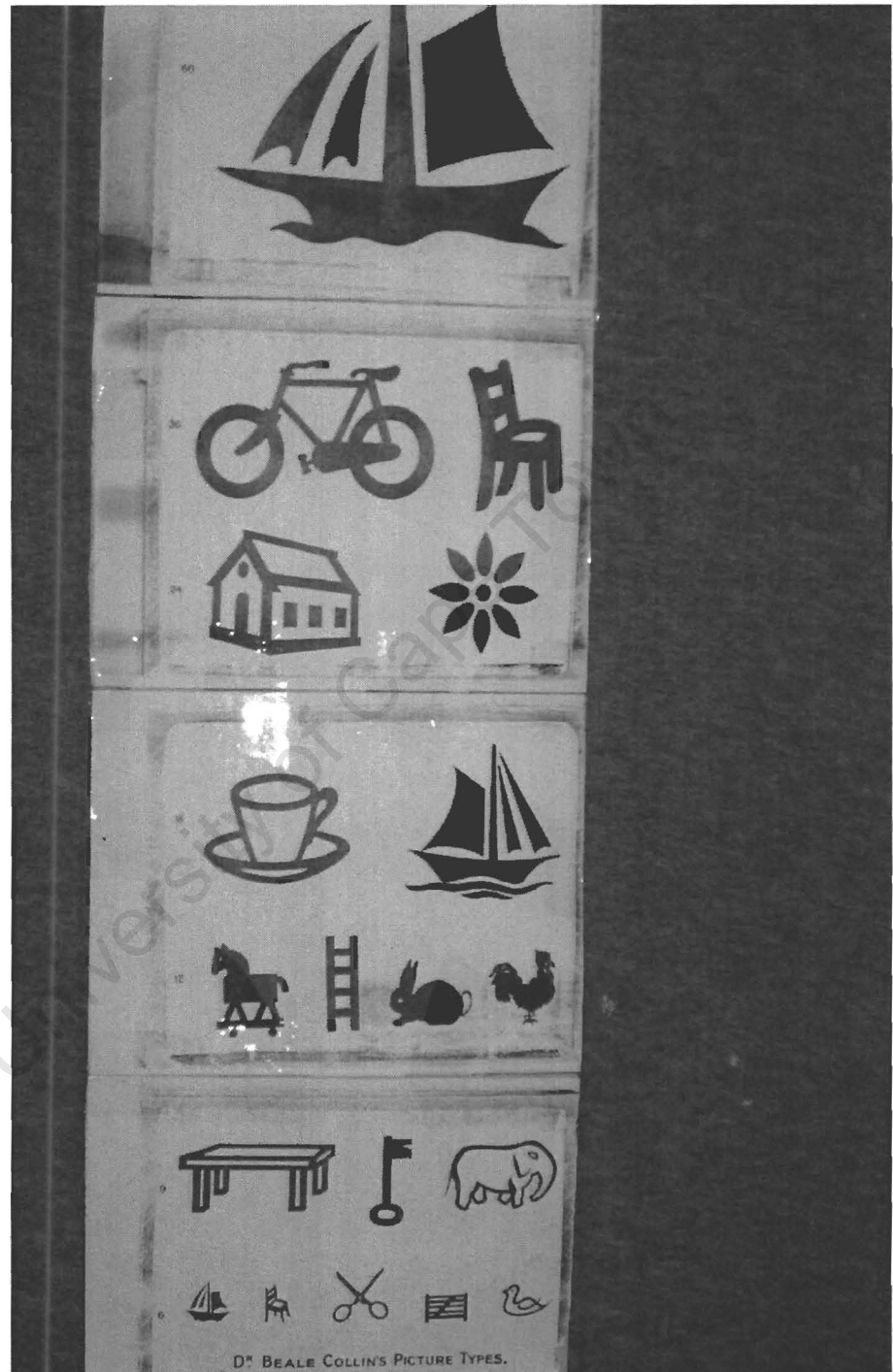
- |        |  |
|--------|--|
| Step 1 | VA testing with Snellen E chart                                  |
| Step 2 | Recognition of pictures in Powell Picture Types chart            |
| Step 3 | Recognition of pictures in Dr Beale Collin's Picture Types Chart |
| Step 4 | VA testing with Powell Picture Types Chart                       |
| Step 5 | VA testing with Dr Beale Collin's Picture Types Chart            |
| Step 6 | VA testing with Powell Picture Types Chart                       |

The researcher conducted steps 1 to step 5 on the first day and step 6 on the following day to ensure reliability of the data collection tool (Appendix H).

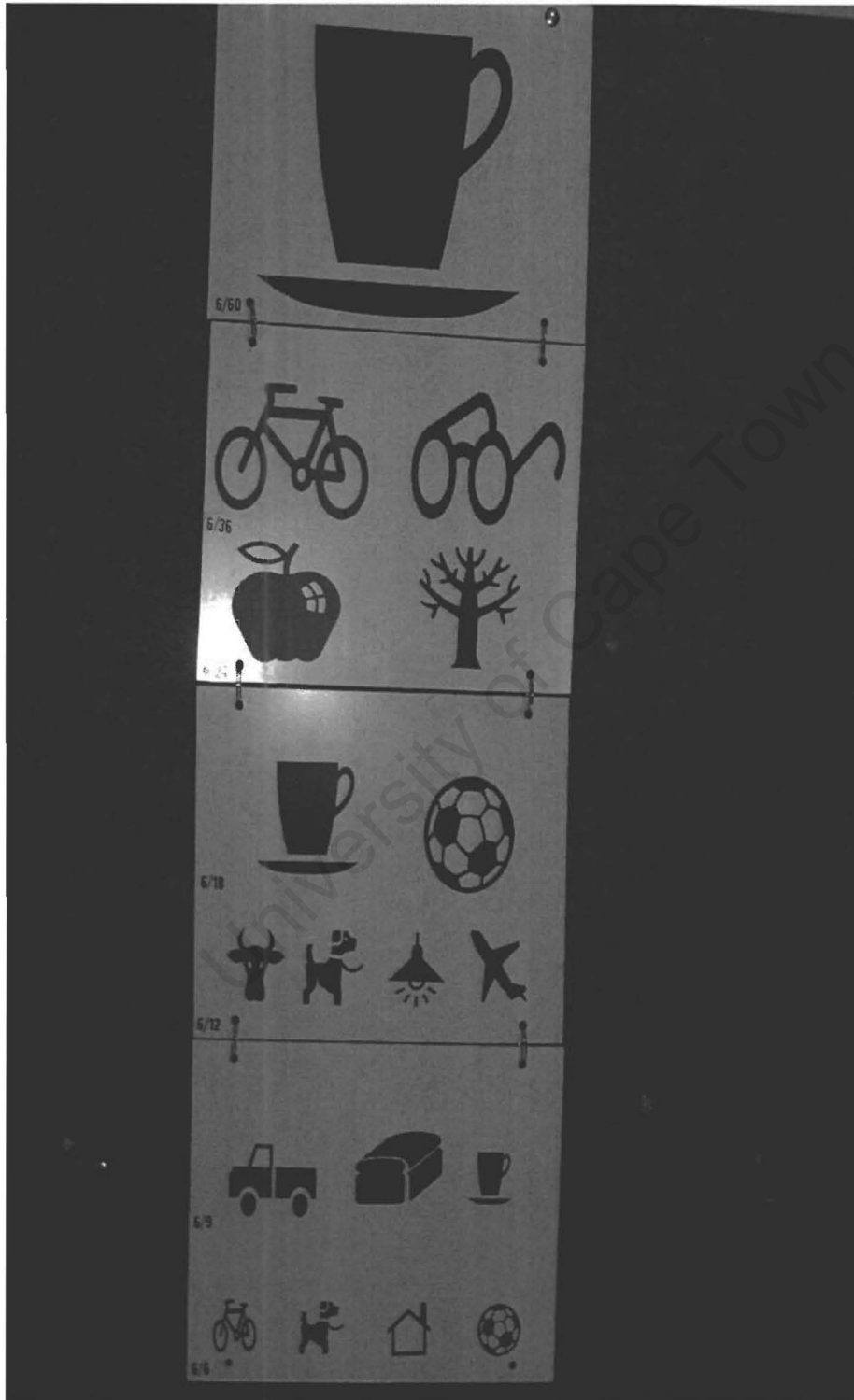
The Snellen E Chart



Dr Beale Collin's Picture Types Chart



Powell Picture Types Chart



## Appendix M

### Participant (Standard One learners) Information and Assent form

UNIVERSITY OF CAPE TOWN - DIVISION OF NURSING AND MIDWIFERY

**NAME OF THE RESEARCHER:** Mr Oageng Edrick Lesowa

**STUDENT NUMBER:** LSWOAG001

**NAME OF SUPERVISOR:** Mrs Una Kyriacos

**Researcher's contact details:** 027833626880/0026771613939 (mobile) email- olesowa@yahoo.com

### **An evaluation of the appropriateness of the Westernized Dr Beale Collin's Picture Types Chart for testing Rural Botswana children's eyes**

My name is Mr Oageng Edrick Lesowa and I am studying for a Master's degree at the University of Cape Town, South Africa. I am in the process of conducting a study on the evaluation of the appropriateness of the Westernized Dr Beale Collin's Picture Types chart for testing rural Botswana children's eyes. The purpose of this study is to establish whether the Dr Beale Collin's Picture Types Chart or the Powell Picture Types Chart is the most effective for eye screening of children in rural Botswana. The study has been approved by the University of Cape Town.

You will be asked to read from the chart to determine your visual acuity using each chart and you will be asked to identify pictures depicted on each chart. The study will take approximately 10 minutes for each child. The study might be conducted during school hours or after school depending on the agreement with the principal and the class teacher. I therefore ask for your permission to take part in the study. Your parent has agreed that you take part in the study. Please note that the results for the test will be kept anonymous and your name is not written anywhere. You are allowed to choose whether to take part or not and you will not be penalized for that. If you are found to have some eye problems you will be referred to the village nurse for management. The study involves no risks.

Thank you for your cooperation.

**Learner's Name:**

**Signature:** \_\_\_\_\_

**Date**

### Child Assent (Setswana)

KITSISO YA MOTSA YA KAROLO KA TSAMAISO YA PATLISISO LE TUMALANO

UNIVESITI YA CAPE TOWN –LEPHATA LA BOOKI

LEINALAMOTSAMAISA PATLISISO: Mr Oageng Edrick Lesowa

LEINA LA MOETELEDIPELE WA PATLISISO: Mrs Una Kyriacos

MEGALA YA MOTSAMAIISA PATLISISO: 027833626880/0026771613939 (mogala wa letheke) email-olesowa@yahoo.com

MOGALA WA MOETELEDIPELE: 027761422676 (mogala wa letheke)

TSHEKATSHEKO YAGO BONA GORE A SETLHATHOBA MATLHO SESE DIRILWENG KO MAFATSHENG A BOPHIRIMA (DR BEALE COLLINS PICTURE TYPYES) SEKA TLHATLOBA MATLHO A BANA BA BOTSWANA BA DIKGAOLO

Go motsadi

Leina lame ke Oageng Edrick Lesowa, ke moithuti wa Mmadikolo wa Cape Town (South Africa). Ke ithutela booki jwa matlho. Ke sekaseka gore a setlhatlhoba matlho sese dirilweng ko mafatsheng a bophirima (Dr Beale Collin's Picture Types) a se siametse bana ba dikgaolo mo Botswana. Maikaelelo kego sekaseka gore faele setlhatlhoba matlho sese dirilweng ko mafatsheng a bophirima (Dr Beale Collin's Picture Types) le sese dirilweng mo South Africa (Powel Picture Types) ke sefe sese kgonang go tlhatlhoba bana botoka.

Lotla kopiwa go bala setlhatlhoba matlho go bona gore baka kgona go bala gole kae. Lotla bua gore diithwantsho tse di dirisiwang ke dife. Patlisiso etla tsaya metsotso eka nna lesome. Patlisiso etla dirwa ka nako ya dithuto kgotsa morago ga sekole go setswe morago tumalano ya mogokgo le morutabana wa mophato. Motsadi wag ago o dumetse gore oka tsenelela patlisiso. O letlelelwa go tlhopha go tsenelela patlisiso kana gosaa e tsenelela go sena ditlamorago. Ga ke tsee maina a lona ketlaa lofa dinomore Gagona katholo e aotlaa efiwang fa osa rate go tsenelela patlisiso. Fa ke bone onale mathata a matlho ketla itsise motsadi rebe rego romela ko mooking wa motse gore ago thuse.

Ke lebogela tirisano ya gago

Maina a motsaya karolo

Setlanyo/monwana:

Letsatsi/ngwaga: