UNIVERSITEIT VAN PRETORIA
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STRATEGIES FOR TEACHERS IN SUPPORT OF LEARNERS WITH COLOUR VISION DEFICIENCY

by

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Submitted in partial fulfilment of the requirements for the degree

MAGISTER EDUCATIONIS

Department of Educational Psychology

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PRETORIA

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DECLARATION OF ORIGINALITY

I, Anneke Louw (student number 17310832), declare that the mini-dissertation "**Strategies for teachers in support of learners with colour vision deficiency**", which I hereby submit for the degree Magister Educationis in Educational Psychology at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

27 April 2022

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Anneke Louw **Date**

ETHICAL CLEARANCE CERTIFICATE

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This Ethics Clearance Certificate should be read in conjunction with the Integrated Declaration Form (D08) which specifies details regarding:

- Compliance with approved research protocol,
- No significant changes,
- Informed consent/assent,
- Adverse experience or undue risk,
- Registered title, and
- Data storage requirements.

DECLARATION FROM LANGUAGE EDITOR

21 April 2022

Louise Pretorius
Editing, writing and translation services

To whom it may concern:

This letter serves to confirm that I have edited a mini-dissertation for English language usage, by Anneke Louw, with the primary research question: *How can teachers support learners with CVD in an inclusive classroom context?,* submitted in partial fulfilment of the requirements for the degree Magister Educationis (Educational Psychology) in the Department of Educational Psychology, Faculty of Education, University of Pretoria.

Yours sincerely

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ABSTRACT

Inclusive education implies an approach where all learners, despite any specific learning needs, are accommodated and supported in the classroom. Currently, only blindness and partial sightedness are recognised as visual barriers to learning in South Africa, with the result that no formal guidelines exist to accommodate learners with colour vision deficiency (CVD) in schools. Furthermore, teachers in South Africa are not formally trained in this field, resulting in them being unaware of and feeling ill-equipped to assist these learners.

The purpose of the current study is to contribute to the existing knowledge base on the experiences of learners with CVD with the aim of identifying supportive strategies that may be employed by the teachers of such learners. To this end, I explored and described the classroom experiences of five individuals with CVD and documented their recommendations for possible supportive classroom strategies. In compiling a conceptual framework, I integrated concepts of Bronfenbrenner's (Rosa & Tudge, 2013) systems theory with the sociocultural theory of Vygotsky (Tchombé, 2011). I adopted interpretivism as epistemology, implemented a multiple case study research design, and followed a qualitative methodological approach. I relied on both purposeful and convenience sampling in selecting participants. Semi-structured interviews, observations, field notes and a reflective journal were utilised for data generation and documentation. I analysed the data through inductive thematic analysis.

Three themes with related sub-themes emerged. First, the results of my study indicate that CVD is often inherited and discovered during the primary school years by a parent or teacher during colour-related activities. Secondly, the classroom experiences of individuals with CVD seemingly include the need for additional time to complete colour-related learning activities even though the participants did not indicate significant negative experiences regarding their general scholastic performance or social and emotional functioning. Thirdly, participants highlighted the importance of self-help coping strategies, teacher awareness, an inclusive physical classroom space, the cautious application of colour in class, worksheets, textbooks and tests, as well as peer support, for learners with CVD. Based on my findings I can conclude that the impact of CVD in school may be reduced through self-help coping strategies as well as teacher and peer support. To this end, my study may provide teachers with possible supportive strategies to implement in class, making it more inclusive of learners with CVD.

KEY CONCEPTS

- Accommodation of learners with special needs
- Colour vision deficiency (CVD)
- Inclusive classroom context
- Inclusive education policy implementation
- Learner support
- Learners with colour vision deficiency
- Learning difficulties associated with colour vision deficiency
- Normal colour vision
- Special education needs
- Supportive strategies

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CHAPTER 1: OVERVIEW OF THE STUDY

1.1 INTRODUCTION AND RATIONALE FOR UNDERTAKING THE STUDY

This study forms part of a broader research project that focuses on the effect of colour vision deficiency (CVD) in educational contexts. Focus areas of the broader research initiative include the effect of a holistic intervention on learners with CVD; the development, implementation, and outcome of a parent guidance intervention, as well as a teacher intervention in support of learners with CVD; and an analysis of school textbooks regarding the use of colour. My study was aimed at adding insight into possible strategies that teachers may apply in the classroom to better accommodate learners with CVD. For this purpose, I explored and describe the viewpoints of individuals with CVD on such possible supportive strategies.

In accordance with the Education White Paper 6 (Department of Education, 2001), inclusive education and training implies a holistic approach to respecting and accepting differences in the learning needs of individuals. The policy aims to promote supportive structures and learning methodologies. This implies that all learners, despite any specific learning needs, should be optimally supported in the classroom.

CVD including its different types is recognised by the World Health Organisation as a visual disturbance (World Health Organisation, 2016) and has a specific ICD.10 code assigned to it. CVD furthermore has a fairly high prevalence of CVD of 8% in males and close to 0.5% in females (Tanuwidjaja et al., 2014; Wong, 2011), however, the South African Government Gazette No 29466 only recognises blindness and partial sightedness as visual barriers to learning (Department of Education, 2006) and not CVD. As a result, formal guidelines for accommodating these learners in the school and general classroom context are seemingly lacking. Furthermore, prospective teachers do not currently receive formal training in this field, resulting in teachers often not being sufficiently equipped to recognise and assist learners with CVD in class (Sullivan, 2010). CVD is also not listed in the DSM-5 (American Psychiatric Association, 2013) as a classifiable visual disability.

A review of existing literature reveals that limited information currently exists regarding CVD and that the information that is available typically relates to selected groups of individuals such as medical students and dentists (Stoianov et al., 2019). Even though some strategies have been identified for implementation in the classroom in related studies, evidence of such

implementation, as well as the outcome of such interventions, from the viewpoint of learners with CVD, seems to be limited, especially in South Africa (Stoianov et al., 2019). More specifically, qualitative research on the experiences of learners with CVD, both nationally and internationally, as well as research on the prevalence of CVD in South Africa, require ongoing attention. Research of this nature may subsequently support the inclusion[1] of learners with CVD in everyday activities, as well as classroom settings, thereby potentially assisting them to flourish despite the potential effect of CVD on their lives.

Against this background, I aimed to gain an in-depth understanding of the experiences of individuals with CVD, as well as their ideas on how teachers can assist learners with the condition within the school and classroom context. The ultimate aim is to identify possible intervention strategies for implementation by school teachers, as part of a follow-up study within the broader project. In addition to the apparent need for research in this field, the current study is of personal interest to me, based on my belief that all learners should be accommodated and included in class, as stipulated by the Education White Paper 6 (Department of Education, 2001). Every learner accordingly has the right to receive the best possible education, which is only possible if different needs, disabilities and challenges are considered and addressed through the implementation of suitable strategies that can assist learners to overcome the barriers to learning they face. As background to developing such supportive strategies, insight into the experiences and needs of learners with a specific condition, such as CVD, may hold great value.

1.2 PURPOSE OF THE STUDY

As indicated, my study forms part of a broader research project that focuses on CVD and how to accommodate and support learners with this condition in both the home and school environment. Within the broader project, the purpose of my study is to contribute to the emerging body of knowledge on the experiences of and support for learners with CVD in the South African context. To this end, I firstly explored and described (Morgan & Sklar, 2012) the experiences of individuals with CVD; and secondly focused on their recommendations for supportive strategies that may be implemented by teachers in the classroom. I thus aimed to understand the participants' school experiences and their ideas for teacher support. I accordingly analysed the data with the purpose of identifying potential supportive

[1] In this study, 'inclusion' is conceptualised in terms of the Education White Paper 6 (Department of Education, 2001), which describes it as accommodating and supporting any special need a learner may have in the classroom.

strategies that may be implemented by teachers in future, based on the participants' personal experiences and viewpoints.

1.3 RESEARCH QUESTIONS

I was guided by the following primary research question: *How can teachers support learners with CVD in a classroom context?*

To enable me to answer the primary research question, I formulated the following secondary questions:

- How did individuals with CVD experience their school careers in terms of teaching and learning activities?
- How was the participants' functioning affected on academic, emotional, and social levels?
- Which strategies, if any, were implemented by teachers to support the participants?
- Which recommendations can be made to strengthen strategies routinely used by teachers to support learners with CVD?

1.4 WORKING ASSUMPTIONS

In undertaking the current study, I assumed the following:

- Many teachers have limited knowledge and expertise on how to accommodate learners with CVD in the school context.
- The average teacher will not sufficiently focus on accommodating the needs of learners with CVD in the classroom.
- Learners with CVD may be affected negatively by this condition in terms of their academic, emotional and social functioning in school.
- Participants will be able to reflect on their school experiences in relation to their condition of CVD.
- Participants will be able to make suggestions for ways in which teachers may better accommodate and support learners with CVD in the classroom.

1.5 CONCEPT CLARIFICATION

In this section, I clarify the key concepts of my study.

1.5.1 Learners with colour vision deficiency (CVD)

Colour vision deficiency (CVD), often inaccurately referred to as colour-blindness, occurs when one or more of the three eye cones (red, green, or blue) are either absent or functioning abnormally (Ramachandran et al., 2014). As a result, an individual with CVD is not able to discriminate certain colours when seen under regular light (Woldeamanuel & Geta, 2018). An individual can inherit CVD due to a recessive X-gene or acquire it later in life due to a disease or brain damage (Simunovic, 2016).

Depending on the type and severity of the CVD, an individual with CVD may find it difficult to distinguish between certain colour combinations (Torrents et al., 2011). In the case of Red-Green CVD, the individual may see everything in shades of green or red, or, in the case of Blue-Yellow CVD, in shades of blue (Hasrod & Rubin, 2016). Lastly, an individual with Total CVD may see everything in shades of white, grey and black (Sullivan, 2011). Within the school context, all such learners are regarded as having CVD. For the purpose of this study, I accordingly did not select participants based on the type or severity of their CVD, but merely recruited individuals who fall in the group of people with CVD and who had completed at least their primary school years.

1.5.2 Inclusive classroom context

Kozleski et al. (2014), describe an inclusive classroom, as cited by Engelbrecht et al. (2015), as a setting that supports the learning needs of all learners, and focuses on the strengths of each individual learner instead of following a deficit approach. As most contemporary classrooms represent a diverse population of learners (Department of Education, 2001), an inclusive classroom context implies a setting where these differences are taken into account and activities are facilitated that are inclusive of all learners in the class (Oyler, 2011).

In their policy document, the South African Department of Education (2001) stipulates that all teachers are required to address barriers to learning faced by some learners to help them feel included in the classroom. According to the policy document, available support systems in the classroom should be adapted to include all learners, regardless of their specific learning needs (Department of Education, 2001). For the purpose of the current study, an inclusive classroom context implies a classroom where the needs of learners with CVD are

considered during teaching and learning activities, to enable such learners to learn and benefit from lessons in the same way as learners without CVD.

1.5.3 Supportive strategies

Engelbrecht (2013) refers to supportive strategies as strategies implemented by teachers to prevent the occurrence of future barriers to learning and to eliminate already existing ones. According to Lerner and Johns (2012), a successful supportive strategy will be developed when a teacher identifies the demands of the curriculum and develops learning strategies that can assist learners to meet the demands, considering all individual learning needs. For the purpose of my study, supportive strategies refer to strategies that teachers can develop and/or implement to support learners with CVD in their classrooms. Such support can assist learners to achieve the intended learning outcomes despite the possible barriers to learning they may experience as a result of CVD.

1.6 PARADIGMATIC CHOICES

In this section, I introduce the conceptual, meta-theoretical and methodological frameworks of my study. More detailed discussions follow in Chapter 3.

1.6.1 Conceptual framework

My study was informed by elements of the bio-ecological systems theory of Bronfenbrenner (Donald et al., 2010; Swart & Pettipher, 2011) and Vygotsky's sociocultural theory of cognitive development (Snowman & McCown, 2013). Both these theories recognise the importance of the interaction between different role players, environments, and the learner during the development process (Nel et al., 2013; Rosa & Tudge, 2013). Both theories are thus built on the premise that specific developmental outcomes can occur for learners through interaction, referred to as proximal processes, with others more knowledgeable than themselves and in an environment which encourages learning (Snowman & McCown, 2013; Swart & Pettipher, 2011).

Bronfenbrenner's bio-ecological systems theory of development foregrounds the development of learners in interaction with their contexts and various systems (Bronfenbrenner, 1976[2]). As such, Bronfenbrenner views learners as active participants in their own development and assumes that learners' perceptions of their contexts will influence how they interact with the environment (Bronfenbrenner, 1976). In terms of the

[2] This salient source is included as Bronfenbrenner introduced the bio-ecological systems theory of development and, as such, this article can be regarded as a primary source on the topic.

Process-Person-Context-Time (PPCT) model that builds on the bio-ecological systems theory (Rosa & Tudge, 2013), my study highlights the context domain, through the microsystem, which includes the family, school and peers of learners with CVD, as well as the macrosystem. The latter relates to South Africa's national school curriculum and the inclusion of all learners in all classrooms, by accommodating any special needs (Bronfenbrenner, 1976).

For the time domain, derived from the chronosystem, I considered the meso-time area by exploring the variety and quality of resources and support that had been provided to the participating individuals with CVD by their peers as well as their teachers in the classroom context, at the time they attended school (Nel et al., 2013).

Closely aligned, Vygotsky's theory (Tchombé, 2011; Vygotsky, 1978[3]) is included in my framework as I focused on ways in which teachers, as well as the school and classroom environment, can support learners with CVD to enable them to learn according to their zone of proximal development (ZPD). Teachers play a significant role in learners' actualisation of their ZPD as they can support learners' acquisition of knowledge and skills through methods such as scaffolding, illustrations, or guiding questions (Donald et al., 2010; Strydom, 2011; Tchombé, 2011).

1.6.2 Meta-theoretical paradigm

I relied on interpretivism, thereby acknowledging that any person's perception of reality is informed by personal experiences and subjective meaning-making of the individual (Schurink et al., 2011). Interpretivism thus assumes that there is no one single reality, but that a multitude of different realities exist, based on the personal meanings that individuals attribute to experiences through their interaction with others (Merriam & Tisdell, 2016). In viewing the data I obtained through an interpretivist lens, I aimed to make sense of how the participants had experienced the classroom context as learners with CVD, in terms of their learning as well as their emotional and social experiences (Kawulich & Holland, 2012; Terre Blanche et al., 2006). I discuss the selected meta-theoretical paradigm in more detail in Chapter 3.

[3] I acknowledge that this is a dated source, however, Vygotsky's original theory of social constructivism is central to the conceptual framework informing this study.

1.6.3 Methodological approach

I followed a qualitative research approach based on my focus on the experiences and perceptions of human participants. Kawulich and Holland (2012) describe qualitative research as research that seeks to make sense of and interpret phenomena based on the meaning that participants attach to these. In this way, qualitative research aims to produce a coherent story of participants' experiences from their own subjective perspectives, as told by them (Tuli, 2010). According to Denzin and Lincoln (2018), qualitative research is therefore especially suitable for studies that explore participants' unique experiences, which in my case relate to the experiences of people with CVD in terms of the support they had received in school (Schurink et al., 2011).

1.7 OVERVIEW OF THE RESEARCH PROCESS

In this section, I introduce the research process and methodological techniques I used. I include more detailed discussions in Chapter 3.

1.7.1 Research design

I utilised a descriptive case study design (Fouché & Schurink, 2011; Yin, 2003) based on the purpose of my study, namely to explore and describe the views of specific individuals (with CVD), which can be taken as a bounded system (Merriam & Tisdell, 2016). According to Yin (2018), a descriptive case study design entails the in-depth investigation, description, and analysis of a specific phenomenon within such a bounded system, as it functions in its real-life context. A case is bounded by certain set parameters, such as space and time, leading to the exclusion and inclusion of cases in a study (Yin, 2018).

In the current study, individuals with CVD who had at least completed primary school were included as participants, together forming a bounded system. An exploration of the participants' perceptions allowed me to study and understand the phenomenon of CVD, specifically in terms of learners' needs in the classroom. In addition, I was able to document recommendations made by individuals with CVD for teachers to implement in a typical classroom setting (Stake, 1995).

1.7.2 Selection of participants

I used purposeful sampling (Nieuwenhuis, 2016a) to select five individuals with CVD (ages 15 to 21), based on the assumption that they would be able to provide rich information on the phenomenon under study, thereby assisting me to answer the formulated research questions and achieve the aims of the study (Tracy, 2013). A component of convenience

sampling was also present (Strydom, 2005) as I had access to a list of individuals with CVD, who had participated in a small-scale study in 2019, conducted by a high school learner guided by my supervisor. I thus contacted these individuals as potential participants as a starting point yet also relied on my own networks and colleagues in the teaching profession to identify and select suitable participants (Laher & Botha, 2012).

The following selection criteria (Palys, 2008) applied:

- participants had to be colour vision deficient;
- participants had to have completed primary school;
- participants had to be able to converse in either English or Afrikaans;
- participants had to provide informed consent to participate;
- participants had to be available for an individual interview.

1.7.3 Data generation, documentation and analysis

I conducted five semi-structured individual interviews for data generation purposes (Laher & Botha, 2012), supported by observation, field notes, a reflective journal, and audio-recordings of all interviews, which were subsequently transcribed verbatim (Tracy, 2013). Even though semi-structured individual interviews required participants to respond to specific formulated questions (Nieuwenhuis & Smit, 2012), the nature of this data generation technique allowed for flexibility. It also presented the option of moving between the questions captured in the interview schedule, clarifying responses, probing participants to expand on answers, and re-focusing the conversation when needed (Brinkmann, 2018).

While conducting the interviews, I furthermore relied on observation and field notes to document what I observed and what the participants shared with me. Observation enabled me to generate data in addition to what was shared by the participants verbally, by relying on my senses to see and hear what was not directly stated (Seabi, 2012). I compiled field notes during and after the interviews to include detailed descriptions of what I had observed, in the form of both factual accounts, for example of non-verbal cues that I noticed, as well as my personal interpretations of these (Andrade, 2009). In further support, I kept a reflective journal to capture my experiences in the field, my feelings, hunches, reactions, speculations, initial interpretations and working assumptions, as well as my reflections on the non-verbal cues of the participants (Yin, 2018). These reflective comments, attentive listening and meaningful interaction with the participants enabled me to gain somewhat of an insider perspective, as participants could share their experiences with me in an open and authentic manner (Creswell, 2016; Greeff, 2011).

As the primary research instrument, my insights and continuous reflections on my own feelings and experiences during the interviews, prevented me from being influenced by personal biases or preconceived ideas (Yin, 2018). I furthermore remained cautious of the fact that I was conducting research interviews with the purpose of generating data as opposed to educational psychology interviews which imply another purpose and approach. In order to avoid the aforementioned potential challenge, I relied on regular discussions with my supervisor (Patton, 2015), in addition to the said reflexivity I practiced.

For data analysis, I used inductive thematic analysis, thereby following the process of categorisation, segmenting, summarising, and reconstruction, in order to identify essential and recurring themes and sub-themes and subsequently report on these (Ayres, 2008). In following this approach, I thus attempted to identify the main ideas and consistencies in the data, and make meaning of the participants' responses (Patton, 2015). I regard inductive thematic analysis as suitable for this study as it enabled me to categorise the data and give meaning to the categories, which ultimately formed patterns and led to the discovery of themes across the various sets of data (Braun & Clarke, 2006; Braun & Clarke, 2022).

1.8 ETHICAL CONSIDERATIONS

Throughout my study, I acted in accordance with the research guidelines stipulated by the University of Pretoria's ethics committee (University of Pretoria, 2021). I obtained the necessary ethical clearance (24 July 2020 for adult participants and 6 April 2021 for minor participants) before commencing with any data generation and requested the participants to provide written informed consent prior to their participation, after informing them about the purpose, methods, duration, and possible uses of the study. In the case of the minor participant, I obtained assent from him and consent from his parents. As part of the process of obtaining informed assent/consent, I explained to the participants that their participation was voluntary and that they could withdraw from the research process at any time, should they feel uncomfortable or violated in any manner (Elias & Theron, 2012).

Participants were furthermore informed that all data would be dealt with in a confidential way and would not be accessible to any unauthorised person (Merriam & Tisdell, 2016). I used pseudonyms to protect the privacy of the participants and ensure anonymity (Ogletree & Kawulich, 2012). I also adhered to the principle of non-maleficence which, according to Terre Blanche et al. (2006), will ensure that participants are neither directly nor indirectly harmed, wronged, or deceived in any way by taking part in the research. Raw data are being kept in a safe place at the University of Pretoria for a period of fifteen years following completion of

my study and all electronic data are password protected. Finally, I attempted to report on my results in a truthful, precise, and authentic manner in this mini-dissertation (Elias & Theron, 2012).

1.9 TRUSTWORTHINESS OF THE STUDY

In the course of this study, I was guided by the criteria set out by Lincoln and Guba (1985) as cited in Morsen (2018), namely credibility, transferability, dependability, and confirmability. In addition, I attempted to ensure authenticity of my findings as mentioned by Ferreira (2012). Some of the strategies I employed in pursuit of meeting these criteria include member checking, data saturation, keeping an audit trail (Morsen, 2018), triangulation of data generation methods and sources, crystallisation (Di Fabio & Maree, 2012) and keeping a reflective journal containing field notes and observations (Nieuwenhuis & Smit, 2012; Patton, 2015). In Chapter 3, I discuss the way in which I employed these strategies in more detail.

1.10 OUTLINE OF THE CHAPTERS

Below, I provide a brief overview of the chapters of this mini-dissertation.

Chapter 1: Overview of the study

In Chapter 1, I provide an outline of the research background, rationale and purpose of the study. I also introduce the conceptual framework and my working assumptions, clarify the key concepts of the study, and briefly describe the research methodology. Lastly, I mention the ethical considerations and trustworthiness criteria I considered in undertaking the research.

Chapter 2: Literature review

In this chapter, I discuss the literature I explored to understand the phenomenon of CVD, as well as its potential effects on the academic, emotional, and social functioning of learners with CVD. I also discuss the importance of accommodating learners with CVD in the classroom, and refer to the limited support that is currently available for learners with CVD in the school context. I conclude the chapter by explaining the conceptual framework that guided me in undertaking my study and interpreting the results.

Chapter 3: Research design and methodology

In Chapter 3, I explain the research design and methodological process. I elaborate on the selection of participants, as well as the data generation, documentation and analysis procedures. Finally, I discuss the ethical considerations and quality criteria that I considered.

Chapter 4: Results and findings of the study

In this chapter, I present the results of my study in terms of the themes and sub-themes I identified by means of inductive thematic data analysis. In the second part of the chapter, I interpret the results in terms of the literature I explored in Chapter 2, thereby discussing the findings of the study.

Chapter 5: Conclusions and recommendations

The final chapter of the mini-dissertation includes my conclusions in terms of the research questions I formulated in Chapter 1. I highlight the contributions and limitations of my study, and make recommendations for further research, training and practice.

1.11 CONCLUSION

In this chapter, I introduced my study and explained the rationale in terms of limited available research in the field, as well as my personal motivation for selecting this focus. I stated the purpose of the study, formulated research questions and clarified the key concepts. I also provided a brief outline of the selected paradigms, research design, and methodological strategies I relied on. Lastly, I referred to ethical aspects and the quality criteria of the study. I also provided an overview of the chapters of this mini-dissertation.

In the next chapter, I discuss existing literature relevant to the focus of my study. I also explain my conceptual framework, which is based on Bronfenbrenner's bio-ecological systems theory (Swart & Pettipher, 2011) and Vygotsky's sociocultural theory of cognitive development (Snowman & McCown, 2013).

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

In the preceding chapter, I introduced the study I undertook. I also provided an overview of the paradigmatic and methodological choices I made. Chapter 1 thus paved the way for the rest of the chapters in the mini-dissertation.

In this chapter, I explore the existing literature on the phenomenon I explored, namely CVD. I focus on the potential effects of CVD on the functioning and performance of learners with this condition, and the importance of supporting them. My discussion is set against the background of inclusive education and the Education White Paper 6 (Department of Education, 2001). I also explain my conceptual framework.

2.2 UNDERSTANDING COLOUR VISION DEFICIENCY (CVD)

Colour vision refers to the ability of the eye to use the wavelengths of light that are transmitted, produced, or reflected by objects to differentiate between them (Hasrod & Rubin, 2016). Normal colour vision (NCV) implies that all three cones in the eye are fully functioning; these are referred to as short-(red), medium-(green) and long-(blue) wavelength cones. An individual with NCV is thus able to see and distinguish between the complete spectrum of colours (Frane, 2015).

On the other hand, defective colour vision, or CVD implies atypical functioning in an individual's eye cones, resulting in the individual not being able to recognise and perceive differences between certain colours (Chakrabarti & Chakraborti, 2015; Mashige & Van Staden, 2019). In Figures 2.1 and 2.2 a comparison is provided of how someone with NCV will see an image when compared to someone with CVD (Colour Blind Awareness, n.d.). Figure 2.2 specifically applies to a person with type Red-Green CVD.

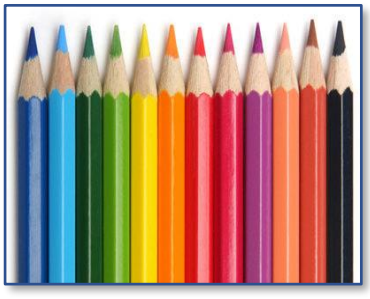

Figure 2.1: Coloured pencils as seen by someone with normal colour vision

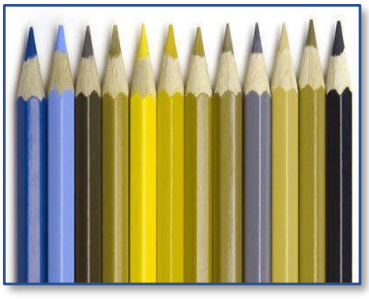

Figure 2.2: Coloured pencils as seen by someone with CVD

The causes of CVD can be either congenital or acquired (Berger et al., 2016). Congenital CVD entails an inherited visual disorder, which is present from birth. It is incurable and will not change over time (Shayeghpour et al., 2014). On the other hand, acquired CVD will develop later in an individual's life and is characterised as symptomatic. It can either be progressive or regressive during a person's life span (Chan et al., 2014; Hasrod & Rubin, 2016). CVD can, among other causes, be acquired as a result of chemical or physical damage to parts of the brain, eye, or optic nerve system (Shayeghpour et al., 2014).

2.2.1 Types of CVD

Three main types of CVD are distinguished, namely Red-Green, Blue-Yellow, and Total or Complete CVD. In Table 2.1, a summary of the main types of CVD and the various forms of each are provided, with an illustration of how Figure 2.3 will be seen by someone with each specific form of CVD (Colour Blind Awareness, n.d.).

Figure 2.3: Image as seen by someone with normal colour vision

Table 2.1: Types and forms of CVD

TYPE	FORM	EXAMPLE OF WHAT IS SEEN
Red-Green CVD	Deuteranopia (severe) Deuteranomaly (mild)	
	Protanopia (severe) Protanomaly (mild)	

TYPE	FORM	EXAMPLE OF WHAT IS SEEN
Blue-Yellow CVD	Tritanopia (severe) Tritanomaly (mild)	
Total/Complete CVD	Monochromacy	

The various types of CVD can thus take on different forms. Red-Green CVD in one of its two severe forms is known as deuteranopia and occurs when the green-sensitive cone pigment is absent, resulting in an individual being unable to absorb green light and thus seeing everything in shades of green. The milder form of deuteranopia is deuteranomaly in which case the individual's green-sensitive cone pigment is not completely absent but is less sensitive to green light. This will generally cause an individual to experience difficulty to discriminate between green, brown, orange, red, and yellow (Gaines & Curry, 2011).

Another severe form of Red-Green CVD is protanopia, in which case the red-sensitive cone pigment is absent, causing everything to appear in shades of red. The milder form of protanopia is referred to as protanomaly, where the red-sensitive cone pigment is not absent, but reduced sensitivity to red light is experienced, resulting in difficulty to discriminate between pink and grey, as well as purple and blue (Frane, 2015).

The second main type of CVD is Blue-Yellow CVD, which can take the form of tritanopia in which case the blue-sensitive cone pigment is absent and all colours are seen in shades of blue. Blue-Yellow CVD can also present in a milder form, known as tritanomaly, where the blue-sensitive cone pigment is not absent, but less sensitivity to blue light is experienced, causing confusion between red and purple, as well as green and blue (Shayeghpour et al., 2014). Severe cases of CVD occur when eye cone pigments are completely absent, while milder cases imply a reduced function of certain eye cone pigments even though these are still present (Chakrabarti & Chakraborti, 2015).

Finally, Total or Complete CVD implies the complete absence of colour vision, where the individual perceives everything in shades of grey, white, and black. This is known as monochromacy and occurs when the red-, green-, and blue-cone pigments are absent, with the eyes not able to absorb any light (Hasrod & Rubin, 2016). It is worth noting that this type of CVD is the only one to which the term 'colour-blindness' can be applied, as the other types entail only partial 'colour-blindness' (Turgut & Karanfil, 2017).

2.2.2 Prevalence of CVD

The prevalence of CVD has been reported to vary across geographical areas and ethnic groups (Mashige & Van Staden, 2019). As the global population continues to grow, it is expected that the prevalence of both acquired and congenital CVD will continue to vary across contexts (Chan et al., 2014). International studies however indicate that the overall prevalence of CVD is 0.5% among females and 8% among males (Shayeghpour et al., 2014), with specific reference to the European and American populations (Berger et al., 2016; Berisso, 2018; Collins, 2015; Hasrod & Rubin, 2016). For Asian countries, a prevalence of between 4% and 6.5% has been indicated for Chinese males, 0,35% for Saudi Arabian females, 6.37% for Indian males, and 2.03% for Indian females (Chakrabarti & Chakraborti, 2015; Rajavi et al., 2015).

Limited data are currently available for Sub-Saharan Africa. Hasrod and Rubin (2016) indicate a prevalence of 3 - 4% for African males which, according to Mashige and Van Staden (2019), is rising. Furthermore, Woldeamanuel and Geta (2018) report a 4.1% prevalence among South Ethiopian boys and 0.6% among South Ethiopian girls. In South Africa, a study by Mashige and Van Staden (2019) found a 2.2% prevalence (4.2% in males and 0.6% in females) among isi-Zulu learners in Durban, which is lower than what has been reported in South and Central Ethiopia (Woldeamanuel & Geta, 2018), but equivalent to the 2.3% prevalence previously reported for Southwest Nigeria (Ugalahi et al., 2016).

As the results of Mashige and Van Staden's (2019) study however only apply to a specific region in the country, the need for additional national studies to create a representative database for South Africa, as well as the rest of the African continent, is clear. Research involving South African citizens from various ethnic groups and races may result in a better understanding of the prevalence of CVD for the population (Mashige & Van Staden, 2019).

In addition to the limited available studies on the prevalence of CVD, many individuals with CVD are seemingly unaware of their condition prior to screening (Khairoalsindi et al., 2019).

As such, current limitations in terms of sufficient screening for CVD together with possible unawareness among people with the condition, may have resulted in CVD being under-reported. Available statistics may therefore not necessarily reflect the current situation, especially in South Africa where research in the field is limited (Woldeamanuel & Geta, 2018). As a result, individuals with CVD may be inadequately accommodated or supported both in schools and the broader society (Mashige & Van Staden, 2019).

Although the overall estimate of 8% in males and 0.5% in females may seem like a fairly small percentage, other disabilities with a similar prevalence are often catered for in the inclusive classroom. The occurrence of CVD is in fact higher than many other known learning disabilities and counts among the vision defects that occur most widely (Collins, 2015). To put this into perspective, in a class of 25 learners, two of the learners may be unable to observe all the particulars of colours applied in the classroom (Collins, 2015). It follows that the impact of CVD on learners requires ongoing investigation.

2.2.3 Diagnosis of CVD

Studies by Steward and Cole (1989), as well as Sullivan (2011), indicate that the majority of individuals with CVD only become aware of the fact that they have difficulty to distinguish between certain colours during high school while performing colour-related tasks. The severity and type of CVD can however only be formally diagnosed when undertaking a colour vision test with an optometrist (Chan et al., 2014; Spalding, 2004). According to these authors, most individuals will only be able to recall the difficulties they experienced to distinguish between colours during their school years once formally diagnosed (Chan et al., 2014; Sullivan, 2011). Existing literature on the age and way in which individuals discover that they have CVD seem to be limited, which once again points to the need for more research in this field.

2.3 POTENTIAL EFFECT OF CVD ON LEARNERS OF SCHOOL-GOING AGE

From a young age, people use colour as a medium and resource for communication in everyday life (Torrents et al., 2011). More specifically, colour is generally utilised to emphasise and convey visual information during daily routines, regardless of the person's lifestyle or culture (Stoianov et al., 2019). It follows that abnormal colour vision may qualitatively have an impact on the life of an individual in a personal and unique way, even if it is only noticeable by the specific individual (Stoianov et al., 2019).

Within the educational context, colour is widely relied on in various ways. Colours are, for example, used in the classroom and learning materials to provide information, explain, warn, emphasise, organise, identify, differentiate, categorise, enrich content and decorate the learning environment (Chaparro & Chaparro, 2017). Certain colours that may be aimed at conveying information may however confuse learners with CVD, preventing them from interpreting the information as it had been intended (Kvitle, 2018). In this regard, Cole (2015) states that, even though CVD may not necessarily affect academic achievement, one needs to consider the possibly confused world of a learner with CVD in a classroom where colour is used as a primary tool for communication and learning. The possibility of a negative effect on scholastic performance cannot be ruled out.

In more practical terms, Tanuwidjaja et al. (2014) state that learners with CVD may find certain tasks in the classroom difficult to complete successfully due to their visual limitations and inability to experience all the nuances of a learning task or experience. For example, learners with CVD may find it difficult to distinguish between different species of plants and insects, perform dissections in the natural science class, or understand coloured diagrams (Berisso, 2018). They may struggle to compare the colours of objects and decide whether these are different or similar, for example, when requested to sort blocks by colour (Simunovic, 2016) or match puzzle pieces (Tanuwidjaja et al., 2014). The same principle applies to the use of colour in textbooks which, according to Maule and Featonby (2016), are not typically written while keeping learners with CVD in mind. As a result, many current textbooks contain content that is not easily accessible to and may confuse these learners.

Ugalahi et al. (2016) point out that learners with CVD may experience learning activities as challenging when these entail the identification of colours in mathematical charts and graphs, analysis of maps, observation of wavelengths of prisms, descriptions of reactions between chemicals, or viewing content on a white board (Zorn & McMurtrie, 2019). These learners may struggle with arts and crafts, as well as certain tasks done on a computer, such as the interpretation of electronic images (Chaparro & Chaparro, 2017, Ugalahi et al., 2016). During physical activities such as sports and games, learners with CVD may find it difficult to identify coloured sport equipment.

In terms of scholastic performance, Torrents et al. (2011) found that with memory tasks not involving colour, young learners with CVD will not perform significantly different from their classmates with NCV, even though they may fall behind with tasks that require colour judgment. Ugalahi et al. (2016) similarly indicate a correlation between CVD and certain

learning difficulties they assessed among learners, as well as learners struggling to cope academically and performing below what is expected of them in class. Berger et al. (2016) confirm that learners with CVD may be mistaken for learners who experience a learning difficulty. Such misconceptions may result in teachers applying adjusted assessment measures, which can affect learners' academic achievement (Torrents et al., 2011).

It follows that even though a learner with CVD may encode, process, and complete instructions at a slower pace than the norm when carrying out tasks involving colour, this does not necessarily point to the learner's intelligence or academic abilities (Ramachandran et al., 2014). However, the potential danger of misjudging CVD as a learning disability remains a reality. Even though the association between cognitive control capabilities and colour perception implies that people with CVD may struggle to perform well on goal-directed tasks and appropriately adapting their responses to changing auditory stimuli during the completion of a task (Berger et al., 2016), such tendencies do not necessarily indicate a learning disability. The effect of abnormal colour vision may however have an effect on scholastic performance.

In addition to difficulties with specific academic tasks, Zorn and McMurtrie (2019) point out that learners with CVD, more specifically those who have not yet been formally diagnosed, may feel incompetent and hesitant to ask for support. This can result in their processing of information taking longer than expected. It follows that CVD may affect various areas of functioning for learners with the condition. In addition to academic performance, a learner may, for example be teased in class when applying incorrect colours or asking questions when the answers are obvious to their classmates (Chaparro & Chaparro, 2017). Stoianov et al. (2019) state that in addition to such experiences potentially affecting the emotional functioning of a learner, instances of ridicule, mockery, and prejudice may lead to general challenges with maintaining social relationships. Even though a few earlier studies (e.g., Wilkinson, 1992[4]) report on the social-emotional effects of CVD on learners, limited research has been undertaken in this area (Kvitle, 2018).

Kvitle (2018) states that a learner who is unaware of having CVD and takes longer to complete tasks when using colour, or who makes numerous mistakes, may develop a low self-esteem, which can negatively influence a sense of accomplishment and belonging. This may in turn affect a learner's confidence when interacting with peers in the classroom or, for

[4] I acknowledge this is a dated source, however, I include the work of Wilkinson as it illustrates the need for ongoing research in the field of CVD for the past few decades.

example on the sports field (Ugalahi et al., 2016). Due to the general population's limited awareness of CVD, difficulties such as these may remain undetected, potentially resulting in a learner with CVD receiving little or no beneficial modifications that may support healthy functioning (Chan et al., 2014). Berisso (2018) adds to this argument by pointing out that even though CVD may not necessarily be regarded as an unbearable condition, it may negatively affect the functioning and performance of those living with the condition. As ongoing research is required in this field, the current study may potentially contribute in terms of possible ways in which teachers may support learners with CVD in school, based on the reported first-hand experiences of the participants.

2.4 IMPORTANCE OF ACCOMMODATING LEARNERS WITH CVD IN AN INCLUSIVE CLASSROOMS CONTEXT

The Education White Paper 6 (Department of Education, 2001) explains inclusive education in terms of enabling education systems, learning methodologies, and structures, with the purpose of addressing the needs of all learners. This implies that each individual learner's needs are considered to be equally important to accommodate, resulting in a practice where any barriers to learning should be identified and addressed by teachers in class. Even though learners with CVD may display varying learning difficulties depending on the type and severity of their condition (refer to Section 2.2.1), CVD is not currently classified or formally recognised as a barrier to learning (Department of Education, 2006). Higher awareness and the formal acknowledgement of CVD as a potential barrier to learning or a special education need may be the first step towards creating a learning environment that will be inclusive of and supportive to learners with CVD (Kvitle, 2018).

The need to increase awareness among the wider public, as well as among teachers and other learners, in order to ensure supportive resources and inclusive classrooms for learners with special needs – including those with CVD – seems clear (Collins, 2015). As it is general practice for teachers to use colour, a concerted effort may however be required to raise teachers' awareness of tasks that learners with CVD may experience as challenging. Furthermore, there is a need for ongoing research on possible supportive strategies that will enable these learners to perform consistent with their potential (Landsberg, 2011).

In line with the principles of inclusive education, teachers are required to continuously adapt their lessons to meet the needs and learning preferences of the learners they teach. The fact that lessons are often not adapted for learners with CVD does not imply that teachers are unwilling to support these learners but may rather point to teachers' limited knowledge

of the condition and the related need for support that may be provided to such learners (Collins, 2015). Maule and Featonby (2016) concur that current teacher training programmes do not adequately prepare future teachers for the challenges that learners with CVD may face.

With this study, I intend to add knowledge to the field of CVD, potentially identifying ways in which teachers can more effectively assist learners with CVD in class. More specifically, I set out to obtain a better understanding and add insight in terms of the experiences and needs of learners with CVD, and how these may be addressed by teachers in the classroom.

2.5 SUPPORTING LEARNERS WITH CVD IN THE SCHOOL CONTEXT

Existing literature on adjustments that are generally made in schools, as well as on existing supportive teaching material and resources for learners with CVD, are limited (Torrents et al., 2011). Current research indicates that, instead of adapting teaching methods and materials to accommodate learners with CVD, teachers seldom give special attention to the needs of these learners when preparing lessons or compiling teaching material (Collins, 2015). As stated earlier, this cannot necessarily be ascribed to teachers' unwillingness to support such learners but may rather be a result of teachers' limited knowledge, or teachers (and even the learners themselves) being unaware of their condition.

Presently, it can therefore be assumed that these learners are typically left with no choice but to develop their own strategies to adapt in class and overcome the difficulties they experience when performing learning tasks that involve colour (Maule & Featonby, 2016; Torrents et al., 2011). Even though limited literature is available on accommodation strategies that are currently implemented in inclusive classrooms, numerous sources exist that relate to the strategies that teachers may consult. For the purpose of my discussion of such strategies in this section, I categorise the strategies in groups that can be reviewed and compared to the results I present in Chapter 4.

2.5.1 Early screening

Existing literature in the field of CVD suggests that early screening should form part of school policy to assist learners in becoming aware of the condition at an early age and to help them develop and apply coping strategies, as well as utilise any resources available to them (Berger et al., 2016). To this end, Ramachandran et al. (2014) state that learners will benefit from knowing that they are colour vision deficient and from being informed about the

consequences of the condition. Awareness and knowledge about the condition can help learners to feel more in control and be more adaptable.

In addition, awareness about the condition among the key role players may enable teachers to adjust their teaching material by making it more accessible to learners with CVD (Metsing et al., 2018). Early screening will reduce the risk of teachers not being aware of such learners and thus incorrectly assuming a cognitive delay, learning disability or behavioural problem when a learner takes longer to process instructions or complete a task, or makes mistakes due to not being able to recognise certain colours (Tanuwidjaja et al., 2014).

2.5.2 Increased teacher awareness

Another strategy suggested by Kvitle (2018) to accommodate learners with CVD relates to teachers becoming more knowledgeable about CVD as a first step towards enabling them to assist the learners in class. Collins (2015) emphasises the important role of teachers, especially in the early school years, in identifying possible cases of CVD. Since teachers spend a lot of time with learners and often make use of colour as a teaching aid, they have ample opportunity to observe learners in their classrooms.

As such, early childhood and foundation phase teachers may be in the best position to notice learners who regularly struggle to name and recognise different colours. They will also be able to notice learners who are slower than other learners in starting or completing tasks that involve colour or are unwilling to participate in games involving knowledge of colours, do not perform as well as expected in certain tasks, behave disruptively or are easily distracted when performing certain tasks (Albany-Ward, 2015). In such cases it is important for the teacher not to act surprised when routine practices such as colour-coding, colour-assigning, or using colour-specifics within a lesson cause confusion, but rather to explore what the cause of such confusion may be (Zorn & McMurtrie, 2019).

However, existing studies indicate that the majority of teachers are not adequately trained to recognise CVD, with the result that they may not be able to identify and assist such learners (Sullivan, 2010). As mentioned earlier, limited training may contribute to the level of awareness among teachers about the implications of CVD. In this regard, Albany-Ward (2015) found that a mere 53.3% of the teacher participants in his study were aware of the possible effects of CVD on learning, with 26.3% not being aware of this at all.

Related studies (Collins, 2015; Kvitle, 2018) indicate that when teachers may become more aware of CVD and its possible occurrence in their classrooms, their attitude will change. Once they gain the necessary knowledge and insight, teachers may become more open

towards adjusting their teaching spaces to accommodate learners with CVD. It should however also be kept in mind that, due to the variety of types and severity of colour vision defects, a teacher who becomes aware of a learner with CVD in the class, may not necessarily understand the specialised needs of the learner. Teachers may thus benefit from discussions with other role players in the learner's life, as well as from some research in the field (Collins, 2015).

2.5.3 Suitable teaching material and resources

Chaparro and Chaparro (2017) recommend that colour be used sparingly when teachers give instructions, convey information, distinguish between visual elements, or request a response from learners. When teaching a learner with CVD, the teacher can, for example emphasise key concepts by underlining, circling, or labeling them instead of using different colours (Maule & Featonby, 2016; Serrantino et al., 2015). Furthermore, teachers are advised to limit the number of colours used in a task to three in order to avoid confusion. Using various shades of the same colour instead of multiple colours is also regarded as a better option for learners with CVD (Berisso, 2018; Meeks et al., 2016; Torrents et al., 2011).

When combining colours for presentations on a white board or when different colours are used in other teaching material, certain colour combinations will cause confusion for learners with CVD and should rather be avoided. For example, combinations of yellow and blue, red and green, purple and blue, as well as green and blue, should be used cautiously or avoided altogether (Berisso, 2018; Torrents et al., 2011). To this end, it is important for teachers to check worksheets prior to handing them out and to consider the use of colour when planning classroom activities and lessons (Maule & Featonby, 2016).

However, since colour is a valuable resource for the majority of learners when utilising memory, teachers should continue using coloured resources to support other learners with the coding, processing, and retrieving of information (Sullivan, 2011). They should nevertheless also include modifications for individuals with CVD. In this way the needs of all learners can be accommodated (Department of Education, 2001).

If, for example, a mathematics task requires three or more colours, which according to Torrents et al. (2011) might be confusing to a learner with CVD, the task can be presented as a group assignment or completed in pairs where a learner with CVD works alongside a 'colour-buddy', being someone with normal colour vision (Klooster, 2016; Tchombé, 2011). In certain cases, coloured images may be changed to monochrome or high-quality greyscale images, or other visually discriminating features can be relied on, such as dotted and solid

spaces (Berisso, 2018; Meeks et al., 2016; Torrents et al., 2011). In this way, contrast between a background and a foreground, or between different parts of a figure, may be accessible to all learners (Klooster, 2016). It goes without saying that the stronger the contrast, the easier it will be for a learner with CVD to identify the different elements of an image.

Even though greyscale images can be useful, Maule and Featonby (2016) point out that these images will not be suitable in all cases and for all learners with CVD, specifically when the brightness and shades of the original colours are not of a good quality or high resolution. As a result, it remains important to always ensure that learners understand what is expected of them without them having to rely on the information provided by an image only. Finally, when using colour in teaching material, teachers can include notes in any modified or original material in support of learners with CVD (Torrents et al., 2011).

2.5.4 Use of technology

Supportive technology, such as corrective EnChroma glasses (Serrantino et al., 2015; Tanuwidjaja et al., 2014), may improve the colour vision of someone with CVD, potentially enabling the person to see colours in a more saturated or vibrant way. Another example of supportive devices is colour transparency overlays. However, these may only apply to a specific image or worksheet at a time (Serrantino et al., 2015).

In general, electronic teaching material, computer settings, and web pages can be adapted, and then checked with learners with CVD to ensure that they can identify the relevant information and that they will be able to do what is required of them (Sullivan, 2011). Similarly, software for interactive white boards or presentations can be checked to ensure that the colours that are more difficult to recognise, for example green and red, are not used in important messages (Maule & Featonby, 2016). Furthermore, by adjusting the colour of a laser pointer, it may be more visible to all learners as opposed to when red is used, even for learners without CVD (Serrantino et al., 2015).

Even though there are different views regarding the value of using technology in the general learning environment, teachers can rely on technology to support learners with CVD. Despite the implied possibilities, Collins (2015) states that technology should however always be used with caution as it may also cause some confusion among learners with CVD. In contrast, Torrents et al. (2011) argue that technology in itself can be used as an avenue to implement transformation and modifications for the use of colour in learning material,

including textbooks. Yet, it seems clear that ongoing research is required regarding the value of technology as a supportive strategy to shed more light on this debate.

2.5.5 Providing extra time

Serrantino et al. (2015) consider extra time when completing a task as another potential supportive strategy for learners with CVD. More specifically, extra time may help learners with CVD to surmount some barriers, for example when non-colour key identifiers are included, which the learner will be able to identify, but which may require additional time to do. Klooster (2016) agrees with the notion of extra time, especially when learners with CVD have to complete tasks on a computer, since they have been found to work slower and make more mistakes than learners with normal colour vision when completing such tasks. The reason for this is most likely that learners with CVD find it hard to complete tasks that include colour when it is organised and presented in complex visual displays on a screen.

In an opposing view, Maule and Featonby (2016) argue that additional time will not necessarily help a learner who is not able to accurately identify colours if this is necessary to complete a task. These contradicting arguments once again emphasise the importance of ongoing research in this emerging field of study.

2.5.6 Involvement of different role players

The various role players in the environment of a learner with CVD can be guided to assist the learner. As mentioned earlier, a fellow learner with normal colour vision can, for example be assigned as a ‘colour buddy’ to a learner with CVD. While sitting next to each other, the ‘colour buddy’ can support the learner with CVD in choosing and identifying colours for colouring tasks, as well as during painting and drawing activities, or during other assignments where the use of colour is required (Sullivan, 2011).

Within the school context, all teachers who teach learners with CVD should be informed about these learners’ condition and should have access to the relevant individualised education plans for the specific learners (Maule & Featonby, 2016). To support their children, parents can assist with homework and provide emotional and practical support. Parents may also exchange ideas with other parents and teachers, which may help both parties to provide better support at home and at school (Sullivan, 2011).

2.5.7 Supportive physical learning space

As mentioned earlier, according to Torrents et al. (2011), most learners with CVD find it easier to discern yellows and blues than greens and reds. As a result, it is preferable to use

yellows and blues when designing the physical classroom. It is thus recommended that these colours should rather be used when, for example indicating emergency exits or safe zones as part of an evacuation plan (Kvitle, 2018). In addition to the physical space, items in the classroom, for example building blocks, beads, toys, materials used for colouring and art, as well as books can be labelled and grouped according to size, purpose or colours that can be recognised by all learners (Chan et al., 2014). Creative alternatives can be used by offering a cue and/or additional information about an item which aligns with the colour used. For example, a picture of leaves can be added on a box of green building blocks.

Such additions may assist learners with CVD to cope better in class while also expanding all learners' vocabulary and facilitating additional associations for the entire class (Sullivan, 2011). In the same way, instead of using different colours to label the various categories or reading levels on the books in a bookshelf, symbols can be used. Furthermore, if all learners have their own boxes or shelves with books, it is important to ensure that they know these without having to rely on different colours of boxes only (Sullivan, 2011). Finally, teachers need to ensure that all coloured pens, pencils, and paints used in class are labelled according to colour (Albany-Ward, 2015).

As lighting plays a significant role in the ability to accurately perceive colour (Gaines & Curry, 2011), learners with CVD should be seated in an area with good natural light, in such a way that no glare is reflected from the board (Maule & Featonby, 2016). According to Kvitle (2018), it is important to ensure that there is adequate lighting in any learning environment. Furthermore, to accommodate all learners during story time, teachers can, for example describe a picture in some detail or ask learners questions about the pictures shown to them. While this approach will support learners who struggle to see colours, it will also help those sitting at the back of the class or who have other vision defects (Collins, 2015).

2.5.8 Need for ongoing research on supportive strategies

As research in the field of CVD and its impact on people living in the 21st century is limited, learners with CVD, as well as their teachers, can be regarded as a primary source of information in gaining more insight into the phenomenon (Maule & Featonby, 2016). My literature review points to a generally low level of awareness among the wider public about the prevalence of CVD, as well as the challenges that learners with CVD may face, and the strategies that can be implemented to support them (Chan et al., 2014; Collins, 2015). Regarding South Africa specifically, Mashige and Van Staden (2019) emphasise the scarcity of information on the prevalence of CVD in the country across all ages, races and ethnicities.

The study of these authors does therefore not contribute to data on the prevalence of CVD for the entire South African population, neither does it add to the understanding of how CVD is perceived in the classroom or how teachers can support learners to overcome some of the challenges they may face in the learning environment.

In the current study (refer to Chapter 4), I compare the above-mentioned recommendations (refer to Sections 2.5.1 to 2.5.7) with the participants' views on possible supportive strategies that teachers may implement to accommodate learners with CVD. According to Meeks et al. (2016), learners' own views are always important, i.e., the views of the research participants in the current study. Teachers can, for example rely on learners to talk about the problems they experience with colour in the classroom. Teachers can then attend to these within an inviting environment where learners can voice any problems they may experience (Meeks et al., 2016; Tchombé, 2011).

Based on the rather limited repertoire of information on the implementation and effectiveness of potential supportive strategies, as reported on in the preceding sub-sections, the current study aims to contribute to this field of literature by sharing the voices of learners with CVD who have experienced the phenomenon first hand.

2.6 CONCEPTUAL FRAMEWORK OF THE STUDY

I relied on elements from Bronfenbrenner's bio-ecological theory of human development (Donald et al., 2010; Swart & Pettipher, 2011) and Vygotsky's sociocultural theory of cognitive development (Snowman & McCown, 2013; Tchombé, 2011).

2.6.1 Bronfenbrenner's bio-ecological theory of human development

Bronfenbrenner's bio-ecological theory of human development (Bronfenbrenner, 1976; Tudge et al., 2016) holistically views the development of an individual as something that takes place over time as a result of interactions between the various systems within which the individual functions (Swart & Pettipher, 2011). Earlier versions of this theory produced a model that consists of interacting systems, i.e., a micro-, meso-, exo-, macro-, and chronosystem (Bronfenbrenner, 1976, Swart & Pettipher, 2011). The original theory later evolved to become known as the process, person, context, and time (PPCT) model, consisting of four interacting elements, being proximal processes, person characteristics, context, and time, with each element incorporating the interaction systems previously mentioned (Rosa & Tudge, 2013; Tudge et al., 2016).

In considering the development of an individual, the evolved bio-ecological theory of human development (Rosa & Tudge, 2013; Tudge et al., 2016) allows for the consideration of all four elements included in the PPCT model and how they interact with and influence one another. As such, an individual's development and subsequent behaviour and behavioural patterns cannot be viewed or supported by considering only one of the environments in which the individual functions (Rosa & Tudge, 2013; Tchombé, 2011; Tudge et al., 2016).

With reference to the PPCT model, I specifically relied on the context domain in the current study. This domain incorporates the microsystem of the learner (also those with CVD), i.e., the family, school, teacher, peers, and how these role players interact with one another as well as with the learner (Donald et al., 2010). Relying on the context domain, which includes the interacting microsystems of an individual, also justifies the involvement of parents in their child's schooling as well as the interaction between the parents and the school (Donald et al., 2010). The context domain furthermore incorporates the learner's macrosystem, which include national education policies and curriculum, i.e., whether classrooms are inclusive of learners with CVD and whether or not CVD is recognised as a special education need (Department of Education, 2001; Department of Education, 2006).

In addition to the context domain, I considered the time domain, which incorporates the chronosystem. This allowed me to evaluate the quality and availability of supportive strategies and resources provided by peers, teachers, and the physical learning environment with which learners with CVD may interact (Nel et al., 2013).

2.6.2 Vygotsky's sociocultural theory of cognitive development

According to Vygotsky's sociocultural theory of cognitive development (Snowman & McCown, 2013; Tchombé, 2011), learning is facilitated through social interaction between a learner and others more knowledgeable than the learner in a specific learning area. This premise emphasises the importance of creating an environment in which learners can interact with others for social learning to take place, rather than having a teacher fulfilling the role of facilitator of learning (Schunk, 2012; Scrimsher & Tudge, 2003). In this regard, Vygotsky (1978) states that interaction with others in the environment can facilitate cognitive growth when learners reorganise and adjust their prior knowledge and thinking, based on their social experiences (Esteban-Guitart, 2018; Kail & Cavanaugh, 2018; Schunk, 2012).

As element of Vygotsky's (1978) sociocultural theory, the Zone of Proximal Development (Kail & Cavanaugh, 2018; Schunk, 2012; Smith, 2006) indicates how much learning is possible with the guidance of someone else, i.e., a more knowledgeable other, when

compared to what will be learned when a person learns without any assistance. A learner and teacher or a learner and peer can thus work on a task collectively and complete the task successfully, whereas the learner as an individual may not necessarily complete the task on the same level (Esteban-Guitart, 2018; Smith, 2006).

In the current study, I considered the "more knowledgeable other" involved in an individual's ZPD as referring to individuals with normal colour vision, i.e., those who are more skilled in identifying colours than learners with CVD (Esteban-Guitart, 2018; Smith, 2006). It follows that peers or teachers can thus support learners with CVD and assist them with activities involving colours (if needed) if the former has normal colour vision. Such support may enable learners with CVD to perform activities at a higher difficulty level than would have been possible if they worked on their own (Kail & Cavanaugh, 2018; Snowman & McCown, 2013).

In undertaking my study, I considered the school and learning experiences of the participants while keeping the ZPD in mind. This concept helped me to determine the potential role of the role players in the environment in assisting learners with CVD with tasks requiring knowledge of colours and whether or not this could influence development. Guided by Vygotsky's sociocultural theory of cognitive development (Esteban-Guitart, 2018), I attempted to add insight into the manner in which school-based supportive strategies may be grounded in collaboration between a teacher and a learner with CVD, with the possibility of such strategies being adapted and applied in other inclusive classrooms (Kellogg, 2019).

2.6.3 Integrating Bronfenbrenner's and Vygotsky's theories in a conceptual framework

I viewed my research through the lens of the PPCT model, specifically relying on the context domain and the way in which this incorporates the microsystems of individuals. As such, I considered the participants' experiences of CVD in the classroom against the background of their families, schools, teachers and peers, and the interactions between these. To this end, Vygotsky's sociocultural theory assisted me in understanding the subsequent learning process, based on the participants' classroom experiences, involving individual learners as well as role players such as teachers and peers, in their environments (Tchombé, 2011). I thus viewed the classroom experiences of the participants in terms of the extent to which these were affected by the assistance others.

Drawing on the context domain of the PPCT model also guided me to consider the macrosystems at play in the lives of the participants. These include the extent to which the parents were involved in the participants' schooling and to what extent they intervened and,

for example, informed the relevant teachers of their children's CVD and the possible influence of this on their children's performance, or assisted their children with studying or homework when colour was used. In this regard, I was also guided by Vygotsky's Zone of Proximal Development in considering the performance of the participants in class, as well as with their homework or studying, without the involvement of their parents or their teachers being informed about their CVD.

Finally, by viewing my results through the lens of the time domain of the PPCT model, I was able to focus on the participants in their school contexts as learners who had been interacting with teachers, peers, and the physical learning environment. I considered the results of these interactions in terms of the question whether or not these had been supportive of addressing the needs of the participants and could have contributed to positive learning experiences. In this regard, Vygotsky's (1978) sociocultural theory led me to consider to what extent the application of this theory was evident in the contributions of the participants, and thus how inclusive the participants perceived their classrooms to be, i.e., whether interactions were in fact perceived to have been supportive during their school careers. In my consideration of possible supportive strategies for learners with CVD, I thus considered how collaborative learning and interaction in the school context may enable learners to accomplish what is possible for their level of development.

2.7 CONCLUSION

In this chapter, I discussed existing literature on CVD, more specifically in terms of its manifestation in the classroom, and what this implies. I explained the different types of CVD, its prevalence, the potential effect of CVD on learners, and how such learners may be accommodated and supported in the classroom. In the last part of the chapter, I explained my conceptual framework.

In the next chapter, I discuss the research paradigm, methodological approach, and research design I selected. I explain my selection of participants, as well as the ways of data generation, documentation and analysis. Lastly, I describe the ethical considerations and trustworthiness of the study.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

In Chapter 2, I discussed existing literature on CVD and the effect of CVD on learners in the classroom context. I focused on the prevalence of CVD as well as its effect on academic, social and emotional development, and possible ways in which learners with CVD can be supported in school. I concluded the chapter by explaining my conceptual framework.

In this chapter, I discuss the research methodology I used in my study. I explain the selected paradigmatic perspectives, the research design, and the selection of participants. I subsequently describe the methods of data generation, documentation, analysis and interpretation, and conclude the chapter with discussions on ethical considerations and the trustworthiness of the study.

3.2 PARADIGMATIC PERSPECTIVES

A paradigm can be regarded as a framework that determines how reality is seen and understood in the context of a particular study (Lincoln & Guba, 1985; Ulin et al., 2012).

3.2.1 Interpretivism as meta-theory

I selected Interpretivism as epistemological paradigm as I aimed to gain insight into the experiences and perceptions of the participants relating to the selected research phenomenon (CVD). For this purpose, I explored the multiple realities of the participants and then aimed to interpret these in terms of the meaning they had attached to their personal experiences. Due to the subjective nature of meaning making of experiences, such multiple realities may change over time and across circumstances (Andrade, 2009; De Villiers, 2005; Sefotho, 2015; Ulin et al., 2012; Wahyuni, 2012). Against this background, when conducting research from the interpretivist paradigm, one aims to understand a specific phenomenon as it naturally unfolds within its real-life context (Tuli, 2010). As I engaged with the research participants and the data that were generated, I therefore focused on the experiences shared by each participant, the subjective realities informing these experiences, and factors motivating individual beliefs (Wahyuni, 2012).

An advantage of interpretivist studies relates to the researcher being the primary instrument (Creswell, 2014). As such, I was able to listen, question, observe and interpret the generated data in my attempt to obtain sufficient information to address the research questions (Terre

Blanche et al., 2006). Throughout, the focus was on the meanings attributed to participants' experiences by themselves and within their specific contexts (Creswell, 2014), in terms of possible supportive strategies that teachers may implement, based on the participants' views and experiences. In addition to the advantage of being able to gain insight into the perceptions of the participants (Ferreira, 2012), interpretivism enabled me to give meaning and interpret the responses of the participants through interaction, while obtaining an in-depth understanding of the phenomenon under study.

A potential challenge of interpretivist studies relates to the possibility of data analysis being subjected to bias based on the researcher's preconceived ideas, history, social class, gender, race, and/or ethnicity, all of which may differ from that of the participants (Denzin & Lincoln, 2018). To avoid this pitfall, I relied on reflexivity by keeping a reflective journal and engaging in regular debriefing discussions with my supervisor (Merriam & Tisdell, 2016). I also used member checking to ensure that I had interpreted the information as the participants intended (Creswell, 2014).

Another potential challenge, as mentioned by Nieuwenhuis (2016b), concerns the difficulty of generalising the findings of interpretivist studies. Based on the nature and selected methodology of my study, I did not aim for generalisability. Yet, in support of transferability, I include detailed descriptions of the research process in this mini-dissertation, enhancing the possibility of the findings being applied to similar contexts (Merriam & Tisdell, 2016).

3.2.2 Qualitative methodological paradigm

I followed a qualitative approach, which enabled me to explore, richly describe, and interpret the experiences of the research participants (Tuli, 2010). I could subsequently rely on personal contact and interactions between the participants and myself to gain in-depth insight into the contexts in which the participants had experienced their realities and to create meaning from the generated data (Cohen et al., 2018; Ulin et al., 2004). Throughout, I aimed to gain an understanding of how the participants made sense of their life-worlds by attributing meaning to their day-to-day experiences in school (Nieuwenhuis, 2016b).

Qualitative research implies the possibility of a true understanding of the essence of a phenomenon (Ferreira, 2012). In this regard, the trust and rapport that can be established between a researcher and the participants may lead to the generation of in-depth data on the perceptions and experiences of participants (Creswell, 2014). This, in turn, may result in a deep understanding of what is researched, thus implying the possibility of obtaining

trustworthy findings (Tuli, 2010). Cohen et al. (2018) as well as Creswell (2014) accordingly define the task of a qualitative researcher as one of understanding, describing, and explaining different interpretations and the meanings that participants attribute to their unique experiences. In following a qualitative approach, I aimed to gain insight into the experiences of the participants in terms of possible support that can be offered to learners with CVD in the classroom. Even though I did not generate the data in the natural setting in which the participants had their experiences, I attempted to understand the context and complexity of their primary school settings at the time (Ulin et al., 2012).

In following a qualitative approach, I was thus able to focus on the subjective perceptions of the participants, their reported behaviours and how they experienced that of their teachers and peers at the time when they attended school, as well as on understanding their contexts, which include both their social and physical environments (Ulin et al., 2012). I endeavoured to identify similarities and trends in the experiences of the different participants in an attempt to gain a holistic understanding of the multiple realities they shared (Cohen et al., 2018).

Despite the advantages associated with qualitative research, the potential limitation of bias and subjective interpretations exists (Kawulich & Holland, 2012). To this end, I aimed to conduct my study in a reflective, logical, and balanced way by continuously re-evaluating the research process, methodological choices and analysis I completed. Another possible limitation aligns with that of interpretivism, with generalisation being limited (Nieuwenhuis, 2016b). As stated previously, based on the nature of my study, I did not aim to obtain generalisable findings, but rather relied on a small, purposive sample to gain an in-depth understanding of the experiences of a few informed participants relating to the phenomenon under study (Merriam & Tisdell, 2016).

Finally, the data sets generated during qualitative studies are often large in volume, resulting in the analysis process potentially being time-consuming (Creswell, 2014). To complete the processes of data generation and analysis as time-efficiently as possible, I approached the analysis in an organised way by, for example, keeping data sets separate and labelling data clearly, thus making it easier to analyse, identify potential gaps, and keep track of the text (Nieuwenhuis, 2016c). In addition, I worked according to a fixed schedule and commenced with transcriptions and data analysis soon after I had completed the first interview.

3.3 RESEARCH METHODOLOGY

In this section I describe the research process and methodological choices I made.

3.3.1 Case study research design

I implemented a case study design since my study entailed an in-depth investigation of an existing phenomenon as found in its natural context (Yin, 2018). In this study, the phenomenon I aimed to gain insight on was CVD as it occurred in its natural environment, being how it was experienced by individuals with CVD in their everyday lives during their school careers. I more specifically utilised a descriptive case study design in order to be able to understand and provide a detailed and authentic description of the experiences of learners with CVD as well as their ideas for teacher support, based on their experiences at school (the real-life context) (Merriam & Tisdell, 2016; Schwandt & Gates, 2018; Yin, 2018). For this purpose, I selected several occurrences of the case, i.e., five participants, who informed my study (Schwandt & Gates, 2018).

Case study research is characterised by a bounded unit that is being studied, such as a specific person or group of people bounded by certain requirements which will either include or exclude them from the unit. This case boundary enabled me to select appropriate participants to inform the current study. To this end all the participants had established that they have CVD and had completed primary school at the time of data generation. In line with the general trend of case study research relying on a variety of data generation techniques, I used different methods to generate data on the perspectives and experiences of individuals in a particular and similar set of circumstances, i.e., people with CVD who had completed primary school (Hamilton & Corbett-Whittier, 2012; Schwandt & Gates, 2018). Building on this premise, Stake (1995) points out that a case is not usually studied with the primary aim of understanding other cases, but rather to understand the complexity of a single case. A descriptive case study design has the specific advantage that various aspects of a research phenomenon can be explored as they occur in different yet similar contexts, while using a variety of sources and methods to generate data (triangulation) (Andrade, 2009).

When implementing a case study design, the researcher is not required to control any events, i.e., the experiences being studied (Yin, 2018), as was the case in the research I undertook. More specifically, I explored events that occurred during the school careers of the participants, without these being controlled by me as the researcher. According to Stake (1995), a case study design can allow a researcher to identify suitable case(s) to be studied and then report on a study in such a way that readers may gain an understanding of the

context. As the current study aims to ultimately inform teachers who read the findings how they can support learners with CVD in the classroom, a case study design seemed fit.

Furthermore, due to the researcher working within a bounded system, cases that are potentially information-rich can be selected, where participants may hold a good understanding of the phenomenon under study (Merriam & Tisdell, 2016). As case study research generally relies on multiple data sources, the findings may provide a rich and thick description of the phenomenon based on a holistic perspective of the various participants or cases involved (Stake, 1995; Yin, 2018).

A potential limitation often associated with case study research relates to the trustworthiness of the findings and convincing the reader of the legitimacy of these, as well as of the theoretical inferences deduced from the findings (Andrade, 2009). In an attempt to address this potential limitation, I adhered to the required methodological procedures while conducting my study. I also include detailed descriptions of the cases as well as the research process, providing a trail of evidence in this mini-dissertation (Yin, 2018).

Another challenge of case study research concerns limited generalisability of the findings (Creswell, 2016), however, as already indicated, based on the selected epistemology of interpretivism and the qualitative approach I followed, I did not aim at obtaining generalisable findings. I rather focused on obtaining a thorough understanding of the cases involved in my study (Andrade, 2009). The possibility of the findings being transferable exists, where the findings may be transferred to contexts similar to the one of my study (Yin, 2018).

3.3.2 Selection of participants

I relied on purposeful sampling to select five individuals who could potentially inform my study. As mentioned in Chapter 1, in addition to purposeful sampling, I also relied on a component of convenience sampling in mobilising my supervisor's connections and other professional networks to identify potential participants who were easily available and accessible to me (Babbie, 2010; Merriam & Tisdell, 2016). A brief description of each of the five participants selected follows.

- Participant 1 was a female first year student studying for a degree at a University in Pretoria, Gauteng.
- Participant 2 was a female student in her second year of studying towards a teaching degree at a University in Pretoria, Gauteng.

- Participant 3 was a male first year student studying for a business degree at a University in Pretoria, Gauteng.
- Participant 4 was a male young adult who has completed his studies and was working as a designer at a distribution company in the Western Cape.
- Participant 5 was a male Grade 9 learner at a secondary school in Pretoria, Gauteng.

Purposeful sampling is a nonprobability sampling method where participants are selected based on the anticipated richness, they may add to the data generated in a study in terms of relevance, as well as their representativeness of the population being studied (Babbie, 2010; Yin, 2016). All the participants in this study were thus selected based on the belief that they would be able to assist me in obtaining the necessary information to address the research questions (Creswell, 2014). As such, I attempted to select information-rich participants, who could share detailed information, according to the selection criteria included in Section 1.7.2 (Patton, 2015).

Yin (2016) suggests the selection of participants with varying views on a topic to maximise richness in the generated data and to limit the potential effect of personal bias when utilising purposeful sampling (Yin, 2016). Although the generation of divergent data is regarded as an advantage of case study research, it also implies the challenge of selecting participants without knowing in advance whether or not they will provide varying views and ideas. In this regard, I attempted to select participants who would offer variation in terms of for example gender, age, and background. I also compared the participants' responses throughout the research process in order to ensure that I included the views of the various participants (Strydom, 2005). Based on the selection approach I followed, I experienced the advantage of flexibility since I could continue selecting participants until data saturation occurred. In addition, the convenience aspect of sampling that I utilised, made the process of participant selection easy and relatively inexpensive (Tracy, 2013).

As the number of participants I selected were limited to five, I faced the potential challenge of data saturation not being met. To this end, I continuously reviewed and reflected on the generated data and commenced with data analysis while data generation was still taking place, with the possibility of referring back to selected participants if necessary, or recruiting additional participants (Nieuwenhuis, 2016a).

In addition, based on the limited number of participants, the findings may not necessarily be generalisable (Babbie, 2010) as the participants may not represent the entire population from which they were selected (Merriam & Tisdell, 2016). That being said, in relying on a

combination of purposeful and convenience sampling, I was able to obtain an in-depth understanding of the particular phenomenon with the implied possibility of transferable findings being obtained (Cohen et al., 2018, Strydom, 2005).

3.3.3 Data generation and documentation

I used semi-structured interviews for data generation as this method is sensitive to context (Cohen et al., 2018) and could potentially enable me to obtain detailed information on the phenomenon I studied. As such, I encouraged the participants to speak freely in order for me to gain a good understanding of their experiences of CVD and ways in which teachers may support learners with CVD in class (Tuli, 2010). While conducting the interviews, I also relied on observation, documenting my observations in the form of field notes (Flick, 2014). I furthermore included a reflective journal and used audio-recordings to not only capture what was said, but also to create a written record of the interview data (Tracy, 2013).

3.3.3.1 Semi-structured interviews

I conducted five interviews of approximately forty minutes each during the period December 2020 to May 2021. All interviews were facilitated at venues of the participants' choice, for example, their homes and places of work, at times that suited them best. All interviews were audio-recorded and later transcribed verbatim (refer to Appendix C).

In preparation of the semi-structured interviews (Merriam & Tisdell, 2016), I compiled an interview schedule (included as Appendix B) that could guide me through the interviews. All questions were formulated in an open-ended manner and allowed for flexibility, as they could be reordered and expanded if required (Cohen et al., 2018). As such, the order in which the questions were asked varied from one participant to the next, based on the responses I received. I was also able to add unforeseen, new and additional lines of inquiry where suitable (Nieuwenhuis, 2016a; Patton, 2015; Tracy, 2013). In addition, I included probes and follow-up questions for more detail (Merriam & Tisdell, 2016). All these techniques guided me in gaining an in-depth understanding of the subjective meaning given by the participants to their lived experiences and to their viewpoints of CVD, as well as how teachers may support learners with the condition (Tracy, 2013).

As I followed a structured yet flexible approach, participants could thus raise matters that had not been included in the interview schedule, allowing for additional avenues of exploration up to the point of data saturation (Silverman, 2014). The interviews allowed for mutual reflection and follow-up explanations of the participants' views (Silverman, 2014). I

was also able to mention existing research and ask the participants to provide their opinions about this, thereby adding further richness to the data I obtained (Tracy, 2013). A related advantage allowed for the participants to provide both factual information and emotional experiences, which added richness to the data (Silverman, 2014; Tracy, 2013).

As the richness of interview data is often determined by the relationship and rapport between a researcher and participants (Cohen et al., 2018), I aimed to not only be an interviewer, but also a conversational partner during the interviews I conducted (Tracy, 2013). At the same time I remained aware of the fact that a high level of familiarity could potentially also have led to some of the conversations steering away from the topic. In an attempt to avoid this potential pitfall, I took caution to give the necessary direction to all dialogues, while maintaining an inviting atmosphere (Tracy, 2013).

Closely related, Patton (2015) warns that another challenge of semi-structured interviews concerns the possibility of obtaining limited data from each interview. In order to ensure that I obtained rich data, I spent sufficient time on each interview and relied on strategies such as prompting, probing and active listening, as indicated earlier. My aim was not to gain enough data to make it representative of the entire population and reach generalisable findings, but rather to obtain a deep understanding of the five selected participants' experiences (Cohen et al., 2018).

3.3.3.2 Observation

I included observation as a supportive method of data generation during the interviews, thereby applying my senses of hearing, seeing and intuition (McKechnie, 2008), to systematically generate data that were not necessarily communicated verbally by the participants (Nieuwenhuis, 2016a). I took special note of the participants' facial expressions, body language and any other non-verbal cues to identify any responses that could provide a deeper understanding of what the participants shared with me (Ulin et al., 2012).

In line with the interpretivist paradigm, I, to a certain extent, attempted to develop an insider's view of the phenomenon, based on the outsider's perspective of what I observed (Ulin et al., 2012). As such, I aimed to not only hear what the participants had experienced but to also place myself in their shoes while objectively describing their experiences to the outside audience (Patton, 2015). To capture my observations, I made short, abbreviated notes during the interviews about the non-verbal cues I noticed. I elaborated on my field notes as soon as possible after each interview to avoid having to rely on my memory and in my

attempt to document accurate descriptions (Greeff, 2011). In compiling field notes, I summarised my observations, while integrating mental notes and impressions, as well as my reflections on how my observations could contribute to addressing the research questions (Patton, 2015; Ulin et al., 2012).

An advantage of using observation in this study relates to the possibility of interpreting the participants' verbal responses and gaining new insights, yet also being able to sense when follow-up questions or clarification were needed. Based on my observations, I could thus inquire into the experiences of the participants in more depth when necessary (Ulin et al., 2012).

In terms of potential challenges often associated with observation, Kawulich and Holland (2012) as well as Cohen et al. (2018) warn against possible subjectivity since observation relies on the human researcher, who may interpret participants' responses from a personal point of view. In an attempt to avoid this, I remained aware of and guarded against possible personal biases and pre-conceived ideas influencing my interpretation of the data. I asked the participants questions to verify my understanding of their contributions when necessary (Creswell, 2014; Kawulich & Holland, 2012) and included member checking after completing the data analysis. To help me reflect on my thoughts and possible personal biases and pre-conceived ideas, I furthermore kept a reflective journal (Yin, 2018) and engaged in regular debriefing sessions with my supervisor, where I could reflect on my observations.

3.3.3.3 Field notes and reflective journal

Greeff (2011) describes field notes as the written version of what a researcher sees, hears, thinks about, and experiences during data generation sessions, for example during interviews. I made field notes in the first person (refer to Appendix D) and focused on descriptive elements of the generated data, for example participants' demeanour, facial expressions, gestures, and backstories, in addition to the contributions they made (Brodsky, 2008).

I furthermore kept a reflective journal (refer to Appendix E) to document my reflections on the study and the research process, as well as my preliminary findings and discoveries. Reflective journals typically include both in-depth descriptions of the participants and their contributions, as well as reflective thoughts concerning any patterns that are observed in the data and the research process (Brodsky, 2008). In my reflective journal, I therefore included reflections on my first impressions, feelings and assumptions of the data that were

generated during the interviews and simultaneous observations (Merriam, 2009), as well as reflections on descriptions and the analyses I completed, the methods I used and the applicable ethical considerations (Cohen et al., 2018).

The process of entering and reviewing my field notes and reflective journal entries, assisted me in remembering and further exploring the interview process when analysing the data (Greeff, 2011). This enabled me to gain insight into my observations and reflect on my state of mind during the interviews (McKechnie, 2008). Post-interview notes also allowed me to reflect on the data generation process, to identify areas that required further clarification or elaboration, and to start with data analysis while data generation was still underway (Merriam, 2009).

In undertaking a qualitative study, I faced the challenge of writing my field notes and reflections in an interpretive style rather than using neutral language and focusing on exactly what had been said and observed (Beuving & De Vries, 2015). In an attempt to improve the objectiveness of my field notes and reflections, I distinguished between the information I entered as personal reflections and the information related to my conceptual framework, the research process and the participants' backgrounds (Beuving & De Vries, 2015).

3.3.3.4 Audio-recordings and verbatim transcripts

I recorded all interviews, after obtaining permission from the participants, with the use of a digital voice recorder. In this way I could ensure that the information shared during the interviews was captured, with all recordings being transcribed verbatim for data analysis purposes (Creswell, 2014). I attempted to keep the recorded information as well organised as possible, labeling each file according to the participants' pseudonyms and the dates of the interviews (De Vos, 2011). All digital files were saved with protective passwords for the sake of research ethics.

An advantage of audio-recordings of generated data as suggested by De Vos (2011), relates to the possibility of listening to recorded interviews again at a later stage. This can in turn contribute to objective interpretations during the data analysis phase. Recordings and the related transcriptions of the first few interviews furthermore enabled me to identify ways in which I could improve my questioning techniques for subsequent interviews (Merriam, 2009). It also helped me in coding the participants' responses as I was able to identify hesitations, derailing, resistance to answer, and possible misstatements while listening to

the recordings (Neuman, 2014). Such instances could then be compared to my field notes to confirm related observations and could be used during data analysis (Creswell, 2014).

A challenge often associated with audio-recordings of interviews is the risk of a digital voice recorder malfunctioning. In order to avoid this risk, and to prevent any data from being lost, I also recorded the interviews on my mobile phone (as a second recording device) and made as many notes as possible during the interviews (Creswell, 2014). Another potential challenge mentioned by Merriam (2009), relates to participants being uncomfortable with being recorded, which may result in them feeling hesitant to freely share personal information. However, I did not experience this challenge as recordings were done unobtrusively and the participants did not seem to be influenced by the fact that the conversations were being recorded (Merriam, 2009). In accordance with the ethical guidelines for conducting interviews with human participants, all participants were informed about the recordings before the interviews commenced (Elias & Theron, 2012).

3.3.4 Data analysis and interpretation

I conducted inductive thematic analysis, thereby following a bottom-up approach. Accordingly, my data analysis started with specific circumstances and observations i.e., during individual interviews, and then proceeded to generalisations as the data were compared across the different data sets (Tracy, 2013). I was therefore guided by the steps of segmentation, categorisation, summaries, and reconstruction of the data to capture the main concepts present in the data in the form of themes and patterns which speak to the research questions (Ayres, 2008; Flick, 2014). As I identified themes and patterns, I also considered the relationships between the various categories with the aim of identifying not only similarities to strengthen specific themes, but also to detect differences and contradictions across the data sets (Miles et al., 2014). In such instances, I attempted to provide possible explanations for the differences and contradictions (De Vos, 2011).

In moving from specific to general aspects while identifying codes and ultimately themes and subthemes (Braun & Clarke, 2006; Braun & Clarke, 2022), I was guided by the following steps of inductive analysis, as suggested by Creswell (2014) and captured in Appendices C to E.

- Step 1: Preparing and organising the data for analysis by means of transcription of the interviews, typing of field notes and reflective journal entries, and sorting of generated data according to their sources.

- Step 2: Reading through all the generated data to start forming general ideas of what the participants had said and to get an overview of the depth, possible use, and credibility of the information.
- Step 3: Coding the generated data by organising it into potential categories and using concepts in the margins to describe these categories, i.e., labelling or coding each category. As part of this step, I highlighted corresponding codes with different colours, then listed and defined the codes, and coded any additional data by comparing it to already existing codes (Kawulich & Holland, 2012).
- Step 4: Using the potential categories (indicated in Step 3) for further clustering in order to identify and describe possible sub-themes and then grouping these into main themes that emerged from the data (Appendix F).
- Step 5: Determining how to present the identified themes in the study, for example in the form of narrative passages that convey the findings of the study, as done in Chapter 4 of this mini-dissertation.
- Step 6: Interpreting the findings by comparing them to the existing literature and determining similarities and differences between the two.

As limited literature currently exists on possible supportive strategies for learners with CVD in the school context (Stoianov et al., 2019), the selected method of analysis (without preconceived categories or themes in mind) implied the benefit of discovering the essence of the participants' views. As such, inductive analysis allowed for the possibility of new insights that may not have been anticipated, based on the similarities and differences identified across the data (Creswell, 2014; Kawulich & Holland, 2012). I was furthermore able to interpret the data in terms of emotional, as well as social experiences (Braun & Clarke, 2006; Braun & Clarke, 2022), both of which are areas that seem evident in the lives of individuals with CVD (Berisso, 2018; Chan et al., 2014).

A final advantage of inductive analysis in the current study relates to this method allowing me to summarise the key aspects of a relatively large data set. This, in turn, enabled me to include rich descriptions and examples of the data when reporting my findings (Chapter 4) in an accessible manner (Braun & Clarke, 2006; Braun & Clarke, 2021).

A possible challenge often associated with inductive thematic analysis relates to contradictions that may be identified across data sets; as this may make the interpretation and reporting of findings challenging (Kawulich & Holland, 2012). De Vos et al. (2011) point

out that alternative explanations are however typically available in such cases. In the current study, I thus focused on finding such explanations when required.

Another potential challenge may occur when new information and insights are discovered that can potentially affect the initial research plan (Schurink et al., 2011). In this regard, I remained aware of the possible need to rearrange data and ideas in order to create a coding system that would provide the best possible insight into the phenomenon under study. Finally, in order to avoid subjective analysis and interpretations of the data my supervisor reviewed my coding structure and checked that the labels I allocated to the data matched the raw data sets. In addition, I relied on reflexivity to prevent my analysis and interpretation from being influenced by personal bias (Thomas & Magilvy, 2011).

3.4 ETHICAL CONSIDERATIONS

In undertaking this study, I abided by the ethical principles of research as stipulated by the University of Pretoria's ethics committee (University of Pretoria, 2021). I describe the way in which I attempted to ensure ethical research in the subsections that follow.

3.4.1 Informed consent and voluntary participation

According to Ogletree and Kawulich (2012), informed consent entails an agreement to participate without feeling pressured to do so after being informed of the specific methods, purpose, duration, uses, and any risks and benefits which may be involved in a study. In this regard, Hammersley and Traianou (2012) point out that potential participants need to be provided with sufficient information about a study before participating, allowing them to make an informed decision about whether they want to participate or not.

In the current study, I informed the participants of all the relevant aspects before they signed the consent/assent forms. In the case of informed assent (one participant of fifteen years old), the necessary informed consent was obtained from the parents. I treated the participants as individuals with autonomy at all times and ensured that they understood that their participation was voluntary and free from inappropriate influence (Cohen et al., 2018; Hammersley & Traianou, 2012). Participants were furthermore informed that they could withdraw from the study at any time should they wish to do so (Elias & Theron, 2012).

3.4.2 Privacy, confidentiality, and anonymity

Confidentiality concerns the way in which generated data are handled, as well as how research findings are reported and published (Hammersley & Traianou, 2012). With regard

to the handling of data, Ogletree and Kawulich (2012) indicate that no information which may embarrass or harm participants should be disclosed to any unauthorised parties.

Confidentiality furthermore implies that participants' names, research locations and any other identifying information will remain anonymous (Patton, 2015). In the current study I informed the participants that the data would be handled with confidentiality and would not be accessible to any unauthorised person (Maree, 2012). I used pseudonyms to protect the participants' privacy and respected the requirements of confidentiality and anonymity in terms of their personal information (Cohen et al., 2018; Ogletree & Kawulich, 2012).

3.4.3 Protection from harm

As the researcher, I aimed to ensure that no participant was directly or indirectly harmed, wronged or deceived in any way as a result of the research in which they participated (Neuman, 2014; Terre Blanche et al., 2006). To this end, I considered, both before and during the research process, whether or not any questions or findings would harm, damage, or deceive the participants, in which case the questions would not have been asked and such findings would not have been reported. I furthermore attempted to act in a non-maleficent way and in the best interest of the participants (HPCSA, 2016). Finally, I remained aware of the risk of possible harm which may have been caused by aspects of the research and guarded against these by adhering to the principles of privacy, confidentiality and anonymity (Neuman, 2014).

3.4.4 Trust and respect

The extent to which participants will be open and contribute during data generation activities is generally influenced by the respect and trust that exist between the researcher and the participants (Neuman, 2014; Patton, 2015). To establish mutual respect and trust, I attempted to create a reciprocal relationship where I could obtain information based on the participants being allowed an opportunity to openly share their experiences, which could in the future possibly help others who are experiencing similar challenges (Patton, 2015). Throughout, I attempted to communicate to the participants that their contributions were valued and an essential part of my study. I also treated the participants with the necessary respect and as individuals with value, dignity, and worth at all times (Hammersley & Traianou, 2012; HPCSA, 2016).

3.5 QUALITY CRITERIA

Kawulich and Holland (2012) describe trustworthy research as research that provides the reader with sufficient information and descriptions of the data and process of a study, to the extent that the reader can determine whether or not appropriate methods were used and if the results represent accurate interpretations. In my attempt to ensure trustworthiness, I adhered to the aspects of credibility, transferability, dependability, confirmability and authenticity, as discussed below.

3.5.1 Credibility

According to Yin (2018), a qualitative study can be regarded as credible when data are generated and interpreted appropriately, and conclusions and findings provide an accurate reflection of the phenomenon under study. Tuli (2010) adds that credibility can be strengthened when the research rationale justifies the selected methods and processes for data generation, analysis and interpretation.

To this end, I implemented a strategy suggested by Nieuwenhuis and Smit (2012), i.e., using various methods to generate and document data. I also relied on data triangulation, aimed to provide rich descriptions of the data, and engaged in peer debriefing and member checking (Creswell, 2014; Tracy, 2013). Finally, I recorded well-defined accounts of the research process, including the decisions made and the methods used during the process (Lincoln & Guba, 1985).

3.5.2 Transferability

Transferability is described by Nieuwenhuis and Smit (2012, p. 94) as the “degree to which one can apply results found within a specific context to another context”. Transferability differs from generalisability in which case the findings of a study can be generalised to the broader population. As in the case of this study, where research is context sensitive, no claim for generalisation of the findings can be made (De Vos, 2011). However, by providing readers with detailed descriptions of the research process and context, findings may be transferable to similar contexts (Lincoln & Guba 1985; Patton, 2015).

I attempted to ensure transferability by including a comprehensive description of the research process and context in this mini-dissertation. In support of my descriptions, I include a trail of evidence of the generated data and my analysis in Chapter 4 and the related appendices (Lincoln & Guba, 1985; Merriam & Tisdell, 2016).

3.5.3 Dependability

Dependability implies that an accurate representation of the data is provided when reporting on a study (Maree & Hansen, 2011). This informs the extent to which the reader will believe the research results and take these as a true reflection of what had occurred in the field (Terre Blanche et al., 2006). Dependability can be ensured by including in-depth discussions on how the research findings were deduced and how they relate to different contextual factors, as captured in Chapter 4 of this mini-dissertation (Terre Blanche et al., 2006).

To improve the dependability of the current study, I relied on multiple data generation methods (Merriam & Tisdell, 2016) and continuously monitored the standard of these in order to improve where I could (Maree, 2012). I furthermore include a detailed audit trail by describing how I generated data and made decisions throughout the research process. I kept a reflective journal and documented the research process in the form of field notes, thereby providing the reader with a trail of evidence that is both traceable and logical to follow in the current and following chapters, as well as the related appendices (Lincoln & Guba, 1985; as cited in Morsen, 2018; Patton, 2015). Finally, I employed member checking to ensure that my interpretation of the participants' voices capture their contributions (Creswell, 2014).

3.5.4 Confirmability

Lincoln and Guba (1985) relate confirmability to the presentation of research that is objective in the sense that the data and interpretations thereof are firstly based on links that are made between the findings and credible sources, and secondly, generated through objective and valid methods. To attend to the criterion of confirmability, I thoroughly documented the generated data, decisions made, and methods used during the research process, thereby creating a detailed audit trail (Maree & Hansen, 2011). I also relied on reflexivity and by doing so, aimed to minimise any bias I might have had, improve the accuracy of the findings, and report these in an objective and neutral way (Creswell, 2014).

Throughout the study, I aimed to emphasise evidence-based findings and provide a concrete description and analysis of the data rather than my subjective perspective, while still acknowledging my subjective human nature and the role this may have played in the research process. I furthermore relied on regular debriefing sessions with my supervisor and member checking with the participants (Patton, 2015).

3.5.5 Authenticity

Yin (2018) explains authenticity as implying that the data sources of a study, including all the information shared by participants, are accurately represented. In support of this view, James (2008) emphasises that the way in which research is conducted and evaluated should be credible and honest, with the aim of reporting the participants' lived experiences, as well as the specific context of any shared experiences.

In support of authenticity, I did member checking after analysing the data. For this purpose, I presented the themes to the participants so that they could confirm my interpretations of their responses, to establish whether or not these were in line with what the participants had intended to convey (Creswell, 2014). In addition to member checking, Merriam and Tisdell (2016) refer to the importance of reporting the ‘where’ and ‘when’ of data generation and interpretation to the reader (as done in this mini-dissertation), as yet another strategy that can support authenticity. Finally, as authenticity also involves an awareness of one’s own perspective and appreciation for the perspectives of the participants, I included reflective journaling and regular discussions with my supervisor throughout the research process to remain aware of any potential differences in these perspectives (James, 2008; Patton, 2015).

3.6 CONCLUSION

In this chapter, I discussed the research process and methodological choices I made. For this purpose, I described the selected research paradigm, design, and methods I used to generate, document and analyse the data. I also explained the strategies I relied on to ensure ethical research and trustworthiness.

In Chapter 4, I present the results of my study in terms of the themes and subthemes I identified during the inductive data analysis I completed. I then interpret the themes and subthemes against the background of the existing literature I reviewed in Chapter 2. For this discussion, I focus on similarities, as well as differences between the results of the current study and those captured in existing literature, thereby presenting my findings.

CHAPTER 4: RESULTS AND FINDINGS OF THE STUDY

4.1 INTRODUCTION

In the preceding chapter, I discussed my research design and methodology. To this end, I explained how I utilised the interpretivist paradigm and qualitative research approach in conducting research as well as how I selected participants and generated, documented and analysed the data. I also attended to ethical considerations and trustworthiness.

In this chapter, I present the research results in terms of the three themes I identified, with the related sub-themes. In support of my discussion, I include examples of participants' verbatim responses as well as excerpts from my field notes and reflective journal. In the second part of the chapter, I discuss the findings of my study in relation to the way in which the results of the current study confirm and contradict existing literature.

4.2 RESULTS OF THE STUDY

In Table 4.1 I provide an overview of the results of my study.

Table 4.1: Overview of the results of my study

THEME	SUB-THEMES
Theme 1: Participants' discovery of being colour vision deficient	**1.1.** Age at time of discovery **1.2.** Process of discovery **1.3.** Causes of the condition
Theme 2: Effect of being colour vision deficient	**2.1:** General experience of being colour vision deficient **2.2:** Effect on learning and scholastic performance **2.3:** Effect on social and emotional functioning
Theme 3: Coping with CVD in the school context	**3.1.** Developing self-help coping strategies **3.2.** Importance of teachers being informed **3.3.** Support from teachers and peers in class **3.4.** Recommendations for teachers to support learners with CVD

4.2.1 Theme 1: Participants' discovery of being colour vision deficient

This theme, together with its three related sub-themes, captures the participants' reported experiences on their discovery of having CVD. Table F.1 in Appendix F provides an overview of the inclusion and exclusion criteria I relied on in identifying the relevant sub-themes, which concern the participants' age of discovery, how the condition was discovered and which aspects contributed to the condition.

4.2.1.1 Sub-theme 1.1: Age at time of discovery

Four of the participants discovered their difficulty to distinguish between certain colours in primary school. Two of the participants were in more advanced grades, as indicated in the following contributions: "*I think it was about Grade 6 or 7"* (P1[5], p. 1), and *"…I think around Grade 6 or 7"* (P2, p. 9). The similarity in age of discovery for these two participants may be based on the fact that they are *"…sisters and aged close together"* (RJ, 1 December 2020). Two other participants indicated their discovery at an earlier age, saying: *"…Grade 1 or 2, if I am not mistaken"* (P4, p. 23), and *"When I was young, I think I was in kindergarten or Grade R or Grade 00…"* (P5, p. 38).

It is of interest to note that the interviews with the participants who discovered their CVD at a later age, were significantly shorter and less detailed when compared to the participants who reported discovery of their difficulty to distinguish certain colours at a younger age. I noted, for example, that Participant 4 (who discovered the condition in Grade 1 or 2) *"…shared a lot of information and a lot of details about various aspects of CVD"* (FN-P4).

4.2.1.2 Sub-theme 1.2: Process of discovery

The participants reported that their discovery of having CVD mostly involved a third party, often within the school context. They shared the following:

- *"We had a test about the primary colour wheel thing, and I couldn't distinguish some of the colours"* (P2, p. 9)
- *"We got these colouring assignments where they told us to colour parts of the pictures with certain colours …The teacher said to make the grass green, the sky purple, and I made the sky green, so the teacher asked: 'What's going on here?'"* (P5, p. 38)

[5] Henceforth, the following abbreviations apply: P = participant, FN = field notes, RJ = reflective journal.

- ❖ *"Basic colouring books stuff, normal entertainment during classes and …the teacher asked me a few questions about colours…, and I could not distinguish between certain colours, which then led to my parents taking me for a colour-blind test"* (P4, p. 23).

One of the participants first realised his difficulty with distinguishing between certain colours during a non-school related activity. He explained his discovery as follows: *"I think me and my mum were driving, …we stopped at a traffic light and …it was red and I couldn't see it was red, …but when it hit green, I told her I think the light is yellow, she can drive but then she told me it's not yellow, it is green, …I was sure that it was yellow"* (P3, p. 14).

Even though all the participants were aware of their condition, only two indicated that they had been formally diagnosed with CVD. According to these participants, *"…she (optometrist) did the test and told me he is colour-blind"* (mother of P3, p. 14), and *"They (parents) took me to the paediatrician and after some tests, I came up positive to being colour-blind, was born with it"* (P4, p. 24). One of the participants indicated an informal diagnosis by her parents in conjunction with a self-diagnosis by means of online tests available for CVD. Her diagnosis was thus made *"…only with online tests"* (P2, p. 9).

4.2.1.3 Sub-theme 1.3: Causes of the condition

Three of the five participants indicated that some of their family members also have CVD. Two participants (sisters) indicated that their father has CVD: *"My dad is colour-blind also, I think he is diagnosed with it…"* (P1, p. 1) although *"…their younger sister does not have CVD"* (RJ, 1 December 2020). Another participant mentioned that his maternal grandfather has CVD, stating that *"…she (mother) had this recollection that my grandfather had colour-blindness and that I may have inherited those genes from him"* (P5, p. 38) while the maternal uncle of another participant reportedly also has CVD. The mother of this participant indicated that, *"I am not colour-blind, but my brother is…"* (mother of P3, p. 21).

As such, three of the participants in my study fall into the category of inherited CVD. Only one of the participants was not aware of any family members from whom he could have inherited the condition, however, the possibility cannot be excluded in this case.

4.2.2 Theme 2: Effect of being colour vision deficient

This theme, with its three related sub-themes, captures the participants' experiences of the effect of CVD on various areas of their functioning, including their academic performance as well as their social and emotional wellbeing. Table F.2 in Appendix F provides an overview of the inclusion and exclusion criteria I relied on to identify the relevant sub-themes.

4.2.2.1 Sub-theme 2.1: General experience of being colour vision deficient

Overall, the participants seemingly did not experience their condition in a very negative way. They for example stated, *"It (CVD) is not a problem; it is not limiting at all. I still see the world as any other person would"* (P4, p. 24), and *"I don't sit and think that colour-blindness had …such a bad impact on my life. It is a detail, it is still there, and you have to keep it in mind, but it isn't this major thing…"* (P5, p. 53). The participants therefore apparently accepted CVD as part of their lives, with some of them viewing it as something that adds to their uniqueness. In this regard, one of the participants remarked, *"…I think it is kind of unique. I don't really care that I am colour-blind…"* (P1, p. 6). Another participant similarly indicated that, *"I… think it is one of those things that made me unique at a younger age, because I was very artistic. I thought, I am artistic and colour-blind, I will make it work"* (P4, p. 26).

Upon reflection, I came to the conclusion that it may have been *"…difficult for them to recall specific experiences on the spot"* (RJ, 1 December 2020). My conclusion was based on the participants' inability to initially report on negative experiences, as well as on my observation that CVD may not have been experienced by them as having a significant impact on their general functioning in class, due to them having learned *"…to cope with having CVD in various settings"* (RJ, 15 January 2021) at an early age.

As the interviews progressed and questions became more focused, the participants were however able to recall several negative experiences, especially related to academic functioning, as captured in the next section. I noted this as follows: *"…but as the interview progressed and I asked him for example how he experienced mapwork at school, he recalled that he had some difficulties with that"* (RJ, 2 December 2020), and *"…as he shared experiences, more recollections were triggered…"* (RJ, 15 January 2021). The tendency not to mention a negative impact at the start of the interview, but doing so as the interview progressed was observed during most of the participants' interviews.

4.2.2.2 Sub-theme 2.2: Effect on learning and scholastic performance

In this sub-theme, I report on the participants' experiences in terms of the effect of CVD on their academic performance. When discussing this aspect, the participants referred to and included examples of various subjects in which they had reportedly experienced difficulty. One participant, for example mentioned that he: *"(Had difficulty) in …Biology and those subjects where they put pictures of certain things. …I had Hospitality and when there were pictures in the textbook and it was different layers of something, or the difference between two plates of stuff, then it was kind of hard for me…"* (P1, p. 4).

Another participant referred to Mathematics, and said the following:

> *"…when it came to …Maths… they have a table on the side showing the colours, but that was never a problem because the colours were very distinguishable. The colours would usually be yellow and blue or a shade of green. If it were a graph with a little bit of green and a little bit of yellow and a little bit of red, there I would have had trouble. Especially if the shades were very close to one another. …but usually when it came to something like that, I just asked the teacher… even in an exam"* (P4, p. 28).

This contribution once again points to the participants' trend to merely accept the condition of CVD and finding ways of coping, for example, asking a teacher for clarity on something that involved colour.

The same participant explained how he had experienced difficulty in the subject Engineering Graphics and Design: *"…we had this one mechanical drawing that was colour isolated, some of the different parts of it, and that gave me some trouble, … it was in the final Grade 12 exam, and I just asked the teacher, and explained my situation to him..."* (P4, p. 28). For this participant, Information Technology apparently did not pose a challenge, as evidenced in the following excerpt taken from the data: *"Coding is not a problem, and if you do work with colours, it is very easy to find a colour on a computer…"* (P4, p. 28). On the other hand, however, another participant reported some difficulty with Computer Science, saying that, *"…when we had to do tasks, there would be colours that really looked the same to me, …and I had no idea what they (different colours) were, and I needed to know for the tasks"* (P3, p. 18). As such, the participants therefore shared different experiences regarding Information Technology/Computer Science in school.

As could be expected, the majority of the participants mentioned that they had experienced some challenges in Art. The following contributions capture their experiences:

- *"…in Art class till Grade 9, …that was the main thing, where it was a bit of a problem"* (P2, p. 9)
- *"…every time the teacher would look at my painting or drawing, she was really angry so she would always start yelling at me: 'How can you paint this green?'* (P3, p. 15)
- *"Creative Arts from Grade 1 to 9… on anything that was colour related, it was a little bit of an issue…"* (P4, p. 25)
- *"…there were always Art assignments, and they were the worst because I wanted to be independent… So, if someone said 'hey, the skin is green instead of…', I would say 'it was meant to be green'"* (P5, p. 41).

Finally, regarding Physical Education as a subject, a participant shared some difficulties to perform due to being colour vision deficient. He mentioned that, *"…concerning the colour of for example cricket balls. …They blend in with the grass, they are very hard to see… And then when playing in teams as well, to distinguish the different teams"* (P5, p. 45).

Even though the participants reported these difficulties in various subjects they seemed to be of the view that CVD did not severely impact the final marks they obtained. They said, for example, *"…but it didn't have a big impact in the sense that my marks went down"* (P1, p. 4), *"I never did bad in a subject…"* (P4, p. 25), and *"Yes, it takes me longer. It is not necessarily that it impacted my marks negatively…"* (P5, p. 47). Only one of the participants recalled an instance where her marks were affected negatively, mentioning that, *"I know there was one test in Art I think, and I did so bad in it, because of the colours…"* (P2, p. 10). However, I noticed the following during our interview: *"… (she) did not seem bothered or uncomfortable… not even during the part where she shared that she thought she did badly in a test in primary school because of a colour-related issue"* (FN-P2). This observation once again points to the possibility of the participants simply accepting the condition without feeling disadvantaged about it.

In terms of their classroom experiences, the participants reported some difficulty when certain colour markers were used on a white board. They explained their experiences as follows: *"When the teachers write with yellow on the whiteboards, I can't see … Sometimes like a light blue, or the normal blue is difficult to see"* (P1, p. 2), and *"…yellow I couldn't see that clearly, but the rest of them (colours) …I could see …clearly enough."* (P2, p. 11). Writing in yellow on a whiteboard was however noticed as a potential problem for all learners, as: *"Everyone struggles with it (reading yellow on white)"* (P5, p. 52). For this participant, the combination of red and black was confusing when he was not sitting close to the whiteboard, as captured in the following words: *"Black and red on a whiteboard get a teensy bit hard to distinguish, if you are sitting further back"* (P5, p. 41). In summary, the participants' responses indicate that different individuals with CVD may experience difficulty with different combinations of colours on a whiteboard, depending on the specific colours they have difficulty to distinguish. In the words of one of the participants, *"For me… it would be green and brown, they look the same. …pink, blue and purple all look the same to me"* (P3, p. 18).

Regarding the use of colour in worksheets, tests and exam papers, some of the participants mentioned that they struggled to interpret illustrations when printed pictures were unclear.

They explained that, *"In Biology we had illustrations that they sometimes asked about, and I was not always sure what the colours were"* (P2, p. 10), and *"…if the pictures (in a test) are blurry or the colours are mixed with each other, that is not good, they should make sure the pictures in a test are clear …I struggled with that in tests if the pictures were not clear enough for me"* (P1, p. 5). Another participant concurred: *"the pictures were always in black and white. In the exam material you could not even make out what picture it was, it was just a smudge…"* (P4, p. 29).

On the other hand however, one of the participants mentioned that tests presented less colour-related issues than for example textbooks. He explained that, *"…tests were never really in colour, it is more just being able to learn better with colours and avoid that confusion"* (P5, p. 46). For worksheets specifically, a participant explained that when less colour is used, learners with CVD will experience less difficulty. This participant remarked, *"… but only in the textbook (colour played a role) because on printed sheets, they avoid colour. …Usually, they would give different shades of grey, which makes it easier to see…*" (P4, p. 30).

When prompted further about their experiences of textbooks, the participants shared different views. For some textbooks posed *"No problem, because none of them had much to do in colour, they were in colour, but you didn't have to answer anything about the colours"* (P2, p. 10), while other participants mentioned some difficulty in terms of the textbooks used for language subjects. They explained their views as follows:

> *"With the English and Afrikaans textbooks there are different parts of the sentences, saying this is the verb and this is the noun …in different colours, …the verb is green, and the noun is red. …I confused verbs with nouns. Then there are also the different parts of speech and different sentence punctuations... It is hard to differentiate the different parts of speech… from each other when they are printed in colours that are so close together"* (P5, p. 41),

and *"…in English and Afrikaans we sometimes had… activities to do, and it had something to do with colour, and it would say for example: 'How many blue apples are there?' …any activity that had to do with colour (in Afrikaans and English) slowed me down"* (P3, p. 15).

Several of the participants reported similar instances where CVD resulted in them spending more time to complete activities or study for a subject than what would be expected. They for example said that, *"It took me longer and it was harder to study..."* (P1, p. 4), and *"…it's the same end destination, and I do get the work done, but it's with a lot of extra steps, a lot*

of asking in-between … It just takes longer to study and write stuff down from the board" (P5, p. 47).

Two other aspects which reportedly influenced the participants' classroom experiences relate to their positioning in class and the role of lighting. Regarding the former, a participant explained: *"I could see if I was sitting close, but the further back I sat, the more I doubted myself (regarding distinguishing colours). … If I am sitting at the front of a classroom, I can easily distinguish, oh that's red and that's black"* (P5, p. 42). A learner's position in class is however an aspect that can be easily addressed and used as a supportive strategy, as mentioned later in Section 4.2.3.3. In terms of the second aspect, namely lighting, the participants shared the following views: *"(The colour I see) depends on a few things, say it is sunny outside, I see colours in a lighter …shade, especially with blue and purple, pink, brown, green, and red…"* (P3, p. 14), and *"I can also try and do that (identify colours by saving a picture in a specific digital format), I am never accurate though, because it all depends on the sun and how much lighting there is on the colour. The more saturation there is, the lighter the colour will be. The darker it is, the darker the colour will be..."* (P4, p. 29).

With regard to the experiences of the participants in terms of their learning and scholastic performance, their responses became more detailed as the interviews progressed, resulting in the generation of rich information. I captured my reflections on this as follows: *"…there were many topics he did not raise himself when answering questions, …but as the interview progressed and I asked him for example how he experienced mapwork at school, he recalled that he had some difficulties with that"* (RJ, 2 December 2020), and also: *"…he struggled with some activities in Afrikaans and English which he admittedly did not recall at first"* (RJ, 2 December 2020).

4.2.2.3 Sub-theme 2.3: Effect on social and emotional functioning

The majority of experiences of a socio-emotional nature shared by the participants stemmed from their primary school years. These experiences often related to them being misled when asking peers for assistance with colour when doing assignments. An example of such an experience is captured in the following contribution: *"…in Art class, we had to paint a portrait of nature. …I asked this one guy, can you give me the blue crayon, and he knew that he was giving me the wrong colour, …but he did it on purpose."* (P3, p. 16). When sharing this experience, the participant *"…did not seem upset or dwell on the incident upon sharing it"* (RJ, 2 December 2020). Another participant shared the following: *"…it was a tiny bit of bullying, when people found out… all my pens and pencils were marked, so it was like taking*

the label off the blue pen and putting it on the purple pen or switching the inks in the red and green pens and I wouldn't realise. … I think the most verbal form of teasing or bullying was me asking 'hey, is this purple?' and then holding up a blue pencil and they said: 'Yes, it's purple'" (P5, p. 52).

According to the participants, their experiences during their high school years could mostly be related to others' curiosity, which resulted in repeated questioning by peers. They mentioned that, *"Mostly people just came to me because they were intrigued by it, and they wanted to know more about it…"* (P4, p. 26), and *"…the usual reaction (when peers find out he was colour-blind) is 'what colour is this?' '…do you only see black and grey?' '…do you only see red?'"* (P5, p. 53). These experiences were, however, not accompanied by negative feelings on an emotional level, as captured in the following excerpt taken from the data: *"But you won't say it has influenced your self-esteem? … No, not at all"* (P5, p. 53).

In addition to their classroom experiences, some of the participants seemed to be affected on a socio-emotional level when involved in extra-curricular activities. When participating in physical activities, including sports, the participants for example experienced the following: *"I played netball… you do certain practices where the coaches used different crayons to draw on the floor, … and I didn't know which colour was which and they would say: 'run to the yellow' for example, and I would be like 'which one is yellow?'"* (P1, p. 2). In this instance, the participant's teammates would usually guide her by saying which colours were used where. On the other hand, one of the participants reportedly did not have any negative experiences. He stated that, *"I played rugby, cricket, and did swimming. …I don't think the colour-blindness had any effect on me choosing those sports…"* (P3, p. 17).

Regardless of whether or not CVD negatively affected the socio-emotional wellbeing of the participants during their primary school years, no long-lasting effects were reported or observed during the interviews I conducted. In this regard, I noted that: *"Participant appeared confident and comfortable during our interview"* (FN-P2), *"He was well-spoken and mentioned numerous social activities, participation in a number of sports, and serving on the matric council of his school"* (RJ, 2 December 2020), and *"Participant seemed confident and openly shared both positive and less positive experiences related to having CVD in the school context*" (FN-P4).

4.2.3 Theme 3: Coping with CVD in the school context

This theme, with its four related sub-themes, captures the participants' ways of coping with CVD in the school context in terms of the support they required and received, how informed their teachers were about the condition, and possible strategies that teachers may implement to support learners with CVD in the classroom. Table F.3 in Appendix F provides an overview of the inclusion and exclusion criteria I relied on to identify the relevant sub-themes.

4.2.3.1 Sub-theme 3.1: Developing self-help coping strategies

Many of the coping strategies mentioned by the participants were developed as self-help mechanisms as they learnt how to function despite having CVD. Some of these strategies required the participants to become accustomed to the way they perceived different colours and to find suitable ways to compensate, in addition to accepting their condition. In this regard, participants shared that: *"I am so used to being colour-blind, it doesn't matter to me that much, I don't really see it anymore, when I'm working with colours and stuff..."* (P1, p. 7), and *"…I was never limited. I never did bad in a subject, because of it (CVD), because I could always ask, or rely on some of my senses"* (P4, p. 25). This participant thus relied on other senses to compensate for the inability to distinguish between some colours.

Another participant adapted by making associations between the names of colours and what she could see, as explained in the following example: *"…and the teacher said: 'Look at the red part' and I thought to myself, well it's pink to me, then it must be red, and I just went with that"* (P1, p. 2). One of the participants reported that humour may also be relied on, by for example arguing with peers about the different ways in which they saw certain colours, in order to highlight the condition in a humoristic way and reduce its impact on their daily lives. She said: *"…I can always joke about it… this whole colour-blind thing is really funny to me"* (P1, p. 6).

During one of the interviews, I identified self-driven research as yet another possible self-help coping strategy. Even though I only observed this in the case of one of the participants it is interesting to note. I reflected on this in the following way: *"…he seemed to have done a fair amount of research on CVD. …this might have equipped him to cope with the condition as well as not letting it influence his functioning too much…"* (RJ, 15 January 2021). It therefore seems clear that various strategies were utilised to cope with the challenges the participants faced as a result of CVD.

When discussing possible supportive strategies for the classroom, the majority of the participants indicated that they did not hesitate to ask a friend for assistance when experiencing a colour-related difficulty. Contributions such as the following capture this:

- "*I would usually ask a friend in front of me: 'Excuse me, can you tell me what is written on the board?' (or) '…can I borrow your orange crayon?' '…That is how I got over it in the early stages"* (P4, p. 31)
- *"If I were sitting in the back of the classroom when the teacher was writing with black and red, I would say to myself that that word looks a different colour than everything else, I'm going to ask this person sitting next to me, because I am not completely sure"* (P5, p. 42)
- *"…in Art where you had to do colouring-in and all of that stuff, it was quite difficult for me so I would ask my friend: 'Which colour is yellow? Which colour is red, purple, or blue?'"* (P1, p. 1).

The success of this strategy however relied on the attitude of peers and whether or not they were supportive. In cases where they were not supportive, the participants apparently experienced teasing and even some levels of bullying, as reported earlier.

While most of the participants agreed that they would not hesitate to ask a teacher for assistance, more specifically during a test or exam, they also indicated that they did not find it necessary to communicate their difficulty to see certain colours to teachers before requiring assistance, i.e., when they faced a colour-related challenge. One of the participants explained that: *"…I didn't tell them (teachers) from the beginning, just when …I couldn't see something, I would say 'I am colour-blind, I can't see what you're doing'"* (P1, p. 2).

Finally, one of the participants mentioned a coping strategy he used to apply when studying, once again involving some of the other senses. He explained that he, *"… find other ways to study, I learn audibly, so I read it aloud to myself and try and understand it instead of just remembering it and remembering what the different colours means…"* (P5, p. 46). This contribution does not only indicate a coping strategy used by the participant, it also points to the importance of self-knowledge and insight into his personal strengths and abilities.

4.2.3.2 Sub-theme 3.2: Importance of teachers being informed

This sub-theme emerged based on the participants' alleged experiences of some teachers being impatient when unaware of a learner with CVD or when not understanding what the

condition implies. One of the participants for example mentioned that, when his uninformed teacher looked at his drawing, she became very angry and *"…ten minutes after yelling and screaming, she would leave the classroom and then when she came back, I would tell her I'm colour-blind"* (P3, p. 15). Another participant shared the example of a teacher saying that *"…it (coloured-in picture) was not the colour it is supposed to be"* (P4, p. 25), upon which the participant *"…retried and retried, and I never got it right and that's when she started testing me. …They (teachers and day care personnel) tried teaching me colours by constantly going through the crayons even after being diagnosed (with CVD)…"* (P4, p. 25).

However, when teachers were informed that a learner in their class had CVD and required assistance, the participants experienced them as being willing to assist. Examples of such support provided by informed teachers are included in Section 4.2.3.3.

This sub-theme therefore illustrates the need to inform teachers of a learner's CVD, yet also of what the condition entails and implies in the classroom context. According to the participants, when informed, teachers would be better able to provide suitable support. The participants for example commented that,

> *"There is not really a general thing that you… can tell the teacher to fix the problems, it is more like a general go research it, and understand it. Because when they understand how it works, what colours affect which students, then they can, as a general rule of thumb, know what to avoid and what to include more of"* (P5, p. 42).

4.2.3.3 Sub-theme 3.3: Support from teachers and peers in class

As mentioned in Section 4.2.2.2, the participants reported that they had experienced certain colour-related difficulties in class during their primary school years, for example in terms of the way they saw certain colours on the whiteboard. In response to such challenges, and being made aware of this, teachers would apparently spontaneously provide support, as captured in the following example: *"…if I told them I was colour-blind they would either put me more forward in the class or use colours (on the board) that were a lot more opposite..."* (P5, p. 41). This accommodating reaction was also mentioned by another participant, who found it hard to follow colour-related instructions in his textbook, with the teacher offering the following support: *"For today's class you can come sit here at the front and I (teacher) will tell you which paragraph is which colour and until where you should go"* (P3, p. 15).

In confirmation of the view that their teachers had been willing to support them, the other participants remarked the following:

- *"A few of them, when I told them I am colour-blind and I can't see, they said 'Oh' and they switched to another colour later"* (P1, p. 2)

- *"Yes (felt comfortable asking for support), I wasn't embarrassed to say that I didn't know, and they were fine with me saying that and then they made changes"* (P4, p. 10)
- *"I would say 'please would you not use that colour; would you use another colour,' and they would switch. …They (teachers) will help me if I ask them, and if they see I am doing something wrong"* (P5, p. 49)
- *"…I have seen improvement in the classrooms, I have seen the difference in the PowerPoints (Biology and Physical Science)*. …*more arrows and black and white pictures, instead of including colours and coloured diagrams"* (P5, p. 48).

To me, such reports of instances where teachers made changes to presentations or worksheets are encouraging. I captured this view as follows in my reflective journal: *"It was encouraging to hear reports of instances where teachers have made changes to PowerPoint presentations or worksheets here and there to better suit the needs of learners with CVD"* (RJ, 18 May 2021).

In terms of accommodating strategies provided by teachers without learners indicating difficulty or a need for assistance, but with the teacher being aware of the condition, limited reports were shared by the participants. One example concerns a primary school Art class teacher, as captured in the following excerpt: *"…I think we had the same tests as the students with normal colour vision, but I think that mine was in black and white. In most of the exams, they would ask us to complete the colour wheel, but …I never had to do that. …the teacher said, 'you can tell me and at least get the marks for this'"* (P3, p. 20). Regarding this experience, the participant's mother, who joined the interview, mentioned that she had informed the Art teacher about her child having CVD. Another example of accommodating CVD in class was reportedly done by a Mathematics teacher, who: *"In tables and diagrams, instead of using different colours, she uses different shades of black and grey, …and different patterns"* (P5, p. 43).

4.2.3.4 Sub-theme 3.4: Recommendations for teachers to support learners with CVD

The participants identified an array of possible strategies that teachers can employ to support learners with CVD. They however agreed that no universal strategies exist to accommodate learners with all types of CVD, saying that, *"Because every colour-blind person is different"* (P1, p. 6), "*…not all colour-blind kids see the same colours, like 'wrong', it depends on student to student…"* (P3, p. 18), and *"It is not about catering for one specific type, it is more about using one solution, to almost cater for all*" (P5, p. 42). As such the

participants were seemingly of the view that certain general accommodations may be put in place to make the classroom more inclusive for all learners with CVD. To this end, the participants recommended that teachers for example: *"…just ask the class in general, 'can you read this?'"* (P5, p. 51), or *"An easy solution is using black and then a colour that is lighter, but not too light"* (P5, p. 43).

For individual cases of CVD, the participants agreed that it is the learner's responsibility to ask for assistance if needed and to inform teachers accordingly, who would usually be willing to cater for such communicated needs. A participant explained this view as follows: *"…when a child comes to them (teachers), or the parents come to them …to say: 'My child is colour-blind, he can't see this, this, and this,' then they need to make certain that they don't use those colours. Or when they do use it, they can tell us, 'Okay this is green, that is blue'…"* (P1, p. 6).

In making recommendations for potential supportive strategies the participants thus focused on teacher awareness, yet also on practical guidelines for classroom teaching and teaching material. They also formulated some advice for parents. To ensure awareness among teachers, the participants' suggestions focused on the following possibilities:

- *"… do you think it might be useful to include that… colour-blindness test, …when the children come into Grade 1?"* (Researcher, p. 32) *"I think that would actually be a very efficient way"* (P4, p. 34)
- "*…it is better to know earlier on, so that you can start learning what the correct colours are..."* (P1, p. 7)
- *"… on their (school) website, they can have another sign-in form, so if you are colour-blind you can list your name there, and if you feel like you need special treatment, you keep it there"* (P4, p. 36).

Participants recommended a differentiated approach to classroom-based support, as the type of required assistance could differ from one learner with CVD to the next. The participants ascribed this to some learners allegedly not minding public acknowledgment while others would, saying that: *"…I personally wouldn't be bothered because I have no shame in the fact that I am colour-blind, but I think just to be safe, …I would say go up to the student and ask them, 'Can you see this? Can you see that? Can you identify that?'"* (P3, p. 19), and *"…I told them (teachers) at the beginning, 'I am colour-blind and I'll be fine if I ask people around me what the colours are', and they (teachers) were mostly fine with it"* (P2, p. 10).

When making suggestions for classroom teaching and teaching material, the participants provided several practical hands-on guidelines for the use of colour, such as the following:

- Putting up a colour correction chart in class: *"This (colour chart) can help someone with colour-blindness, …it can display different colours with their names listed underneath them*" (P4, p. 35)
- *"…use blackboard and chalk or black marker on a white board, because white and black will always be distinguishable, no matter what type of colour-blindness you have…"* (P4, p. 36)
- *"…don't use colours that can blend in easily when they are written with"* (P1, p. 5), *"…stay away from colours that would look the same… use black, red, blue, and I think green, but it truly depends (what the individual with CVD struggles to see) …"* (P3, p. 18), and by using black and a lighter colour, the idea of someone with CVD being able to *"…see that this colour, or this word is a different colour to all the other words …and understand that it is supposed to mean something in a sentence"* (P5, p. 43)
- Avoid highlighting words, instead *"…use different colours for different words"* (P5, p. 47)
- *"Use clear black and white pictures, not blurry black and white (pictures)"* (P1, p. 5)
- For textbooks, do not rely on colour only when emphasising or explaining something: *"Like what they do in the dictionary, you will find a certain word and then in brackets say it is a noun or a verb or an adjective… or write adjective in a different colour and draw an arrow to the word or underline the word and draw an arrow to 'adjective'"* (P5, pp. 47-48).

For Mathematics, the participants recommended the following:

- In the case of circle diagrams: *"…shade with different shades of black to white or just use different patterns"* (P5, p. 43)
- *"…instead of using coloured lines to represent different numbers, …just use black and then another colour, instead of using green for one line and red for another one"* (P5, p. 43)
- *"…abstain from using any colour, or any shading at all, it is not really that necessary if you can see the distinctions, you can see the line going from the midpoint of a circle to the outside of the circle..."* (P5, p. 44)
- *"With pie charts, instead of writing in the blocks next to the chart, write in the actual sectors and diagrams etc. It works fine in black and white as well"* (P5, p. 49).

For parents (and also teachers), the participants suggested that *"…they (teachers/parents) can put a sticker on his markers"* (P1, p. 6), *"Label the pencils"* (P2, p. 12), *"Labelling would be useful, …"* (P4, p. 34), and *"So, when someone with colour-blindness like me, paints something, or especially in art, they can just look at the crayons, and read black, green, brown, red, whatever colour they need, and that will really help them"* (P3, p. 18). Regarding this suggestion, I noticed that one of the participants mentioned this but did not implement it himself, as captured in my reflective journal: *"…he preferred not to label his pencils and pens… even though he suggested this and other strategies (like informing people beforehand of having CVD) to other learners with CVD"* (RJ, 15 January 2021). A strategy that this participant had in place, which may possibly have affected his views, relates to him having worn corrective glasses for several years prior to my study.

One of the participants suggested the supportive strategy of getting *"…colour correction (EnChroma) glasses which changes how light reflects into your eyes and changes the different shades of colours"* (P4, p. 32), yet only Participant 5 had experience with the glasses. Finally, the participants shared the view that accommodating learners with CVD in the classroom should not have a negative effect on any of the other learners. They explained the realisation that, *"Colour does grab attention and keep attention spans…"* (P5, p. 48), and thus suggested that teachers should, *"Not necessarily (use) less colours, (but) …be mindful of which ones they do use"* (P5, p. 49). This participant continued by saying that, *"…you (teachers) need to think, … 'how can I include this colour-blind person', not 'how can I change everything to suit this colour-blind person?'"* (P5, p. 50). This participant in particular had previously completed an EXPO school project on CVD and *"…seemed open minded about the practicality of the possible supportive strategies available to teachers"* (FN-P5).

4.3 FINDINGS OF THE STUDY

In this section, I interpret the identified themes and sub-themes in terms of the existing literature I discussed in Chapter 2. As part of my discussion of the findings, I highlight similarities and contradictions between the results of my study and existing literature.

4.3.1 Effect of CVD on learners

The findings of my study indicate that the participants with CVD generally seemed to be coping well in their daily lives, mostly without the assistance of others. This finding correlates with the studies of Maule and Featonby (2016), as well as Torrents et al. (2011), who report that learners with CVD are often forced to develop self-help coping strategies that they apply in the classroom to overcome colour-related barriers to learning due to a lack of existing

support structures from others and/or the environment. To this end, Stoianov et al. (2019) posit that CVD will have a significant and unique impact on any individual, even though this impact may not be visible to anyone other than the individual him/herself.

Based on the perceptions of the participants who initially reported that they were not significantly affected by CVD, yet later in the interviews revealed several areas where they had been affected negatively, it stands to reason that people with CVD may tend to merely accept their condition and learn to cope with challenges without expecting any special support from others. Ongoing research in terms of this probability is required.

In terms of scholastic performance, the findings of my study suggest that, even though learners' academic performance may not necessarily be affected by the condition of CVD, they may face distinct challenges and take longer to complete activities when colours are used, for example to emphasise or label concepts. This finding confirms the research of Chaparro and Chaparro (2017), Cole (2015), Kvitle (2018), Ramachandran et al. (2014), as well as Tanuwidjaja et al. (2014), all of whom discuss the use of colour as a learning tool and the negative effect it may have on learners with CVD.

My study furthermore indicates that the learners with CVD who participated in the study, experienced some textbooks as containing too much colour, resulting in activities and studying from the textbooks being strenuous and time-consuming. This finding is supported by the work of Maule and Featonby (2016), who indicate that textbooks are often compiled without considering the needs of learners with CVD.

The participants in the current study furthermore indicated that they found it difficult to read from graphs and charts in Mathematics. This finding corresponds with the findings of Berisso (2018) and Ugalahi et al. (2016). In addition, the participants in the current study found it challenging to complete Creative Art activities, which is consistent with the research of Chaparro and Chaparro (2017), as well as Ugalahi et al. (2016). Regarding computer work, I obtained varied results, with one participant reporting no challenges in Information Technology, while another participant reported some difficulty when completing colour-related activities on a computer screen. Even though studies by Chaparro and Chaparro (2017), as well as Ugalahi et al. (2016) also indicate that learners with CVD may find it difficult to complete certain tasks on a computer, the opposing view of the other participant in my study cannot be confirmed by existing literature. This contradictory finding highlights the need for additional research in this area.

In addition to the challenges experienced with specific school subjects, the findings of my study indicate that learners with CVD will probably experience classroom teaching as challenging due to the teaching material generally used in class. This finding confirms the research of Berisso (2018), Torrents et al. (2011), as well as Zorn and McMurtrie (2019), who similarly indicate that learners may struggle to see images or words on a white board when certain colour combinations are used. The same challenge may be experienced when viewing a PowerPoint presentation on a data projector.

Problematic combinations of colours mentioned in my study as well as in existing research vary and include, among others, using yellow together with any other colour, using red and green, purple and blue, green and blue, or black and red. As such, the findings of my study indicate that the colour combinations that learners find challenging can differ and highlight the importance of lighting as well as the type and severity of CVD as contributing factors to the challenges experienced by these learners. In this regard, existing studies emphasise the importance of checking PowerPoint presentations before using them, in order to ensure that colours which may be difficult to differentiate, are not used (Maule & Featonby, 2016; Sullivan, 2011) and that any presentation is accessible to all learners in the classroom, including those with CVD. This recommendation aligns with some of the participants' suggestions on how teachers can accommodate learners with CVD in class.

As in the case of classroom presentations, the findings of my study indicate that it may be difficult for learners with CVD to interpret and complete a worksheet, presentation, or textbook that include too many colours. To this end, existing research suggests that colours can be changed to monochrome or that high-quality greyscale images can be used as an alternative (Berisso, 2018; Meeks et al., 2016; Torrents et al., 2011). In this regard Maule and Featonby (2016) however caution that greyscale images of a low quality may still cause confusion. This was confirmed by the participants of the current study, especially for worksheets printed in low quality greyscale that include pictures that are too blurry to identify.

In terms of the potential challenges that may be experienced in the physical classroom space, the findings of my study highlight the potential effect of lighting and the position of a learner in the classroom. Specific reference is made to the effect that closeness to the board or screen may have on a learner with CVD's ability to read from the board or to distinguish colours correctly. The important role of lighting is confirmed by the work of Gaines and Curry (2011), Kvitle (2018), as well as Maule and Featonby (2016), while the findings of Kvitle

(2018) correlate with my findings regarding a learner's positioning in the classroom to be able to accurately distinguish colours.

With regard to the effect of CVD on the social and emotional functioning of individuals, the findings of my study indicate no long-lasting negative effect in these areas, as perceived by the participants. A few experiences which may have had an emotional effect were however shared by the participants, from their years in primary school, when their peers, for example, tricked them into using incorrect colours. In addition to these shared experiences, the finding that participants tended to struggle on their own rather than ask a teacher's help in order to avoid drawing attention to themselves, points to the possibility that they were affected on a socio-emotional level without realising it.

The participants' experiences in high school primarily included being repeatedly asked obvious questions about their CVD. Even though these experiences of learners with CVD confirm the research of Chaparro and Chaparro (2017), based on the limited findings in this area of development and the limitation in terms of available literature in this field, it seems important to conduct more research to gain a better understanding of both the immediate and long-term effect of CVD on the social and emotional functioning of learners.

Along the same lines, even though existing literature indicates concern for learners with CVD's self-esteem (Kvitle, 2018) being negatively influenced due to them for example taking longer to complete tasks, the current study does not confirm the negative effect on self-esteem based on the participants' perceptions of their own functioning. This is despite my findings also indicating that learners with CVD will take longer to complete certain tasks when compared to their peers. As it may however be difficult to report on self-esteem in an honest way, the possible link between challenges such as taking longer to complete tasks, being teased by friends and learners' self-esteem require ongoing research.

My findings however do support, to a certain extent, Stoianov et al.'s (2019) concern that learners with CVD may be ridiculed (mention was made of unaware teachers doing this), mocked (indirectly done by peers misleading participants about correctly applying colours), exposed to prejudice, or experience difficulty with social relationships. As indicated in brackets, the findings of my study correlate with the first two possibilities yet do not confirm the latter two opinions, with all of these experiences potentially having an effect on the self-esteem of individuals. As stated, more research is required before coming to conclusions about the effect of CVD on a learner's self-esteem.

4.3.2 Importance of teacher and learner awareness and understanding of CVD

The findings of my study indicate that several of the participants' teachers were unaware of the learners in their classrooms with CVD. They were seemingly also not well-informed about CVD and how to accommodate learners with CVD in their classes, according to the recollection of the participants. This finding confirms the research of Maule and Featonby (2016) as well as that of Sullivan (2010), who both indicate that a lack of teacher training about this condition has resulted in teachers generally being unaware of what learners with CVD may experience in class (Albany-Ward, 2015).

My study, however, furthermore indicates that teachers often discover that learners in their classrooms have CVD when they notice, for example, a learner who applies colour in an unusual way. These findings confirm the work of Collins (2015), who discusses the important role of teachers in discovering CVD during the foundation phase, especially due to the long periods of time these teachers spend with the learners in their classrooms. The findings of my study also emphasise the need to implement Kvitle's (2018) recommendation that teachers should be equipped with knowledge on CVD to equip them to effectively assist learners with CVD. This finding is closely related to my finding that, when teachers become aware of learners with CVD and realise that these learners are experiencing certain difficulties, they will be open to accommodating the learners, as also anticipated by both Collins (2015) and Kvitle (2018).

Closely aligned, the findings of my study indicate that teachers' unawareness or lack of knowledge on how to accommodate learners with CVD, may accordingly lead to learners being inadequately supported in school. This possibility is cautioned against by Albany-Ward (2015), Mashige and Van Staden (2019), as well as Zorn and McMurtrie (2019). In addition, a lack of knowledge about inherited CVD, as discussed by Shayeghpour et al. (2014), may prompt some teachers to attempt curing the condition by, for example, practicing the names of colours with learners, which I found in my study, and which is also mentioned by Tanuwidjaja et al. (2014). According to the findings of the current study, teachers may as a result become impatient and misinterpret a learner's attempts, or even (as was the case in one instance in my study) not award suitable marks to the learner in a test. In the support of the findings I obtained, Torrents et al. (2011) also cautions against such occurrences.

In addition to the possibility of teachers being unaware of learners with CVD, my study also indicates that learners themselves may be unaware that they have CVD, until they discover this through a colour-related activity. This finding confirms the research of Khairoalsindi et

al. (2019) as well as Woldeamanuel and Geta (2018), which indicate that many individuals with CVD are seemingly unaware of their condition prior to a screening process. With regard to screening, only two participants in my study underwent formal screening, with an additional two engaging in online informal screening exercises. However, these processes did not seem to entail early or preventative screening measures, as it was only conducted once a parent or teacher started to suspect that the child may be experiencing some challenges with colour recognition. In this regard, early screening upon primary school entrance was suggested by one of the participants, which confirms the suggestions of Berger et al. (2016), Metsing et al. (2018) and Ramachandran et al. (2014) to use early screening as an avenue for an early diagnosis and suitable adaptations by individuals with CVD.

4.3.3 Supporting learners with CVD in the classroom

The findings of my study suggest that teachers may become more attentive to possible challenges in the classroom context and in terms of the teaching material they use once better informed about CVD and the implications of the condition. These findings confirm the findings of Meeks et al. (2016) as well as Tchombé (2011), who indicate that learners will feel more comfortable to seek assistance from teachers if the teachers are informed and able to assist.

My findings furthermore indicate that learners with CVD will often prefer to ask a friend for help or try and complete a task without assistance rather than asking a teacher for support and drawing attention to themselves, regardless of whether they think the teacher is willing to assist or not. This finding correlates with the research of Zorn and McMurtrie (2019), who also point out that learners may be reluctant to seek help, which may result in them taking longer to complete certain tasks. To an extent this finding however does not support the suggestion by Sullivan (2011) to assign a ‘colour buddy’ to each learner with CVD or doing group work when tasks involve multiple colours, even though the participants in the current study seemed willing to be assisted by peers. It therefore seems clear that additional research is required in this field before final conclusions can be reached.

Even though the findings of my study highlight the importance of a parent or learner informing teachers of a learner’s CVD, the participants did not mention individualised supportive strategies by parents, as proposed by Maule and Featonby (2016). Furthermore, research by Sullivan (2011) emphasises the importance of parents’ involvement during homework activities as well as regular communication between parents and teachers. The

fact that the participants in my study were silent about these strategies may point to their desire to function independently and to ask for assistance based only on their own discretion. Additional research in this area may shed more light on this finding.

Finally, due to the type and severity of CVD varying widely, the findings of the current study emphasise the implementation of universal strategies in class, to be able to accommodate learners with various levels or severity of CVD. This finding is confirmed by the research of Chaparro and Chaparro (2017) as well as Collins (2015), who suggests that one such universal supportive strategy may require teachers not to rely on colour as the only medium to convey or emphasise information. In agreement with my findings, research by Maule and Featonby (2016) as well as Serrantino et al. (2015) suggest that any activity where colour is used can be accompanied by for example underlining, circling, or labelling, to support learners who experience difficulty to differentiate between colours.

4.3.4 Recommendations for supportive strategies

In terms of existing accommodation strategies used by teachers in classroom, the findings of my study confirm the research of Chan et al. (2014), by indicating that very few accommodation strategies have been formalised and put in place for implementation across school settings. My findings furthermore support the suggestion of Berisso (2018), who emphasise the importance of developing and implementing such strategies. With regard to examples of such accommodating strategies, I found that supportive strategies do not necessarily imply the removal of all colour from for example worksheets, but that teachers should rather be mindful when designing and printing worksheets to ensure that these are accessible to all learners. Teachers should thus ensure that the use of colour adds to the learning experience of the entire class and will not confuse learners with CVD.

These findings are confirmed by the work of Chaparro and Chaparro (2017), Maule and Featonby (2016), Metsing et al. (2018), Sullivan (2010,) as well as Torrents et al. (2011), who encourage teachers to check all worksheets for possible colour-related challenges which can be eliminated, prior to handing them out. This finding also supports Torrents et al.'s (2011) notion that teachers should ensure that learners with CVD, as well as those with normal colour vision, do not have to rely on an image alone for instructions, but should have access to additional cues that can guide them.

In terms of teaching material, my study indicates that, instead of using different colours, shades of grey and patterns that label different areas in a mathematical graph, may for

example, be more effective. Closely related, I found that, by not highlighting words in a presentation or other teaching material, and by using high resolution greyscale images, the risk of colour-related difficulties can be reduced for learners with CVD. These findings are supported by Chaparro and Chaparro (2017), Maule and Featonby (2016), as well as Serrantino et al. (2015), who suggest labeling, circling, or underlining as ways to emphasise concepts, instead of using colour. In addition, research by Berisso (2018), Meeks et al. (2016), and Torrents et al. (2011) suggest that different shades of the same colour can be used rather than different colours, to support learners with CVD.

In accordance with this suggestion, I also found that universal strategies are not recommended for accommodating learners with various types of CVD in the classroom. This finding confirms the work of Collins (2015), who posit that a teacher may not necessarily understand the specialised needs of a learner with CVD merely by becoming aware of the condition. In this regard, I found that strategies such as those mentioned above, as well as the habit of a teacher asking the entire class whether they can clearly see what is written on the white board or being projected, may be implemented in every classroom. As the latter part of this finding is not indicated by existing literature, further research is required on this proposed supportive strategy and its suitability.

Next, I found that it remains the responsibility of the learner with CVD to ask for assistance rather than expecting a teacher to know when to provide assistance. As I could not obtain any existing literature in support of this notion, further research is recommended in this area. To this end, I did however find that, when teachers were asked for help, they were willing to accommodate the needs of learners with CVD in the classroom, yet help could often not be offered due to teachers not being informed about what CVD entails. This finding confirms the research of Collins (2015) and Kvitle (2018), indicating that once teachers become aware of these learners they tend to be open to learn about CVD and to find ways of accommodating them.

My findings also indicate the importance of creating an accommodating physical learning space for learners with CVD by, for example placing a colour-correction chart on the wall, using black markers on a white board, and pairing contrasting colours when writing on a board or creating a presentation. These recommendations are supported by Berisso (2018) as well as Torrents et al. (2011), who caution against the use of combinations of certain colours when writing on a white board or during presentations to avoid confusing learners with CVD.

Another supportive strategy suggested by the findings of the current study, relates to early screening for CVD as a way of enabling learners with CVD to acquire self-coping strategies from a young age. This finding supports the research of Berger et al. (2016), who found that early screening may assist learners with CVD to access their available resources and also, according to Ramachandran et al. (2014), to feel more in control and able to adapt to the challenges associated with CVD.

During my study, one participant reported that CVD had a negative impact on her academic performance. This concurs with a finding by Tanuwidjaja et al. (2014), who highlight the fact that difficulties related to distinguishing between colours can mistakenly be ascribed to something other than CVD. To this end, my study indicates that early screening and informed teachers may reduce such misunderstandings, thus supporting Tanuwidjaja et al.'s (2014) notion that early screening can reduce the risk of teachers misinterpreting the cause of certain colour-related challenges experienced by learners.

Another suggested supportive strategy mentioned in my study, relates to corrective glasses. The benefits of wearing such glasses are confirmed by the research of both Serrantino et al. (2015) and Tanuwidjaja et al. (2014). Furthermore, my findings relating to labelled pens and pencils is confirmed by the research of Maule and Featonby (2016) as well as Serrantino et al. (2015). However, Albany-Ward (2015) cautions that teachers who take responsibility to label pens, pencils, and paint, may experience this task as an addition to their workload. In this regard, my study points to parent support, rather than placing the responsibility on the teachers only.

Additionally, my study indicates that learners with CVD may prefer to ask a friend for assistance instead of a teacher. This corresponds with the research of Sullivan (2011), who suggests that learners with CVD may be assigned a 'colour buddy' to assist them with colour-related assignments. It furthermore aligns with the suggestion of both Klooster (2016) and Tchombé (2011), who point out that activities involving colours may be completed in pairs where a learner with CVD can work alongside someone with normal colour vision.

When considering the notion of inclusive education as described by the Department of Education (2001) in The Education White Paper 6, the findings of my study provide examples of simple and costless measures that can be put in place to make the classroom more inclusive for learners with CVD, as also proposed by Collins (2015). This can be done without necessarily classifying CVD as a special education need, as suggested by Kvitle (2018). My findings furthermore correspond with Landsberg (2011) in positing that, whether

CVD is recognised as a barrier to learning by the Department of Education (2006) or not, strategies can be implemented to assist these learners to overcome the challenges they face in the learning environment.

As mentioned, while the supportive strategies suggested by the findings of my study will not require too much effort from teachers, it does imply significant benefits for learners with CVD. The nature of the suggested supportive strategies is similar to those often incorporated by teachers to meet the various other special needs of learners in their classrooms. To this end, my findings support Collins' (2015) statement that teachers are used to accommodating learners with special needs and that adaptations in the classroom and of teaching material for learners with CVD will probably not be experienced as too challenging by teachers, thus increasing the possibility of implementation.

4.4 CONCLUSION

In Chapter 4, I presented the results of my study in terms of the three themes I identified, each with various sub-themes. I included verbatim quotations to enrich my discussion of the results. In the second part of the chapter, I compared the results of my study to existing literature, thereby presenting my findings.

In the following chapter, I draw conclusions in terms of the formulated research questions. I contemplate potential contributions of the study, reflect on the challenges and limitations I experienced, and make recommendations for training, practice and research.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION AND OVERVIEW OF PRECEDING CHAPTERS

In **Chapter 1,** I introduced the focus of my study, being the experiences of learners with CVD in the school context and their views on how teachers may support such learners. The chapter includes the research questions and my clarification of key concepts as well as my working assumptions. I furthermore introduced my conceptual framework as well as the research design, epistemological paradigm, and methodological strategies I selected. I briefly referred to ethical guidelines and trustworthiness considerations.

In **Chapter 2,** I discussed the phenomenon of CVD, teachers' awareness of the phenomenon, typical experiences of individuals with CVD, and supportive strategies that can be employed in the classroom to support these learners. Throughout my discussion, I identified limitations in existing literature that require ongoing research. I concluded the chapter by explaining my conceptual framework in more detail.

Chapter 3 includes a comprehensive explanation of the selected research design and the research process of my study. I discussed interpretivism as epistemological paradigm, the qualitative methodological approach I followed, how I selected the participants and how I generated, documented and analysed the data. In conclusion, I described the ethical considerations and quality criteria that I applied in more detail.

In **Chapter 4,** I presented the results of my study in terms of the three main themes and related sub-themes I identified. In the second part of the chapter, I related the results to existing literature and discussed the findings of my study.

In this final chapter of the mini-dissertation, I come to conclusions by addressing the research questions formulated in Chapter 1. I furthermore discuss the potential contributions of the study as well as the challenges and possible limitations I identified. I conclude with recommendations for training, practice and further research.

5.2 CONCLUSIONS

In this section, I discuss the conclusions I have drawn from my study based on the findings I made. I first attend to the secondary research questions, followed by the primary research question included in Chapter 1.

5.2.1 Secondary Research Question 1: How did individuals with CVD experience their school careers in terms of teaching and learning activities?

The results of my study indicate that individuals with CVD who participated in this study did not experience their school careers as specifically negative. However, even though the participants did not perceive their condition to have had a serious negative impact, they were able to identify several challenges they faced in class with various school subjects. As the participants seemingly relied on self-driven coping strategies or asked their peers and/or teachers to assist them with the challenges they faced, it is probable that they did not experience their primary school years in a particularly negative way. It is also possible that they simply accepted their CVD without expecting special support from others. It is further possible that the participants may have spontaneously developed some coping strategies, since the wider public is generally not familiar with or do not acknowledge the condition of CVD. However, these coping strategies may in turn have enabled them to overcome the challenges they faced as a result of CVD. These are nevertheless mere hypotheses that require additional research before conclusions can be drawn.

The participants indicated that the challenges they did experience during learning and teaching activities primarily relate to additional time and higher concentration levels to complete class and homework activities that involved different colours. They also found it strenuous and time consuming to work and study from textbooks where colour was used for labelling and identification purposes. In addition, the participants struggled to read and copy from a white board or presentation where colours were similarly shaded or non-contrasting. Such activities include the interpretation of graphs and illustrations, or completing assignments in language subjects where different colours were used to indicate different word classes in a sentence.

All activities, including those completed on a computer, which require interpretations based on the ability to distinguish colour, were similarly experienced as challenging and more time-consuming than when only black-and-white colour schemes were used. It is important to note that the teaching and learning challenges experienced by the participants seemed to depend on the severity and type of CVD in each individual case. This finding points to the importance of individualised support in terms of the combinations of colours used in teaching material, as well as suitable lighting and placement in the classroom.

Despite the above-mentioned challenges, the participants' general learning experiences seemed to be positive. According to the participants, they were able to understand the

learning content and perform academically, regardless of the challenges they faced. When the learners with CVD asked teachers for assistance or slight alterations to teaching material, they were generally accommodated and assisted in support of and to improve their learning. Alternatively, they relied on self-help strategies or asked their peers for assistance to optimally benefit from their learning experiences.

When viewed through the lens of my conceptual framework, these findings firstly illustrate the importance of Vygotsky's notion of sociocultural learning. According to this concept, the involvement of role players such as parents and peers may reduce the risk of CVD having a negative effect on learners' classroom experiences. Secondly, when the interaction between the different role players, such as teachers and peers, as well as with the participants, is viewed from the context domain of Bronfenbrenner's PPCT model, the value of these interactions is emphasised.

5.2.2 Secondary Research Question 2: How was the participants' functioning affected on academic, emotional, and social levels?

Even though the participants experienced colour-related challenges in subjects such as Biology, Mathematics, Art, Engineering and Graphic Design, they indicated that these challenges did not significantly affect their academic performance and general functioning in the classroom. Instead, they seemingly to accepted the challenges as part of their reality and adjusted accordingly. More specifically, they developed self-help strategies to cope and requested assistance from their classmates and teachers, even though teachers were only requested to assist when aware of the CVD. The impact of CVD-related challenges on these learners' academic performance was thus apparently minimised as a result of them following a solution-orientated approach and taking ownership to overcome the challenges they faced.

In terms of the social and emotional effect of CVD, the participants did report some negative responses. More specifically, some of the participants seem to have been ridiculed by peers when using a colour incorrectly. They also felt misunderstood when teachers were not aware of their condition. Adding to this, the individuals with CVD reported incidences where they were deliberately misled by their peers when asking for assistance relating to the use of colour. Even though the participants did not voice the view that CVD might have had a negative impact on their self-esteem or social functioning, it stands to reason that instances of teasing and mockery by peers could have had a negative effect.

In this regard, I argue that learners with CVD may compromise and protect themselves from being harmed emotionally by, for example, not drawing attention to themselves through asking for help in cases where their condition had not been disclosed. Alternatively, they value CVD as something which adds to their uniqueness and provides a source of conversation and humour among their friends.

With regard to the tendency to avoid conversations about their condition or downplaying negative comments and experiences, I posit that individuals with CVD may more often than not have no choice but to fully accept their condition and learn how to cope so that their functioning on academic, social and emotional levels are not affected too negatively. In terms of Bronfenbrenner's bio-ecological theory, this finding may however also illustrate that it is precisely because some of the systems in which the participants functioned were actively involved, for example by asking a teacher for assistance, that the participants' academic, social and emotional levels of functioning were not negatively affected.

5.2.3 Secondary Research Question 3: Which strategies, if any, were implemented by teachers to support the participants?

Based on the findings of the current study, I can conclude that the teachers of the individuals who participated in the study did not spontaneously implement supportive strategies for learners with CVD in the classroom. One exception was found in a primary school Art test where the teacher did not expect the learner with CVD to complete (colour in) a colour wheel, while the rest of the class was expected to do so. Instead, the learner was requested to merely name the colours in the wheel to receive the relevant marks. This learner was therefore accommodated and supported to perform well despite his condition of CVD.

Even though teachers allegedly did not spontaneously support learners with CVD, the findings of my study indicate that teachers will generally be accommodating once they are informed that a learner has CVD, or if they are aware of a learner experiencing challenges as a result of CVD when completing activities in class. The teachers who became aware of such special needs supported the learners by, for example, changing the colours used on the chalk/writing board or in PowerPoint presentations, allowing learners to move closer to the front if they experienced difficulty to see the colours, and assisting learners with colour-related questions while completing activities or during a test or exam. These examples point to the willingness and ability of teachers to support learners with CVD in class, provided that they are aware of or informed about such learners and their needs.

Next, no mention was made in my study of supportive strategies implemented by teachers of their own accord to address the social and emotional needs of learners with CVD. Even though the findings did not explicitly indicate that the learners required support from teachers in these areas, I argue that the support that was indeed offered by the teachers primarily focused on academic performance, with the possibility of this indirectly addressing learners' social and emotional needs that could arise in the classroom.

Finally, the findings of my study indicate that individuals with CVD often prefer to ask peers for assistance instead of a teacher, for the sake of not drawing attention to themselves. The notion of not drawing attention to oneself when experiencing an academic task as challenging, confirms my argument that the social and emotional functioning of participants may have been negatively affected despite their perceptions of this not being the case. However, in cases when assistance was requested from peers, it was occasionally not provided in an appropriate way. Examples of misleading behaviour by peers may have been intended in a humoristic way, yet could still have had a negative effect on the individuals with CVD.

5.2.4 Secondary Research Question 4: Which recommendations can be made to strengthen strategies routinely used by teachers to support learners with CVD?

The findings of my study highlight the notion that supportive classroom strategies for learners with CVD cannot be generalised and applied in a universal way. As the needs of every individual with CVD will differ based on the type and severity of the CVD, various ways of support may be required. To this end, even though my study recommends some general strategies aimed at accommodating as many as possible of the various forms of CVD, each individual case needs to be assessed when formulating a support plan.

General recommendations for supportive strategies include not using the colour yellow when writing on a white board or for presentations, and avoiding colours that may appear similar. Instead, the use of black together with another colour was recommended by the participants as a more suitable option. Furthermore, when using multiple colours in a sentence and relying on these colours to emphasise different aspects of the work, for example different types of words in a sentence, teachers are encouraged to use less rather than more colours, and to ensure that the contrast between the various colours is clearly distinguishable. In this way, even though learners with CVD may not necessarily be able to correctly name a colour used with black, they should be able to distinguish between black and the other colour. They

should thus be able to see that certain words are presented in another colour and identify which part of a sentence is emphasised.

Regarding recommendations for graphs and charts, for example when used in Mathematics or Tourism, the participants suggested the use of different shades of grey or patterns instead of various colours. In addition, the use of legends that require learners to accurately distinguish and match various coloured lines or sections of a graph or chart for interpretation, was indicated as being unsuitable and should be avoided during teaching and learning activities. Instead, labelling sections in a pie chart were recommended as an alternative.

Regarding the design of classroom space, apart from attending to sufficient lighting and the positioning of learners in class, the findings of my study suggest that teachers should put up colour charts in their classrooms, showing the colours which are often used in teaching material with their names. In this way, learners with CVD can search for the name of a colour that is used in an activity or test, based on the resources available to them. Regardless of whether or not learners with CVD will see a colour in the same or a different way than their peers, the emphasis is on ensuring that all learners can identify the colours, as referred to by the teacher. If learners are able to make such connections, they may be able to complete an activity or a test in a similar way as their peers, even though this may require additional time. This finding once again highlights the importance of accommodating strategies (such as additional time) and individual support plans for learners with CVD in classes where colour is used.

Likewise, when using illustrations in worksheets and tests, limited use of colour is suggested in support of learners with CVD. Where greyscales are used, it is important that the quality of greyscale images is as high as possible. When utilising colours to emphasise certain aspects of a lesson, participants suggested the use of additional indicators, such as underlining or circling words along with changing their colours. Recommendations such as these, lead to my conclusion that the use of colour should not be avoided altogether as this may prevent learners with normal colour vision from having optimal learning experiences in cases where colour could cultivate interest.

Finally, the findings of my study indicate that when a teacher becomes aware of a learner with CVD, support can be provided in a twofold way. Firstly, teachers are encouraged to make the necessary accommodations to the extent which is possible; and secondly, teachers should attend to a learner and the required accommodations as discreetly as possible. This can be done, for example by asking the whole class if they can see clearly on

the board, or by inviting all the learners to ask questions during a test regarding the clarity of an illustration. In this way, learners with CVD will not be placed on the spot or feel ashamed when indicating that they require assistance. In addition, the participants in my study recommended that if a teacher is aware of learners with CVD, the teacher should allow the learners to ask peers for assistance with colour-related issues within appropriate boundaries, for example that such interaction should not disrupt the rest of the class.

When interpreting these findings in terms of Vygotsky's sociocultural theory with specific reference to the ZPD, the supportive strategies recommended to teachers involved either a teacher and/or a peer who could be regarded as a more knowledgeable other when considering the identification of colours. To this end, such support by others may enable learners with CVD to perform better in activities that rely on the ability to distinguish colours than what they would otherwise have been able to do.

Based on my findings, and on the participants indicating that they preferred teachers to become aware of their condition only when they required assistance, I argue that CVD may perhaps have had a more significant effect on the participants than what they realised or were willing to acknowledge. Additional research is however required to provide a deeper understanding in terms of this premise.

5.2.5 Primary Research Question: How can teachers support learners with CVD in a classroom context?

Based on the findings of the current study, I posit that the first step towards improving support for learners with CVD, entails the training of teachers to equip them with the required knowledge of the condition and what it implies for learners. If teachers are better informed about what CVD entails, such as that inherited CVD is not curable and that CVD varies in type and severity; and if teachers are aware of the prevalence of CVD, they may understand the statistical probability of teaching a learner with CVD at some time during their teaching career. Once teachers are better informed, they may furthermore be able to better accommodate the needs of learners with CVD in the classroom when the need arises. In addition, knowledge about CVD may enable teachers to identify leaners with CVD at an early stage, and to refer such learners for a formal assessment and diagnosis.

The findings of my study subsequently indicate that learners with CVD in general do not wish to have special attention drawn to them in class as this may create the impression that they require special treatment to be able to successfully complete their academic work. As

such, teachers need to include these learners in classroom activities and attend to their special needs without singling them out or excluding the rest of the class, for example by avoiding the use of colour altogether. It follows that the supportive strategies that are implemented should be beneficial to the whole class and not exclude any learner.

Suggestions for strategies that can be implemented include proper lighting, using a maximum of three contrasting colours in one activity, and avoiding the use of yellow for writing on boards and in presentations. Moreover, to accommodate a learner with CVD, colour images can be replaced with high-quality greyscale images, while the use of colour as the only medium to add meaning or emphasis should be avoided. The findings of my study furthermore suggest that when writing on the board or using an illustration on a worksheet, for example, teachers should often ask questions such as “Can everyone see this clearly?” This will allow learners with CVD to seek clarification without drawing too much attention to themselves. Teachers are advised to also not become impatient or angry when a learner applies colour incorrectly or in an unusual manner.

Finally, if a teacher witnesses any sign of learners with CVD being teased about the CVD, such incidences should be addressed immediately. Adding to this, as the findings of my study indicate a preference by learners with CVD to ask peers for assistance rather than teachers, teachers should allow this and not force a learner to ask a question out loud. As a prerequisite for this, the teacher however needs to be informed about the learner’s condition and the preferred way of coping with the challenges experienced in class. In this way, and on condition that peers who provide support do this in an honest and supportive way, the needs of a learner with CVD can be addressed in class.

Based on these findings, I can conclude that in addition to a learner implementing self-help coping strategies, the other role-players in a classroom setting, namely the teacher as well as peers, can fulfil a supporting role. Such support will align with the Inclusive Education Policy, which requires teachers to accommodate and support learners with special needs, such as those with CVD. In addition, this finding confirms the premise of Bronfenbrenner’s theory that support in one system (teacher/peer support to individuals with CVD) will have an influence on the functioning and development of the individual. It also aligns with Vygotsky’s theory on sociocultural learning, since an inclusive classroom context can enable learners with CVD to learn optimally within a ZPD, while being supported by their peers and teachers when they experience colour-related challenges.

5.3 CONTRIBUTIONS OF THE STUDY

The current study contributes to the existing field of literature on CVD, specifically regarding the way in which it is experienced by individuals with the condition, as well as ways in which leaners with CVD can be accommodated and supported in the classroom. Ongoing research is required to strengthen teachers' understanding of the phenomenon and its implications in terms of the needs of learners with CVD, as well as the best ways to support them in the classroom. To this end, the findings of my study may offer teachers some basic knowledge of CVD in terms of its prevalence and various forms of manifestation. The findings may specifically raise teacher awareness and provide teachers with possible supportive strategies to make their classrooms more inclusive for learners with CVD. When teachers are informed about a learner with CVD, they may better understand the challenges that these learners will generally face and how to assist them in a suitable manner.

In addition to the contributions for theory building and practical application, my study may pave the way for follow-up research that could eventually lead to the South African Department of Education recognising CVD as a special educational need. Such recognition may acknowledge the importance of accommodations for learners with CVD in the general classroom, as required by the Inclusive Education Policy (Department of Education, 2001).

5.4 CHALLENGES AND POSSIBLE LIMITATIONS OF THE STUDY

Qualitative research implies the potential challenge of researcher subjectivity. To avoid this and in support of trustworthiness, I relied on reflexivity, thereby acknowledging the fact that my experiences and preconceived ideas may have influenced my data generation and analysis processes. To this end, I regularly reflected on my experiences and interpretations of the data, and included member checking with the participants.

Another challenge I experienced relates to the participants initially finding it hard to recall the CVD-related challenges they experienced during their primary school years. The interviews mostly started off with the participants indicating that they experienced little difficulty in school apart from some challenges in the Art class. However, as each interview progressed and I asked more specific questions about their experiences in certain subjects, the participants recalled several examples of and relevant information about the challenges they experienced in a variety of school subjects. To this end, I remained cautious not to ask leading questions and risking manipulation of the data. As a result, I repeated the participants' answers, and requested them to confirm that I had understood them correctly. Even though further questioning and prompting may have added even more data, I believe

that the data captured the main ideas based on the participants' contributions, which were integrated when reporting on the results.

A related challenge and potential limitation of the study concerns the participants' inability to readily recall their learning experiences in primary school. They seemed to be focused on their current situations and high school years when recommending potential supportive strategies that teachers could consider. As I did not specifically remind the participants that the recommendations should include primary school experiences, this part of my study can be explored further before coming to final conclusions.

5.5 RECOMMENDATIONS

In this section, I formulate recommendations for training, practice and further research.

5.5.1 Recommendations for training

Based on the findings I made, I recommend that information about CVD, including the different types and severities, its prevalence, and its potential impact on a learner at academic, social, and emotional levels, should be included in the curriculum of all teacher training programmes at tertiary institutions. I also recommend that prospective teachers receive training on how to screen teaching material and adapt those where colour-related challenges may arise, to accommodate learners with CVD. In addition, ways in which to accommodate learners with CVD in the classroom and to ensure that they are able to optimally benefit from the learning experience, should also form part of teachers' training programmes. Finally, future teachers can benefit from guidance on how to adapt the physical classroom space to be inclusive of learners with CVD.

For teachers who already stand in the profession, but have not been trained on CVD as part of their tertiary studies, I suggest in-service training on inclusive classrooms and CVD-related aspects. In-service workshops can, for example, include group discussions where teachers share ideas about feasible ways in which to adapt their classrooms and teaching material to effectively accommodate learners with CVD. In this way, practicing teachers may get the opportunity to generate supportive strategies that can be applied in the school context, depending on available resources.

5.5.2 Recommendations for practice

The supportive strategies recommended for teachers in the current study can be implemented in practice, with the aim of accommodating learners with CVD. In this way,

such learners may better benefit from the learning experiences. The recommendations include those relating to physical classroom space; the use of colour in class, worksheets, textbooks and tests; encouraging peer support, yet also offering guidance where needed; and protecting learners with CVD from bullying and teasing.

In addition, parents of school-going children with CVD can support their children by, for example labelling their children's pens and pencils. Parents should furthermore ensure that the school and relevant teacher(s) are informed of their children's CVD as well as of any related special needs. Finally, the Department of Basic Education may consider adapting existing teaching material (including textbooks) to accommodate learners with CVD with their special needs.

5.5.3 Recommendations for further research

The following future studies are recommended:

- Participatory research with high school learners with CVD to explore their experiences in the various school subjects.
- Intervention research with teachers on the implementation and potential value of supportive classroom strategies for learners with CVD.
- Follow-up case study research involving current primary school learners with CVD, as well as their parents and teachers to identify additional challenges and possible supportive strategies for learners with CVD.
- Participatory research on self-help coping strategies for individuals with CVD.
- Follow-up research on the significance of the impact of CVD on learners, pertaining to the short- and long-term effects of CVD on their emotional and social functioning.

5.6 CONCLUDING REFLECTIONS

In this study, I explored the school-related experiences of individuals with CVD as well as their suggestions for supportive strategies that teachers may implement to assist learners with CVD in class. The findings of my study indicate that the participants mostly relied on self-developed strategies to cope in the classroom, and would only ask for help from their peers or teachers when necessary and without drawing unwanted attention to themselves. As a result of the way in which the participants adapted and learned how to cope without strongly relying on others, they seemed to hold the view that during their primary school years, CVD did not have a significant impact on their scholastic performance, or their social

and emotional functioning. However, when prompted further, they recalled a range of challenges that they did experience in various school subjects.

The participants made practical and universal recommendations for teachers to support learners with CVD bearing in mind the various types and severity of CVD. They specifically recommended strategies that could accommodate learners with CVD without excluding or hindering the learning experience of learners with normal colour vision. These recommendations can be easily implemented at no additional cost and with little extra effort, as they mostly entail minor adjustments to lesson plans and/or teaching material for the entire class, instead of creating separate learning material for the learner with CVD. Equipping teachers with knowledge on CVD and providing them with ideas for supportive strategies, may promote awareness about learners with CVD, with the potential of more efficient support for such learners within an inclusive education system.

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APPENDIX A: INFORMED CONSENT AND ASSENT

CONSENT LETTER

Adult Participant

Strategies for teachers to support learners with colour vision deficiency

Dear Research Participant

My name is Anneke Louw and I am currently doing my MEd study in Educational Psychology through the University of Pretoria. As part of the requirements for completing the degree, I will be conducting a research study to explore possible supportive strategies for teachers who have learners with colour vision deficiency in their classrooms. I would like to invite you to participate in my study.

Please note that the participation in this study is voluntary and you may withdraw from the study at any time. In such a case, please notify me of your decision to withdraw. You will not be penalised should you choose to withdraw. Your participation in this study will consist of one face to face semi-structured interview lasting 45 to 60 minutes with you at a place, date, and time of your choosing and, being able to withdraw at any time, you may also refrain from answering any question(s) you may find uncomfortable to answer. Your interview will be recorded using a digital voice recorder and transcribed into a written format thereafter.

You will not be exposed to any risk or harm in the study. The discussions held will be recorded to assist me with compiling the necessary research report. Your information will be kept confidential and no one other than the research supervisor and myself will have access to the information that you contribute to and your information will be stored at the University of Pretoria for 15 years. Your identity will be kept confidential, and your name will not be included in the final report, instead a Pseudonym will be used to protect your identity. You will not be subjected to any acts of deception or betrayal in the research process or its published outcomes. I will furthermore also inform you about any changes in the study that may affect you in any way. Additionally, I cannot promise any type of reward for participating in the research study. It is completely of a voluntary nature.

If you feel psychologically vulnerable from the semi-structured interview in any way, please inform me so I can arrange for the appropriate support. Before completion of the study, I will refer to you for comments on the draft created of our interview, ensuring that you agree with that which forms part of the data.

I would also like to request your permission to use your data, confidentially and anonymously, for further research purposes, as the data sets are the intellectual property of the University of Pretoria. Further research may include secondary data analysis and using the data for teaching purposes. The confidentiality and privacy applicable to this study will be binding on future research studies.

Once the study is completed, a summary of the results will be emailed to you on request.

Should you agree to partake in the study, our interview will take place at a setting convenient for you. Due to the ongoing Covid-19 pandemic, strict safety guidelines will be in place, i.e. keeping a social distance, wearing a face mask, and sanitising hands and surrounding surfaces. Should you feel uncomfortable to attend the interview in person or the country returns to a level of lockdown prohibiting us to meet in person, the interview will take place online via a password protected Zoom meeting.

Please do not hesitate to contact myself, my supervisor, Professor Ronél Ferreira (ronel.ferreira@up.ac.za) or the Faculty of Health Sciences Research Ethics Committee (012 356 3084; www.up.ac.za/healthethics) should you have any questions or concerns regarding your participation in the research.

Yours sincerely,

_____

Anneke Louw

Researcher

apieterse101@gmail.com or 071 2166 346

DECLARATION AND SIGNATURE FOR INFORMED CONSENT

I, _____, declare that I have read and understood all the above and hereby consent to participate in the study.

_____

Signature of research participant

INFORMED ASSENT

Minor Participant

Strategies for teachers to support learners with colour vision deficiency

Dear Research Participant

I am currently busy with my MEd study in Educational Psychology at the University of Pretoria. As part of my degree, I am conducting research on possible supportive strategies for teachers of learners with colour vision deficiency. I herewith invite you to participate in this research study.

If you agree, I will conduct one face to face semi-structured interview of 45 to 60 minutes with you at a place, date, and time of your choosing during which you may choose not to answer any question(s) that you feel uncomfortable with. The interview will be audio-recorded and transcribed verbatim into a written format after the interview has been completed.

Participation is voluntary and you may thus withdraw from the study at any time, without being penalised. You will not be exposed to any risk or harm during the study and all the information that you share will be kept confidential and stored at the University of Pretoria for 15 years. I will not reveal your name in the final report, instead a Pseudonym will be used to protect your identity.I will furthermore, inform you about any changes in the study that may affect you in any way. You will not receive any reward for participating in the study.

I would also like to request your permission to use the data I obtain for further research purposes, in a confidential and anonymous way, as the data belong to the University of Pretoria. Further research may include secondary data analysis and using the data for teaching purposes. The confidentiality and privacy applicable to this study will also be binding on future research studies.

Should you agree to partake in the study, our interview will take place at a setting convenient for you. Due to the ongoing Covid-19 pandemic, strict safety guidelines will be in place, i.e. keeping a social distance, wearing a face mask, and sanitising hands and surrounding surfaces. Should you feel uncomfortable to attend the interview in person or the country returns to a level of lockdown prohibiting us to meet in person, the interview will take place online via a password protected Zoom meeting.

Please do not hesitate to contact myself, my supervisor, Professor Ronél Ferreira (ronel.ferreira@up.ac.za) or the Faculty of Health Sciences Research Ethics Committee

(012 356 3084; www.up.ac.za/healthethics) should you have any questions or concerns regarding your participation in the research.

Yours sincerely,

_____

Anneke Louw

Researcher

apieterse101@gmail.com or 071 2166 346

DECLARATION AND SIGNATURE FOR INFORMED CONSENT

I, _____, declare that I have read and understood all the above and hereby consent to participate in the study.

_____

Signature of research participant

INFORMED CONSENT

Parent of Minor Participant

Strategies for teachers to support learners with colour vision deficiency

Dear Parent

I am currently busy with my MEd study in Educational Psychology at the University of Pretoria. As part of my degree, I am conducting research on possible supportive strategies for teachers of learners with colour vision deficiency. I herewith kindly request your consent to include your child as participant in this research study. Your child's participation will involve one face to face semi-structured interview of 45 to 60 minutes with him/her at a place, date, and time of his/her choosing during which he/she may refrain from answering any question(s) that he/she may feel uncomfortable with. The interview will be audio-recorded and transcribed verbatim into a written format after the interview has been completed.

Please note that participation is voluntary and that you may thus withdraw your child from the study at any time, without you or your child being penalised. Your child will not be exposed to any risk or harm during the study and all information shared will be kept confidential and stored at the University of Pretoria for a duration of 15 years. Your child's identity will be kept anonymous and his/her name will not be included in the final report, instead a Pseudonym will be used to protect his/her identity. I will furthermore inform you as well as your child about any changes in the study that may affect either one of you in any way. No type of reward will be provided for participation in the study.

My research is not of such a nature that any injuries are foreseen. However, should your child feel vulnerable in any way during or after the interview, I will arrange the appropriate support. Before completion of the study, I will invite your child to make comments on the draft created of our interview, to ensure that he/she agrees with the information shared.

I would also like to request your permission to use the data obtained for further research purposes, confidentially and anonymously, as the data sets are the intellectual property of the University of Pretoria. Further research may include secondary data analysis and using the data for teaching purposes. The confidentiality and privacy applicable to this study will also be binding on future research studies.

Once the study is completed, a summary of the results will be sent to you on request.

Should you agree to partake in the study, our interview will take place at a setting convenient for you. Due to the ongoing Covid-19 pandemic, strict safety guidelines will be in place, i.e., keeping a social distance, wearing a face mask, and sanitising hands and surrounding surfaces. Should you feel uncomfortable to attend the interview in person or the country returns to a level of lockdown prohibiting us to meet in person, the interview will take place online via a password protected Zoom meeting.

Please do not hesitate to contact myself, my supervisor, Professor Ronél Ferreira (ronel.ferreira@up.ac.za) or the Faculty of Health Sciences Research Ethics Committee (012 356 3084; www.up.ac.za/healthethics) should you have any questions or concerns regarding your participation in the research.

Yours sincerely,

_____

Anneke Louw

Researcher

apieterse101@gmail.com or 071 2166 346

DECLARATION AND SIGNATURE FOR INFORMED CONSENT

I, _____, declare that I have read and understood all the above and hereby consent that my child may participate in the study.

_____

Signature of parent of research participant

APPENDIX B: INTERVIEW SCHEDULE

- When did you first discover that you might have trouble discriminating between certain colours?
- Which colours do you find difficult to discriminate between?
- Have you been formally diagnosed with colour vision deficiency (CVD)?
- How did you experience the classroom as a learner with CVD? Did you experience any specific difficulties?
- Would you say your CVD impacted your learning and achievement at school level?
- Which strategies, if any, were implemented by your teachers to support you in class both academically as well as on a social and emotional level?
- How was the classroom physically adapted to attend to your needs?
- How did the implementation of these strategies and adaptions impact your learning experiences and performance?
- Did you feel comfortable asking your teacher for support in the classroom?
- Which intervention strategies will you recommend for teachers who work with learners with CVD learners in their classes?
- Were your classmates helpful and did you feel comfortable asking them for support?
- How did you experience the social and emotional side of your school career?
- Is there anything else you would like to add which you think might also contribute to my study?

APPENDIX C: EXAMPLE OF TRANSCRIBED AND CODED INTERVIEW

My interview with Participant 1 serves as an example of how I analysed each interview. All analysed interviews can be viewed on the flash disk submitted with my mini-dissertation.

Research event: Interview with Participant 1

Place: Participant's place of work: Pretoria Eye Institute, Arcadia, Gauteng

Date: 1 December 2020

RESEARCHER: Good morning, thank you very much for agreeing to do the interview with me, I am going to start and ask you when did you first discover that you might have trouble discriminating between colours?		
PARTICIPANT 1: It is quite hard to say the exact age, I think it was like grade 6 or 7. My dad is colour blind also, I don't know what colours he can't see, but me and my sister, we just said: "I don't know if it's yellow or orange." It is difficult for me to see, and then in Art where you had to do colouring-in and all of that stuff, it was quite difficult for me so I would ask my friend: "Which colour is yellow? Which colour is red, purple, or blue?" I think it was about grade 6 or 7.	Cause of condition: Inherited from father who also has CVD Discovered how: • Difficulty distinguishing between yellow and orange (possibly at home?) Activity unclear • Could not distinguish colours when colouring in Art Peer support: Asked friend for help Age of discovery: Grade 6 or 7	ST1.3 ST1.2 ST1.2 ST3.3 ST1.1
RESEARCHER: You couldn't see then which colours you are struggling with, but you knew you were struggling, with certain colours? So, the colours you found difficult, just to recap it was yellowish?		
PARTICIPANT 1: Yellow, red, green, and sometimes also blue and purple, sometimes black and grey, it is also hard to see light pink and white, so to me it's all the colours that look alike, but other people can see a clear difference.		
RESEARCHER: Grade 6 and 7 is quite young for you to realise that, did somebody formally diagnosed you with it?		
PARTICIPANT 1: My dad is colour blind also, I think he is diagnosed with it, but me and my sister just got it, like my younger sister, she doesn't have it, it is just me and my older sister that have it. When we told my mum "That's purple", she was like "No, that is blue."	Cause of condition: Inherited (from father) Not formally diagnosed	ST1.3

RESEARCHER: Interesting. Then, going into a classroom, how was the classroom for you, as someone with colour blindness?		
PARTICIPANT 1: I don't know, it wasn't like it had a big impact on me. I always joke about it with my friends. They would say: "No, that is not the correct colour" and I am like "Okay" and just carry on, so it wasn't that difficult for me to work with it, so it didn't have a big impact, even now it is not that big a deal for me, I can see the difference, I can see that that's the wrong colour, then my mum is like "No."	General/overall experience of low impact of having CVD Self-help coping strategy: Joke about it with friends, i.e. humour Parent support: Mom corrected her when mistake related to colour was made	ST2.1 ST3.1
RESEARCHER: So, you didn't have difficulty with schoolwork, not at all, in any of your textbooks or anything like that?		
PARTICIPANT 1: No, maybe like biology or something, when they included pictures or something, and the teacher said: "Look at the red part" and I thought to myself, well it's pink to me, then it must be red, and I just went with that. So, kind of learn which colour, you can't see and then you just work from there.	Effect on scholastic/ learning: Sometimes struggled with biology (images) Self-help coping strategy: learn which colours you have trouble seeing and which colours appear closest to those colours to you.	ST2.2 ST3.1
RESEARCHER: Then writing on the board? I know some people struggle with certain colours on the whiteboard. Do you?		
PARTICIPANT 1: Oh yes, I think when the teachers write with yellow on the whiteboards, I can't see, I then ask them if they can please use a different colour, because I can't see what they are writing on the board. Sometimes like a light blue, or the normal blue is difficult to see.	Difficulty seeing on whiteboard with colours: yellow and light (and other) blue. Possible Teacher support: Ask teacher to write with a different colour	ST.2.2 ST3.3
RESEARCHER: Interesting, and then do they listen to you? Do they change the colours?		
PARTICIPANT 1: Sometimes.	Teacher support: Sometimes switched colours when asked	ST3.3
RESEARCHER: Did you tell your teachers that you were colour blind?		
PARTICIPANT 1: A few of them, when I told them I am colour blind and I can't see, they said "Oh" and they switched to another colour later.	Teacher support: Sometimes switched colours used when asked	ST3.3
RESEARCHER: That is nice.		
PARTICIPANT 1: But not like, because I didn't tell them from the beginning, just when I couldn't see something, I would say "I am colour blind, I can't see what you're doing".	Informing teachers: Not from the start, only when she had trouble seeing colours	ST3.2

I played netball from grade 1, and then you do certain practices where the coaches used different crayons to draw on the floor, to test with them, and I didn't know which colour was which and they would say: “run to the yellow” for example, and I would be like “which one is yellow?”	Impact on sports (Netball): some trouble seeing colours drawn on the floor during practice	ST2.3
RESEARCHER: And then, how did they help you out?		
PARTICIPANT 1: The other girls were like always screaming “It's red. It's green.”	Peer support: Teammates helped her out during practice	ST3.3
RESEARCHER: And the coaches? Did they make any exceptions for you?		
PARTICIPANT 1: No, it is not that big of a deal in netball really, it's like the flash colour cards, and you do something, and they tell you, “Look out the time you got, the colour you see” then I would say the wrong colour, and they would be like “No.” Then they are just, “No it is fine, you can say what you see.”	Didn’t get in trouble with coaches if she named the wrong colour	ST3.3
RESEARCHER: So, they were accommodating?		
PARTICIPANT 1: Yes.		
RESEARCHER: But it doesn't sound as though it was a big deal for you, or still isn't a big deal, or something you are self-conscious about?		
PARTICIPANT 1: No I think it is, unique kind of, I sometimes argue with people, about the colour they see and the colour I see, so if they say that chair is green or grey or whatever, and I say “No it's green”, and they go “It’s not green, it's grey”, and I say “No, no, no, no, no it's green.”	Effect on social/emotional: Makes her unique, seemingly no negative impact on self-esteem	ST2.3
RESEARCHER: Okay, so this chair is green.		
PARTICIPANT 1: It looks kind of green, yes, what do you see?		
RESEARCHER: Grey, but I can also see a green tone to it but grey, more grey than green. And the rest of the chair?		
PARTICIPANT 1: Remains silver. I can see.		
RESEARCHER: Silver and gold you can see?		
PARTICIPANT 1: Yes, that is clear to me. Like rose gold and gold, I can't see the difference between those.		

RESEARCHER: Interesting, with regards to academic learning achievements, do you think it had any impact?		
PARTICIPANT 1: No, not really.	Effect on scholastic / learning: According to her it did not impact performance at school	ST2.2
RESEARCHER: Did you struggle, with learning in the sense that some things took longer, because it wasn't certain colours or, you weren't sure about the colours or something like that?		
PARTICIPANT 1: I think so, like in Biology and those subjects where they put pictures of certain things. For example, I had Hospitality and when there were pictures in the textbook and it was different layers of something, or the difference between two plates of stuff, then it was kind of hard for me but it didn't have a big impact in the sense that my marks went down.	Struggled with studying subjects e.g., Biology and Hospitality: images involved No negative impact on scholastic performance	ST2.2 ST2.2
RESEARCHER: I just wanted to ask that, the marks, you don't feel like you did worse because of a colour blindness? Did it take you longer to study?		
PARTICIPANT 1: It took me longer and it was harder to study, but it didn't bring down my marks or anything.	Studying took longer, BUT no negative impact on marks (scholastic performance)	ST2.2
RESEARCHER: And the teachers, and the classroom and everything, did they make any exceptions, or adaptions to accommodate you?		
PARTICIPANT 1: Because my colour blindness isn't so bad, I didn't struggle so much, I told you with the whiteboard and the yellow marker or green or red or whatever, I just told them I can't see the yellow marker, and then they switch to another colour. Like my friends and stuff, my classmates, nothing really, we always made a joke about it, so it wasn't like the classmates had an impact on it or anything.	When asked, teachers accommodated her (e.g., switching to different marker when she told them that she couldn't see)	ST3.3
RESEARCHER: Then, it seems like you felt comfortable asking for support in the sense that when you couldn't see, then you asked the teacher?		
PARTICIPANT 1: It was like a kind of joke to me, I see it as a joke because, it is funny to me that I can't see the difference between colours. So, I would ask the teacher: "Can you switch to yellow? I am colour blind, I can't see yellow" and she would be like "Oh, okay." and we would just laugh about it.	Felt comfortable asking teacher for help/accommodation Teachers switched colours when asked	ST3.2 ST.3.3
RESEARCHER: That is amazing. So, it seems to me like nobody had to make major changes in your classroom or		

your textbooks, it just took you longer to study, but it didn't reflect on your marks as such. And you felt comfortable asking. So now, with regards to recommendations, is there anything else you would recommend to teachers, in a classroom? In Primary and/or High School that they can do from their side? **PARTICIPANT 1:** If the student tells the teacher, like with me I can't see on the whiteboard, don't use yellow anymore. If it is on a chalkboard, it is different, because then the yellow pops out, so don't use colours that can blend in easily. And what else? Pictures in the test, that is quite important, if the pictures are blurry or the colours are mixed with each other, that is not good, they should make sure the pictures in a test are clear. Because I struggled with that in tests if the pictures were not clear enough for me. **RESEARCHER:** What would you say they must rather do? Use black and white pictures? **PARTICIPANT 1:** Black and what pictures would be better. **RESEARCHER:** Okay. **PARTICIPANT 1:** I just think, like that is the only thing that I struggled with what the teachers can do better with. Use clear black and white pictures, not blurry black and white. **RESEARCHER:** Why not blurry? **PARTICIPANT 1:** Because it is difficult then. And then just don't use colours that can blend in easily when they are written with. **RESEARCHER:** You said it took longer to study, so do you think there is anything in the textbooks that can be changed so that you could study just as quick as the next person? **PARTICIPANT 1:** I don't know exactly, a textbook is like mass produced, so it's not like you can go to the producer and tell them “Okay, there's one colour blind child in the school, you need to change the whole book.” So, I think if that child can just summarise their own work, in the way that he wants to study, in the way that he wants to see a picture. And it will be easier for them, but sometimes that	• Change colour of marker used if asked • Don’t use colours together which blends easily • Ensure images included in tests are not blurry and colours are not blended Struggled in tests if pictures were not clear Use black and white pictures Use good quality black and white pictures Don’t combine colours which blends easily	ST3.4 ST3.4 ST3.4 ST2.2 ST3.4 ST3.4

also takes time. I don't really know; I can't think of anything that can make it's quicker.		
PARTICIPANT 1: If there are changes made, it is going to be difficult for the people that isn't colour blind, for them to be compensated with the colour blind people textbooks. So, it is going to be difficult for normal people to understand how we see it then. Because every colour blind person is different, with men it is, green and red, they switch completely, so you can't make everything that's green, red in the textbook for them, because then it's going to be a huge, huge mess.	No recommendation for changing textbook, not worth it for only one learner with CVD and cannot accommodate all types of CVD	ST3.4
RESEARCHER: Okay, but maybe from the teachers side they can make sure that their worksheets…	Parents or child should inform teacher that they are colour blind and what colours they have difficulty with	ST3.2
PARTICIPANT 1: They (teachers) can make sure that, when a child comes to them, or the parents come to them from the beginning to say: "My child is colour blind, he can't see this, this, and this," then they need to make certain that they don't use those colours. Or when they do use it, they can tell us, "Okay this is green, that is blue", let them be certain of which colours they are using.	Teachers should keep this in mind and either not use the specific colour(s) or tell the learners which colours are which	ST3.4
RESEARCHER: Then on a social and emotional level, I know you mentioned a little bit about sport, but is there any other way that CVD influenced your school career?	General/overall effect seemingly insignificant	ST2.1
PARTICIPANT 1: Like I said before, this whole colour blind thing is really funny to me, I can see how big of an impact it can have on certain people, but with me, I am chilled about it. I think it is kind of unique. I don't really care that I am colour blind, I can always joke about it, my sport and everything we laugh about it, so at school I didn't really care that I was colour blind. It was more like a funny thing for me to have because you can always just joke about it.	May even be positive impact on emotional and social functioning – Adds uniqueness to self-concept Self-help coping strategy: joke about it (Humour)	ST2.2 ST3.1
RESEARCHER: Is there anything else that you think is useful, that you can contribute? In terms of teachers and support in the classroom for those kids?		
PARTICIPANT 1: I think with small children it is important that the teachers help them. I didn't realise at a young age, like grade 1, that I was colour blind, but if a child knows or the parents know, they need to tell the teacher, the teacher will need to compensate in everything they do, to make certain that the child understands which colour he is using, and they can put a sticker on his markers. So, they need to be made aware and help them, because otherwise it is going to make it difficult for them.	If teachers find out young child in their class is colour blind, they must assist as much as possible by e.g., making sure they are using the right colours (easy to read) and labelling the colours	ST3.2 ST3.3 ST3.4

RESEARCHER: But for you it wasn't difficult when you were young. So, you just got by and never realised you're colour blind? **PARTICIPANT 1:** No, not till grade 6 or 7. **RESEARCHER:** So, you didn't do anything wrong and colour in the wrong colour in pictures for example?	Parents should make teachers aware as soon as they know	
PARTICIPANT 1: I did that in art, I used weird colours or something and people looked at it and said: "That is not the correct colour for what you are colouring in." and I'd say: "Oh, I thought it was". With clothing and stuff, I would say: "these match" and my Mum goes: "No, that's green shoes with a pink t-shirt and it doesn't work." **RESEARCHER:** So she helped you at least. Would you suggest that every child do a colour blind test when they enter school? **PARTICIPANT 1:** That is not a bad idea, it is actually a good idea. **RESEARCHER:** Okay, so rather that than figuring it out along the way?	Sometimes used wrong colour in art class General experience - Matches odd colours from wardrobe sometimes (social functioning?) Online test upon entering school for early diagnosis	ST2.2 ST2.1 ST2.3 ST3.4
PARTICIPANT 1: It is better to know earlier on, so that you can start learning what the correct colours are, before you struggle when you are older, and people tell you that that is not correct, or you get in trouble or lose points or something like that.	Early diagnosis better	ST3.2 ST3.3 ST3.4
RESEARCHER: So, you never lost marks at school for using the wrong colours that you can remember? **PARTICIPANT 1:** No, not that I can remember. **RESEARCHER:** Okay, my last question, how is your studies now? Have you experienced any difficulty related to CVD?	Didn't lose marks because of colour	ST2.2
PARTICIPANT 1: I think the thing is, I am so used to being colour blind, it doesn't matter to me that much, I don't really see it anymore, when I'm working with colours and stuff, I just use what I want, and if it's wrong later I don't really care. It doesn't impact me that much anymore. **RESEARCHER:** Okay, cool, then I think we have everything.	General experience of low impact Self-help coping: Used to having CVD, no impact on after school studies	ST2.1 ST3.1

APPENDIX D: EXAMPLE OF ANALYSED FIELD NOTES

An excerpt from my field notes is provided as hard copy. All analysed field notes can be viewed on the flash disk.

Research event: Interview with Participant 4

Place: Participant's place of work: Floraland, Bredasdorp, Western Cape

Date: 15 January 2021

• This interview was about 2 to 3 times as long as the 1st 2 interviews. • The participant shared a lot of information and a lot of details about various aspects of CVD that is not necessarily relevant to the study, BUT I found that the more he shared about things he read or heard, the more it also triggered memories of experiences with him that he then shared which was more relevant to the study. • It was awesome to hear about and see his workplace and realise that the kind of work he does, even though it has to do with drawing, is not limited by him having CVD. • Participant seemed confident and openly shared both positive and less positive experiences related to having CVD in the school context. • He came across as unbothered and unaffected by having CVD and was very comfortable to talk about the topic without becoming upset or emotionally triggered at any point during our lengthy interview. • I could bounce certain suggestions off the participant and he did not hesitate to disagree if he felt it necessary or correct me if I misunderstood or misinterpreted something he said.	General experience of having CVD Self-help coping – do research for understanding the condition No notable emotional impact of CVD evident in the manner of and experiences shared by participant Recommendations *NB to keep in mind viewpoint of the learner Further research NB	ST2.1 ST3.4 ST2.3 ST3.4

APPENDIX E: EXCERPT FROM REFLECTIVE JOURNAL

An excerpt from my reflective journal is provided as hard copy. My full reflective journal can be viewed on the flash disk.

Journal entry date: 2 December 2020

• I conducted my 3rd interview today with a 2nd year student. • His mom said she will be joining our conversation as she may be able to also share some insight into her son's experience of CVD and her brother (P3's maternal uncle) has CVD. I was initially a bit concerned that her presence would make the participant's responses less authentic. • It was interesting for me to have the mom part of the interview, she was opinionated and disagreed with her son regarding one or two of his recollections especially regarding his experience with Art as subject in Primary School. They did, however, end up in agreement about the specific topic. His mom mentioned in the interview that she spoke to his Art teacher – it seemed that this was the only instance where parent involvement was mentioned but no other parent joined an interview so it might have been a different situation then, although participants mostly gave the impression that they did not prefer teachers being informed about their CVD, by themselves or a parent, unless they deemed it necessary. • It helped that he was also opinionated and certain about his recollections and didn't seem like he was withholding information because his mom was present, so I am certain that it was still an authentic and reliable interview in that sense. • I noticed that there were many topics he did not raise himself when answering questions, he most probably didn't think of them, but as the interview progressed and I asked him e.g., how he experienced mapwork at school, he recalled that he had some difficulties with that. • He also recalled some information he heard from peers who took certain subjects that he did not have, e.g., Tourism. So he shared how he think he would have experienced it as someone with CVD. • He struggled with some activities in Afrikaans and English which he admittedly did not recall at first. • He was well-spoken and mentioned numerous social activities, participation in a number of sports, and serving on the matric council of his school. He came across as someone with a healthy self-esteem. • He mentioned one incident where someone tricked him in Primary School using colours, but he did not seem upset or dwell on the incident upon sharing it.	Process of discovery Causes of the condition Effect of having CVD on learning Teacher was informed and could thus make accommodation Manner in which teacher should be informed – Learner's discretion NB Possible indication of low overall impact Effect on learning (mapwork) Effect on learning (Tourism) Effect on learning (Afrikaans and English) No evidence on negative effect on social and emotional functioning Social – some teasing in primary school – impact seemingly not big/negative	ST1.2 ST1.3 ST2.2 ST3.2 ST3.3 ST3.2 ST3.3 ST2.1 ST2.2 ST2.2 ST2.2 ST2.3 ST2.3

APPENDIX F: INCLUSION AND EXCLUSION CRITERIA

Table F.1: Inclusion and exclusion criteria for Theme 1

Theme/Sub-theme	Inclusion criteria	Exclusion criteria
Theme 1: Participants' discovery of being colour vision deficient (CVD)	All data related to participants' discovery of being colour vision deficient.	All data not related to participants' discovery of being colour vision deficient.
Sub-theme 1.1: Age of discovery	All data related to participants' ages upon which being colour vision deficient was discovered.	All data not related to participants' ages upon which being colour vision deficient was discovered.
Sub-theme 1.2: Process of discovery	All data related to the process through which participants discovered that they had CVD.	All data not related to the process through which participants discovered that they had CVD.
Sub-theme 1.3: Causes of the condition	All data related to possible causes of the condition occurring with each of the participants respectively.	All data not related to possible causes of the condition occurring with each of the participants respectively.

Table F.2: Inclusion and exclusion criteria for Theme 2

Theme/Sub-theme	Inclusion criteria	Exclusion criteria
Theme 2: Effect of being colour vision deficient	All data related to the effects of being colour vision deficient on participants.	All data not related to the effects of being colour vision deficient on participants.
Sub-theme 2.1: General experience of being colour vision deficient	All data related to the participants' general experiences of being colour vision deficient.	All data not related to the participants' general experiences of being colour vision deficient.
Sub-theme 2.2: Effect on learning and scholastic performance	All data related to the effect of having CVD on the participants' learning and scholastic performance.	All data not related to the effect of having CVD on the participants' learning and scholastic performance.
Sub-theme 2.3: Effect on social and emotional functioning	All data related to the effect of having CVD on the participants' social and emotional functioning.	All data not related to the effect of having CVD on the participants' social and emotional functioning.

Table F.3: Inclusion and exclusion criteria for Theme 3

Theme/Sub-theme	Inclusion criteria	Exclusion criteria
Theme 3: Coping with CVD in the school context	All data related to how the participants coped with CVD in the school context.	All data not related to how the participants coped with CVD in the school context.
Sub-theme 3.1: Developing self-help coping strategies	All data related to the self-help coping strategies developed by the participants with CVD.	All data not related to the self-help coping strategies developed by the participants with CVD.
Sub-theme 3.2: Importance of teachers being informed	All data related to the importance of teachers being informed about CVD.	All data not related to the importance of teachers being informed about CVD.
Sub-theme 3.3: Support from teachers and peers in class	All data related to support from teachers and peers in class.	All data not related to support from teachers and peers in class.
Sub-theme 3.4: Recommendations for teachers to support learners with CVD	All data related to recommendations for teachers to support learners with CVD.	All data not related to recommendations for teachers to support learners with CVD.