

The use of technology to minimise learning barriers for learners with cerebral palsy

By Soené Botha

Submitted in partial fulfilment of the requirements for the Degree
Magister Educationis in the Faculty of Education, University of Pretoria

Supervisor

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DECLARATION

I declare that the dissertation, which I hereby submit for the degree of Magister Educationis 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.

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ABSTRACT

Learners with CP experience many barriers to learning in the classrooms. Due to these barriers, learners are often deprived of quality education. These barriers may be minimised with the use of ATs. This study aims to explore how ATs can be used to minimise the barriers to learning that learners with CP experience in the classroom. Specifically, it investigates how ATs can be integrated into special needs education and how meaningful ATs are used in lessons to minimise learning barriers for learners with CP.

A qualitative research design and semi-structured interviews were chosen to gain knowledge about the personal experiences of participants.

The semi-structured interviews were conducted with learners and educators at an LSEN school catering for learners with CP in the Gauteng area.

The TPACK and SAMR models were chosen as theoretical frameworks to interpret the findings. The findings showed that learners do experience many barriers to learning in the classroom but with the use of ATs by learners and educators, these barriers can be minimised. ATs can be integrated into the pedagogy of educators and the content in many ways.

Recommendations include more training for learners and educators on the use of ATs and a more supportive environment. More research is also needed on the training programs needed to educate learners and educators on ATs and how educators can use ATs to bring about transformation in their lessons.

Keywords: Cerebral palsy, Assistive technology, pedagogy, content, barriers, support

LANGUAGE EDITOR'S DISCLAIMER

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Chapter 1: Introduction and background

This chapter includes a brief introduction to the topic, background of the school, a problem statement, a purpose statement, the research questions and clarification of concepts used in this study. This chapter will also include a concise outline of the methodology that will be used in this study.

1.1 INTRODUCTION

Learners with physical disabilities such as cerebral palsy (CP) experience the educational environment as challenging as a result of the difficulties arising from their condition. CP is a condition that affects communication, muscles, motor coordination, mobility, reflexes, posture, and balance, caused by a brain injury before, at or shortly after birth (Kouroupetroglou, 2013; Stevenson & Waite, 2011). These difficulties result in challenges with writing, engaging in classroom tasks, communicating with the educator and his/her peers, hearing and vision, specific subject tasks, extra-curricular activities and being independent in the classroom (Batshaw et al., 2019; Dewey & Tupper, 2004; Landsberg et al., 2019).

These challenges that learners with disabilities experience should be addressed and accommodated to prevent barriers to learning (Landsberg et al., 2019). The Department of Basic Education (2001) states in the White Paper 6: Special Needs Education, that inclusive education can overcome barriers to learning for learners with disabilities. Inclusive education refers to the belief that all learners should be educated regardless of their learning abilities (Bagon et al., 2018).

Assistive technology (AT) offers the opportunity to create an inclusive education system (Emiliani et al., 2011; Starcic, 2010). Over the last decade, AT has made a significant impact on learning and teaching. These impacts can also be seen in special needs education (Chiang & Jacobs, 2010). Without AT learners with disabilities may have trouble with mobility and classroom activities, such as seeing on the board, hearing and reading the textbook, using facilities and interacting with peers (WHO & UNICEF, 2012). Furthermore, AT has the potential to improve academic achievement, simplify learning activities (Chiang & Jacobs, 2010) and enables the educator to adapt his or her teaching to accommodate learners with different abilities (Bagon et al., 2018; Starcic, 2010). Fernández-López, Rodríguez-Almendros and Martínez-Segura (2013)

state that AT enhances a learner's ability to acquire skills and knowledge that is needed to succeed. AT also improves reasoning skills and provides significant learning experiences (Yeni & Gecu-Parmaksiz, 2016, p. 118). It follows that AT may provide learners with physical disabilities the opportunity of fully accessing the curriculum, an opportunity they may not have without AT. Therefore, this study aims to identify the barriers that learners with CP experience in the classroom and how AT can be used to minimise these barriers from the perspective of the educators involved in the education of learners with CP.

1.2 BACKGROUND

This study was conducted at an LSEN (Learners with Special Education Needs) school situated in the Germiston area. The school specialises in the education of learners with physical disabilities such as CP, poliomyelitis, muscular dystrophy, congenital amputation, phocomelia, spina bifida, arthrogryposis, and hydrocephalus.

This school is a boarding school for learners from grade R to eleven. It is open to all cultures and races, as well as income groups. Most learners are from underprivileged backgrounds, but there are learners from middle- and high-income groups.

The hostels can accommodate up to 180 learners. The hostels provide the learners with daily meals, a safe play area, spacious rooms with en-suite bathrooms, and night supervision and care. The play area is equipped with slides, trampolines and jungle gyms.

Each classroom can accommodate up to a maximum of 12 learners per class. The classrooms are equipped with various support (technological and physical) devices to ease learning and teaching. There are class aides assigned to each classroom. These class aides assist educators, as well as the learners. Learner support includes the turning of pages, moving around if a learner is in a wheelchair, etc. There is also a computer centre available for learners.

The school is a state-aided school, which implies that the Gauteng Department of Education subsidises the school. Further funding must be obtained by holding fund-raisers and through donations.

The school makes use of members of the public and professionals such as therapists, a doctor, nurses, educators, and a psychologist to deliver the much-needed services

to these learners. The school also offers speech therapy & audiology assistance, remedial therapy, physiotherapy, occupational therapy and a clinic.

1.3 RATIONALE

1.3.1 Personal rationale

The researcher's nephew had been diagnosed with CP at a young age. He is still in primary school and is experiencing severe difficulties in education such as accessing the curriculum, the use of writing tools, accessing buildings and partaking in physical activities. The researcher has since been searching for ways to ease learning, enabling this boy to actively participate in his academics. In the researcher's opinion, ATs can ease learning and provide the opportunity of some independence in his academic career.

1.3.2 Impact of the study

Education improves the quality of life for learners with a physical disability (Lamichhane, 2013). Furthermore, education provides learners with empowerment, prospects of employment, the possibility of higher education and the opportunity to choose a specific career (Akwasi, 2019). Despite the advantages, learners with physical disabilities "are often deprived of the benefits of quality education" because of the barriers that they experience (Lamichhane, 2013, p. 312).

AT has the potential to minimise these barriers. According to Bagon, et al. (2018) AT creates an inclusive environment, where learning and teaching can be adjusted to suit the different needs of the learners. This adaption provides learners with CP the opportunity to access the curriculum, leading to success in the educational environment. This study could benefit these learners, as well as the educators involved in the education of these learners by providing much-needed information on how to improve the educational environment by using AT. This study could also inform training programmes for educators in LSEN schools and provide curriculum improvements, especially at university level where more learning material on AT in the classroom can be explored.

1.3.3 The gap in the literature

Most studies focus on one type of disability, such as the study conducted by Pennington (2010). Pennington (2010) focused on technology integration to assist

learners with autism spectrum disorder. Research on education and technology integration focuses on learner characteristics (such as computer experience, ability and age), software programs and the effect of learner characteristics on learning with technology (Florian & Hegarty, 2004); such as the study done by Fitzgerald, Koury, and Mitchem (2008) which focused on technology integration and the effects thereof on the learning outcomes of learners with disabilities. The few studies that address barriers to learning for learners with CP did not address the problem in-depth, such as the study of Hasselbring and Glaser (2000), which focused broadly on technology use for learners with special needs. There is a lack of studies on how AT can minimise and address barriers to learning for learners specifically with CP.

1.4 PROBLEM STATEMENT

The researcher aimed to identify the different barriers to learning that learners with CP may experience and how AT can be used to minimise these barriers. Barriers lead to learners not being able to realise their ideal learning potential. Minimising these barriers could lead to improved quality of life for learners with CP.

1.5 PURPOSE STATEMENT

In attempting to fill the above-mentioned gap, this study aimed to explore how AT can be used to minimise the barriers to learning that learners with CP experience in the classroom.

This was done by identifying the Atps currently used and the impact of that technology on the learners, educators and school.

1.6 RESEARCH QUESTIONS

In this regard, this study's research questions were articulated as follows:

1.6.1 Primary research question:

How can assistive technology be used to minimise the barriers to learning that learners with cerebral palsy experience?

1.6.2 Secondary research questions

1.6.2.1 What barriers to learning do learners with cerebral palsy experience?

1.6.2.2 How can assistive technology be integrated into the pedagogy of educators in special needs education?

- 1.6.2.3 How can assistive technology be integrated into the content in special needs education?
- 1.6.2.4 How meaningful is the assistive technology incorporated into lessons to transform or to enhance the lessons?

1.7 RESEARCH DESIGN AND METHODOLOGY OVERVIEW

This study used a qualitative research approach, which included a case study as a research design. This was done from an interpretive ontological stance and socio-constructivist paradigm, which states that multiple accounts of the truth exist and that knowledge is gained through social interaction (Kivunja & Kuyini, 2017; Myburgh, 2013). The data collection methods included semi-structured interviews and field notes. Additional details and an in-depth discussion will be given in chapter 3.

1.8 CONCEPT CLARIFICATION

The key concepts used in this study can be explained as follow:

Assistive Technology (AT)

Liu, Wu and Chen (2013) used the term AT to refer to a range of technological resources that support learning and teaching. In this study, AT refers to any software, such as text to speech, or hardware, such as trackballs and touch screens, that simplifies learning and teaching for learners with CP.

Barrier

The term barrier can be defined as “an obstacle to communication, understanding or progress” (Stevenson & Waite, 2011, p. 110) and causes the exclusion of learners in the education system (Landsberg et al., 2019). In this study, a barrier refers to any factor, physical and cognitive, which prevents a learner from realising his/her ideal learning potential. Examples of physical barriers can be impaired motor function which affects writing, poor posture control which will lead to difficulty controlling a pencil, or poor communication which impacts a learner’s ability to communicate in the classroom (Landsberg et al., 2019; Miller & Bachrach, 2006). Examples of cognitive barriers can be problems with working memory, short attention span, problem-solving and comprehension problems (Cerebral Palsy Guidance, 2020; Jenks et al., 2009; Rosenbaum et al., 2007).

Cerebral Palsy (CP)

CP is “marked by impaired muscle coordination and spastic paralysis, caused by damage to the brain before or at birth” (Stevenson & Waite, 2011, p. 232). This is the most common form of physical disability (Landsberg et al., 2019). In this study, CP refers to a condition that affects muscle control and coordination, body movements and communication.

Inclusive education

Landsberg, et al. (2019) defined inclusive education as “acknowledging and respecting that all learners can learn and that all learners learn differently and have different learning needs, which is equally valued.” (p.20). This definition reflects the definition given by the Department of Basic Education (2001) and Galloway (2007). In this study inclusive education refers to an education system that accommodates all learners regardless of any learning differences.

LSEN school

An LSEN school or Learners with Special Educational Needs school, refers to a school where learners receive specialised education and support (Department of Basic Education, 2001). These schools are specifically designed for learners with disabilities.

Physical disability

Broadly, a physical disability or impairment refers to learners who experience mobility and physical challenges (Landsberg et al., 2019). This includes disorders of the skeleton, joints or muscles, such as CP, epilepsy, muscular dystrophy, arthritis and Spinal Bifida (Kruger & Adams, 1998; Landsberg et al., 2019).

Substitution Augmentation Modification and Redefinition framework (SAMR)

SAMR refers to a model that describes and facilitates the integration of technology into the classroom (Puentedura, 2015). The model can also be used to evaluate and reflect on technology dependence in the classroom.

Technological Pedagogical and Content Knowledge framework (TPACK)

This model describes how educators can coordinate their pedagogy, the content and technology into their classrooms (Mishra & Koehler, 2006). This model is used for effective teaching and learning with the use of technology.

1.9 CONCLUSION

This chapter gave an outline of the study. The aims were described and the concepts were defined. The data collection methods and analysis were briefly addressed and will be discussed in-depth in Chapter 3. A study of relevant literature will be conducted in the next chapter.

Chapter 2: Literature review and theoretical frameworks

2.1 INTRODUCTION

In chapter one, the researcher presented background information and the context of this study. The research questions that guided this study were discussed and an overview of the rest of the study was proposed.

This chapter consists of the literature review and theoretical frameworks. The literature review will attempt to give an outline of knowledge that is available in this field as well as to identify shortcomings in the existing literature. The researcher will make use of the “Technological, Pedagogical, and Content Knowledge model (TPACK)” (Koehler & Mishra, 2009, p. 62) and the “Substitution, Augmentation, Modification, and Redefinition Model (SAMR)” (Puentedura, 2015, p. 2) as theoretical frameworks to guide the research.

2.2 LITERATURE REVIEW

AT provides new opportunities “to improve the quality of life” for learners with disabilities (Lamichhane, 2013, p. 312) by fostering access to the curriculum. To explore the issues surrounding the role of AT in the minimising of barriers to learning for learners with CP in the classroom, a subset of literature has been selected based on its relevance to CP, learning barriers, inclusive education, and AT integration to support learners with CP. The researcher used the following keywords in her search: CP, physical disability, CP and AT, CP and assistive devices, physical disability and AT, physical disability and assistive devices, CP barriers in the classroom, inclusivity and policies on special education needs.

2.2.1 Cerebral palsy

Although the definition for CP continues to develop, change and evolve, Landsberg, et al. (2019) provide the following definition:

“Cerebral palsy describes a group of permanent disorders of the development of movement and posture causing activity limitation that is attributed to non-progressive disturbances that occurred in the developing foetal or infant brain.”
(p. 364).

CP is a disability that affects the physical body. This disability occurs due to damage to the brain prior to, at or shortly after birth (during the early childhood phases of a child's life) (Dewey & Tupper, 2004; Kouroupetroglou, 2013; Stevenson & Waite, 2011). It primarily affects a learner's movement and posture (Landsberg et al., 2019). It is non-progressive in the sense that it is a single event that causes brain damage (Batshaw et al., 2019; Landsberg et al., 2019).

According to Dewey and Tupper (2004), clinical manifestations of CP involves "primitive reflexes, abnormalities in tone, inability to move against gravity, and poor variability of movement" (p.114). Landsberg, et al. (2019) supports this view and further explains that CP is comprised of one or more of the following physical characteristics: paralysis, weakness, difficulty with coordination, difficulty with controlling posture, and difficulty with their motor movements. Furthermore, learners with CP also display difficulties with cognition and communication (Rosenbaum et al., 2007; Van Rooijen et al., 2016).

Comorbid impairments may also exist together with CP. Epilepsy, intellectual impairments, sensory impairments and perceptual impairments are some of the common comorbid impairments (Landsberg et al., 2019). Comorbid refers to a condition where two or more impairments co-occur (Stevenson & Waite, 2011). Visual impairments, hearing impairments, seizures, cognitive deficits, delayed growth, speech and language disorders and psychiatric deficits can also be comorbid impairments (Cerebral Palsy Foundation, 2019; Dewey & Tupper, 2004). Similarly, Landsberg, et al. (2019) proclaimed that "intellectual, convulsive, sensory, perceptual and affective" impairments are common in learners with CP (p. 364). Batshaw, et al. (2019) is of the opinion that communication and behaviour are also affected.

2.2.2 Causes

As stated above, CP can be defined as a physical disability that occurs due to damage to the brain (Dewey & Tupper, 2004; Kouroupetroglou, 2013; Stevenson & Waite, 2011). CP can also occur due to brain malformation during the developmental phases of the brain (CerebralPalsy, 2020). Several events may lead to brain damage before, at or after birth. Some of these causes are discussed below.

There are several risk factors for an unborn child. According to CerebralPalsy (2020) "prenatal disturbance of brain cell migration" and "prenatal poor myelination

(insulation) of developing nerve cell fibres” are events that may lead to brain damage before birth. Brain cell migration is caused by environmental and/or genetic factors that disturb the brain development in the early stages of brain development (CerebralPalsy, 2020; Landsberg et al., 2019). Poor myelination refers to inadequate protection over the nerve cells which is partly responsible for transmissions (CerebralPalsy, 2020). Landsberg, et al. (2019) also suggested the following risk factors for unborn children: multiple births, infections and diseases such as AIDS, sexually transmitted diseases, chromosome abnormalities, biochemical genetic disorders and German measles during the pregnancy.

The birthing process also has risk factors involved. According to CerebralPalsy (2020) “perinatal brain cell death” may lead to brain damage during the birthing process. Brain cell death is caused during the birth process when the brain is starved of oxygen (CerebralPalsy, 2020). This occurs when labour is too long or too abrupt, causing a lack or poor oxygen supply to the baby (Landsberg et al., 2019). The starvation of oxygen is also referred to as asphyxia (Stevenson & Waite, 2011). Fox (2003) and Miller and Bachrach (2006) agree that preterm babies and asphyxia at birth is a common cause of brain damage in young children. Premature babies have a low birth weight which may also lead to CP (Miller & Bachrach, 2006).

Early childhood also has some risk factors. According to CerebralPalsy (2020) “postnatal non-functional or inappropriate connections (synapses) between brain cells” may lead to brain damage. Inappropriate connections between brain cells may be caused by infections, trauma, and asphyxia (CerebralPalsy, 2020; Landsberg et al., 2019). Trauma may include head trauma from “shaken baby syndrome” or no known cause of damage to the head (Miller & Bachrach, 2006, p. 4). In addition, Landsberg, et al. (2019) suggests that trauma may refer to damage caused by motor vehicle accidents and near-drownings. Landsberg, et al. (2019) also suggested the following risk factors for early childhood: infections such as meningitis, haemorrhage, and poisoning.

2.2.3 Types and classification of CP

Classification of learners with CP is possible seeing that CP manifests differently for each learner (Ogoke, 2018). The classification is often difficult seeing that there are

so many different manifestations and classifications which are not comprehensive enough (Ogoke, 2018).

Batshaw, et al. (2019) divided learners with CP into categories based on “physical appearance”, “neurological findings” and “body limbs” that are predominantly affected (p. 431). CerebralPalsy (2020) identified the four most common classification systems: “classification based on severity level”, “classification based on topographical distribution”, “classification based on motor function” and “classification based on gross motor function”. Ogoke (2018), Batshaw, et al. (2019) and Landsberg, et al. (2019) similarly state that CP can be classified in the following ways: clinically, pathophysiologically and topographically, which includes appearance, limbs, severity and motor functioning. These classification systems will be discussed below.

Classification based on the level of severity.

This classification system classifies CP by severity level. These levels include mild, moderate, severe or no CP (CerebralPalsy, 2020; Ferluga et al., 2013). The following table illustrates the severity level classification system.

Table 1: Severity level of CP

Severity	Description
Mild	This level indicates that a learner will be able to move around without assistance and their daily tasks are not restricted.
Moderate	This form of CP indicates a dependency on braces, medications, and AT to complete everyday tasks.
Severe	These learners will need a wheelchair and will experience difficulties with daily tasks.
No CP	This learner shows signs of CP, but the brain damage occurred after the brain is developed. The impairment is then classified under “the incident that caused the cerebral palsy”.

(CerebralPalsy, 2020)

Although this classification system is common, it still lacks critical information about the impairment (CerebralPalsy, 2020). This method is useful when determining the scope of the impairment (CerebralPalsy, 2020).

Classification based on motor function.

This classification provides a guideline and a description of how the body is affected (CerebralPalsy, 2020). It consists of two main divisions: “spastic cerebral palsy” and “non-spastic cerebral palsy” (CerebralPalsy, 2020). Spastic CP refers to an increased muscle tone (CerebralPalsy, 2020). Ferluga et al. (2013) agree and further explains that spastic implies muscles that contract, stiff limbs and muscles that are rigid and resistant to relaxing and flexing. Non-spastic CP refers to decreased muscle tone (Miller & Bachrach, 2006). Ferluga, et al. (2013) extends this explanation by stating that non-spastic CP is marked by involuntary movement, slow or fast movement, repetitiveness and rhythmic movement. According to CerebralPalsy (2020), each division has multiple variations, as well as a mixture of both.

Clinical classification

Learners with CP differ “clinically” with regards to the nature of the impairment, the distribution of the impairment, presence of comorbid disorders and the degree of the impairment (Ogoke, 2018, p. 22). The “clinical classification” of CP entails the “clinical presentation of cerebral palsy” (Dewey & Tupper, 2004, p. 114). These presentations include “spastic cerebral palsy, ataxic cerebral palsy, hypotonic cerebral palsy, and extrapyramidal cerebral palsy” (Dewey & Tupper, 2004, p. 114). Spastic CP includes “increased muscle tone, increased or hyperreflexia and the persistence of primitive reflexes” (Dewey & Tupper, 2004, p. 114). Extrapyramidal CP refers to “a variety of abnormal motor patterns and postures” (Dewey & Tupper, 2004, p. 114). Hypotonic CP refers to a “generalized decrease in muscle tone” (Dewey & Tupper, 2004, p. 114).

Physiological or motoric classification

Physiological classification refers to the type of motor symptoms that are present (Landsberg et al., 2019; Ogoke, 2018). Landsberg, et al. (2019) is of the opinion that there are five subtypes of physiological CP:

a) Spasticity

Spasticity refers to the “abnormal increase in muscle tone resulting from increased resistance to muscle stretch and lengthening” (Batshaw et al., 2019, p. 423). Spasticity is accompanied by weakness in the muscles that work in opposition to the affected muscles (Landsberg et al., 2019). Fox (2003) concluded that voluntary muscle control is also often difficult. Muscles constantly contract which leads to limbs being stiff and resistant to flexing and relaxing (CerebralPalsy, 2020). This may affect learners reflexes and movement (CerebralPalsy, 2020).

b) Dyskinesia

Dyskinesia manifests in one of the following ways:

Athetosis

According to Ogoke (2018), Batshaw, et al. (2019) and Landsberg, et al. (2019) this type of dyskinesia is marked by irregular involuntary movements that do not follow a precise pattern. Learners with athetosis have slow movements and intentional movement of limbs are impaired (Landsberg et al., 2019). In short learners with athetosis have little to no muscle control (Miller & Bachrach, 2006). This often affects a learner’s hands, arms and legs (CerebralPalsy, 2020).

Choreiform movements

This type of CP is marked by excessive, sudden, rapid and random jerking movements (Batshaw et al., 2019; Landsberg et al., 2019) and slow writhing movements (Ogoke, 2018). According to Ogoke (2018), these movements affect the body parts closer to and further from the torso.

Dystonia

Dystonia is marked with repetitive “twisting movements” and “distorted postures” (Batshaw et al., 2019, p. 434). This encompasses the “trunk muscles more than the limbs” (CerebralPalsy, 2020). It is also used to describe slow movements. Dystonia occurs when “there is a simultaneous contraction of both agonist and antagonist muscles” (Ogoke, 2018, p. 25).

Choreoathetosis

Choreoathetosis occurs when athetosis (slow and meaningless movements) and choreoid movements (jerking) happens simultaneously (Batshaw et al., 2019; Landsberg et al., 2019).

c) Ataxia

Ataxia is marked by poor coordination, balance and body posture (Fox, 2003; Landsberg et al., 2019; Miller & Bachrach, 2006). Learners with ataxia are not able to perform regular movements and have poor, or lack fine motor skills (Batshaw et al., 2019; Landsberg et al., 2019). There are no spasticity or involuntary movements involved with this type of CP (Landsberg et al., 2019). According to CerebralPalsy (2020), this affects a learner's walking, eye movement, depth perception and fine motor skills.

d) Mixed types of CP

Learners with CP may experience symptoms of more than one type of classification. This refers to a situation where more than one type of motor pattern is present in a learner, without one symptom being dominant (Batshaw et al., 2019).

Topographical classification

The topographical classification refers to the body parts that are affected by a motor impairment (Landsberg et al., 2019). Ogoke (2018) and Landsberg, et al. (2019) states that the topographical classification can be subdivided into the following categories:

a) Quadriplegia

Quadriplegia involves all four limbs. Learners with quadriplegia experience spasticity in their lower limbs (legs) and athetosis in their upper limbs (arms) (Landsberg et al., 2019). According to Ogoke (2018) learners with quadriplegia experience "equal and severe spasticity of all four limbs" (p. 25).

b) Diplegia

Diplegia also involves all four limbs. Learners with diplegia experience motor impairments in all four limbs, but they experience a greater impairment in the lower limbs (CerebralPalsy, 2020; Landsberg et al., 2019; Ogoke, 2018).

c) Hemiplegia

This occurs when only “one side of the body” is affected (Landsberg et al., 2019, p. 365). According to Ogoke (2018) and CerebralPalsy (2020), this involves impairment in the upper and lower limbs of the same side of the body. Landsberg, et al. (2019) argues that the arms (upper limbs) are more affected than the legs (lower limbs). This also occurs in spasticity (Landsberg et al., 2019).

d) Monoplegia

Monoplegia refers to “one-limb spasticity” (Ogoke, 2018, p. 25). This occurs when only one limb is affected (Landsberg et al., 2019).

e) Triplegia

Triplegia is a rare condition where three limbs are affected (CerebralPalsy, 2020; Ogoke, 2018). Landsberg, et al. (2019) illustrate that triplegia usually occurs in both legs and one arm, but according to CerebralPalsy (2020), triplegia could also refer to one upper limb and lower limb and the face. Landsberg, et al. (2019) also states that this form of CP can be a combination of hemiplegia and paraplegia, or diplegia and hemiplegia.

f) Paraplegia

According to Landsberg, et al. (2019) and CerebralPalsy (2020) paraplegia involves both lower limbs and the lower half of the body are affected. The upper limbs are not affected (Landsberg et al., 2019).

Gross Motor Functioning Classification system

This classification system makes use of five levels of impairment to determine the extent of the impairment (CerebralPalsy, 2020). The levels range from low impairment to high impairment and are determined by age and activities that the child can perform such as head movement, walking, motor skills, etcetera (CerebralPalsy, 2020; Ferluga et al., 2013). Table 2 illustrates the Gross Motor Functioning Classification System (GMFCS).

Table 2: Gross Motor Functioning Classification system (GMFCS)

Severity	Description
GMFCS Level I	This learner walks without limitation.
GMFCS Level II	This learner can walk, but with restrictions such as challenges when walking for long periods and balancing. This learner cannot run, jump and walk as easily as a level I learner. They may also need some assistive devices to ease mobility.
GMFCS Level III	This learner can walk “with adaptive equipment assistance”, but they may require “hand-held mobility” assistance to move around indoors and “wheeled mobility” for outdoors. They can also sit on their own but may need some assistance in some cases.
GMFCS Level IV	They have some mobility when using powered “mobility assistance”. This learner needs assistance with sitting. Their “self-mobility” is limited, and they may need to use a wheelchair.
GMFCS Level V	These learners have severe “head and trunk control” limitations. They need extensive use of assistive technology. They also need to make use of a wheelchair.

(CerebralPalsy, 2020)

2.2.4 Treatment

CP is non-progressive but ever-changing (Landsberg et al., 2019). Ever-changing or “often changing” refers to a situation where a learner improves their condition (Landsberg et al., 2019, p. 364). Similarly, CerebralPalsy (2020) states that a brain injury cannot be healed, but the impairments associated with CP can be minimised. This improvement may occur due to medical treatment and therapy.

Medical treatment includes surgical, paediatric and/or neurological treatment (Landsberg et al., 2019). According to Landsberg, et al. (2019) these treatments include the shortening of muscles, lengthening of muscles or replacement of muscles, supplying prosthetic aids and/or supplying the learner with sedatives, stimulants, anticonvulsive medication, etc. Cerebral Palsy Guidance (2020) acknowledges the value of surgery to reduce the symptoms of CP. Surgery assists learners with reduced muscle spasticity and increased function. According to Cerebral Palsy Guidance (2020) medications are used to reduce symptoms such as uncontrollable movements, seizures and muscle spasms.

Therapy may also be used to improve the living standard of learners with CP. There are many therapeutic options available such as “physical therapy, occupational therapy, recreational therapy, speech and language therapy and behavioural therapy” (Cerebral Palsy Foundation, 2019; Cerebral Palsy Guidance, 2020; CerebralPalsy, 2020). Physical therapy makes use of exercises to improve muscles, coordination, balance, flexibility and motor functions (CerebralPalsy, 2020). Occupational therapy aims to improve upper body functioning by improving mobility and posture (Cerebral Palsy Foundation, 2019). Cerebral Palsy Guidance (2020) agrees that occupational therapy improves a learner’s life by assisting them with everyday tasks. According to the Cerebral Palsy Foundation (2019), recreational therapy involves the use of sport and cultural activities to improve physical and cognitive health. This improves a learner’s quality of life by improving self-esteem, social skills, speech, etc. (Cerebral Palsy Foundation, 2019). Speech and language therapy aid learners by improving their language use and communication skills (Cerebral Palsy Guidance, 2020). Speech and language therapy furthermore improves learners’ speaking abilities, teaches learners new methods of communicating such as sign language, and improves their facial muscle control. The Department of Health Republic of South Africa (2020) is of the opinion that a speech therapist must also work with a dietician to improve feeding and the use of the mouth, jaw and tongue. Lastly, behaviour therapy improves learners’ emotional and behavioural problems (Cerebral Palsy Guidance, 2020). This is done by changing negative behaviour and teaching adaptive behavioural patterns (Cerebral Palsy Guidance, 2020). According to Ferrari (2010), psychotherapy is also important. Psychotherapy is concerned with treating and improving mental health (Stevenson & Waite, 2011). Psychotherapy is specifically

concerned with understanding the disability, self-regulation, self-control, awareness of emotional states, problem-solving and the effects of the disability on everyday tasks (Ferrari, 2010).

According to CerebralPalsy (2020), the main goal of treatment is to improve mobility and control, lessen pain, prevent and manage comorbid disorders, optimize independence, improve social skills and interactions, encourage self-care, optimize learning and provide quality of life. Rosenbaum (2003) is also of the opinion that the goal of treatment should be to “promote function”, “prevent secondary impairments” and increase “developmental capabilities” (p. 972).

2.2.5 Policies on disability in South Africa

There are several policy documents and legislation in South Africa that aim to address the problems of disabilities and the exclusion of these learners in education.

Some of these papers include “the White paper on Education and Training (1995), the South African Schools Act of 1996, the White Paper on an Integrated National Disability Strategy (1997)” (Galloway, 2007, p. 2; Mathopa, 2007, p. 22). The South African Government (2020) extended this list by stating that some of these papers also include the “White Paper on Science, Technology and Innovation (2019)”, “White Paper on the Rights of Persons with disabilities (2016)”, and the “Integrated National Disability Strategy White Paper (1997)”.

The Department of Basic Education (1997) in the National Commission on Special Needs in Education and training (NCESS) suggested principles that need to be adopted to overcome barriers to learning in South Africa (Kokot, 2006, p. 136; Kruger & Adams, 1998, p. 249), such as:

- respect and no discrimination towards any learner
- the “right to quality education” for all learners
- the opportunity for every learner to partake in their education
- the right of every learner to actively participate in the curriculum
- the right of all learners to be provided with the needed support to enable these learners to access the content.

There are also policy documents and legislation in South Africa that aim to integrate technology into education. These documents include the White Paper 6: Special Needs Education (2001) and the White Paper on e-Education (2004). The Department

of Education (2001) states that “information and communications technologies” should be implemented to “accommodate the full range of diverse learning needs” (p.55). The Department of Education (2004) in the White Paper on e-Education aims to make content accessible to learners “with disabilities and barriers to learning” (p. 23).

2.2.6 Barriers for learners with CP

Learners with CP may experience several learning barriers. A barrier refers to “an obstacle to communication, understanding or progress” (Stevenson & Waite, 2011, p. 110) and causes the exclusion of learners in the education system (Landsberg et al., 2019). These barriers can be physical and cognitive.

Physical barriers

According to Miller and Bachrach (2006) learners normally develop four major skills: communication skills, fine motor skills, gross motor skills and social skills. The barriers that learners with CP experience with regards to these skills will be discussed below.

Gross motor skills refer to skills that make use of large muscles, such as sitting, walking, posture and head lifts (Miller & Bachrach, 2006). According to Landsberg, et al. (2019) impaired gross motor functioning may have several implications for education. Impaired gross functioning leads to barriers involving reflexes, posture control, balance in a classroom (Landsberg et al., 2019). CerebralPalsy (2020) agrees that impaired gross motor functioning leads to restricted capability of achieving normal physical tasks, for example, walking, running, balancing, and jumping. Poor posture control and movement may affect learners’ daily functioning and effective performance, seeing that self-care such as eating, washing, bathing and dressing is affected as well as sitting and walking (Van Der Heide et al., 2004).

Fine motor skills involve manipulative skills that require the use of small muscles such as feeding, grasping, reaching, holding writing tools, etc. (Miller & Bachrach, 2006). According to Landsberg, et al. (2019) the use of writing tools such as pens, pencils and keyboards are challenging for a learner with CP. Miller and Bachrach (2006) supports this view and explains that the ability to write legibly may be hindered.

Communication skills refer to verbal and non-verbal capacities of understanding others and expressing oneself (Miller & Bachrach, 2006). Impaired muscle functioning may affect a learners’ speech and communication skills negatively seeing that their facial muscles are affected (Landsberg et al., 2019; Rosenbaum et al., 2007). Fox (2003)

supported this statement by explaining that if learners' facial muscles are affected, a learner may experience barriers in communication and socialisation because they struggle with producing speech and articulation. In this regard, Cerebral Palsy Guidance (2020) argues that learners may also have communication problems due to having slow or slurred speech.

Social skills refer to skills that are needed to communicate with others (Miller & Bachrach, 2006). Learners with CP may experience low self-esteem due to bullying and being perceived as different (Miller & Bachrach, 2006), which may lead to learners not being able to concentrate during class, having lower grades or learners simply dropping out of school (Cerebral Palsy Guidance, 2020). Cerebral Palsy Guidance (2020) indicates that bullies normally target learners with CP or other disabilities due to these learners not being able to defend themselves; they are perceived as "strange", they have a "lower social standing" and they tend to have "meltdowns" making them easy targets. However, according to Landsberg, et al. (2019) prejudice may also be a factor that influences a learner's self-esteem. As stated above a learner may experience barriers in communication and socialisation because they struggle with producing speech and articulation (Fox, 2003; Landsberg et al., 2019). According to Landsberg, et al. (2019), learners with CP are often ignored because people cannot understand them.

Comorbid disorders may also cause barriers to education. Cerebral Palsy Guidance (2020) stated that vision problems may affect how learners see objects, judge distances and visual range. Fox (2003) is also of the opinion that visual processing and visual problems lead to reading problems. Speech problems may develop as a result of hearing difficulties or difficulties with facial muscles (Cerebral Palsy Guidance, 2020).

Cognitive barriers

Learners with CP often experience cognitive learning barriers as well. Several studies indicate that cognitive learning barriers involve problems with numeracy and arithmetic, reading skills, working memory, non-verbal understanding, short attention span, learning and comprehension problems, executive functioning, problem-solving and hyperactivity (Cerebral Palsy Guidance, 2020; Jenks et al., 2009; Rosenbaum et al., 2007; Van Rooijen et al., 2016). Problems with arithmetic skills exist due to a delay

in “the acquisition of counting, subitizing and simple arithmetic operations” (Van Rooijen et al., 2016, p. 736). However, Dewey and Tupper (2004) argue that the barriers differ between the types of CP. In this regard, Dewey and Tupper (2004) also proclaimed that there is a need for research based on the cognitive functioning of learners with CP.

Learners with CP display behavioural problems, such as anger, anxiety, emotional outbursts and depression (Cerebral Palsy Guidance, 2020; CerebralPalsy, 2020). This behaviour may occur due to the learner experiencing learning difficulties or learners feeling “misunderstood” (Cerebral Palsy Guidance, 2020).

These learners also often experience comorbid disorders such as learning disabilities or intellectual impairments (Dewey & Tupper, 2004; Odding et al., 2006). Batshaw, et al. (2019) agrees that learners often develop “disorders of higher cortical function” (p. 426). According to Cerebral Palsy Guidance (2020), more comorbid disorders are attention deficit hyperactivity disorder (ADHD) and attention deficit disorder (ADD). The prevalence of epilepsy is also high among learners with CP (Odding et al., 2006).

2.2.7 Inclusive education for learners with CP

The Department of Basic Education (2001) states in the White Paper 6: Special Needs Education that “learning disabilities arise from the education system rather than the learner” (p. 12). It follows that the principle of inclusion is based on this opinion. Landsberg, et al. (2019) acknowledged this definition, but described inclusive education as the “acknowledgement that all learners can learn, all learners learn differently and have different learning needs, which is equally valued” (p. 20). According to the Department of Basic Education (2001), an inclusive education system refers to a system that:

- recognises the ability of every learner with regards to learning
- recognises that all learners need support
- recognises the diversity among learners
- recognises that each learner has different learning needs
- meets the needs of learners by having accessible structures, systems and methodologies
- includes the community as a form of informal educational structure

- aims to change behaviour, attitudes, teaching strategies, curricula and the educational environment to satisfy learner needs
- optimizes participation in the educational environment
- empowers all learners by allowing learners to develop their strengths.

In short, inclusive education can also refer to a framework that recognises the diverse learning needs of learners, addresses learning barriers and accommodates all learners regardless of their needs (Department of Basic Education, 2001). This accommodation refers to having accessible structures, systems and methodologies, changing behaviour, attitudes, teaching strategies, curricula and the education environment to satisfy learner needs, and empowering all learners by allowing learners to develop their strengths (Department of Basic Education, 2001). Technology creates an inclusive environment, where learning and teaching can be adapted per the needs of the learner (Bagon et al., 2018; Florian & Hegarty, 2004). Florian and Hegarty (2004), are also of the opinion that technology provides an equal opportunity for learners with disabilities to learn as a result of the learning support that technology provides.

2.2.8 AT integration to support learners with CP

The Department of Basic Education (2004) stated in the White paper 7 on e-education that the integration of ATs into education can have many advantages. These advantages may include higher-order thinking, comprehension, problem-solving, creativity and reasoning skills. Florian and Hegarty (2004), believe that ATs provide an equal opportunity for learners with disabilities to learn as a result of the learning support that AT provides. There are several ways in which ATs can support learners with CP. This support can be physical support or cognitive support.

Physical support

There are several ways in which AT can physically support a learner with CP.

Landsberg, et al. (2019) suggests the following assistive technologies to support learners with CP in the classroom: assistive drawing devices, hand-grip assistive devices, a moving drawing board, adapted keyboards and mice, voice- or eye-activated computers and computer programs, and a mouthpiece instead of a computer mouse or keyboard. Cerebral Palsy Guidance (2020) and CerebralPalsy (2020) suggest the use of electronic communication boards, speech-generating devices and

eye-tracking devices to aid communication. Cerebral Palsy Guidance (2020) and CerebralPalsy (2020) also suggest word prediction and spell- and grammar check software to support writing and typing. Cerebral Palsy Foundation (2019) further explained that the use of magnifiers, larger text and fonts, and sound amplifiers to support learners with vision and hearing problems may be beneficial.

Rahamin (2004), Kouroupetroglou (2013) and Cerebral Palsy Guidance (2020) provide the following guidelines for the use of technology to support a physically disabled learner in general: using trackballs, touch screens, higher contrast displays, enlarged cursors and text, using a keyguard, speech-generating devices and text to speech facilities. Kouroupetroglou (2013) divided these assistive devices into categories and methods which are summarised in Table 3.

Table 3: Summary of support for a physically disabled learner

Category	Support
Adjusting time limits on activities	<ul style="list-style-type: none"> • Extended time limits on reading • Extended time limits on completion of activities, such as moving the mouse
Keyboards	<ul style="list-style-type: none"> • Delayed repeat • Delayed debounce of keys • Dismiss short key presses • Extended modifier keys time
Mice and pointers	<ul style="list-style-type: none"> • Slowed mouse speed • Slowed double-click speed • Adjusted cursor size • Identify the cursor location with a keypress • Highlight and drag without pressing a button
Alternative methods of entering text	<ul style="list-style-type: none"> • Voice input • Virtual / On-screen keyboard • Alternative input switches • Reduced keyboard

Alternative methods of pointing	<ul style="list-style-type: none"> • Input by making use of head-tracking devices • Input by making use of Joystick-to-mouse devices • Input by making use of eye-tracking devices • Using the keyboard to control the cursor pointer
Automation of common tasks and error prevention	<ul style="list-style-type: none"> • Hotkeys • Pre-recorded actions • Shortcut keys

(Kouroupetroglou, 2013)

Some operating systems have built-in features to assist learners with a variety of needs. Windows have an “ease of access” feature that assists learners. Table 4 is a summary of these features:

Table 4: Microsoft assistance for learners with physical disabilities

Feature	Use
Narrator	This feature allows the user to control their computer and allows the computer to read the text on the screen.
Magnifier	This feature allows the user to magnify the content on the screen.
Contrast	This feature allows the user to change the contrast of the screen. This feature also allows the user to change the colour theme of the computer.
Closed captioning	This feature adds text to videos.
Keyboard	This feature allows the user to use an on-screen keyboard. This feature also incorporates a “sticky-key” function that allows the user to press one shortcut key.

Filter key	This setting ignores repeated keypresses and accidental key presses and slows down the typing time.
Mouse	This feature allows the user to change the pointer size, use inverted colours and highlight the pointer location with the press of a key.

(Microsoft Education, 2016a)

It is evident that there is a lack of studies that specifically address AT for learners with CP and not just a physical disability in general. As seen above, Kouroupetroglou (2013) and Hasselbring & Glaser (2000) only address AT for learners with a physical disability as a whole. Similarly, studies that do address AT for learners with CP specifically, do not address this in-depth by stating which barrier is minimised, such as Landsberg, et al. (2019), Cerebral Palsy Guidance (2020), CerebralPalsy (2020) and Cerebral Palsy Foundation (2019), which only lists the available assistive technology.

Cognitive support

Raja (2016) suggests that AT can support a learner in their cognitive functioning with accessing and understanding the content, classroom participation, organisation and memory. Resources being in an electronic format, differentiating the learning and teaching material, assistive software such as magnification and text to speech, smart devices and recording of lectures supports accessing and understanding the content (Raja, 2016). Support with classroom participation includes communication devices and electronic whiteboards to ease participation (Raja, 2016). Support with organisation and memory includes calendars, categorisation and organisation applications and memory aids (Raja, 2016).

Microsoft created a browser, Microsoft Edge, that allows learners to minimise distractions while using the internet (Microsoft Education, 2016b). This browser includes a reading view that takes away adverts and any unnecessary data that may distract learners. Learners can also use the note-taking feature that allows learners to make notes on the web page (Microsoft Education, 2016b).

Microsoft also developed a program called OneNote to assist a variety of learners. Learners can use this program to organise their work, collaborate, share content, present, read aloud, do research and add pictures (Grissom, 2017). They can also use the Immersive reader function which provides learners with reading cues, a picture dictionary and a text-to-speech function or the Mathematics function, which allows learners to draw graphs, solve equations and see solutions for problems (Grissom, 2017).

From the above, it is also evident that more research is needed with regards to the cognitive support that supportive technology can provide for learners with specifically CP.

2.2.9 The availability of AT in South Africa

The Department of Basic Education (2004) stated in the Paper on e-Education, that every educator, manager and learner must be computer literate and use technology in innovative ways to teach and learn by 2013. This goal has not been realised. Mnisi (2015) acknowledges that this is a concern for the Department of Education. According to Neves (2020), there exists a “deep inequality” in access to connectivity, hardware and even “stability in households to make online learning possible”, especially in low-income areas. Du Plessis (2014) agrees that especially the rural schools do not have the basic infrastructure for assistive devices. Rural schools often do not have access to necessities such as running water or electricity. As a result, there is little opportunity to integrate assistive devices in these schools (Du Plessis, 2014). The Department of Basic Education (2015) reacted by publishing an action plan to realise this goal by 2025, detailing that educators must improve their computer literacy throughout their career and learners must have access to a “wide range of media, including computers”.

Although these policies and strategies exist, Meyer and Gent (2016) are of the opinion that the implementation thereof is slow, some objectives are unclear, the strategy is inadequate and access to technology is restricted. The Department of Basic Education (2015) in the action plan of 2019 recognized that technology in South African schools is not progressing sufficiently. However, according to Meyer and Gent (2016), there are various other problems with the availability of assistive technology. These problems include the high cost of connectivity, unstable internet connections, security

concerns, maintenance of assistive devices and extensive training is needed (Meyer & Gent, 2016). Adu (2016) also explained that there is a shortage of devices, as well as support for educators using the devices.

Despite these challenges and problems, technology is still used in South Africa to aid learners with physical disabilities. According to Mnisi (2015), the Department of Basic Education still considers the White Paper 7 and the Action plan of 2014 to 2025 as relevant and should be implemented in South African schools.

2.2.10 The availability of AT in other countries

The availability of AT is also limited internationally. According to the World Health Organisation (2018), there is a growing need for AT that is not being fulfilled. Rohwerder (2018) is of the opinion that the majority of people who need assistive technology, do not have access to such technology. The World Health Organisation (WHO) (2018) further stated that a few countries have policies in place to address technology education.

Developing countries may have limited access to assistive technology. Various studies indicate this problem in developing countries such as the study by Onejeme (2017) and Sawaikar (2019). According to Onejeme (2017) in Nigeria devices such as adjustable tables, writing tools, hearing aids and electronic devices that assist with talking, text-to-speech facilities and recorded formats of work are available. But, it is noted that the availability of these devices is dependent on the cost of devices and data, scarcity and skill level of the user (Onejeme, 2017). According to Sawaikar (2019), although the costs of assistive devices in India is relatively low, government funding is needed for poorer families to obtain these devices. In India, assistive devices such as tablets, software such as text-to-speech and recording facilities are relatively commonly available (Sawaikar, 2019).

The World Health Organisation (2018) stated that assistive devices are “rationed” and often not available in high-income countries as well. In the United Kingdom, there is a need for training and skills necessary to integrate and use technology (Ecorys UK, 2016). Socio-economic status is also a determinant in the availability of AT especially for learners with a disability in the United States (Ahmed, 2018). According to Ahmed (2018), funding and costs for technology is a concern. In China, the production of AT is on the rise (Rohwerder, 2018). But, according to Ka-Ho Wong (2018), the industry

lacks qualified professionals. Few universities offer courses in disability and assistive technology. China also struggles with low-income areas, where people cannot afford ATs (Ka-Ho Wong, 2018).

It is evident that there is a general limit in access to assistive devices, high costs of devices and data and lack of user skills. WHO (2018) also noted that they are currently supporting the “Global Cooperation on Assistive Technology (GATE)” which aims to provide everyone with AT around the globe, especially those with disabilities.

2.2.11 The availability of research on AT for learners with CP

Although a limited number of studies have been done with regards to AT for learners with CP, many studies address the issue of AT for learners with a physical disability.

Various studies discuss a definition of CP, symptoms, classification, causes and possible treatment such as studies done by Rosenbaum (2003), Rosenbaum (2014) and Ogoke (2018). Other studies highlight the barriers that learners with CP may experience such as the studies done by Pirila, et al. (2007), Jenks, et al. (2009) and Van Rooijen, et al. (2016). Authors such as Fox (2003), Florian and Hegarty (2004), Fernández-López, et al. (2013) and Landsberg, et al. (2019) discuss various methods and technology that can be integrated to support learners with different disabilities. Some authors such as Cerebral Palsy Guidance (2020), CerebralPalsy (2020) and Cerebral Palsy Foundation (2019) specifically discuss technology use among learners with CP, but not in-depth.

It is thus evident that there is a lack of studies that specifically address AT for learners with CP and not just a physical disability. The above-mentioned research does not address the issue of how technology can reduce learning barriers, but rather provides a list and description of available technology.

Broadly, this study aims to explore how technology can be used to minimise the learning barriers that learners with CP experience in the classroom. The researcher is specifically interested in the technology used by learners with CP and the educators that educate these learners. In this study, the researcher wanted to identify the technology currently used in this school and the impact of that technology on the learning barriers that learners experience.

2.3 THEORETICAL FRAMEWORKS

This study used the “Technological, Pedagogical, and Content Knowledge model (TPACK)” (Koehler & Mishra, 2009, p. 62) and the “Substitution, Augmentation, Modification, and Redefinition Model (SAMR)” (Puentedura, 2015, p. 2) as frameworks to guide the researcher during the research process. Both these models provide a guideline for technology integration into the classroom.

2.3.1 Technological Pedagogical and Content Knowledge framework (TPACK)

Overview

The TPACK model is based on Shulman’s (1986) explanation of Pedagogical Content Knowledge (PCK). Shulman’s model explains how educators’ PCK work together to produce effective learning and teaching (Shulman, 1986). TPACK extended these two main elements to create three main elements for effective teaching and learning: content, pedagogy and technology (Graham, 2011; Koehler & Mishra, 2009).

The framework is represented in the diagram below. This diagram presents the three main types of “knowledge”: “Content Knowledge (CK), Pedagogical Knowledge (PK) and Technological Knowledge (TK)” (Koehler & Mishra, 2009, p. 62) as well as the three new types of knowledge: “Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK) and TPACK” (Koehler & Mishra, 2009, p. 63).

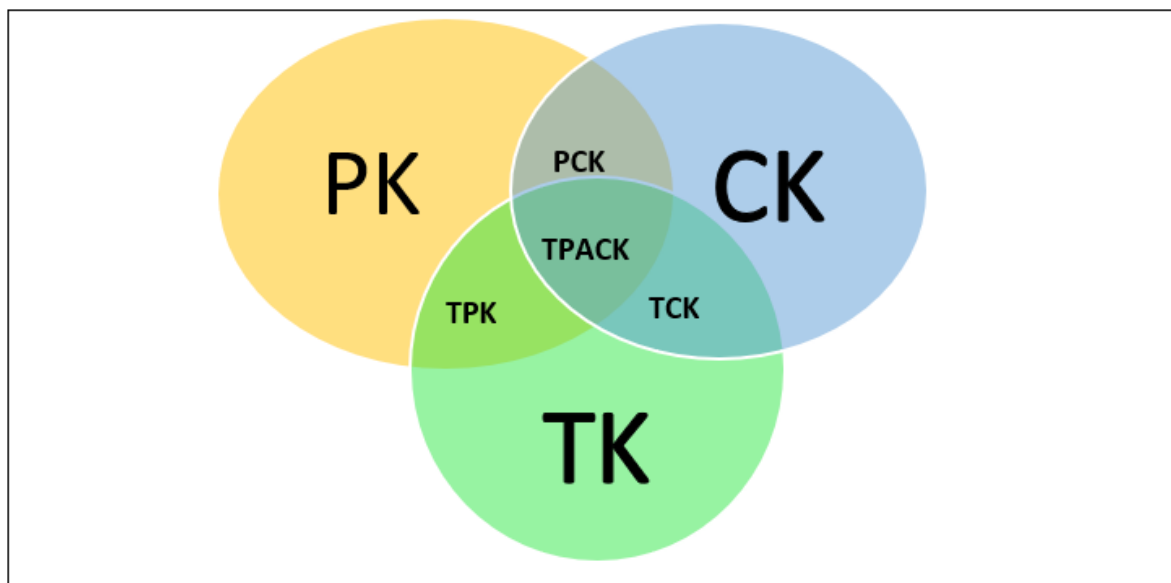


Figure 1: TPACK Model

PK refers to an educator's knowledge about instructional design, learning theories and teaching methods (Koehler & Mishra, 2009). CK depicts an educator's insight into the content of the subject (Koehler & Mishra, 2009, p. 63). TK describes knowledge about technology and the use of technology as a tool in the classroom to support learning and teaching (Mishra & Koehler, 2006). PCK is the intersection of content and pedagogical knowledge. This element represents an educator's ability to organise, adapt and represent the content in a meaningful lesson (Koehler & Mishra, 2009). TCK is the intersection of technology and content knowledge and describes the educator's ability to integrate content and technology to create a meaningful lesson. TPK is the intersection of technology and pedagogical knowledge. This element refers to the ability of the educator to incorporate technology into their teaching methods and strategies, choose the tools that will facilitate learning the best and manage the technology use. Lastly, TPACK refers to the integration of technology, pedagogy and the content. This theory explains the set of knowledge that educators need to teach their learners the content effectively with the use of technology.

The concept of TPACK in this study

A lesson consists of multiple elements, such as content, pedagogy and technology. Shulman (1986) describes that an educator must be knowledgeable in these three areas to successfully integrate technology into their classroom and lessons.

In this study, this model was used to determine and describe how technology is integrated into the lessons. This description includes:

- How technology is used in an educator's pedagogy to support learners with CP
- How technology influences the content that is being taught
- How technology and the content is integrated to support learners with CP
- How technology is used to create a lesson (pedagogy and content)

The use of this model provided a detailed explanation of how a lesson, the content and the pedagogical approach is adapted to accommodate each learner and their disability. This model was used to answer the question: How can technology be integrated into special needs education?

2.3.2 Substitution Augmentation Modification and Redefinition framework (SAMR)

Overview

The SAMR model was designed by Puentedura (2010) to describe and facilitate the integration of technology into the classroom. The model consists of two phases: enhancement and transformation. Enhancement refers to technology integration with little to no significant value (Puentedura, 2010). It refers to improvements in the existing methods of usage. The technology is not important in the learning tasks. Transformation refers to technology integration that changes the classroom, pedagogy and learning outcomes (Puentedura, 2010). This phase refers to technology that is effectively used in everyday tasks to improve and assist learning and teaching. The two phases are divided into four levels: “Substitution, Augmentation, Modification and Redefinition” (Puentedura, 2010, p. 4). Figure 2 presents these phases and levels. The first level, substitution, refers to technology replacing activities and traditional instructional and learning tools in the classroom with no significant value or change (Puentedura, 2010). The second level, augmentation, refers to technology replacing an activity with practical value (Puentedura, 2010). The third level, modification, refers to technology that allows for “significant task redesign” (Puentedura, 2010, p. 9). This refers to technology that improves and significantly changes teaching and learning. The fourth level, redefinition, refers to technology integration that enables the educator to create lessons that were impossible before the integration of technology (Puentedura, 2010).

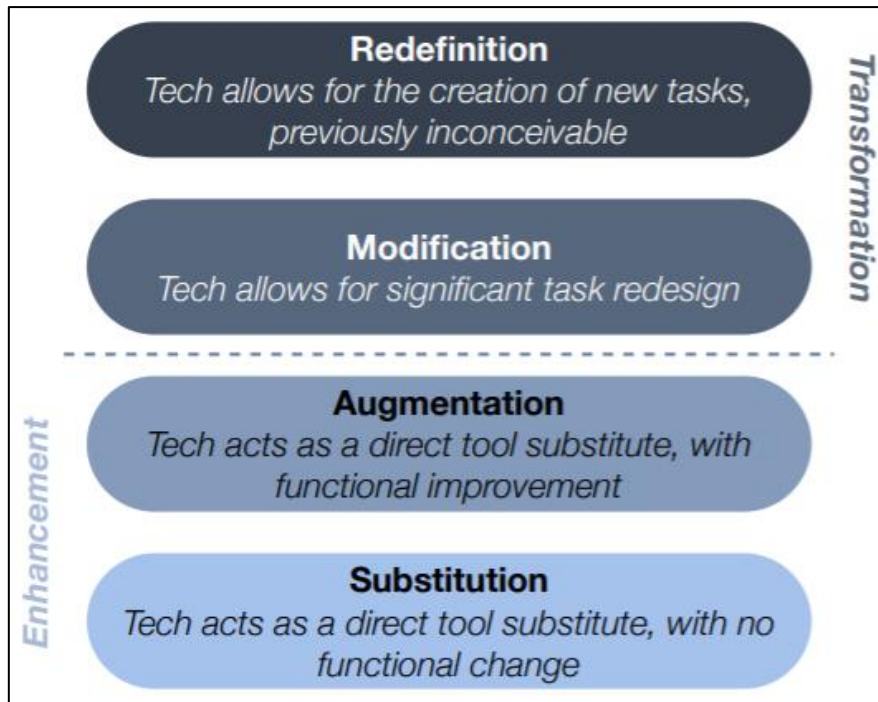


Figure 2: SAMR Model (Puentedura, 2010)

The concept of SAMR in this study

This model is used to describe the technology integration at a school. This model was used to determine how effective technology is integrated into the classroom, the value that the technology has in the classroom for the educators and learners and on which level the school is integrating the technology into the classrooms.

This will lead to an in-depth explanation of how dependent the learners and educators are on the support that is provided by technology integration. This model was used to answer the question: How meaningful is the technology incorporated into lessons to transform or to enhance the lessons?

2.4 CONCLUSION

This chapter is an attempt to understand what CP is, the policies that exist, the technology available and the availability of the technology in different countries. There is a gap in the literature with regards to how technology can be used to support a learner specifically with CP. Previous research focused on physical disability as a whole and not specifically on CP. The researcher used the “Technological, Pedagogical, and Content Knowledge model (TPACK)” (Koehler & Mishra, 2009, p. 62) and the “Substitution, Augmentation, Modification, and Redefinition Model (SAMR)” (Puentedura, 2015, p. 2) as frameworks to guide her during

the research process. Both these models provided a guideline for technology integration into the classroom.

In the next chapter, the researcher will discuss the methodological aspects of this study. This includes the research paradigm, research methodology, the trustworthiness of the study, and the ethical considerations of the study.

Chapter 3: Research design and methodology

3.1 INTRODUCTION

In the previous chapter, the researcher discussed the literature review and theoretical frameworks. The literature review identified shortcomings in the research currently available and gave an overview of knowledge that is available in this field. This chapter consists of the research paradigm, research methodology, the trustworthiness of this study, and the ethical considerations of the study. The research methodology includes research design, sampling, and data-collection methods. This study was done in line with the interpretive ontological stance and socio-constructivist paradigm.

3.2 RESEARCH PARADIGM

Philosophy can be described as the study of the truths of existence that guides research (Sefotho, 2018; Stevenson & Waite, 2011). A paradigm is made up of different philosophical assumptions and is used in philosophy to describe a person's values and beliefs (Sefotho, 2018) that informs research theories and methodologies (Stevenson & Waite, 2011). Ontology and epistemology form part of philosophy.

3.2.1 Ontology

Ontology refers to the study of reality or the perception of reality (Mabila, 2017; Sefotho, 2018). This study makes use of an interpretive ontological stance. Interpretivism is based on the belief that multiple realities exist (Maree, 2016). This stance requires the researcher to take into account the personal interpretations of participants and their worldviews (Maree, 2016). Therefore, the reality of this study was subjectively created and socially constructed by the participants in the study.

This stance does have some limitations. One limitation is that participants must be studied in their natural environment and social contexts (Maree, 2016). This study used interviews and observations to ensure that participants were studied in their day-to-day lives as educators. Another limitation was that a researcher must understand events through the meanings and constructions that participants assign to these phenomena (Maree, 2016). This study used voice recordings and thick descriptions of the context, participants, and the data. This ensured that the understanding and constructs of the participants were clear.

3.2.2 Epistemology

Epistemology is concerned with gaining knowledge about the social world (Maree, 2016). The researcher used a social constructivist (also referred to as an interpretive) paradigm to gain this knowledge.

Constructivism is concerned with people's views and understanding of the world around them (Leedy & Ormrod, 2015). The socio-constructivist paradigm stems from the assumption that knowledge is constructed through contact and interaction with other people (Myburgh, 2013) seeing that individuals are unique and interpret experience in unique ways (Kivunja & Kuyini, 2017).

This paradigm holds implications for this study. This paradigm leads to an investigation into the "complexity of views", rather than a "few categories" (Creswell, 2013, p. 39). The interview questions must be open-ended to ensure that the participants' views are captured correctly (Creswell, 2013). The study used semi-structured interview questions to ensure that participants have the freedom to express themselves. The researcher's own background and experiences also influenced the interpretation of the data, therefore the researcher had to "make sense of the meanings others have about the world" (Creswell, 2013, p. 39). This study used thick and rich descriptions of the context, participants, and the data. This helped the researcher in understanding the participants and their constructs.

3.3 RESEARCH METHODOLOGY

3.3.1 Research approach

This study used the qualitative research approach. Qualitative research makes use of data that cannot be decreased to numbers (Leedy & Ormrod, 2015; Maree, 2016; Neuman, 2014). Qualitative research aims to understand situations in their natural environment (Leedy & Ormrod, 2015) and focuses on understanding experiences from the point of view of the people experiencing it (Rudestam & Newton, 2015).

Qualitative research is in line with the interpretative philosophical approach and socio-constructivist paradigm. Learning barriers are a personal experience and is a unique experience for every learner. The experience of learning barriers for learners with CP can only be understood through interaction with the individuals experiencing the barriers.

This method does have potential advantages and challenges. Advantages of this method includes the study of the situation or phenomena in natural settings, and the study of this situation or phenomena in-depth (Leedy & Ormrod, 2015). This leads to better insight into the situation and better validity (Leedy & Ormrod, 2015). Possible challenges of this method include the time, preparation and planning needed to conduct research (Leedy & Ormrod, 2015) and the difficulty to generalise findings (Christensen et al., 2015).

3.3.2 Research design

Case study

This study used a case study as a research design. A case study is a comprehensive investigation of a unique case and is especially useful for learning more about a unique situation (Leedy & Ormrod, 2015). A case study is also used to contribute to the existing knowledge and understanding of an individual or a group (Yin, 2014).

Within this case study design, this study used an explanatory and exploratory case study. An explanatory case study aims to find and describe the relationships between events (Maree, 2016). This type of case study also focuses on real-life situations (Maree, 2016). An exploratory case study explores situations where the outcomes are unclear and no single outcome exists (Maree, 2016).

This study was an attempt to understand the learning barriers that learners with CP experience and how AT can minimise these barriers. This information was gained through the personal experiences of the educators educating learners with CP and learners that have been diagnosed with CP. An in-depth investigation was needed to understand these experiences and learn more about the barriers, and technology's role in minimising the barriers. This was a case study seeing that the researcher investigated the experiences of educators and learners in one LSEN (Learners with Special Educational Needs) school. The focus was on CP and AT integration to minimise the barriers associated with CP.

There are several benefits and challenges related to a case study design. According to Christensen, et al. (2015) and Leedy, et al. (2015) advantages of this design are that a researcher can study a case in-depth and as a result learn more about this case, provide insight into a little-known case and refine an explanation for the case. Maree (2016) believes that this design also has the advantage of being in a realistic context.

Possible challenges of this design are that it is time-consuming and the findings cannot be generalised due to the participants not being a representative sample of the community (Christensen et al., 2015; Leedy & Ormrod, 2015).

3.3.3 Sampling

A sample refers to a representative portion of the population (Christensen et al., 2015). The researcher used convenient and purposive sampling. Convenience sampling is a method where the researcher selects easily available participants (Leedy & Ormrod, 2015; Maree, 2016). The selected school is convenient and close to the researcher's location. With this approach, information-rich educators were selected seeing that they specialise in the education of learners with a physical disability and specifically CP. Information-rich learners were also selected seeing that these learners are experiencing barriers in learning due to their disability. Purposive sampling is used when a researcher targets specific people with specific criteria and a purpose in mind (Leedy & Ormrod, 2015; Maree, 2016). The school and educators were chosen due to this school specialising in the primary education of learners with physical disabilities. The staff have experience with AT and educating learners with a physical disability. The learners were chosen due to being diagnosed with CP.

The researcher used a sample of educators consisting of 10 educators. These educators are involved with the education of different grades and subjects.

The criteria for the selection of educators can be articulated as follows:

1. The educator must be using technology in his or her classroom.
2. The educator must be employed at this LSEN school.

The researcher selected six learners that have been diagnosed with CP. The criteria on which these learners were selected can be articulated as follows:

1. The learner must have been diagnosed with CP.
2. The learner is in a specific LSEN school.
3. The learners must be able to communicate.

The total participants were sixteen.

3.3.4 Data collection methods

Data collection methods are the methods that researchers use to collect data for their study (Maree, 2016). The researcher made use of Zoom to conduct some data collection due to the COVID 19 pandemic. Some interviews were done in person.

Semi-structured interviews

Semi-structured interviews refer to interviews where a researcher may follow a standard list of predetermined questions and additional questions to get clarification or understand a person's reasoning when necessary (Leedy & Ormrod, 2015).

The use of semi-structured interviews has many advantages. Semi-structured interviews enable a researcher to prepare questions ahead of the interview (Cohen, 2006). This leads to the appearance of being prepared and competent during the interview (Cohen, 2006). Adams (2015) states that semi-structured interviews are suitable for a variety of tasks, such as follow-up queries with open-ended questions. This method has the advantage of gaining insight into a case (Maree, 2016).

Semi-structured interviews also have disadvantages. Semi-structured interviews are time-consuming and can be costly (Adams, 2015). The process of preparing the questions, conducting the interviews and analysing the data takes time and requires considerable effort (Adams, 2015). It also requires an experienced interviewer to conduct the interviews effectively (Adams, 2015). According to Adams (2015), the researcher must be "knowledgeable about the relevant substantive issues" (p. 493).

The list of interview questions for the learners and educators was based on the primary and secondary research questions. These questions were also guided by the theoretical frameworks to ensure that information-rich explanations were gathered.

Fieldnotes

Field notes are the action of taking notes consisting of unforeseen data as it surfaces, such as body language (Leedy & Ormrod, 2015). This study used field notes to capture information that cannot be captured on the voice recorder such as body language.

Observations

Observations require a researcher to spend extended periods of time in the field to record data about surroundings, context and situation (Leedy & Ormrod, 2015). This was done with the aim of collecting extensive data that is not easily gathered through

speech (Christensen et al., 2015). According to Christensen, et al. (2015) the actions of people and their interview answers may often differ. The researcher observed educators in their classes to gain insight into how technology is used to minimise the learning barriers of learners.

Data collection process plan

The researcher used the following process to prepare and collect the necessary data:

- i. Plan and revise the interview questions.
- ii. Choose participants with the help of the school therapist.
- iii. Conduct the interviews with the semi-structured list (on Zoom and in-person).
- iv. Transcribe the interviews.
- v. Verify the transcriptions with the participants.

As mentioned above, some interviews took place over Zoom due to COVID 19 restrictions.

3.3.5 Data analysis and interpretation

The researcher used content analysis as a data analysis and interpretation strategy. Content analysis involves the systematic and detailed analysis of data to identify patterns or themes (Leedy & Ormrod, 2015). The data was analysed to find patterns.

The data analysis took place in the following order and steps, as suggested by Creswell in his Data Analysis Spiral (Leedy & Ormrod, 2015):

- i. Organizing the data and breaking large sections into smaller units
- ii. Obtaining an overview of the data
- iii. Developing categories and finding patterns or themes in the data
- iv. Synthesis of data.

The researcher used Atlas.ti to assist with the data analysis. Atlas.ti is a software program that assists with data analysis in research (ATLAS.ti Scientific Software Development, 2017).

3.4 THE TRUSTWORTHINESS OF THE STUDY

3.4.1 Quality criteria

The following criteria should be considered by a researcher in pursuit of trustworthiness (Guba, 1981):

Credibility

Credibility refers to the researcher's certainty about the accuracy of the findings (Guba, 1981; Krefting, 1991; Maree, 2016). This study used direct quotes from respondents, clearly defined sampling methods and detailed data-collection methods.

Dependability

Dependability refers to the consistency of findings if the study is repeated (Guba, 1981; Krefting, 1991; Maree, 2016). The researcher described the precise data gathering methods, analysis, and interpretation of the data.

Confirmability

Confirmability is the degree to which a researcher maintains some neutrality during the research process and to which research is bias-free (Krefting, 1991; Maree, 2016). The researcher's involvement in the study was limited seeing that there was no established relationship with the participants before the interview or observation. The researcher also reproduced enough data to decrease her own interpretation.

Transferability

Transferability is seen as the process of determining whether the findings of a study can be applied in another context (Guba, 1981; Krefting, 1991; Maree, 2016). To increase transferability, the researcher focused on how representative the participants are to the context. A thick description of the context, participants and research design ensured the transferability of the study.

Rigour

Rigour refers to the steps that a researcher takes to ensure thorough data collection, recording of data and data analysis, as well as the steps that a researcher takes to be as objective as possible throughout the study (Leedy & Ormrod, 2015). This study used thick and rich descriptions of the data collection, organisation of data and analyses of data. This study used triangulation. Triangulation refers to the "collection

and comparison” of multiple data sources to find inconsistencies (Leedy & Ormrod, 2015, p. 390). This took place by comparing the answers to the interview questions from the educators and learners, as well as the observations made in the classrooms and field notes.

3.5 ETHICAL CONSIDERATIONS

Ethical measures were maintained at all times by adhering to the following guidelines: informed concept, voluntary participation, confidentiality and anonymity.

Informed consent

Informed consent refers to the participants being completely informed about aspects such as the objectives, benefits, and disadvantages of the study (Christensen et al., 2015). Informed consent ensured that participants were informed about the objectives, benefits and disadvantages of the study and the participation in this study (Leedy & Ormrod, 2015). Before each interview, the researcher explained all aspects of the study to the participant. The participant also received an information and consent form explaining these aspects of the study. These forms were signed to ensure that each participant was giving a voluntary, written consent to partake in this study.

Voluntary participation

Participation should be voluntary and participants should not feel pressured to participate (Leedy & Ormrod, 2015). No reward was given for participation (Leedy & Ormrod, 2015). Participants may also withdraw their participation in the study whenever the need arises (Leedy & Ormrod, 2015). The researcher asked potential participants if they would be willing to participate in this study after explaining all aspects of the study. If the participant was willing to participate, they had to sign a consent form. Participants could withdraw from the study at any given time and all data gathered from this participant would then be destroyed.

Confidentiality

Confidentiality was used to protect the privacy of all participants, by not revealing any information obtained from this study (Christensen et al., 2015). The researcher ensured the confidentiality of the participants by giving each participant a unique number, which was used in the place of an identifying characteristic of the participant.

Only the researcher and her supervisor had access to the data. All data collected from participants will be kept safely at the University.

Anonymity

Anonymity can be defined as keeping the identity of all participants unknown (Christensen et al., 2015). The researcher ensured the anonymity of the participants in this study by using pseudonyms. Each participant received a unique number, to ensure their anonymity. This number was used to label all the data as well as the findings and results.

3.6 CONCLUSION

In this chapter, the research design and methodology were described. The philosophical standpoint was described and the influence thereof on the study. The philosophy applied was interpretivism and the paradigm was socio-constructivism. This study was in line with the interpretative philosophical approach and socio-constructivist paradigm, which states that multiple accounts of the truth exist and that knowledge is gained through social interaction. This study used the qualitative research approach. This study was in line with the interpretative philosophical approach and socio-constructivist paradigm, which states that multiple accounts of the truth exist and that knowledge is gained through social interaction. The researcher also described the research methodology in this chapter. The research design was a case study. The data collection and analysis concerning the study were discussed. The data-collection methods included semi-structured interviews, observations and field notes. The data-analysis methods included the Data Analysis Spiral developed by Creswell (Leedy & Ormrod, 2015). The selected case study involved educators that were chosen by using convenience and purposive sampling strategies. These were all appropriate for the study, which wanted to determine how technology can be used to minimise the learning barriers that learners with CP experience.

Chapter 4: Data analysis interpretation and discussion of findings

4.1 INTRODUCTION

In the previous chapter, the researcher discussed the research design and methodology. It also included a discussion on the philosophical standpoint. In this chapter, the researcher will be discussing the data analysis. The data was gathered through semi-structured interviews from teachers and learners and through observations and field notes that took place. The researcher made use of Atlas.ti to assist with the analysis of the data.

4.2 BACKGROUND OF THE PARTICIPANTS

Ten educators and six learners were interviewed on the barriers that are experienced in their classrooms and the technology that is used in the classrooms. The participants consisted of both female and male teachers from various age groups as well as learners from various grades. The biographical data of educators are set out in Table 5 and the biographical data of learners are set out in Table 6.

Ten educators from various grades and subjects were involved in this study. As explained in chapter 3, these educators use technology in their classrooms and are employed at an LSEN school. The participants were asked to provide some demographical information to give the reader background information about the educators involved.

Table 5: Educator biographical data

Educator Participant (EP)	Gender	Age	Teaching grade	Employment period	Teaching subject
1	Female	29	1	4	Foundation Phase
2	Female	50	1	15	Foundation Phase
3	Male	28	5 and 7 to 9	4	Sesotho and EMS
4	Female	29	8 to 11	5	Language and Mathematics

5	Male	56	9 and 10	2 and ½	LO and English
6	Female	66	2	3	Foundation Phase
7	Female	27	7 to 9	4	English and Creative Arts
8	Female	26	10 and 11	1	Consumer Studies and Tourism
9	Male	27	7 to 9	1 and 9 months	Life Skills, Natural Science and Technology
10	Female	59	4 and 7 to 9	9	LO

Six learners from various grades were also involved in this study. These learners, as explained in chapter 3, have been diagnosed with cerebral palsy, are at an LSEN school and can communicate. The demographic information of the learners was included to give the reader an idea of the educational level that these learners have. These learners were comfortable talking about their disability and the barriers that they experience.

Table 6: Learners biographical data

Learner Participant (LP)	Gender	Age	Grade
1	Male	18	8
2	Male	17	9
3	Male	16	7
4	Male	17	7
5	Male	11	5
6	Male	15	6

4.3 DATA ANALYSIS

The researcher transcribed each interview verbatim. The researcher then used Atlas.ti to code the themes. She firstly used open coding, which entails reading the narratives to get an idea of the themes in the data. Open coding involves the division of data into general categories (Leedy & Ormrod, 2015). Axial coding was then carried out by connecting corresponding themes (Leedy & Ormrod, 2015). Themes that emerged

were: Barriers that learners with CP experience, the effect of barriers on learning, AT integration to support learners with CP, the effectivity of AT integration, inclusive education for learners with CP, pedagogy, content and the level of technology integration according to SAMR.

4.3.1 Barriers for learners with CP

Physical barriers

Regarding physical barriers that learners with CP experience in the classroom, several themes emerged from the analysis, namely (a) mobility challenges and poor gross motor functioning, (b) speech and communication problems, and (c) poor fine motor skills.

(a) Mobility challenges and poor gross motor functioning

Most learners with CP have mobility challenges which are related to gross motor functioning challenges. EP 1 indicated that “some of the learners are obviously more physically able than others” because some do have some sort of function where others do not have any function at all. EP 5 and 7 also stated that mobility and “movement” are a big challenge in their classrooms. EP 8 further explained that this is a challenge in her classroom because learners cannot do group work, role play or educational games. “It’s a lot of work for wheelchairs” and a “challenge for crutches” because of the limited space in classrooms. This was evident during the collection of field notes and classroom observations where the researcher also noticed that most learners have limited movement and make use of assistive devices such as wheelchairs and crutches.

(b) Speech and communication problems

Participants also explained that the learners in their classrooms experience barriers with speech and communication. EP 1 and 5 stated that some learners are non-verbal. EP 2 stated that while some cannot speak, others only have a speech problem where she struggles to hear them. EP 5 shared the same sentiments that learners’ vocalisation is a problem but communication is “a bigger issue”. He further explained that one learner was barely vocal and he could “only occasionally understand him”. According to EP 6, it is often difficult to “catch what learners are saying”. EP 9 also highlighted that this is problematic in his classroom. This was affirmed by the observations. Some learners in EP 2, 6, 8 and 9’s classrooms are non-verbal or have

incomprehensible speech. During the interviews, these barriers were seen in two participants. LP 3 and 4 have difficulty in speaking. During the classroom observations, this was also prevalent.

(c) Poor fine motor skills

It is prevalent that most learners with CP struggle with fine motor skills. EP 1 stated that some learners have little to no function of their hands. She further explained that this caused the learners to not have the “finger-pointing function” and as a result must press buttons with their hand or fist. EP 2 stated that she has learners that are only able to use one hand and other learners who are spastic. EP 5 described that some learners can only press one key at a time due to the amount of movement that they have. EP 8 stated that learners in her class are not able to use their hands to “handle some things such as food”. EP 9 experienced learners who cannot complete their practical projects because of a lack of hand functions.

Several challenges that arise from the lack of fine motor skills were also prevalent. According to EP 1, 7 and 9, some learners are physically unable to write and others are unable to type. According to EP 2 learners cannot write because they “can’t even handle a pencil”. LP 1 affirmed this statement by highlighting that he finds writing difficult. EP 4 and 6 also mentioned that learners who can write and type often write and type slowly and take too long to finish their work. LP 2 stated that he is a learner that struggles with writing and typing because he “is slow”. EP 8 supported this statement by stating that learners’ handwriting is also unclear and that she “can’t see a thing”. During the collection of field notes and classroom observations the researcher also noticed that learners have poor and limited hand movement. She also noticed that learners struggle with gripping pens and pencils, shaking hands, and the ability to hold a normal mouse. During the interviews, three out of the six learners asked the researcher to write their names down because they struggle with writing.

Cognitive barriers

Several themes emerged from the analysis regarding cognitive barriers: (a) cognitive delay (b) language and reading problems (c) comprehension problems (d) memory problems and (e) Severe Intellectual Disability (SID).

(a) Cognitive delay

One participant indicated that learners with CP have some form of delay. The most frequent form of delay is an academic or cognitive delay. EP 1 stated that this delay is caused by learners “missing the whole foundation of school” because many are only put into school at a much later age.

(b) Language and reading problems.

Two participants mentioned that learners have problems with language and reading. EP 2 highlighted that learners in her classroom struggle with “recognizing their sounds” which leads to an inability to read. She states that learners also struggle with spelling. LP 6 shared the same sentiment by indicating that he struggles with reading.

(c) Comprehension problems.

Several participants also indicated that learners struggle with comprehension. According to EP 1 cultural difficulties lead to many cognitive delays and comprehension problems. Learners are kept at home much later and only attend school at an older age. According to her, this causes the learners to miss the foundation of schooling or these learners “missed like the peek window of learning”. To depict this scenario, she further explained that she is a grade 1 educator educating learners between the ages of 8 and 13.

According to EP 3 learners further “take time to adjust the information and comprehend the content”. EP 4 also indicated that the learners struggle to understand the content or take time to understand the content. According to EP 7, the learners cannot grasp basic concepts due to not having a good background knowledge. She further explained:

“We will talk about the ocean, some of our kids have never seen the ocean... They don't have, ahm, what's the word? They don't have the foundations that a normal person would have. Like, I said ocean. We take it for granted. We talk about the sea, that everybody's been to the sea or visited it or seen it but our kids have never. Sometimes even basic animals. What is that ma'am? I've never seen it and never heard about it. Flowers, a lot of things our kids lack the basic foundations of it.”

EP 10 also indicated that the lack of background is problematic in her classroom. EP 8 further explained that “you telling them about something, but just because you're speaking, it's foreign to them until you show it to them!”

(d) Memory problems

Only three participants indicated a problem with memory. EP 4 explained that she needs to create symbols for learners that use computers because not all mathematical symbols appear on the computer. She experienced that learners cannot recall these symbols in the examinations. EP 6 also indicated a problem with memory. Her learners often forgot the content if she did not do corrections directly after the activity. EP 7 indicated that her learners have memory problems due to having SID (this will be described below).

(e) Severe Intellectual Disability

Only one participant indicated that she experiences SID in the classroom. According to EP 7, SID includes slow processing or no processing skills at all and memory problems. This is the “biggest issue” that she experiences.

Other barriers

During the analysis, other themes also emerged that could be barriers for learners with CP. These themes are (a) vision difficulties (b) educators (c) cost (d) inexperienced learners (e) power outages and (f) crime.

(a) Vision difficulties

Some learners struggle visually. EP 2 stated that she has learners with low vision in her classroom. These learners need glasses to see on the smartboard. EP 5 and 7 also mentioned that some learners in their classrooms are visually impaired. LP 5 mentioned that he cannot see unless he sits close to the board.

(b) Educators

Some participants indicated that the educator can be a barrier to the learners. EP 9 is of the opinion that “as much as the learners can know devices, everybody is on par, but if a teacher doesn't understand how to use their devices, they still have a learning barrier.” He further explained that an educator must understand how to use AT to avoid becoming a barrier in the classroom. According to EP 1 technology can be a burden to educators. She stated that a common problem is:

“a lot of the teachers are older, are not experienced with using, you know, technology so, they are obviously scared of it and shy away from it and it wasn't being used enough and consistently enough that they are able to grasp the use of it and integrating it with the curriculum.”

EP 2 and 10 also mentioned that educators can be a barrier if they do not know how to work with technology. EP 10 stated that she is one of those educators because she is not “up to date with it” and as a result, she does not use AT in the classroom.

(c) Cost

One of the many barriers involves cost. According to EP 1, “these ATs can be expensive”. EP 5 is of the opinion that it is a “cost-benefit kind of thing” and cost must be weighed up against the benefit. Cost is not only a barrier at school but at home as well. According to EP 1, some learners are only exposed to technology at school because of the cost implications involved in acquiring ATs. This causes educators to not send homework or extra repetition home.

(d) Inexperienced learners

Learners' inexperience with regards to the use of AT can be a great barrier. According to EP 1 learners often repeat grade one because in the first year the school must “get them used to that and sort out access to AT”. In the second year, she can start focusing on the actual content. EP 2 also stated that learners are not taught how to work with ATs in grade R and she must teach them basic computer skills in grade one. EP 9 highlighted that this is a barrier due to the learners still having to learn how to use devices such as keyboards for typing when they are older.

(e) Power outages

Another problem is the power supply. According to EP 7, a power outage is a “huge issue”. She further explained:

“because like, for example, if we have no lights, we struggle. We have wheelchair kids that use motorized wheelchairs so they cannot move. They are immobile. Then those who are using a computer they cannot work because they don't have access. If you're using a smartboard, you can't. And most of our kids, like when we don't have lights, it's very dark for them. If you actually walk

past the classes, you'll see our lights on all the time even when it is sunny. And that's because our kids visually aren't that great.”

EP 8 and 9 shared the same opinion that a power outage is a barrier. EP 9 explained that:

“I am in class and a learner relies on that computer and when we say entirely we mean they cannot write, you know, so if we have no electricity I cannot stop teaching because there's no electricity I need to continue and rely on their decision to write if we don't have electricity for two days that learner will not write for two days and it's a problem.”

(f) Crime

Crime can be a barrier. EP 9 states that these learners cannot take their ATs home. He explained that due to the learners coming from impoverished areas, the crime is high and their ATs get stolen or broken. According to EP 1, this creates a barrier because learners cannot do homework or extra repetition at home.

Effect of barriers on learning

Many themes emerged from the data analyses with regards to the effect of barriers on learning. These themes are (a) the need for concessions and extra time (b) a loss of interest in academics (c) the use of various teaching strategies and (d) failing.

(a) The need for concessions and extra time

Several participants indicated that they or their learners need extra time to complete tasks and concessions to complete examinations. According to EP 2, her learners need “extra time and special attention” to overcome their reading difficulties. EP 3 is of the opinion that his learners take time to comprehend questions in the examinations. EP 5 stated that his learners need “a heck of a lot more time” to complete activities and tasks. LP 2 is one of the learners that stated that he needs extra time to finish tasks.

EP 3 and EP 4 mentioned that their learners need concessions. EP 3 noted that her learners need concessions when they write examinations to ensure that they finish on time. EP 4 also mentioned that he applies for “special time”. Furthermore, EP 3 is of the opinion that the concessions granted are inadequate due to the time that learners

need. Some learners run out of time with concessions in place. LP 2 mentioned that he needs extra time in examinations to “finish writing the test”.

(b) Loss of interest in academics

Many participants mentioned that these difficulties can cause a loss of interest in a learner's schoolwork. EP 4 stated that her learners do not enjoy typing and doing school work because “it takes long”. She further explained that:

“It influences them by not having an interest in any schoolwork because most of the time when you teach you can see other things. They don't want to write, the time even when you talk to them, they don't show an interest, so you have to speak to them, beg them to write. It is really a challenge that we experience.”

EP 8 also mentioned that she needs the learners to interact otherwise she “loses” them.

(c) The use of various teaching strategies

Many educators mentioned that they use repetition a lot. EP 1 and 2 are of the opinion that repetition is very necessary. EP 8 stated that she makes use of one teaching strategy instead of using different teaching strategies because, “You can't have role play or it's not that you can't, it just takes more time, role play, playing games, educational games that become a challenge for the wheelchairs or the crutches.” EP 6 explained that she can only give learners short exercises. Learners tend to make mistakes if the exercises are too long. EP 8 also mentioned that learners get tired easily with long activities. EP 9 explained that he unconventionally uses group work. He will pair learners with other learners that will help ease their barriers. He explained:

“And the type of tasks that we are expected to administer. Because they are competing with the learners in the mainstream education, who are able to create a project with their own hands this one they would also be expected to create the very same project with their own hands. So now because of that, we have to do it, we have to group them according to their strengths. This one, if they can use their hands, they will be paired with somebody that can't. And this one who has a speech problem would be with somebody that is able to speak so that we are able to have a presentation, we're able to have that project being

done as expected by the department. Yeah, yeah. So, I think that is the type of visibility that the learner is having, places barriers to learning.”

(d) Failing

Some of the participants also mentioned that learners fail due to having these barriers. EP 1 explained that learners normally finish grade one in two years. During the first year, she focuses on finding ATs and teaching the learners how to use these ATs. During the second year, she focuses on the content. EP 7 mentioned that many learners “slip through the cracks” because they fail due to their barriers.

4.3.2 AT integration to support learners with CP

AT use by educators

Themes that emerged with regards to AT used by educators can be divided into three categories: (a) hardware (b) visual and auditory tools and (c) other tools.

(a) Hardware

All participants reported that they use smartboards in their classrooms. EP 1-10 explained that they use their laptops and smartboards every day. LP 1, 2 and 5 also stated that their educators use a smartboard in the classroom. EP 2 explained that with a smartboard her writing is clearer, she can increase the size and she can use a diagram. EP 5 also explained that he uses a font that is “easily read by people who’ve got Dyslexia”. LP 2 explained that his teachers make use of data projectors to aid his vision. He struggles to see unless it is projected on the smartboard. The use of smartboards was evident during the classroom observations. All educators use smartboards to aid in teaching and learning. During the observations, some teachers also used the smartboards to do practical work in Mathematics.

(b) Visual and auditory tools

Many participants use visual and auditory tools to aid learning in their classrooms. EP 2 explained that she uses visuals of the stories that the class reads. She also uses “phonetic songs” and “alphabet songs” to aid learners with their memory. EP 3 makes use of Microsoft PowerPoint, videos and pictures to aid in teaching and learning. According to him “it’s much easier to present the pictures or maybe the videos which makes it easier for them, rather than expecting them to read”. EP 4 also makes use of videos and PowerPoint. EP 7 uses visual and auditory tools to aid learners in gaining

a better understanding of concepts. She explained that if her lesson is on the ocean, she will connect to the internet “where they can physically see this is the ocean. This is the sound you’d hear”. EP 8 also uses these tools to aid in understanding. She explained that learners do not understand concepts until “you show it to them”. During the classroom observations, the researcher noticed that most educators use videos, sound and pictures to explain the content.

(c) Other tools

Some participants indicated that they use other tools as well and not just the smartboard and visual and auditory tools. EP 4 explained that she uses polls on the computer to test understanding. EP 6 makes use of a program called “Zodo”. She explained that with this program, her learners can edit DBE books on their computers. During the observations, EP 1 also made use of games to explain to the grade ones how to use the computer, keyboard, and mouse.

AT use by learners

Learners use many different ATs to assist them. These ATs can be divided into the following categories: (a) ATs to assist with writing and typing (b) ATs for communication (c) ATs for mobility (d) programs and (e) other ATs.

(a) ATs to assist with writing and typing.



Photograph 1: AT setup



Photograph 2: Joysticks



Photograph 3: Joystick and Buddy button



Photograph 4: Head clicker



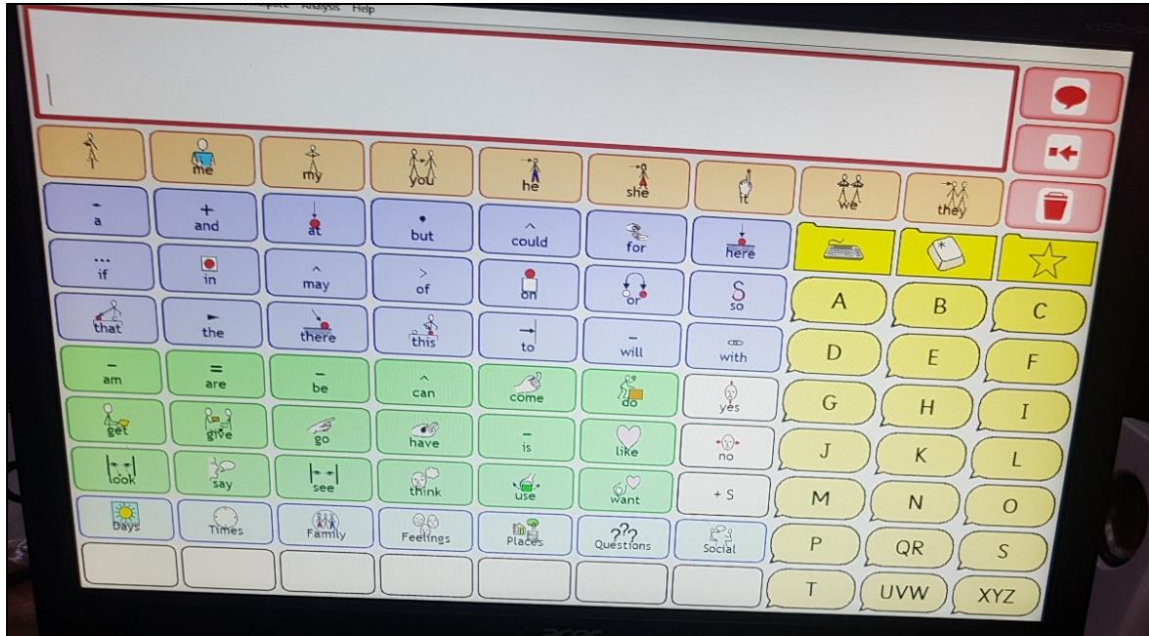
Photograph 5: Keyboard cover

Many learners use ATs to assist in writing and typing. Photograph 1 is the typical setup of a computer to assist in writing and typing. EP 1 explained that most of her learners use big keyboards and rollerballs such as the keyboard and rollerball on photograph 1 and joysticks and buddy buttons such as in photograph 2 and 3. She further explained that one learner uses a head clicker such as in photograph 4. This clicker attaches to a joystick to ease navigation and instead of using a mouse to click, this learner will use her head to click. EP 1 explained that learners can also use a head clicker and a scanning program to type. This program is a process where the computer will scan each key on the onscreen keyboard until the learner selects a key. EP 1 also stated that her learners with Spastic CP need a metal keyboard cover to type. This helps a learner to press one button at a time without pressing the surrounding buttons. According to EP 7, these adapted keyboards are much larger and have brighter colours to aid learners who struggle visually.

EP 2 explained that her learners use a head pointer to type and the scanning program explained above. EP 4, 5, 7, 8, and 10 explained that their learners also use adapted keyboards and mice such as those explained above. EP 9 explained that his learner uses a special mouse that is fitted on the floor. This learner uses her feet to navigate and her tongue to type. EP 5 explained that he uses an adapted mouse. During the field notes and classroom observations, the researcher also noticed that most learners use these ATs to assist with writing and typing.

During the classroom observations, the researcher noticed that learners use many different devices to aid in writing and typing. One learner used a wooden board to keep his work on for easy typing. Most learners made use of adapted keyboards and mice.

(b) ATs for communication.



Photograph 6: The grid

Some learners need ATs to assist them with communication. EP 1 explained that one learner uses a program called “The Grid” to communicate in her classroom. This program allows the learner to communicate through the program. It consists of different grid sets with words and symbols that represent everyday language. The learner will then form sentences by clicking on the words or pictures. EP 1 also explained that this user cannot take her computer home and as a result uses a printed-out version to communicate at home. EP 9 also explained that he has a learner that relies on this program to communicate. This was evident during the classroom observations. Some learners are nonverbal and only communicate by using a speech book.

(c) ATs for mobility

Almost all learners in this school make use of some form of AT for mobility. EP 1, 5, 8 and 9 mentioned that their learners use wheelchairs to move around. During the classroom observations and field notes, these ATs were more prevalent. LP 2 makes use of a motorised wheelchair. In EP 2’s classroom, several learners made use of

wheelchairs, crutches, and walking aids. In EP 8's classroom, some learners made use of wheelchairs, motorised wheelchairs, and crutches. In EP 9's classroom, one learner used a specialised wheelchair since his whole body is paralysed, which is called a Tilt-In-Space Wheelchair. The researcher noticed that while some learners have mobility, others need special equipment to move around such as wheelchairs and crutches.

(d) Programs

There are many programs that learners use to assist them. EP 1 explained that her learners make use of "Dina", a program to practise mouse control and "Nessy Fingers", a program to assist with typing. She also uses "The Grid" in her classroom (as explained above). EP 2 and 6 mentioned that their learners make use of spellchecker to aid them with writing. EP 8 explained that his learners use basic Microsoft programs to type. EP 9 said that his learners use basic Microsoft especially the picture and icon function. LP 1, 2, 5, and 6 explained that they use Microsoft Word and PowerPoint to aid their learning. LP 2 mentioned that he also uses basic Microsoft programs and Spellchecker.

(e) Other ATs

Many learners struggle with practical subjects. EP 8 explained that her learners have many ATs in her classroom due to being a Consumers Studies subject. Her learners use special chopping boards, non-slip mats, and special knives.

"It's a chopping board, whereby it has uhm, I can't say a nail really... Let's call it a nail for now. It has this nail. So, you put your onions on the nail. So, it holds it, so it doesn't move around, because the other hand doesn't work. So, you can't hold the onion. So, you just prick it in that nail, and then you will start chopping with your other hand. So, I found that really, really awesome. And then the other one is a knife. She can't really hold the knife. So that knife has a really nice handle whereby she can use it and cut with it. It's not like your normal knife. And so that is what else is in the kitchen. Oh, another one is a mat, the non-slip mats. Because they can't hold the bowl still. So, it keeps moving around if they tried to stir something, so that mat holds the bowl still. It doesn't move as much."

4.3.3 Inclusive education for learners with CP

Inclusivity is an important theme that emerged from the data. All participants believed that ATs create a more inclusive environment for their learners. EP 1 stated that without ATs her learners would not be able to access the curriculum and as a result be excluded from learning. EP 2 stated that ATs create a more inclusive classroom because she can develop lessons that accommodate all learners. EP 5 explained that ATs provide learners with the opportunity to do things and that his learners would not be able to learn without the ATs. EP 6 is of the opinion that ATs make work and planning easier. EP 7 explained that ATs “bridges the gap between the learner’s actual knowledge and what we are trying to teach”. EP 8 also explained that ATs enable each learner to be “part of the class”. This accommodation was evident during the classroom observations. The researcher did not notice one learner who could not take part in activities and learning.

4.3.4 Pedagogy

Three main themes emerged from the data, pedagogy and ATs, pedagogy adaption and teaching strategies.

Pedagogy and ATs

Many educators incorporated ATs into their pedagogy. EP 1 mentioned that ATs improve efficiency. She explained that with technology educators do not have to “plan six different activities” and “everyone is doing the same thing albeit at different paces”. EP 2 explained that before presenting content, she can plan the content and type everything. She also explained that while presenting content, she can add information or highlight important sections. EP 3 explained that ATs make it easier to present content. He explained that creating slideshows is easier than “the traditional way of writing on the board”. EP 6 explained that with the use of ATs, she can teach more efficiently. She explained that she can plan and incorporate more lessons and skills into her daily lessons. EP 9 mentioned that he can plan lessons that are more accommodating to all learners when using ATs.

Pedagogy adaption

Many educators reported that they had to adapt their pedagogy to either incorporate technology or to accommodate all learners. EP 1 stated that she had to change her “whole way of thinking”. She believes that her basic principles and theories remained

the same but she had to adapt the “carry through” and her “way of thinking” in terms of focusing on the basics and not the whole curriculum. EP 5 stated that he is “fairly adaptive” in his approach to teaching. He adapts his approach to teaching according to “what the needs are and what their capabilities are”. He feels fairly “flexible” in his approach. EP 6 explained that she watches many programs on television that explain content to learners. These programs teach her what teaching approaches work best for different content. She adapts her teaching approach as needed. EP 8 explained that she needed to adapt her approach to teaching. She explained that she talks slower, demonstrates more, and gets the learners involved. She also explained that she did not have to adapt when teaching learners without disabilities.

Contrary to these educators, some educators feel that they did not have to adapt their pedagogy. EP 7 explained that the school is an AT school and therefore she already has a fixed pedagogy. EP 3 also explained that since he started his career “everything has been on technology” and he did not have to adapt.

Teaching strategies

Educators make use of many different teaching strategies. EP 1 and 2 explained that they use repetition in their lessons. EP 2 also explained that she believes in practical experience and allows learners to “do it practically”. EP 8 explained that she makes use of group work, role play, gamification and real-life experiences. She tries to motivate learners to participate by allowing them to explain real-life experiences and take part in practical exercises. EP 9 will pair learners according to their abilities. He explained that “if they can use their hands, they will be paired with somebody that can't” and “this one who has a speech problem would be with somebody that is able to speak so that we are able to have a presentation”. He also explained that he works with each learner individually to ensure that they are “on par”. EP 9 also makes use of practical experience. He explained that ...

“sometimes you find but this learner is not able to use their hands and you want them to touch and feel uhm the smoothness of the surface. Then they are not responding to that what do you use then that is when you rely on videos, you know, to explain, and then they say oh wow it's so smooth. Uhm so, the videos and visuals tell them, and after pairing them with peers you are able to say okay, by now you will tell them about the roughness, tell them about the

smoothness of this thing. Take the object on the chin, if it is a safe object to do so.”

4.3.5 Content

Two main themes emerged from the data, content and ATs and content adaption.

Content and ATs

Many educators use ATs in the content. EP 1 explained that she makes use of “The Grid” to aid learners with the content. She explained that “during a comprehension, the answers can be put in and then they can choose it”. EP 2 explained that she explains the content with the use of visuals, videos and sound. According to EP 3, he makes use of PowerPoints to explain the content. EP 4 also explained that the content is easier to explain when using ATs. EP 7 explained that because her learners cannot use their hands and lack background knowledge, she makes use of videos and pictures to explain the content to the learners. This creates a better understanding of the content. During the observations, the researcher noticed that all educators make use of videos, pictures and sounds to explain concepts. Learners seemed to grasp the content better when using these visual aids.

Content adaption

Many educators explained that the content is too much for learners with CP. EP 1 explained that she cannot fit in as many things into a day or a week. She explained:

“So, the content we try not to water it down too much but you really have to strip it down and figure out what's important and try and focus on that instead of overwhelming them with something that maybe they will catch on in a later stage or maybe that if it's like vital to their basic reading and writing.”

EP 2 explained that she also needs to adapt the content and the assignments to ensure that her learners can understand the content. According to EP 4, Mathematics needs to be adapted to be used by learners. She needs to create symbols that each learner understands and uses. EP 5 explained that he also needs to “strip down the content” and as a result “very little time is spent on in-depth learning”. He only focuses on “the bare bones” of the curriculum because he does not have sufficient time. EP 7 explained that the “CAPS that we use is adapted” and the adaption depends on the teacher. She explained that because she teaches Creative Arts and many learners

cannot make art, she needs to make use of visuals and cannot do practical assignments. EP 10 stated that she also needs to adapt the content because she teaches Physical Education and learners cannot do certain activities. She explained that the CAPS do not accommodate learners with a physical disability.

4.3.6 Level of AT integration according to SAMR

The level of technology integration will be divided into two themes: Level of technology integration by educators and Level of technology integration by learners.

Level of technology integration by educators

Overall, educators only use ATs on level 1 or 2 of the SAMR. Although many educators state that they are dependent on ATs, they only use the ATs for enhancement. EP 2 explained that she uses the smartboard because her handwriting is bad. EP 3 stated that he uses the smartboard to display a soft copy or online copy of the textbook or to present a PowerPoint. EP 8 uses her smartboard to display visuals. EP 5 explained that he uses his smartboard to enable learners to see better.

Some educators use ATs on level three of SAMR. EP 4 uses ATs to assist learning by creating polls and to explain Mathematics. EP 6 also uses her ATs to organise and explain better. She explained that she also makes use of the drawing function. EP 7 explained that she makes use of the smartboard to assist learners with understanding basic concepts. She makes use of videos that incorporates audio and visuals to ensure that learners grasp basic concepts without physically experiencing the concepts, for example, the ocean. EP 9 also uses ATs to aid learners in grasping concepts. He explained that he uses videos to explain the practical use of technology concepts.

Level of technology integration by learners

All learners use their ATs on levels 3 and 4. According to EP 1 and 5, their learners are dependent on ATs and would not have access to education without ATs. EP 1 explained that ATs “completely impact their learning” and learning would not be possible without ATs. EP 6 and 8 are also of the opinion that ATs provide learners with the opportunity to learn and be part of a classroom. LP 3 explained that without ATs he “can do nothing”. He explained that with the use of ATs, he can write properly. LP 6 explained that even though his ATs are old, it helps him “more”. In the field notes, it is evident that LP 1-6 are dependent on their ATs. LP 1, 3, 4, 5 and 6 would not be

able to write without their ATs. LP 2 would not be able to be mobile and move around. During the observations, it was clear that all learners are dependent on some form of AT.

4.3.7 Effectivity of AT integration

Five participants felt that ATs are effective. According to EP 1 ATs “completely impacts their learning” and gives them an advantage for the future job market “where some of their non-disabled counterparts wouldn’t have had the opportunity to learn”. She also explained that ATs can only be effective if the educator and learner work together. EP 2 stated that the ATs are “very effective” in her classroom. EP 4 explained that the AT is effective because it reduces the challenges that learners experience, “especially those who have visual problems”. LP 3 stated that his AT helps him with everything that he needs it to. LP 5 also feels that his ATs help him effectively.

Three participants feel that it is effective but does not address the barriers completely. EP 3 stated that learners take time to comprehend and interpret content even if they use ATs. EP 6 stated that ATs reduce the challenges at times, but not always. She further explained that if a computer is set to correct spelling and punctuation, the learners do not learn that they have made a mistake. EP 9 feels that ATs are effective to a certain extent. He explained that learners who only learn how to use ATs at a later stage struggle with ATs and learning.

Two participants feel that ATs do not effectively address the barriers. According to EP 5 ATs “are nice” but “the fact that they are not the latest” makes them less effective. According to him, ATs are limiting and much more can be done. He feels that learners with vocalisation and communication challenges do not have adequate technology. He also feels that the ATs do not help learners enough because there are ATs that could assist the learners to a greater extent. According to EP 7 “many kids slip through the cracks” even with ATs. She further explained that these learners still struggle to grasp basic concepts and “end up failing”.

4.4 DISCUSSION

4.4.1 Barriers for learners with CP

As indicated in Chapter 2, learners with CP experience physical and cognitive barriers. Educators in this study also referred to other barriers for learners with CP.

Physical barriers

As explained in chapter 2, learners with CP experience many physical barriers. This was affirmed by the interviews and observations.

According to several participants, learners with CP have poor gross and fine motor skills. Landsberg, et al. (2019) and CerebralPalsy (2020) supported this statement by stating that learners with CP experience impaired gross and fine motor functioning. According to Miller and Bachrach (2006), this causes problems with walking, sitting and posture.

According to the researcher's observations and the interviews, learners also experience mobility challenges. This statement was affirmed by CerebralPalsy (2020) and Landsberg, et al. (2019) when they stated that learners with CP often experience difficulties in everyday tasks such as walking, running, balancing, and jumping.

Participants also indicated that learners have problems with communication and speech. This was affirmed by Miller and Bachrach (2006), Rosenbaum (2007) and Landsberg, et al. (2019). These researchers stated that learners experience impaired communication because these learners struggle with articulation. Speech problems may include slurred or slow speech (Cerebral Palsy Guidance, 2020). It was also evident during the classroom observations that some learners cannot speak and other learners have difficulty in articulation.

Cognitive barriers

Rosenbaum et al., (2007), Jenks, De Moor, and Van Lieshout (2009), Van Rooijen et al., (2016) and Cerebral Palsy Guidance (2020) explained that learners experience problems with numeracy and arithmetic, reading skills, working memory, non-verbal understanding, short attention span, learning and comprehension problems, executive functioning, problem-solving and hyperactivity. Based on the information provided by the participants, learners also experience cognitive delays, language and reading problems, comprehension problems, memory problems and SID.

Other barriers

The interviews revealed that learners also experience other barriers. Learners with CP may also experience problems with vision, the cost of ATs, inexperienced learners, inexperienced educators, power outages and crime. These themes did not appear in the research.

Effect of barriers on learning

The interviews highlighted that the barriers have a negative effect on learning for learners with CP. Learners may need concessions and extra time, they may experience a loss of interest in academics which could lead to failing altogether. Educators may feel that they cannot use a variety of teaching strategies and methods. Contrary to the participants, Miller and Bachrach (2006) are of the opinion that learners with CP may experience bullying leading to low self-esteem. Cerebral Palsy Guidance (2020) affirmed this statement by explaining that bullying may further lead to a learner with CP not being able to concentrate during class, having lower grades or learners simply dropping out of school.

4.4.2 AT integration to support learners with CP

Although limited research has been done on ATs to specifically support learners with CP, it was evident during the interviews that there are several ATs available to support learners with CP.

The interviews indicated that ATs used by educators involve hardware such as laptops and smartboards, software that incorporates visual and auditory tools such as videos, songs, pictures and Microsoft PowerPoint and other tools such as programs that ease learning and teaching. Raja (2016) shared the same sentiment by explaining that educators can supply resources in an electronic format, differentiate the learning and teaching material, use assistive software such as magnification and text to speech, smart devices and recording of lectures. The participants also indicated that they use bigger fonts and text to ease reading. Cerebral Palsy Foundation (2019) also emphasized this statement by stating that the use of larger fonts and text can be beneficial.

According to the interviews, ATs used by learners can be summarised into five categories: ATs to assist with writing and typing, ATs for communication, ATs for mobility, programs, and other ATs. The uses of these ATs are summarised in Table 7.

Table 7: AT uses by learners for physical barriers

	Uses	AT
1	ATs to assist with writing and typing	Adapted keyboards Rollerballs Joysticks Buddy buttons Head clickers Scanning Onscreen keyboards Metal keyboard covers Head pointers
2	ATs for communication	The Grid Speech book
3	ATs for mobility	Wheelchairs Motorised wheelchairs Crutches In-space Wheelchair
4	General programs	Spellchecker Microsoft Office (Microsoft Word and PowerPoint)
5	Other ATs	Adapted chopping boards Adapted knives Adapted cutting boards

Some researchers support these sentiments such as Landsberg, et al. (2019), Cerebral Plays Guidance (2020), CerebralPalsy (2020), Rahamin (2004) and Kouroupetroglou (2013). Landsberg, et al. (2019) also suggest using assistive drawing devices, hand-grip assistive devices, a moving drawing board, adapted keyboards and mice, voice- or eye-activated computers and computer programs, and a mouthpiece instead of a computer mouse or keyboard, specifically for learners with CP. Cerebral Palsy Guidance (2020) and CerebralPalsy (2020) suggested programs such as spellcheckers to support learners with CP. Raja (2016) suggested communication devices such as text to speech. Rahamin (2004), Kouroupetroglou (2013) and Cerebral Palsy Guidance (2020) affirmed that trackballs, touch screens, higher

contrast displays, enlarged cursors and text, using a keyguard, speech-generating devices and text-to-speech facilities may aid learners with a physical disability.

4.4.3 Inclusive education for learners with CP

As stated in chapter 2, inclusive education is important for learners with CP. Several participants also indicated the importance of inclusive education. Many participants feel that the learners would not have access to education without ATs creating a more inclusive environment. Florian and Hegarty (2004) supported the participants by stating that ATs provide an equal opportunity for learners with disabilities to learn.

4.4.4 TPACK

As seen from the interviews and observations, many educators and learners use technology to make learning and teaching possible.

PK

Most educators reported that they had to adapt their pedagogy to incorporate ATs and to accommodate all learners. They reported that their general approach to teaching needed to change. Many educators also reported a change in their teaching strategies. Educators use strategies such as repetition, practical learning, group work, role play, gamification and real-life experiences.

CK

To accommodate learners with CP, the content also needed adaption. Many educators reported that the content is too much for these learners. These educators only teach the basics of the curriculum and learners seldom receive in-depth knowledge about a topic.

TPK

Many participants reported that they had to change their pedagogy to include ATs in their lessons. Contrary to these participants, some already used ATs in their pedagogy. Educators incorporate technology into their pedagogy by making use of smartboards, overhead projectors, videos, pictures, and slideshows.

TCK

During the interviews, it was evident that ATs aid in content delivery. Many participants reported that they use ATs to create a meaningful lesson. Educators reported that

most learners do not have background knowledge about many topics. To overcome this lack of knowledge, educators incorporate ATs such as auditory and visual tools. They will use ATs to create a better understanding of the content and to better explain the content.

PCK

As seen in the interviews, educators use a variety of teaching strategies to help learners master the content. Educators use strategies such as repetition, practical learning, group work, role play, gamification, and real-life experiences. The content is also adapted to ensure that learners understand the basic concepts of a topic.

4.4.5 Level of AT integration according to SAMR

According to the researcher's observations, most educators use ATs on level 1 and 2 of the SAMR model. Occasionally some educators use ATs on higher levels. On the other hand, all learners use ATs on levels 3 and 4.

4.4.6 Effectivity of AT integration

Based on the interviews, some participants feel that ATs are effective in the minimising of barriers. Contrary to these participants, others feel that ATs are effective to a certain extent, but not sufficient and more should be done to accommodate learners with CP.

4.5 CONCLUSION

This study aimed to explore how ATs can be used to minimise the barriers to learning that learners with CP experience in the classroom. In this chapter, various data was explored and the data from the sixteen participants revealed a few major themes: barriers for learners with CP, the effect of barriers on learning, AT integration to support learners with CP, inclusive education, AT integration in the pedagogy, AT integration in the content, level of AT integration and the effectivity of AT integration.

Learners experience many physical and cognitive barriers. From the interviews, it is evident that learners also experience other barriers such as vision difficulties, educators as barriers, cost of ATs, inexperience, power outages, and crime. This can have a negative impact on learning since it leads to the need for concessions, a loss of interest in academics, limited teaching strategies and failure. All the participants shared the same view about the potential of ATs to minimise the barriers that learners with CP experience. The findings also indicated that the use of ATs by educators and

learners creates a more inclusive environment for the learners. This allows all learners to take part in learning.

ATs can also be integrated into an educator's pedagogy and the content to support teaching and learning. However, according to most participants, educators need to adapt their pedagogy, their teaching strategies, and the content to accommodate all learners and ATs.

Furthermore, ATs can be integrated on different levels according to the SAMR. It was evident during the interviews and observations that educators mainly integrate ATs on levels 1 and 2. On the other hand, learners are completely dependent on ATs and integrate ATs on levels 3 and 4.

It was evident during the interviews and observations that educators have varied opinions on the effectiveness of ATs. Some educators feel that ATs are effective in minimising the barriers. Contrary to these educators, others stated that these ATs are not effective, and learners should be exposed to more ATs.

The next chapter will include the limitations of the study, the recommendations, and concluding remarks.

Chapter 5: Summary, conclusions, and recommendations

5.1 INTRODUCTION

In chapter 4, the researcher discussed the data analysis and the findings. This was done in line with the purpose of the study. The purpose of this study was to identify the different barriers to learning that learners with CP may experience and how AT can be used to minimise these barriers. From the data, a few major themes emerged: barriers for learners with CP, the effect of barriers on learning, AT integration to support learners with CP, inclusive education, AT integration in the pedagogy, AT integration in the content, level of AT integration and the effectivity of AT integration.

In this chapter, the researcher will present a summary of the findings, the limitations, recommendations, and concluding remarks.

5.2 SUMMARY OF FINDINGS

The study investigated the different learning barriers that learners with CP may experience and how ATs can be used to minimise these barriers. This section of the study attempts to summarise the answers to the primary research question: **How can assistive technology be used to minimise the barriers to learning that learners with CP experience?** The main research question was broken down into four sub-questions, which will be summarised in this chapter:

- What barriers to learning do learners with cerebral palsy experience?
- How can assistive technology be integrated into the pedagogy of educators in special needs education?
- How can assistive technology be integrated into the content in special needs education?
- How meaningful is the assistive technology incorporated into lessons to transform or to enhance the lessons?

5.2.1 Barriers to learning that learners with cerebral palsy experience.

It appears that learners with CP experience many barriers to learning. These barriers can be minimised with the use of ATs. These barriers and the ATs are summed up in Table 8.

Table 8: Barriers experienced by learners with CP

Barriers experienced		ATs
Physical barriers		
	Mobility	Wheelchairs Motorised wheelchairs Crutches In-space Wheelchair
	Motor skills	Adapted keyboards Rollerballs Joysticks Buddy buttons Head clickers Scanning Onscreen keyboards Metal keyboard covers Head pointers Adapted chopping boards Adapted knives Adapted cutting boards
	Speech and communication	The Grid Speech book
Cognitive barriers		
	Cognitive delay	Pictures Videos PowerPoint
	Language and reading	Microsoft Office (Microsoft Word and PowerPoint) Spellchecker
	Comprehension	Pictures Videos
	Memory	Pictures Videos

Although the main barriers experienced can be cognitive and physical, other barriers were also identified. These barriers include vision difficulties, the cost of ATs, inexperienced learners, inexperienced educators, power outages and crime at home.

5.2.2 AT integration into the pedagogy of educators in special needs education

Educators can integrate many ATs into their pedagogy to aid learners with CP. These ATs can be divided into hardware and software. The hardware includes laptops, overhead projectors, and smartboards. The hardware is used to display the software that assists learners with CP. The software includes YouTube, videos, songs, pictures, and PowerPoint presentations.

5.2.3 AT integration into the content in special needs education

Educators mostly make use of auditory and visual tools to aid learners in mastering a topic. These auditory and visual tools include videos, pictures and slideshows that aid learners in the understanding of concepts.

5.2.4 Effectivity and meaningfulness of AT integration into lessons to transform or to enhance the lessons.

ATs can be effective in the minimising of barriers for learners with CP. Although educators rarely implement ATs to promote transformation, they still use ATs to enhance their classrooms by using ATs as a substitute for some function such as a textbook. On the other hand, learners mostly use ATs for transformation. Learners would not be able to study and perform everyday tasks without ATs. It is evident that the school is dependent on ATs since learners with CP need ATs to function.

5.3 LIMITATIONS OF THE STUDY

The study does have a few limitations:

- The study was conducted at one school in the Gauteng district. This limited the researcher in exploring other barriers and ATs in other districts.
- The interviews did not include the principal or SGB. This may cause a contradiction to what the educators and learners reported.
- The Covid-19 pandemic was also a limitation seeing that some interviews were conducted via Zoom. The majority were conducted face-to-face.

- The study focussed on specifically CP and was thus limited by not giving an overview of the barriers and ATs in other schools or taking other disabilities into consideration.
- All learner participants were male. This may cause a contradiction to what female learners may experience.

5.4 CONTRIBUTION OF THE STUDY

As mentioned in chapter 1, there is limited research available on CP and ATs specifically. This study attempts to bridge this gap by not only explaining what CP is, possible treatment and possible barriers, but also how ATs can be used to minimise the learning barriers that learners with CP experience.

5.5 RECOMMENDATIONS

The researcher makes the following recommendations:

- Educators should be trained adequately on how to use ATs and their functions in a classroom.
- Learners should be educated from a young age on ATs.
- Educators and learners should be supported where a lack of resources is present.
- Educators should be creative in their pedagogy to encourage more learner participation.
- Educators should attempt to use ATs to transform their lessons from lessons that were not previously achievable.

5.6 RECOMMENDATIONS FOR FUTURE RESEARCH

Further research is recommended:

- on what training programs are needed to educate educators adequately on the use of ATs.
- on specifically ATs and what can be done to adequately accommodate all learners with CP.
- on the knowledge that these educators have with regards to CP.
- on how educators can use ATs to bring about transformation.
- on other types of disabilities.

- a broad study including more LSEN schools that houses learners with CP.
- on what barriers the comorbid disabilities have for learners with CP.

5.7 CONCLUSION

In this chapter, a summary of the research findings was presented. The limitations to the study were discussed and recommendations were made for schools and future research.

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APPENDICES

APPENDIX A: RESEARCH APPROVAL LETTER



GAUTENG PROVINCE

Department: Education
 REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	01 July 2020
Validity of Research Approval:	04 February 2020 – 30 September 2020 2019/518
Name of Researcher:	Botha S
Address of Researcher:	3 Wit Street Marlands Germiston
Telephone Number:	0849001366
Email address:	soenebotha@gmail.com
Research Topic:	The use of technology to lower learning barriers for learners with Cerebral Palsy
Type of qualification	Master's in Education
Number and type of schools:	1 LSEN School
District/s/HO	Ekurhuleni North

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1. Letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.

1

Making education a societal priority

Office of the Director: Education Research and Knowledge Management

7th Floor, 17 Simmonds Street, Johannesburg, 2001

Tel: (011) 355 0488

Email: Faith.Tshabalala@gauteng.gov.za

Website: www.education.gpg.gov.za

2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. **Because of COVID 19 pandemic researchers can ONLY collect data online, telephonically or may make arrangements for Zoom with the school Principal. Requests for such arrangements should be submitted to the GDE Education Research and Knowledge Management directorate. The approval letter will then indicate the type of arrangements that have been made with the school.**
4. **The Researchers are advised to make arrangements with the schools via Fax, email or telephonically with the Principal.**
5. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
6. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
7. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
8. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
9. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
10. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
11. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
12. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
13. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
14. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
15. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
16. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards



Mr Gurnani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 19/07/2020

2

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APPENDIX B: INVITATION TO PARTICIPATE



Faculty of Education

Dear student

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT:

The use of technology to minimise learning barriers for learners with Cerebral Palsy

What is educational research?

Educational research is something we do to find new knowledge about the way people learn. We use research projects or studies to help us find out more about ways to improve educational practices.

What is this research project all about?

This project wants to find out what barriers you experience in your learning and how technology is used to overcome this barrier.

Who is doing the research?

The project is being done by Ms Soené Botha, who is at the moment enrolled for a Master's degree at the University of Pretoria. One of the requirements to complete this degree is to complete an educational research project that will help improve educational practices.

What will happen to me in this study?

During this study, you will have the opportunity to explain the challenges that you experience when you learn and how you and your school use technology to overcome these challenges. You will also be observed in the classroom while you use technology. This lesson will be audio recorded to ensure that I have all the data.

Can anything bad happen to me?

There are no risks if you should agree to take part in the study.

Can anything good happen to me?

It is possible that, by doing this interview, you will have a greater understanding of how technology can support you in your learning and how technology can minimise the barriers that you experience. Please take note that this participation will not affect your grades or studies. You will also not receive any incentives.

Will anyone know I am in the study?

Everyone's responses and answers to the activities will be kept confidential and it will not be discussed with other teachers or learners. While your thoughts and ideas on the intervention will form part of the results of the study, your name will not be shared with anybody from the school, or the University of Pretoria and you will, therefore, be anonymous.

What if I do not want to do this?

You are not forced to take part in the research project, even if your parents give their consent for you to take part. You are allowed to withdraw from the study at any stage.

What will happen when the study is done?

At the end of the study, you will receive a copy of the study that you may read to gain more knowledge in the use of technology to help you overcome your barriers.

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

Thank you for being willing to consider this invitation to participate in the research project.

Yours in service of education,

S Botha
Student Researcher
University of Pretoria
soenebotha@gmail.com

Dear Sir/Madam,

REQUEST TO PARTICIPATE IN AN INTERVIEW AND OBSERVATION IN A RESEARCH PROJECT:

Title: The use of technology to minimise learning barriers for learners with Cerebral Palsy

My name is Soené Botha. I am currently enrolled for a Master's degree at the University of Pretoria under the supervision of Dr Maryke Mihai. The title of my research study is: The use of technology to minimise learning barriers for learners with Cerebral Palsy.

The aim of the study is to investigate how technology can be used to minimise learning barriers experienced by learners with Cerebral Palsy. Part of the data collection for this study will be interviews with learners and teachers, and classroom observations regarding their use of, and experience of such technology.

The interview with you will take approximately 40 minutes outside of normal teaching time. The classroom observation will take place during teaching time. During this time, I will observe you using technology for teaching.

I request your permission to:

1. Participate in the interview; and
2. Be part of the classroom observation.

All participation is voluntary. No harm or injury will come to you during the interview and classroom observation. Please note that the decision for you to participate is voluntary. None of the results obtained during the interview will be used for assessment purposes. You will be free to request to leave the interview or observation session at any time without any explanation or consequences.

I would also like to inform you that I will be audio recording the interviews and observations for research purposes. The purpose of the audio recording is to capture and transcribe the data accurately. All information obtained during the research study will be treated confidentially. My supervisor and I will have access to the data. No names of the learners, teachers or school will be mentioned during the reporting phase of the study. Pseudonyms will be used to avoid identification of the learner, teacher and school.

At the end of the study, you will be provided with a copy of the research report containing both the findings of the study and recommendations.

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

Thanking you in anticipation.

S Botha
Student Researcher
University of Pretoria
soenebotha@gmail.com

APPENDIX C: ASSENT LETTER



Faculty of Education

ASSENT FORM FOR PARTICIPATION IN RESEARCH

VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED:

The use of technology to minimise learning barriers for learners with Cerebral Palsy

I, _____ (your name)

TICK ONE BLOCK

give consent

do not give consent

to take part in the interview and the classroom observation that is being done by Ms Soené Botha.

I understand what the study is about and what I will be doing when taking part in the study.

I am taking part because I want to. I have been told that I can stop my participation at any time I want to and nothing will happen to me if I want to stop.

Your full name

Signature

Date

APPENDIX D: CONSENT LETTERS



Faculty of Education

LETTER of CONSENT

INDIVIDUAL PARTICIPANT

VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED:

The use of technology to minimise learning barriers for learners with Cerebral Palsy

I, _____, (your name)

TICK ONLY ONE BLOCK

give consent

do not give consent

to participate as an individual in the above-mentioned study introduced and explained to me by Ms Soené Botha, currently, a student enrolled for a Master's degree at the University of Pretoria.

The researcher has explained the aim of this study, its scope and purpose. Data collection methods proposed by the researcher have been outlined and clearly explained as well as how she will ensure confidentiality and the authenticity and integrity of the information.

Full name

Signature

Date

Faculty of Education
Fakulteit Opvoedkunde
Lefapha la Thuto



Faculty of Education

LETTER of CONSENT

SCHOOL AS PARTICIPANT

VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED:

The use of technology to minimise learning barriers for learners with Cerebral Palsy

I, _____, (your name) the principal of _____

TICK ONLY ONE BLOCK

give consent

do not give consent

to allow my school to participate in the above-mentioned study introduced and explained to me by Ms. Soené Botha, currently a student enrolled for Master's degree at the University of Pretoria.

I further declare that I understand, as explained to me by the researcher, the aim, scope, and purpose of collecting information proposed by the researcher, as well as how the researcher will attempt to ensure the confidentiality and integrity of the information she collects.

Full name

Signature

Date

School stamp

Faculty of Education
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Lefapha la Thuto



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PARENTAL CONSENT FORM FOR CHILD PARTICIPATION IN RESEARCH

VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED:

The use of technology to minimise learning barriers for learners with Cerebral Palsy

I, _____, name of parent

TICK ONLY ONE BLOCK

Give consent

Do not give consent

for my child _____ (name of child) to participate in
the semi-structured interview and observation of my research study.

Parent / Guardian full name

Signature

Date



Faculty of Education

LETTER of CONSENT

SGB

VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED:

The use of technology to minimise learning barriers for learners with Cerebral Palsy

I, _____, (your name) Chairman of the SGB,

TICK ONLY ONE BLOCK

give consent

do not give consent

to allow this school to participate in the above-mentioned study introduced and explained to me by Ms. Soené Botha, currently, a student enrolled for Master's degree at the University of Pretoria.

I further declare that I understand, as explained to me by the researcher, the aim, scope, and purpose of collecting information proposed by the researcher, as well as how the researcher will attempt to ensure the confidentiality and integrity of the information she collects.

Full name

Signature

Date

Faculty of Education
Fakulteit Opvoedkunde
Lefapha la Thuto

APPENDIX E: LEARNER INTERVIEW QUESTIONS

Learner interview questions

Topic: The use of technology to minimise learning barriers for learners with Cerebral Palsy

Demographic information:

1. Age:
2. Gender:
3. Grade:

Research question 1: What learning barriers do learners with Cerebral Palsy experience?

1. What learning barriers (physical and cognitive) are you experiencing in your daily activities?
2. How does this barrier (these barriers) influence your learning?

Research question 2 and 3:

- How can technology be integrated into the pedagogy of teachers in special needs education?
- How can technology be integrated into the content in special needs education?

Please note: In this study, technology refers to any software such as text to speech or hardware such as trackballs and touch screens, that simplifies learning for learners with Cerebral Palsy.

1. Are you currently using technology in classrooms? Yes / No. Why or Why not?
 - 1.1 In what classroom(s) is/are technology used?
 - 1.2 Which type of technology are you using in the classroom? Why this technology specifically?
 - 1.3 How are you using technology to support your learning?
 - 1.4 How are your teachers using technology to support your learning?
 - 1.5 Does technology have a significant value in the classroom for you? Yes/ No.
Explain.
- 2 Does teaching with technology create a more inclusive environment in the classroom? If yes, how?

Research question 4: How meaningful is the technology incorporated into lessons to transform or to enhance the lessons?

1. Teachers are using technology as:

- Substitution
- Augmentation
- Modification
- Redefinition

1.1 How does this take place?

Please answer this question for different teachers and different classrooms.

2. Previously you mentioned that ____ is a barrier. What technology are you using to minimise this barrier?
3. How effectively does this technology address this barrier?

Please answer this question for all the different barriers that you experience.

APPENDIX F: EDUCATOR INTERVIEW QUESTIONS

Educator interview questions

Topic: The use of technology to minimise learning barriers for learners with Cerebral Palsy

Demographic information:

1. Age:
2. Gender:
3. At which department are you currently employed?
4. Which subjects do you teach?
5. Which grades do you teach?
6. How long have you been employed at this school?

Research question 1: What learning barriers do learners with Cerebral Palsy experience?

1. What learning barriers (physical and cognitive) are your learners experiencing in their daily activities?
2. How does learner's Cerebral Palsy influence their learning?

Research question 2 and 3:

- How can technology be integrated into the pedagogy of teachers in special needs education?
- How can technology be integrated into the content in special needs education?

Please note: In this study, technology refers to any software such as text to speech or hardware such as trackballs and touch screens, that simplifies learning for learners with Cerebral Palsy.

1. Are you currently using technology in your classroom? If yes, why? If no, why not?
 - 1.2 Which type of technology are you using in your classroom? Why this technology specifically?
 - 1.3 How are you using technology in your pedagogy for learners with Cerebral Palsy?
 - 1.4 How does technology influence your pedagogy?

1.5 How does technology influence the content that you teach?

1.6 How do you integrate the content and technology to create a lesson?

2. Does teaching with technology create a more inclusive environment? If yes, how?

Research question 4: How meaningful is the technology incorporated into lessons to transform or to enhance the lessons?

1. Are you using technology as:

- Substitution
- Augmentation
- Modification
- Redefinition?

How does this take place?

2. Does technology have a significant value in your classroom? Yes / No. Explain.
3. Previously you mentioned that ___ is a barrier. What technology are you using to minimise this barrier?
4. How effectively does this technology address this barrier?
5. Please answer this question for all barriers identified.