The influence of mathematics teachers' beliefs on their inclusive practices for oral hearing impaired learners

by

Linda le Hanie

A thesis submitted in partial fulfilment of the requirements for the degree

PHILOSOPHIAE DOCTOR

Department of Science, Mathematics and Technology Education

Faculty of Education

at the

UNIVERSITY OF PRETORIA

Supervisor: Prof LS van Putten

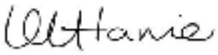
Co-supervisor: Dr JJ Botha

DECEMBER 2022

Declaration

I declare that the thesis, which I hereby submit for the degree Philosophiae Doctor (Ph.D.) 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.

Linda le Hanie



1 December 2022

Ethical Clearance Certificate

Make today matter

FACULTY OF EDUCATION
Ethics Committee

RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE	CLEARANCE NUMBER: **EDU018/19**
DEGREE AND PROJECT	PhD The influence of mathematics teachers' beliefs on their inclusive practices for oral hearing impaired learners
INVESTIGATOR	Mrs Linda le Hanie
DEPARTMENT	Science Mathematics and Technology Education
APPROVAL TO COMMENCE STUDY	25 November 2019
DATE OF CLEARANCE CERTIFICATE	25 November 2022
CHAIRPERSON OF ETHICS COMMITTEE:	Prof Funke Omidire

Mr Simon Jiane
Prof Sonja van Putten
Dr Hanlie Botha

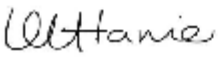
This Ethics Clearance Certificate should be read in conjunction with the Integrated Declaration Form (D08) which specifies details regarding:

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

Ethics statement

The author, whose name appears on the title page of this thesis, has obtained, for the research described in this work, the applicable research ethics approval. The author declares that she has observed the ethical standards required in terms of the University of Pretoria's *Code of ethics for researchers* and the *Policy guidelines for responsible research*.

Linda le Hanie



1 December 2022

Acknowledgements

To have achieved this milestone in my life, I would like to express my sincere gratitude to the following people:

- My Heavenly Father, who provided me with the strength, knowledge, and perseverance to complete this study.
- Prof L.S. van Putten and Dr. J.J. Botha, my supervisors, for their invaluable advice, guidance, and motivation.
- My husband, Dawie, for all his motivation and strong belief in my abilities.
- My children, Elsa and Sumien, for their patience when I was behind my computer busy “writing my book”.
- ‘Francis’ and ‘Debbie’ for sharing their inclusive practices with me, during face-to-face teaching and emergency remote teaching.
- Last, but not least, my editor, Ms Kim Smit.

Abstract

For the effective implementation of inclusion, countries are responsible to define a set of inclusive principles and practical ideas “to guide the transition towards policies addressing inclusion in education” (UNESCO, 2005, p. 12). The context of the study is the inclusion of oral (making use of spoken language) hearing impaired (HI) learners in the general (mainstream) mathematics classroom. *Hearing impaired* in this study refers to learners with moderate to profound hearing loss in both ears and who have hearing aids and/or cochlear implants. The purpose of this study is two-fold. Firstly, to investigate the way teachers teach mathematics in an inclusive, face-to-face classroom containing a few oral HI learners with the view to describing the influence of the mathematics teachers’ beliefs on their inclusive practices. Secondly, to investigate the inclusive practices of the inclusive schools’ mathematics teachers during emergency remote teaching (ERT). To accomplish this aim, an in-depth study was conducted to explore the nature of beliefs held by an inclusive school’s mathematics teachers about the nature of mathematics; the inclusion of HI learners; and the inclusive strategies used by the teachers – during face-to-face teaching and ERT.

For this case design, data was collected from two high school mathematics teachers before and during the pandemic. The theoretical framework was based on international and national guidelines for inclusive education and guided the data collection and analysis processes. Data were collected in the form of interviews, observations, and document analysis.

The main findings of this study are that both teachers have a combination of beliefs about the nature of mathematics, however, their views did not correspond in totality with their practice. Both teachers have positive beliefs about inclusive education, provided that the HI learners can cope on their own. During face-to-face teaching and ERT, neither of the two teachers taught the classes containing HI learners differently from the classes without HI learners, and used limited inclusive practices. Fewer inclusive practices were evident during ERT than during face-to-face teaching. Continuous training to enhance the teachers’ understanding of inclusion is necessary, especially the barriers to learning that HI learners face. Inclusive schools need to implement a clear policy on inclusive, ensuring that the teachers know the policy. Teachers’ inclusive practices should also be strictly monitored.

Key terms:
Inclusive Education, Hearing Impaired, Mathematics, Beliefs, Emergency Remote Teaching, COVID-19, Inclusive Practices.

Kim N Smit Editorial Services

Declaration of Professional Editing

13 December 2022

This letter serves to confirm that Linda le Hanie submitted a thesis to me for editing. The research proposal is entitled, '**THE INFLUENCE OF MATHEMATICS TEACHERS' BELIEFS ON THEIR INCLUSIVE PRACTICES FOR ORAL HEARING IMPAIRED LEARNERS**'.

The following aspects were edited:

- Spelling
- Grammar
- Consistency of layout
- Sentence structure
- Logical sequencing
- References (Reference checking involves proofreading and perhaps some editing with regards to the simple formatting of the references into the referencing style required i.e. changing the order of the elements - author, date, title, series, place, publisher, journal, volume, issue, pagination etc.)

My involvement was restricted to language use and spelling, completeness and consistency, referencing style, and formatting of headings, captions and tables of contents. I did no structural re-writing of the content and did not influence the academic content in any way.

Should you have any further queries, please do not hesitate to contact me.

Kind regards,

Kim Smit

Tel: +27 (0)78 493 6554 Email:
kimnsmit@gmail.com
Member of the Freelance panel for the University of South Africa
Member of the Freelance panel for the University of Pretoria
Full Member of the Professional Editor's Guild

List of abbreviations

B.Ed.	Bachelor of Education
BSc	Bachelor of Science
DBE	Department Basic Education (South Africa)
DoE	Department of Education (South Africa)
D/HH	Deaf and hard-of-hearing
DI	Differentiated instruction
ERT	Emergency remote teaching
HI	Hearing impaired
LSEN	Learners with special educational needs
PGCE	Post Graduate Certificate of Education
PP	PowerPoint
UDL	Universal design for learning

Table of Contents

List of Figures

List of Tables

CHAPTER 1

Introduction and contextualisation

1.1 Introduction

Inclusion is about much more than the type of school that children attend: it is about the quality of their experience; how they are helped to learn, achieve and participate fully in the life of the school. (Department for Education and Skills (DfES), 2004, p. 12)

Inclusion is more than just reorganising services for learners with disabilities, it is the extension of educational opportunities to a spectrum of minority groups who may historically have limited access to schooling (Dyson & Forlin, 1999; UNESCO, 2005). UNESCO (2005, p. 12) views *inclusion* as "a dynamic approach of responding positively to pupil diversity and of seeing individual differences not as problems, but as opportunities for enriching learning" and feels that the move towards inclusion is "not simply a technical or organisational change but also a movement with a clear philosophy". For the effective implementation of inclusion, countries are responsible to define a set of inclusive principles and practical ideas "to guide the transition towards policies addressing inclusion in education" (UNESCO, 2005, p. 12).

White Paper 6 of the South African Department of Education (DoE, 2001, p. 12) mentions that terms such as "*learners with special education needs* and *learners with mild to severe learning difficulties*", are used in the approach that learning disabilities arise from within the learner. However, White Paper 6 (DoE, 2001) advocates for the terminology "*barriers to learning and development*" to be used and that there should be consistency in the inclusive approach that is embraced, namely that learning barriers exist mainly within the learning system.

Utilising full-service/inclusive schools is one aspect of achieving inclusive education in South Africa. "Full-service/inclusive schools … are first and foremost mainstream education institutions that provide quality education to all learners by supplying the full range of learning needs in an equitable manner" (DBE, 2010). Not all mainstream (ordinary) schools will become full-service/ inclusive schools. The DoE (2001) wants to convert 500 out of 20 000 primary schools into full-service schools over a period of 20 years. Even though there were only eight schools country-wide that had completed their transition to full-service/inclusive schools in

2010, due to slow identification and establishing, in 2014, however, 510 full-service schools had been established (Engelbrecht et al., 2015). Basic Education Minister Angie Motshekga, reported in November 2021 that by the end of 2018, 848 full-service schools were designated, not just in the 30 education districts as stipulated in White Paper 6, but in all the education districts (SAnews.gov.za, 2021).

In January 2020 the world as we know it changed dramatically. On 11 March 2020 the World Health Organisation (WHO) declared the COVID-19 outbreak a global pandemic. Academic institutions worldwide were forced to cancel face-to-face teaching due to the COVID-19 outbreaks (Mohmmed et al., 2020). In response to the pandemic many schools implemented remote learning (König et al., 2020; Morgan, 2020). Hodges et al. (2020) are of the opinion that "well-planned online learning experiences are meaningfully different from courses offered online in response to a crisis or disaster" (p. 1) and suggest the term *emergency remote teaching.*

This study aims to gain insight into how inclusive schools' mathematics teachers' beliefs influence their inclusive practices and how the COVID-19 pandemic influences the inclusive practices of the teachers teaching hearing impaired (HI) learners. These teachers have the potential to make a difference, not only in the mathematics classroom, but also in the lives of the learners with disabilities and special needs, especially HI learners.

1.2 Rationale

I have taught mathematics in a private inclusive school for nine years where we strove to make a difference in the lives of oral hearing impaired (HI) learners in inclusive education. Over the nine years I adapted my way of teaching to be able to include oral HI learners in my class. I had to understand what inclusion means and its implications for me as a teacher. For my inclusive practice, I had to modify assessments, content, extent, instruction, learning environment, material, process, product and time frame (Buli-Holmberg & Jeyaprathaban, 2016; DBE, 2011, 2014; Lindner & Schwab, 2020; Villa et al., 2005; Walsh, 2018). My beliefs about the nature of mathematics and the inclusion of HI learners influenced my inclusive practices and as I gained more experience, my inclusive practices influenced my beliefs regarding inclusion.

The study commenced prior to March 2020, when COVID-19 was declared a global pandemic, with the focus on the relationship between inclusive schools' mathematics teachers' beliefs about the nature of mathematics and inclusion and their inclusive practices. However, since

the pandemic caused a lockdown of schools in South Africa for a period of approximately two months, I had to adapt my study and include emergency remote teaching (ERT) as an inclusive practice. As I could not do research in public inclusive schools during this period, the sample size changed from six mathematics teachers in inclusive schools teaching under normal circumstances, to two mathematics teachers in an inclusive school teaching face-to-face and during ERT. Regarding the study's potential value, I consider it essential to conduct a study which focuses on the beliefs and inclusive practices of mathematics teachers teaching oral HI learners together with normal hearing learners during normal, face-to-face circumstances and ERT.

1.3 Problem statement

Since South Africa's transition to democracy in 1994, there has been constant change in educational policies (Krishna, 2013). The DoE (2001) recommends in White Paper 6 that “the process of teaching and learning should be flexible enough to accommodate and include different learning needs and styles” (p. 20). In other words, the teachers should respond with inclusive practices.

There are various beliefs with regard to the inclusion of learners with disabilities in the general classroom. Teachers believe learners with disabilities belong in the inclusive classroom (Avramidis & Norwich, 2002; Hammeken, 1995; Holley, 2015) but it depends on the level of disability (Avramidis & Norwich, 2002; Croll & Moses, 2000; Holley, 2015; UNESCO, 1994) and that inclusion should rather occur in less rigorous academic settings such as Art (Holley, 2015). Some teachers, on the other hand, are willing to make adaptations for learners with disabilities and have the skills to do so, but they do not believe that learners with disabilities can be effectively and successfully accommodated in a general classroom (Santoli *et al*., 2008). Lissi et al. (2017) report on the belief that adaptations of assessments for HI learners make school tasks easier for learners.

The COVID-19 pandemic forced academic institutions worldwide to cancel face-to-face teaching (Mohmmed et al., 2020) and many schools implemented remote teaching (König et al., 2020; Morgan, 2020). Thus, the pandemic also influenced the practise of inclusion.

So how do mathematics teachers’ beliefs influence their inclusive practices? And what influence did the COVID-19 pandemic have on their inclusive practices? More specifically, what influence do mathematics teachers’ beliefs have on their inclusive practices during normal, face-to-face teaching and ERT caused by the COVID-19 pandemic?

1.4 Literature overview and conceptual framework

Chapter 2 consists of a detailed literature review including topics such as, the beliefs of the mathematics teacher regarding the nature of mathematics and inclusion; inclusive education; inclusive practices - especially for HI learners; and the influence of the COVID-19 pandemic, causing the implementation of ERT. Below is a brief overview of the literature.

1.4.1 Teacher beliefs regarding the nature of mathematics

Garofalo (1989) states that “beliefs about mathematics and the nature of mathematical tasks; and beliefs about oneself and others as doers of mathematics”, not only “influence how one thinks about, approaches, and follows through on mathematical tasks but also because they influence how one studies mathematics and how and when one attends to mathematics instruction” (p. 502). Ernest (1989b) argues that apart from knowledge, beliefs could clarify the variations among mathematics teachers. He debates the possibility of two teachers with very similar knowledge having different approaches, one teacher could focus on problem-solving whilst the other follows a more didactic approach (Ernest, 1989b). This study focuses on the beliefs about the *nature of mathematics* and as Ernest (1989b) says, “A teacher’s view of [sic] the nature of mathematics provides a basis for his or her mental models of the teaching and learning of mathematics” (p. 12).

Ernest (1989b) discusses three different views a mathematics teacher can have of mathematics as a discipline, namely, the instrumental view, the Platonist view and the problem-solving view. Dionne (as cited in Bulmer & Rolka, 2005) suggests that world views or beliefs consist of three basic perspectives, the traditional perspective, the formalist perspective and the constructivist perspective. These perspectives correlate with the view of Ernest, described above. Törner and Grigutsch (1994) on the other hand describe mathematical world views in terms of three aspects or components, the toolbox, system, and the process aspect. The *toolbox aspect* refers to the idea that mathematics is a body of laws, practises, techniques, and equations; the *system aspect* relates to reasoning, evidence, clear definitions, and precise mathematical knowledge; while the *process aspect* refers to steps being formed and constructive processes (Liljedahl, 2008b). Liljedahl (2008b) concludes that teachers’ beliefs about the nature of mathematics can rather be seen as a combination of the three aspects where some aspects are preferred over others. The abovementioned researchers’ designs of teachers’ beliefs each consists of three points of view and are in essence very similar.

Stipek et al. (2001) discovered that educators who followed more conventional viewpoints on mathematics and education were less confident than teachers with more inquiry-oriented views and that they might tend to have beliefs and methods that require less decision-making. This resonates in many mathematicians wanting a greater emphasis to be placed by teachers on learning definitions, rules and proof (Kilpatrick, 2001). Garofalo (1989), on the other hand, pleads that mathematics teachers should dispense less information and rather facilitate more and become more of a discussion leader. However, in order for a change in teachers' classroom practices to occur, it may be necessary to influence teachers' beliefs (Green, 1971; Stipek et al., 2001).

1.4.2 Teacher beliefs regarding inclusion

Many viewpoints exist regarding the inclusion of learners with disabilities in regular classes. Teachers believe learners with disabilities belong in the inclusive classroom (Avramidis & Norwich, 2002; Hammeken, 1995; Holley, 2015) but it depends on the level of disability (Avramidis & Norwich, 2002; Croll & Moses, 2000; Holley, 2015; UNESCO, 1994) and that inclusion should rather occur in less rigorous academic settings such as Art (Holley, 2015). Some teachers, on the other hand, are willing to make adaptations for learners with disabilities, and have the skills to do so, but they do not believe that learners with disabilities can be successfully accommodated in a general classroom (Santoli et al., 2008).

Ajzen's theory of planned behaviour was used by Vermeulen et al. (2012) to distinguish three types of beliefs regarding HI learners:

1. *Beliefs about inclusive education*: This is the extent to which inclusive educational settings can foster the academic accomplishment of HI learners (Vermeulen et al., 2012). "Teachers seem to develop an interlinked set of positive emotions and beliefs when they experience success with the inclusion" of a HI learner (Vermeulen et al., 2012, p. 180).
2. *Teachers' beliefs about their self-efficacy:* Teachers' beliefs about their capabilities to perform at designated levels exercising influence over events that affect their lives, thus, determining how people feel, think and motivate themselves as well as behave (Bandura, 1994). Factors increasing self-efficacy levels for inclusive practice are, experience or interaction with persons with disabilities; high levels of training; and knowledge about policy related to inclusive education (Yada & Savolainen, 2017).
3. *Beliefs about the subjective behavioural standard regarding inclusion of students with special educational needs (LSEN)* (Vermeulen et al., 2012, p. 175). This belief refers

to the perceptions of expectations of others such as parents, colleagues, principals and the educational policies that teachers might have (Khamis, 2011; Vermeulen et al., 2012). When schools actively support the adoption of inclusive policies, they expect teachers to embrace inclusion and put forth significant effort to implement inclusive practises (Vermeulen et al., 2012).

1.4.3 Inclusive education

Inclusive education has become an important topic (Schwab & Alnahdi, 2020) and is a complex concept (Ackah-Jnr, 2020; Haug, 2017; Lindner et al., 2019; Roos, 2019) as it has varied conceptualisations within education systems and schools (Ackah-Jnr, 2020; Dela Fuente, 2021; Haug, 2017). Researchers refer to the term inclusion either as ***an ideology/ ideal*** OR ***a way of teaching/ practice/ actions*** (Antia & Stinson, 1999; Bešić et al., 2017; Finkelstein et al., 2019; Haug, 2017; Hill & Rahaman, 2013; Mitchell, 2015; Roos, 2019). UNESCO (2005) lists four key elements regarding the concept of inclusion, namely that inclusion is a process; it has to do with the identification and eradication of barriers; it is about the "presence, participation and achievement of all students" (p. 15); and it "involves a particular emphasis on those groups of learners who may be at risk of marginalization, exclusion or underachievement" (p. 16). So UNESCO views *inclusion* as both an ideology and actions.

The South African DoE defines *inclusive education* in White Paper 6 as:

- Acknowledging that all children and youth can learn and that all children and youth need support.
- Enabling education structures, systems and learning methodologies to meet the needs of all learners.
- Acknowledging and respecting differences in learners, whether due to age, gender, ethnicity, language, class, disability, HIV or other infectious diseases.
- Broader than formal schooling and acknowledging that learning also occurs in the home and community, and within formal and informal settings and structures.
- Changing attitudes, behaviour, teaching methods, curricula and environment to meet the needs of all learners.

- Maximising the participation of all learners in the culture and the curriculum of educational institutions and uncovering and minimising barriers to learning. (pp. 6-7)

Classroom teachers are one of the key resources for achieving the goal of inclusive education (Alothman, 2014; Avramidis & Norwich, 2002; DoE, 2001; Dyson & Forlin, 1999; Eriks-Brophy & Whittingham, 2013; Lindner et al., 2019), hence, teachers must expand their knowledge and skill sets as well as acquire new ones (Alothman, 2014; DoE, 2001). By doing so, there can be, amongst others, lessons with multi-level classroom instruction that address individual learner needs, co-operative learning and curriculum enrichment (DBE, 2011; DoE, 2001; Eriks-Brophy & Whittingham, 2013; Lindner & Schwab, 2020). The teachers need to accept responsibility for creating educational spaces (Lindner & Schwab, 2020) where all learners can learn and feel they belong (Rouse, 2008). However, there are concerns that implementing inclusion will be challenging as the teachers might not know how to do it and have little experience implementing inclusive education (Acquah et al., 2016; Alothman, 2014; Bešić et al., 2017; Rouse, 2008; Schwab & Alnahdi, 2020; Takala & Sume, 2018; Yada & Savolainen, 2017). Teachers should have the necessary education and skills to address the various requirements and preferences of their learners (Alothman, 2014; Eriks-Brophy & Whittingham, 2013; Navarro et al., 2016; Takala & Sume, 2018).

There are certain barriers to the implementation of inclusive policies including the school culture, the curriculum and differentiation, time limitations, resources, and teachers' knowledge and conceptualisations (Adoyo, 2007; Khamis, 2011; Paliokosta & Blandford, 2010). Then there is the most recent barrier, the COVID-19 pandemic, which caused lockdown periods with a lack of face-to-face teaching.

1.4.4 Inclusive practices

Inclusive teaching practices have no consistent definition – it amounts to a "complex combination of several pedagogical approaches" (Schwab & Alnahdi, 2020, p. 321). However, *inclusive practices* can be seen as attempts or actions to overcome barriers to learning so learners with varied abilities can learn in general classrooms (Ainscow, 2005; Finkelstein et al., 2019). Teachers are mostly responsible for good inclusive practices (Antia & Stinson, 1999) and should ensure that inclusive practices are stimulating for all learners (Lindner et al., 2019).

Characteristics of inclusive practices include:

- collaboration and teamwork (Ainscow, 2005; Finkelstein et al., 2019; Lindner & Schwab, 2020; Walsh, 2018);
- grouping (Bešić et al., 2017; Finkelstein et al., 2019; Lindner & Schwab, 2020);
- modifications of content, instruction, material, assessment, extent, learning environment, process, product and time frame (Buli-Holmberg & Jeyaprathaban, 2016; DBE, 2011, 2014; Lindner & Schwab, 2020; Villa et al., 2005; Walsh, 2018);
- determining progress by assessing and monitoring a learner's individualised outcomes, set on the learner's individual education plan or the learners support plan (Finkelstein et al., 2019; Tomlinson & Imbeau, 2010); and
- organisational practices such as how teachers arrange and orchestrate the set-up of the classroom (Finkelstein et al., 2019).

Although the prevailing inclusive practices can be seen as an existing approach, it was found that the implementation of inclusive education in practice is not yet guaranteed (Lindner et al., 2019).

There are two inclusive pedagogical models from literature, namely, universal design for learning (UDL); and differentiated instruction (DI) (Griful-Freixenet et al., 2020). The UDL framework is based on cognitive and neural perspectives on learning (Rose & Strangman, 2007) and was developed by the Centre for Applied Special Technology (CAST) as a framework of lesson planning to help teachers create inclusive lessons (CAST, n.d.) so that learners with disabilities can attend the general education curriculum (Griful-Freixenet et al., 2020). The UDL consists of three principles, namely *multiple means of: engagement*; *representation*; and *action and expression* (CAST, n.d.).

DI is grounded in the belief that diversity exists in any group of learners (Coubergs et al., 2017; Griful-Freixenet et al., 2020; Tomlinson & Imbeau, 2010). It can be viewed as a method of instruction that takes into account the diversity of learners by embracing a particular teaching technique, providing a variety of learning activities, and keeping an eye on each student's requirements – aiming for the best possible learning results (Coubergs et al., 2017; Griful-Freixenet et al., 2020; Suprayogi & Valcke, 2016; Tomlinson & Imbeau, 2010); offering personalised scaffolding (Carolan & Guinn, 2007; Graves & Braaten, 1996); and teachers not only knowing the landscape of their subject matter, but also showing multiple ways to navigate it (Carolan & Guinn, 2007; Tomlinson & Imbeau, 2010).

The model of DI was developed by Tomlinson (2000) who states that "whenever a teacher reaches out to an individual or small group to vary his or her teaching in order to create the best learning experience possible, that teacher is differentiating instruction" (p. 2). Teachers can differentiate a minimum of four classroom elements based on the learners' *affect* (how learners' emotions and feelings affect their learning); *readiness* (a learners' proximity to particular knowledge, understanding, and skills); *interest* (the attention, curiosity, and involvement of a learner)*;* or *learning profile* (how the learner prefers to take in, explore or express content) (Tomlinson, 2000; Tomlinson & Imbeau, 2010). The four elements are *content*; *process*; *products*; and *learning environment*.

The DoE (2001) recommends in White Paper 6 that the "process of learning and teaching should be flexible enough to accommodate different learning needs and styles" (p. 20). According to the *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements* (DBE, 2011), differentiation in the curriculum should take place in response to the diversity of learner needs. Curriculum differentiation consists of three aspects, namely the "differentiating curriculum content; differentiating the learning environment; and differentiating teaching methods" (DBE, 2011, p. 4).

In South Africa, researchers found that teachers:

- do not understand inclusive education (Dalton et al., 2012; Dreyer, 2017; Engelbrecht et al., 2016; Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013; Herman et al., 2014);
- experience a lack of support from the DoE or District offices (Dreyer, 2017; Engelbrecht et al., 2016; Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013; Magano & Mapepa, 2018);
- need resources (Engelbrecht et al., 2015);
- have overcrowded classrooms (Engelbrecht et al., 2016; Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013; Magano & Mapepa, 2018); and
- need guidance regarding sound inclusive practices (Dreyer, 2017; Engelbrecht et al., 2016; Engelbrecht et al., 2015), such as UDL (McKenzie & Dalton, 2020), as they were not trained in inclusive education (Engelbrecht et al., 2016; Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013; Walton & Lloyd, 2012).

1.4.5 The hearing impaired learner and inclusion

The context of the study is the inclusion of oral (making use of spoken language) HI learners in the general mathematics classroom. In this study, learners who are hearing impaired (HI)

are those who use hearing aids and/or cochlear implants and have moderate to profound hearing loss in both ears The study focuses on *oral* HI learners, which indicates the HI learners are able to communicate orally and do not make use of sign language. It is most likely that the percentage of HI learners in the general classroom will increase due to early identification of hearing loss as well as intervention techniques such as cochlear implants (Antia et al., 2009). Hearing loss can be detected as early as the first few days after birth due to modern technology (Pakulski, 2021) and nowadays most HI learners are being taught, for at least a fraction of the day, in general classrooms (Pakulski, 2021; Takala & Sume, 2018).

Even though HI learners' intellectual abilities parallel those of normal hearing learners (Salend, 2011) and their hearing loss was detected at an early stage, on average, HI learners' achievements continue to lag behind their typical hearing peers (Pakulski, 2021). HI learners experience many barriers to learning including, listening; spoken language; comprehension; curriculum; learning material; and exhaustion (Alasim, 2018; Luckner et al., 2012; Salend, 2011; Uys & Selesho, 2017). The language requirements of the high school curriculum may not be something HI learners are ready for as HI learners entering high school have an average language delay of four-to-five years (Furlonger et al., 2010).

Classroom instructional practices can cause barriers for the HI learners, such as, the pace of instruction of the curriculum being too fast and not accommodating the HI learner (Alasim, 2018; Berndsen & Luckner, 2012; DoE, 2001; Uys & Selesho, 2017); a lecturing, non-interactive teaching style; lessons not broken down into smaller sections and not being reinforced with activities; HI learners being unaware of the purpose of the lesson and when the connection to real life is not explained; lessons are not taught in a routine-like and sequential way (Uys & Selesho, 2017); a high number of speakers are involved in a conversation (Berndsen & Luckner, 2012); a lack of visual support (Erbas, 2017; Uys & Selesho, 2017); and unfamiliar vocabulary used by the teacher as HI learners' vocabularies are relatively limited (Erbas, 2017; Uys & Selesho, 2017).

1.4.6 Emergency remote teaching

In response to the pandemic many schools implemented remote learning (König et al., 2020; Morgan, 2020). Hodges et al. (2020) advocate for the difference between online learning and emergency remote teaching. Online learning indicates learning over the internet offered synchronously and asynchronously or some blend of both where synchronous learning refers to direct interactions between learners and teachers using online platforms and asynchronous refers to an independent learning approach as learning occurs indirectly and does not happen

at the same time (Rasmitadile et al., 2020). Hodges et al. (2020) are of the opinion that "well-planned online learning experiences are meaningfully different from courses offered online in response to a crisis or disaster" (p. 1) and suggest the term *emergency remote teaching.* They define emergency remote teaching (ERT) as "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" providing a temporary access to instruction that can be set up quickly and is reliably available during a crises or an emergency (Hodges et al., 2020, p. 6).

Ferri *et al*. (2020) classify the challenges of ERT as "technological challenges; pedagogical challenges; and social challenges" (p. 1). Unreliability of internet connections and the lack of necessary electronic devices are technological challenges, while pedagogical challenges are mainly associated with teachers' and learners' lack of digital skills, learners' lack of motivation and teachers' lack of social presence (Ferri et al., 2020). Ferri et al. (2020) find that the lack of human interaction between teachers and learners and between learners and learners is a social challenge, as well as inadequate physical spaces at home to watch and participate in lessons and the lack of parents' support as they are working remotely in the same location.

Teaching learners with disabilities during COVID-19 has its own challenges and many learners are impacted physically and mentally, and their interactions might be hindered (Krishnan et al., 2020). HI learners experience four main challenges during COVID-19, namely, hearing devices; disruption to comprehend the lesson; unfamiliar with online devices; and being emotionally affected during online classes (Krishnan et al., 2020).

1.5 The purpose of the study

The purpose of this study is two-fold. Firstly, to investigate the way teachers teach mathematics in an inclusive, face-to-face classroom containing a few oral HI learners with the view to establishing the influence of the mathematics teachers' beliefs on their inclusive practices. Secondly, to investigate the inclusive practices of the inclusive schools' mathematics teachers during ERT.

To achieve this, I conducted an in-depth study to explore the nature of beliefs held by inclusive schools' mathematics teachers about the nature of mathematics; the inclusion of HI learners; and the inclusive strategies used by the teachers – during normal (face-to-face) teaching and ERT.

1.6 Research questions

The following primary and secondary research questions guided the study:

1.6.1 Primary research question

What influence do mathematics teachers' beliefs have on their inclusive practices for oral HI learners during face-to-face teaching and ERT?

1.6.2 Secondary research questions

In order to answer the primary question, the following secondary research questions are asked:

1. What is the nature of inclusive schools' mathematics teachers' beliefs?
2. What practices are used during face-to-face teaching and ERT to include HI learners in the general mathematics classroom?
3. How are these practices influenced by the teachers' beliefs about the nature of mathematics and inclusivity?

1.7 Definition of Terms

The following are operational definitions of terms used in this study:

- COVID-19: The coronavirus disease was declared a worldwide pandemic by the World Health Organisation since March 2020.
- Differentiation: Differentiation is the accommodation of diversity that exists among learners so that all the learners have the best possible chance of learning (Uys & Selesho, 2017).
- Emergency remote teaching (ERT): "A temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" (Hodges et al., 2020, p. 6).
- Hearing impaired (HI): In this study, learners who are hearing impaired are those who use hearing aids and/or cochlear implants and have moderate to profound hearing loss in both ears. These learners do not communicate using sign language - they communicate with spoken language (Clark, 2007).
- Inclusion: "Acknowledging that all children and youth can learn and that all children and youth need support. Enabling education structures, systems and learning methodologies to meet the needs of all learners" (DoE, 2001, p. 6).

1.8 Methodological considerations

Social constructivism as research paradigm underpinned this study and is often combined with interpretivism (Creswell & Creswell, 2018). Interpretivists believe that reality is not objectively determined, but socially constructed and therefore there is a greater opportunity to understand the perceptions people have of their own activities when they are studied in their natural environment (Nieuwenhuis, 2016b).

A qualitative approach was deemed appropriate, with an exploratory case study as research design being the best choice for in-depth investigation of the influence of the mathematics teachers' beliefs on their inclusive practices. Timmons and Clairns (2010) are of the opinion that "in education research, using the case study approach not only creates knowledge and understanding but also sets a standard for good teaching practices" (p. 2) and that "case study research is a logical approach to researching many aspects of inclusive education" (p. 6).

In the beginning of the study I planned to do research exploring six inclusive schools' mathematics teachers' inclusive practices regarding HI learners, from at least three inclusive schools in Gauteng, South Africa. However, the COVID-19 pandemic broke out and I had to adapt my study to the new circumstances as I could not visit public schools. I had, however, conducted some of my research at a private inclusive school prior to the lockdown during the pandemic.

The research site is an inclusive private high school in Gauteng, South Africa, where oral HI learners are included and taught alongside their hearing peers. Since HI learners are completely included and take part in the same classes and lessons as their hearing counterparts, the school was specifically chosen for its inclusion strategy. Purposive sampling was used in order to create an in-depth description and to help "understand the problem and the research question" (Creswell & Creswell, 2018, p. 262).

The sample consists of two mathematics teachers teaching both at least two classes of the same grade where one class includes HI learners and the other class does not include HI learners. The one teacher teaches Grade 10 learners and the other teacher teaches Grade 9 learners. The applicable classes were either English or Afrikaans speaking. The low number of available teachers may be a disadvantage of the proposed sampling. The chosen inclusive school only has three mathematics teachers responsible for mathematics Grades 8-12. The third teacher was excluded as she did not teach two classes of the same grade with one class having HI learners and the other class not having HI learners. Useful

data was gathered regarding the beliefs and inclusive behaviours of the mathematics teachers in the inclusive schools.

Semi-structured interviews, observations and document analysis from the teachers' lesson plans, assessments, and worksheets were used to gather data. While the interviews were audio-recorded, the observations were captured on video. As stated by Creswell and Creswell (2018), a document “enables a researcher to obtain the language and words of participants” (p. 264) and audio-visual digital materials “provide an opportunity for participants to directly share their reality” (p. 264). The participants also shared their reality directly with me in the form of the access I was given to their Google Classroom portals. The portals have been active since January 2020 and all the data there up to the end of September 2020 was available. Thus, documentation and audio-visual digital materials, for example worksheets and the lessons the teachers recorded during ERT, was available for the entire period of research.

The data was organised by bracketing chunks or categories. In the study DEDUCTIVE-inductive qualitative data analysis was used. In other words, the analysis was initially deductive and then inductive. Deductive in the sense that a qualitative codebook (Table 3.4) was created using specified codes from the conceptual framework (Figure 2.7) and then categorised into code families (Table 3.3). The ATLAS.ti 9 computer program was used to code the transcriptions of the observations and interviews as well as the provided documentation and audio-visual digital material from each participant. This tool makes it simple to access, sort and combine codes. The inductive approach allowed for themes that emerged that were not included in the framework that guided the analysis, and for correlating the study’s purpose with the findings

1.9 Quality assurance

This qualitative research study took into account the quality assurance criteria of trustworthiness, validity, and reliability. The method used to collect, sort and classify data is referred to as *trustworthiness* (Di Fabia & Maree, 2012), while Gibbs (2018) explains the terms *validity* and *reliability* of results in simple terms when he says results are, “*Valid* if the explanations are really true or accurate and correctly capture what is actually happening and *reliable* if the results are consistent across repeated investigations in different circumstances with different investigators” (p. 2).

Triangulation, member checking, rich, deep descriptions, and clarification of bias were four of the eight validity tactics recommended by Creswell (2014) that I used to ensure validity. I

attempted to avoid looking for information to confirm my existing notions and to remain as objective as I could in order to increase validity. All of the participants were asked the same questions in order to maintain consistency in the approach and enhance study reliability. They received the interview transcripts thereafter so they could check or modify their responses.

Possible limitations to the research include the following:

- Participants only from one inclusive school;
- Small number of participants – limited generalisation;
- Teachers may behave differently as a result of being observed, which is known as the Hawthorne effect (Seabi, 2012); and
- Subjectivity of researcher and participants.

1.10 Possible contributions of the study

Since 1994, inclusive education has received increased attention on a global scale, resulting in more and more disabled learners being educated in ordinary classrooms and no longer in special education classrooms. “As more and more case study research is conducted in inclusive education, patterns will emerge that provide researchers and educators with important results that can influence policy and practice” (Timmons & Clairns, 2010, p. 6). This study is an attempt to contribute to the inclusive practices in South Africa with an understanding of the influence of inclusive schools’ mathematics teachers’ beliefs and their inclusive practices during face-to-face teaching and ERT.

1.11 The structure of the thesis

The thesis consists of six chapters. Chapter 1 consists of the introduction and contextualisation, while Chapter 2 provides an in-depth analysis and synthesis of the relevant literature. The conceptual framework on which this study is based, is also explained. In Chapter 3 I explain the methodology used in this study, and discuss the selection of the participants, research site, data collection instruments, and data analyses procedures. The trustworthiness of the study as well as the ethical considerations also form part of Chapter 3. Chapter 4 consists of the presentation of the results and deals with the in-depth data gathered during normal teaching and ERT. In Chapter 5 the findings are discussed and supported by the literature review and conceptual framework, while in Chapter 6 the research questions are answered and trends are identified and explained. Chapter 6 also contains the conclusions and implications and comprises a chapter summary, recommendations and limitations of the study, and finally, a last word from my side.

CHAPTER 2

Literature Review

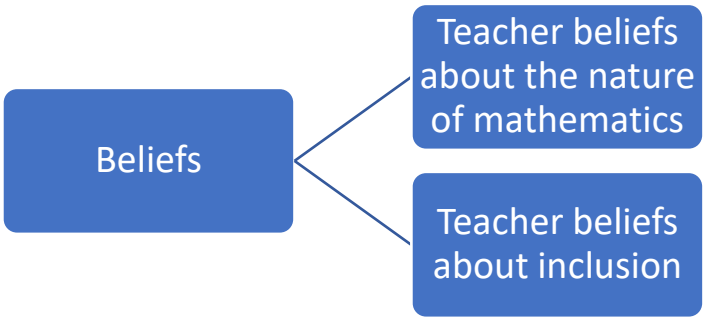
2.1 Introduction

This literature review is a critical and integrative synthesis of various researchers' findings, justifying this research effort. It is important to remember that the South African Department of Education DoE (2001) stipulated in White Paper 6 (DoE, 2001) that the education and training system must transform to accommodate the full range of learning needs with specific attention to instructional and curriculum transformation strategies (DBE, 2011).

As the study concerns inclusive schools' mathematics teachers, teaching oral HI learners, and the influence of their beliefs on their inclusive practices, the literature review begins with a discussion on beliefs, teachers' beliefs about the nature of mathematics and teachers' beliefs about inclusion.

Figure 2.1

Layout of the Discussion of Beliefs

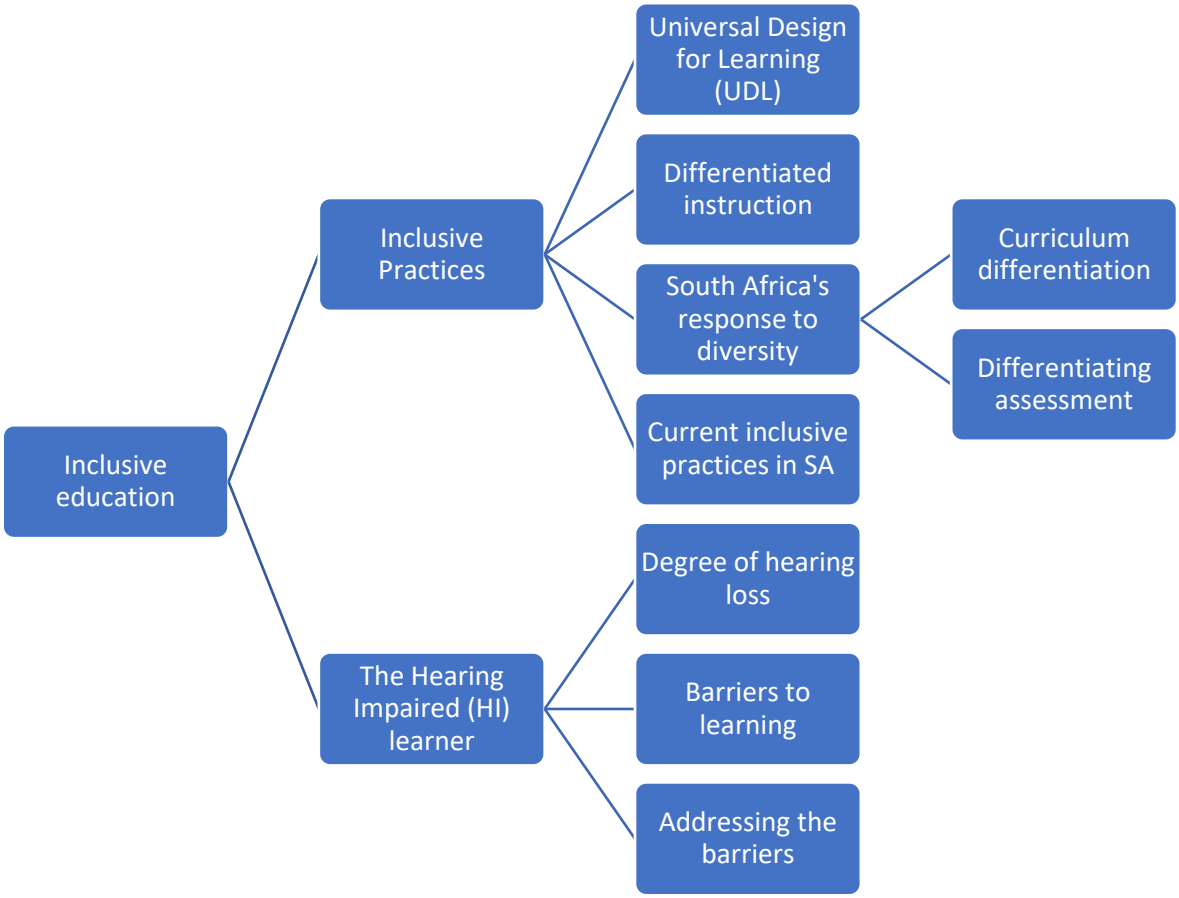


Next is a discussion on inclusive education and a brief introduction of the effects of the COVID-19 pandemic on inclusive education. Following the review on inclusive education is a discussion of the meaning of teachers' inclusive practices and the value of two inclusive pedagogical approaches/models from literature. The two inclusive pedagogical models are the Universal Design for learning (UDL) and Differentiated Instruction (DI). This is then followed by a discussion on how the DoE (2001) requires South African schools to respond to learner diversity in the classroom, namely by curriculum differentiation; and the differentiation

of assessment. Next, the current inclusive practices in South Africa are discussed. Following is a look at the HI learner and a discussion on the degree of hearing loss; barriers to learning; and addressing the barriers, will enhance understanding of the HI learner. See the following figure indicating the layout of the literature review on *Inclusive Education*.

Figure 2.2

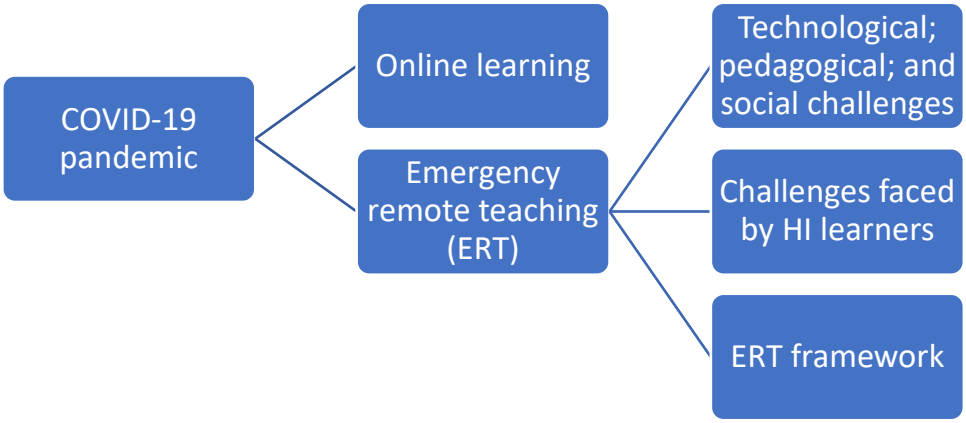
Layout of the Discussion of Inclusive Education



Midway through the research the COVID-19 pandemic started and the study was adapted to accommodate this. The influence of the pandemic on the mathematics teachers' inclusive practices are discussed, including the difference between online learning and Emergency Remote Teaching (ERT); the general challenges during ERT; the challenges faced by HI learners; and an ERT framework to be used during a pandemic such as COVID-19. The design step of the ERT framework is discussed in depth.

Figure 2.3

Layout of the Influence of the COVID-19 Pandemic



The conceptual framework, which is based on concepts and theory from relevant work in the literature[1], is outlined at the end of the literature review.

2.2 Beliefs

In the first quarter of the 20th Century, there was great interest in the study of the nature of beliefs and their influence on people's actions (Thompson, 1992). During the following years that interest faded and only in the 1960s was the interest somewhat renewed with a definite resurgence in the 1980s among scholars from disciplines as diverse as psychology, political science, anthropology, and education (Thompson, 1992). The notion of *belief*, however, has not been dealt with in a meaningful way as researchers have assumed that readers know what beliefs are (Thompson, 1992).

2.2.1 Understanding Beliefs

Since the 1990s research has focused on teachers' beliefs as one of the affective factors behind teachers' teaching behaviour (Hannula et al., 2016). However, they also report on many researchers' indication that there is no internationally accepted definition of beliefs (Hannula et al., 2016). Pajares (1992) is of the opinion that researchers should first decide "what they wish *belief* to mean and how this meaning will differ from that of similar constructs" (p. 308).

[1] The literature review consists of several direct quotations to avoid slight change of meaning to the matter under discussion.

Beliefs have been separated from *knowledge* in a number of ways. Thompson (1992) mentions that, among others, beliefs can be held with different degrees of conviction; and that beliefs are not consistent.

To distinguish between knowledge and beliefs, Thompson (1992) mentions different characteristics.

> A characteristic of knowledge is general agreement about procedures for evaluating and judging its validity; knowledge must meet criteria involving canons of evidence. Beliefs, on the other hand, are often held or justified for reasons that do not meet those criteria, and, thus, are characterised by a lack of agreement over how they are to be evaluated or judged. (p. 130)

Still on the topic of knowledge and beliefs, Leatham (2006) reasons:

> Of all the things we believe, there are some things that we 'just believe' and other things we 'more believe – we know'. Those things we 'more than believe' we refer to as knowledge and those things we 'just believe' we refer to as beliefs. Thus beliefs and knowledge can profitably be viewed as complementary subsets of the things we believe. (p. 92)

Adults have tens, possibly hundreds of beliefs about the world we live in and these beliefs are organised into systems with "describable and measurable structural properties which, in turn, have observable behavioural consequences" (Rokeach, 1968, p. 1). Green (1971) builds on Rokeach (1968) idea of a belief system and argues that "beliefs come always in sets or groups, never in independence of one another" (pp. 41-42) and that these belief systems are not logical systems at all (Green, 1971). On the other hand Abelson (1979) feels that the term *belief system* can be highly confusing, as psychologists, political scientists and anthropologists tend to use the term in quite different ways. However, he proposes seven conditions of a belief system, where none of these are individually definitive and "vary somewhat in the degree to which they distinguish belief systems from knowledge systems" (p. 356) and is of the opinion that any system manifesting most of the conditions will have the essential character of a *belief system* (Abelson, 1979).

The seven conditions are (Abelson, 1979):

1. The constituent parts of a belief system (concepts, propositions, rules, etc.) are not consensual.
2. The existence or nonexistence of particular conceptual entities is a topic that is relevant to belief systems.
3. The representations of "alternative worlds" are frequently found in belief systems.
4. Evaluative and affective components play a significant role in belief systems.
5. Belief systems are likely to contain a significant quantity of episodic information drawn from personal experience, cultural belief systems, folklore, or political theories.
6. The content that makes up a belief system is typically very "open".
7. The degree of certainty with which one holds a belief might vary.

There is a relationship between the different beliefs of a person, as some beliefs will be derived from other beliefs (Green, 1971). He also argues that if a person cannot give a further reason for a particular belief, then that belief can be classified as a 'primary belief', in other words, some beliefs are *derivative* and some are *primary* (Green, 1971). Green (1971) refers to this as a *quasi*-logical structure, as a particular order of beliefs "has little to do with the objective logical relations between beliefs. It has to do, rather, with the order they receive in a particular belief system" (pp. 44-45).

Consider the following example of a quasi-logical relationship (Leatham, 2006, p. 94):

A: Learners need to learn their times tables.

B: Learners should not use calculators.

For some teachers, the relationship between these two statements is that A implies B, meaning, IF you want your learners to study their times tables THEN they should not be allowed to use calculators. If these teachers belief that A is true, namely learners need to learn their times tables, then the statement that learners should not use calculators is also true to them as it is the logical conclusion from knowing that A is true. Thus, belief B is derived from the primary belief A (Leatham, 2006).

Both Rokeach (1968) and Green (1971) refer to the relationship between beliefs as having to do with their psychological strength being central or peripheral. Rokeach (1968) is of the opinion that "the more central a belief, the more it will resist change" and in the case of a change in belief, "the more central the belief changed, the more widespread the repercussions in the rest of the belief system" (p. 3). The formation of beliefs has an influence on teaching

as it has to do not only with *what* we believe, but also with *how* we believe it (Green, 1971). In the relationship between beliefs and grounds, Green (1971) distinguishes between beliefs held evidentially and non-evidentially. Beliefs can be rationally criticised and modified when they are held on the basis of evidence (evidentially), whereas beliefs being held without regard to evidence (non-evidentially) cannot be changed by rational criticism (Green, 1971). Green (1971) feels that if beliefs were resistant to change, teaching would be a fruitless activity, however, sturdy beliefs are difficult to change (Liljedahl et al., 2007).

Fenstermacher (1978) predicted that for research of teacher effectiveness the focus would fall on the study of beliefs. "*Beliefs* are complex constructs and belief systems are even more so" – a *messy* construct (Liljedahl et al., 2007, p. 279; Pajares, 1992). *Belief* falls under the group of constructs that name, define, and describe the structure and content of mental conditions that presumably drives an individual's actions (Zheng, 2009). Teacher beliefs refer to conceptual representations which "store general knowledge of objects, people and events, and their characteristic relationships" (Zheng, 2009, p. 74).

Following are some of the inferences and generalisations of teachers' educational beliefs (Pajares, 1992):

- Beliefs are formed early in life and have a tendency to hold up despite conflicts brought on by reason, time, education, or experience.
- People's belief systems provide an adaptive purpose by assisting with self- and world-definition and understanding.
- The filtering impact of belief systems ultimately screens, redefines, distorts, or reshapes subsequent thought and information processing, even if thought processes may be the precursors to and makers of belief.
- Epistemological beliefs are crucial for knowledge interpretation and cognitive monitoring.
- Beliefs are ranked in order of importance based on how they relate to one another and to other cognitive and affective structures.
- Some beliefs are more indisputable than others because of their very character and place of origin.
- It is more challenging to change a belief the earlier it has been established in the belief structure.
- Belief change in adulthood is a rather uncommon phenomenon, with authority switching or gestalt shifts being the most frequent causes. Even when provided with

scientifically sound arguments, individuals often continue to hold onto beliefs that are the result of inaccurate or inadequate information.

- Individuals' beliefs have a big impact on how they act.
- Beliefs must be inferred, and this inference must take into consideration the consistency of individuals' beliefs, their conscious choice to act in a predetermined way, and their actions that are consistent with the inferred belief.
- By the time a student enters college, their beliefs towards teaching are well-established.

Teacher beliefs determine planning, decision-making and the behaviour of teachers in the classroom (Zheng, 2009) and therefor, teacher educators should provide opportunities for teachers to explore their beliefs about mathematics, teaching and learning (Leatham, 2006).

2.2.2 Teacher beliefs regarding the nature of mathematics

Apart from knowledge, beliefs could clarify the differences between mathematics teachers (Ernest, 1989b). Ernest (1989b) debates the possibility of two teachers with very similar knowledge having different approaches, one can teach mathematics with a problem-solving approach whilst the other follows a more didactic approach (Ernest, 1989b). Garofalo (1989) states that "beliefs about mathematics and the nature of mathematical tasks; and beliefs about oneself and others as doers of mathematics", not only "influence how one thinks about, approaches, and follows through on mathematical tasks but also because they influence how one studies mathematics and how and when one attends to mathematics instruction" (p. 502).

Teachers' conceptions of the teaching and learning of mathematics reflect their beliefs about mathematics (Thomson et al., 2003) and their views (Ernest, 1989b). This study focuses on the beliefs about the *nature of mathematics* and as Ernest (1989b) says: "A teacher's view of [sic] the nature of mathematics provides a basis for his or her mental models of the teaching and learning of mathematics" (p. 12).

In his research, Garofalo (1989) had discussions with high school learners, preservice teachers and high school teachers, and presented two beliefs on the *nature of mathematics*. The first of the two beliefs seems to be held by mathematics students at all grade levels, as teachers enrolled in advanced mathematics classes tend to act with such beliefs themselves (Garofalo, 1989).

The two beliefs are:

Belief 1: Almost all mathematics problems can be solved by the direct application of the facts, rules, formulas, and procedures shown by the teacher or given in the textbook. (Corollary: Mathematical thinking consists of being able to learn, remember, and apply facts, rules, formulas, and procedures.)

Belief 2: Mathematics textbook exercises can be solved only by the methods presented in the textbook; moreover, such exercises must be solved by the methods presented in the section of the textbook in which they appear. (Garofalo, 1989, pp. 502-503)

Even though these beliefs are applicable to mathematics learners, Garofalo (1989) feels that for learners not to have such narrow beliefs about mathematics as mentioned above, there should not be classroom environments that encourage them, for example, the "*Here's the procedure, here's a few examples, now here's some for practice"* method will put learners in a position to develop such beliefs (Garofalo, 1989, p. 504). Liljedahl et al. (2007) conclude that "a belief that teaching mathematics is *all about telling how to do it* may come from a belief that learning mathematics is *all about being told how to do it*" (p. 279). Instead, there should be classroom environments that will help learners to develop more realistic beliefs about mathematics, including activities that "encourage learners to explore mathematical topics; develop and refine their own ideas, strategies and methods; and reflect on and discuss mathematical concepts and procedures" (Garofalo, 1989, p. 504).

There should be a major emphasis on problem-solving and mathematical reasoning rather than the "end-of-chapter textbook sections that emphasise rote manipulations" (Garofalo, 1989, p. 504). For a teacher to shift to a problem-solving approach to teaching requires a change in the teacher's belief system, especially the teacher's concept of the nature of mathematics and mental models of teaching and learning mathematics (Ernest, 1989a). Ernest (1989a) explains that "the teacher's conception of the nature of mathematics, is his or her belief system concerning the nature of mathematics as a whole" (para. 6).

Ernest (1989b) discusses three different views a mathematics teacher can have, namely, the instrumental view; the Platonist view and the problem-solving view. Certain practical classroom outcomes can be linked to each view (Ernest, 1989a):

1. *Instrumentalist view*: This is the lowest level "involving knowledge of mathematical facts, rules and methods as separate entities" (Ernest, 1989a, para. 7). The teacher has a view that "mathematics is useful but unrelated collection of facts, rules and skills" (Ernest, 1989b, p. 8). The teacher with an instrumentalist view is an instructor, a strict follower of a text or scheme, with the mastering of skills with correct performance as an outcome (Ernest, 1989a).
2. *Platonist view*: The teacher has a view of mathematics as a "static immutable product, which is discovered, not created" (Ernest, 1989b, p. 8). The teacher with a Platonist view has "a global understanding of mathematics as consistent, connected and objective structure" (para. 7) and is an explainer with the learner understanding knowledge as an outcome (Ernest, 1989a). The teacher will modify the textbook approach and supply additional problems and activities as enrichment (Ernest, 1989a).
3. *Problem-solving view*: The teacher has a problem-driven view where mathematics is not a finished product but a "continually expanding field of human enquiry" (Ernest, 1989b, p. 8). The teacher with a problem-solving view "sees mathematics as a dynamically organised structure located in a social and cultural context" (para. 7) and is a facilitator with the learner constructing understanding as an outcome (Ernest, 1989a). This teacher is confident in posing and solving problems and is constructing the mathematics curriculum (Ernest, 1989a).

Dionne (as cited in Bulmer & Rolka, 2005) suggests that world views or beliefs consist of three basic perspectives, traditional perspective; formalist perspective; and the constructivist perspective. These perspectives correlate with the view of Ernest (1989a), described above. Törner and Grigutsch (1994) on the other hand describe mathematical world views in terms of three components, the toolbox aspect; system aspect; and the process aspect. The *toolbox aspect* refers to mathematics being seen as a set of rules, procedures, skills and formulae and the teacher with this belief will thus focus on plenty of practice to enforce memorisation and mastery (Liljedahl, 2008a, 2008b; Liljedahl et al., 2007). The *system aspect* refers to logic, proofs, exact definitions and precise mathematical knowledge and a teacher with this belief will make considerable use of definitions and proofs not only as content to be acquired, but also as a pedagogical strategy (Liljedahl, 2008a, 2008b; Liljedahl et al., 2007). The *process aspect* refers to steps being created and constructive processes, and teachers with such a belief will let their learners experience the *doing* of mathematics by incorporating progressive constructivist teaching methodologies in their teaching (Liljedahl, 2008b; Liljedahl et al., 2007).

Teachers who adopted more traditional beliefs about mathematics and learning are less confident than teachers with more inquiry-oriented views and they might be tended to have

beliefs and practices that require less decision-making (Stipek et al., 2001). This resonates in many mathematicians wanting more emphasis to be placed by teachers on learning definitions, rules and proof (Kilpatrick, 2001). Garofalo (1989), on the other hand, pleads that mathematics teachers should dispense less information and rather facilitate more and become more of a discussion leader. However, in order for a change in teachers' classroom practices to occur, it may be necessary to influence teachers' beliefs (Green, 1971; Stipek et al., 2001).

2.2.3 Teacher beliefs regarding inclusion

There are various beliefs with regard to the inclusion of learners with disabilities in the general classroom. Teachers believe learners with disabilities belong in the inclusive classroom (Avramidis & Norwich, 2002; Hammeken, 1995; Holley, 2015) but it depends on the level of disability (Avramidis & Norwich, 2002; Croll & Moses, 2000; Holley, 2015; UNESCO, 1994) and that inclusion should rather occur in less academic classes such as Art (Holley, 2015). Some teachers, on the other hand, are willing to make adaptations for learners with disabilities and have the skills to do so, but they do not believe that learners with disabilities can be successfully accommodated in a general classroom (Santoli et al., 2008).

Other beliefs about inclusion from the literature include:

- the improvement of the educational system (Hammeken, 1995);
- a sensitivity to and an acceptance of all learners (Croll & Moses, 2000; Hammeken, 1995; Khamis, 2011; Meltz et al., 2014; Tomlinson & Imbeau, 2010; Vermeulen et al., 2012);
- inclusion encourages effective teamwork and participation (Hammeken, 1995; Lissi et al., 2017; Yada & Savolainen, 2017), however, for teachers to have enough time for collaboration, their workload needs to be reduced (Yada & Savolainen, 2017);
- the modifications and strategies for teaching learners with disabilities benefits the other learners as these strategies individualise the curriculum for all learners (Hammeken, 1995);
- various beliefs that assist teachers in practicing inclusive education, namely beliefs about teaching experience; knowledge; self-awareness and reflection; and other beliefs – more specifically religion (Khamis, 2011; Lissi et al., 2017; Sabrina, 2017);
- lack of resources in general schools (Meltz et al., 2014) is the reason many learners are in the special school sector (Croll & Moses, 2000);
- inclusion is practically impossible (Croll & Moses, 2000);
- some learners will always need separate provision (Croll & Moses, 2000; Khamis, 2011);

- parental involvement is crucial (Khamis, 2011; Yada & Savolainen, 2017);
- the success of inclusion is measured by the learner's academic achievement (Khamis, 2011);
- adaptations of assessments for HI learners make school tasks easier for learners (Lissi et al., 2017)

Ajzen's theory of planned behaviour was used by Vermeulen et al. (2012) to distinguish three types of beliefs regarding the inclusion of HI learners, namely "beliefs about inclusive education; teachers' beliefs about their self-efficacy; and beliefs about the subjective behavioural standard regarding inclusion of students with special education needs" (p. 175):

1. *Beliefs about inclusive education*: This is the extent to which inclusive educational settings can foster the academic accomplishment of HI learners (Vermeulen et al., 2012). "Teachers seem to develop an interlinked set of positive emotions and beliefs when they experience success with the inclusion" of a HI learner (Vermeulen et al., 2012, p. 180).
2. *Teachers' beliefs about their self-efficacy:* Teachers' beliefs about their capabilities to perform at designated levels exercising influence over events that affect their lives, thus, determining how people feel, think and motivate themselves as well as behave (Bandura, 1994). Factors increasing self-efficacy levels for inclusive practice are: experience or interaction with persons with disabilities; high levels of training; and knowledge about policy related to inclusive education (Yada & Savolainen, 2017).
3. *Beliefs about the subjective behavioural standard regarding inclusion of students with special educational needs (LSEN)*. (Vermeulen et al., 2012, p. 175). This belief refers to the perceptions of expectations of others such as parents, colleagues, principals and the educational policies that teachers might have (Khamis, 2011; Vermeulen et al., 2012). When schools actively support the adoption of inclusive policies, they expect teachers to embrace inclusion and put forth significant effort to implement inclusive practises (Vermeulen et al., 2012).

Vermeulen et al. (2012) find that, regarding the inclusion of specifically HI learners, the teachers' beliefs vary as some teachers are more positive about including HI learners than others. If an HI learner has positive work attitude and a good performance level, the teachers do not experience much difficulty to include the learner and are willing to give the learner additional support and tweak their teaching practices a bit, however, an HI learner with

disruptive behaviour and lack of motivation to learn elicit negativity from teachers (Vermeulen et al., 2012).

2.2.4 Summary of Beliefs

Since the 1990s research has focused on teacher beliefs as one of the affective factors behind teachers' teaching behaviour. There is a relationship between the different beliefs of a person, as some beliefs are derived from other beliefs. Sturdy beliefs are difficult to change, however, if beliefs were resistant to change, teaching would be a fruitless activity. Teachers' beliefs about the nature of mathematics result in either an instrumentalist view; Platonist view; or problem-solving view. Teachers' beliefs regarding inclusion can either be positive or negative. Some teachers believe learners with disabilities belong in the inclusive classroom but it depends on the level of disability and that inclusion should rather occur in less academic classes such as Art. While other teachers believe inclusion is practically impossible and that learners with disabilities cannot be successfully accommodated in a general classroom. Regarding the inclusion of HI learners specifically, three beliefs are featured, namely beliefs about inclusive education; teachers' beliefs about self-efficacy; and beliefs about the subjective behavioural standard regarding the inclusion of students with special education needs.

2.3 Inclusive education

Following is a discussion on *Inclusive Education* as well as an introduction to the effect of the COVID-19 pandemic on inclusive education that is discussed in full in Paragraph 2.6.

2.3.1 Understanding Inclusive Education

UNESCO (2005, p. 12) views *inclusion* as "a dynamic approach of responding positively to pupil diversity and of seeing individual differences not as problems, but as opportunities for enriching learning" and feels that the move towards inclusion is "not simply a technical or organisational change but also a movement with a clear philosophy". For the effective implementation of inclusion, countries are responsible to define a set of inclusive principles and practical ideas "to guide the transition towards policies addressing inclusion in education" (UNESCO, 2005, p. 12).

There were four core approaches to inclusive education over the years, namely, the human rights-based perspective (from 1948 onwards); a response to children with special needs (1990-); a response to minority groups (from 2000 onwards); and transforming education

systems (2005-) (Opertti et al., 2013). Thus, there is an extensive variety of definitions for inclusive education used by many authors from different contexts (Finkelstein et al., 2019; Griful-Freixenet et al., 2020).

Inclusive education has become an important topic (Schwab & Alnahdi, 2020) and is a complex concept (Ackah-Jnr, 2020; Haug, 2017; Lindner et al., 2019; Roos, 2019) as it has varied conceptualisations within education systems and schools (Ackah-Jnr, 2020; Dela Fuente, 2021; Haug, 2017). Researchers refer to the term inclusion either as ***an ideology/ ideal*** OR ***a way of teaching/ practice/ actions*** (Antia & Stinson, 1999; Bešić et al., 2017; Finkelstein et al., 2019; Haug, 2017; Hill & Rahaman, 2013; Mitchell, 2015; Roos, 2019). UNESCO (2005) lists four key elements regarding the concept of inclusion, namely that inclusion is a process; it has to do with the identification and eradication of barriers; it is about the "presence, participation and achievement of all students" (p. 15); and it "involves a particular emphasis on those groups of learners who may be at risk of marginalization, exclusion or underachievement" (p. 16). So UNESCO views *inclusion* as both an ideology and actions.

UNESCO (2005) concludes when saying:

> In short, promoting inclusion is about improving education and social frameworks to cope with new trends in education structures and governance. It involves improving inputs, processes and environments to foster learning both at the level of the learner in his/her learning environment as well as at the level of the system which supports the learning experience. (p. 16)

The South African DoE (2001) define *inclusive education* in White Paper 6 as:

- Acknowledging that all children and youth can learn and that all children and youth need support.
- Enabling education structures, systems and learning methodologies to meet the needs of all learners.
- Acknowledging and respecting differences in learners, whether due to age, gender, ethnicity, language, class, disability, HIV or other infectious diseases.

- Broader than formal schooling and acknowledging that learning also occurs in the home and community, and within formal and informal settings and structures.
- Changing attitudes, behaviour, teaching methods, curricula and environment to meet the needs of all learners.
- Maximising the participation of all learners in the culture and the curriculum of educational institutions and uncovering and minimising barriers to learning. (pp. 6-7)

It can be seen that the South African DoE refers to *inclusion* as both an *ideology* and a *way of teaching*. The DoE (2001) distinguishes between *inclusion* and *mainstreaming or integration* to enhance the understanding thereof (See Table 2.1).

Table 2.1

Inclusion versus Mainstreaming or Integration

Inclusion	Mainstreaming or Integration
Admits and respects the differences among all learners and builds on similarities.	Learners need to fit into set systems or are integrated into existing ones.
Supporting all learners, educators and the system in order to meet the full range of learning needs. Developing good teaching strategies to benefit all learners.	Provide learners with extra support in order for them to fit into the 'normal' classroom routine.
The focus is on overcoming barriers in the system by transforming the support system, in order for learners to reach their potential.	The focus is on learners that need to change – and not the system – so that they can fit in.

Inclusion's primary attribute, as shown in Table 2.1, requires that the system adapt, whereas mainstreaming or integration require that the learner change to fit in (DoE, 2001; Jenkins et al., 1990).

Classroom teachers are one of the main resources for achieving the goal of inclusive education (Alothman, 2014; Avramidis & Norwich, 2002; DoE, 2001; Dyson & Forlin, 1999; Eriks-Brophy & Whittingham, 2013; Lindner et al., 2019) and thus the teachers need to improve their skills and knowledge, and develop new ones (Alothman, 2014; DoE, 2001). By doing so, there can be, amongst others, lessons with multi-level classroom instruction that

address individual learner needs; co-operative learning and curriculum enrichment (DBE, 2011; DoE, 2001; Eriks-Brophy & Whittingham, 2013; Lindner & Schwab, 2020). The teachers need to accept responsibility for creating educational spaces (Lindner & Schwab, 2020) where all learners can learn and feel they belong (Rouse, 2008). However, there are concerns that inclusion is difficult to implement as the teachers might not know how to do it and have little experience implementing inclusive education (Acquah et al., 2016; Alothman, 2014; Bešić et al., 2017; Rouse, 2008; Schwab & Alnahdi, 2020; Takala & Sume, 2018; Yada & Savolainen, 2017) and should be equipped with appropriate training and competences for addressing the diverse needs and preferences of their learners (Alothman, 2014; Eriks-Brophy & Whittingham, 2013; Navarro et al., 2016; Takala & Sume, 2018). Interesting enough, it was found that learners with various kinds of disabilities being included in general education settings academically outperform their peers in exclusive settings when standards-based assessments are used (Artiles et al., 2006).

Inclusion is more than just reconstructing provision for learners with disabilities, it is the extension of educational opportunities to a wide range of minority groups who may historically have limited access to schooling (Dyson & Forlin, 1999; UNESCO, 2005). According to reports from around the world, school cultures can stay static in terms of awareness, acceptance, and accommodation of differences despite the introduction of continuing policy measures (Ainscow et al., 2004; Alothman, 2014; Paliokosta & Blandford, 2010). There are certain barriers to implementation of inclusive policies including the school culture; the curriculum and differentiation; time limitations; resources; teachers' knowledge and conceptualisations; large classes; a lack of training courses; and a lack of collaboration among school staff (Adoyo, 2007; Alothman, 2014; Bešić et al., 2017; Dyson & Forlin, 1999; Engelbrecht et al., 2015; Khamis, 2011; Lindner & Schwab, 2020; Magano & Mapepa, 2018; Pakulski, 2021; Paliokosta & Blandford, 2010; Yada & Savolainen, 2017). Agbenyega and Deku (2011) are of the opinion that if teachers do not understand inclusive education, they will not support it. The issue is that not all teachers in inclusive schools really grasp the idea of inclusion (Ainscow et al., 2004; Alothman, 2014; Cologon, 2014; Le Hanie, 2017; Takala & Sume, 2018).

2.3.2 Emergency remote teaching and its effect on inclusive education

In January 2020 the world as we knew it changed dramatically. On 11 March 2020 the World Health Organisation (WHO) declared the COVID-19 outbreak a global pandemic. The President of South Africa, Mr Cyril Ramaphosa, announced on 23 March 2020 a nationwide lockdown for 21-days with effect from midnight of 26 March 2020 (SAnews.gov.za, 2020). However, the nationwide lockdown was later extended, resulting in South African schools

being closed for more than two months before the phased-in return of the learners. Academic institutions worldwide were forced to cancel face-to-face teaching due to the COVID-19 outbreaks (Mohmmed et al., 2020). Even though the COVID-19 pandemic ravages the world, it is important to address the educational needs of the youth (Reimers & Schleicher, 2020) and many institutions have moved their courses online due to its flexibility (Hodges et al., 2020).

The switch to online instruction has several technological, pedagogical and social challenges (Ferri et al., 2020). Unreliability of internet connections and the lack of necessary electronic devices are technological challenges, while pedagogical challenges are mainly associated with teachers' and learners' lack of digital skills, learners' lack of motivation and teachers' lack of social presence (Ferri et al., 2020). Ferri et al. (2020) found that the lack of human interaction between teachers and learners, and between learners is a social challenge, as well as inadequate physical spaces at home to watch and participate in lessons and the lack of parental support as they are working remotely in the same location.

The COVID-19 pandemic also influences the practise of inclusion. During COVID-19 people with disabilities are not given the provision that they need before, during and possibly after the pandemic, resulting in an internal gap, social exclusion and digital divide (Toquero, 2020). Paragraph 2.6 offers a thorough discussion on the influence of the COVID-19 pandemic on education, such as the implementation of emergency remote teaching (ERT); the technological, pedagogical and social challenges, and on teaching HI learners during the pandemic.

2.3.3 Summary of Inclusive Education

In summary, inclusive education is a complex concept and can be seen as an ideology or a practice or both. Inclusion's primary attribute requires that the system adapt, whereas mainstreaming or integration require that the learner change to fit in. There are certain barriers to implementation of inclusive policies including the school culture; the curriculum and differentiation; time limitations; resources; teachers' knowledge and conceptualisations; a lack of training courses; and a lack of collaboration among school staff. The outbreak of the COVID-19 pandemic and the implementation of ERT have a big influence on inclusive education.

2.4 Inclusive practices

Inclusive teaching practices has no consistent definition – it amounts to a "complex combination of several pedagogical approaches" (Schwab & Alnahdi, 2020, p. 321). However, *inclusive practices* can be seen as attempts or actions to overcome barriers to learning so learners with diverse abilities can learn in general classrooms (Ainscow, 2005; Finkelstein et al., 2019). Teachers are mostly responsible for good inclusive practices (Antia & Stinson, 1999) and should ensure that inclusive practices are stimulating for all learners (Lindner et al., 2019).

Characteristics of inclusive practices include:

- collaboration and teamwork (Ainscow, 2005; Finkelstein et al., 2019; Lindner & Schwab, 2020; Walsh, 2018);
- grouping (Bešić et al., 2017; Finkelstein et al., 2019; Lindner & Schwab, 2020);
- modifications of content, instruction, material, assessment, extent, learning environment, process, product and time frame (Buli-Holmberg & Jeyaprathaban, 2016; DBE, 2011, 2014; Lindner & Schwab, 2020; Villa et al., 2005; Walsh, 2018);
- determining progress by assessing and monitoring a learner's individualised outcomes, set on the learner's individual education plan or the learners support plan (Finkelstein et al., 2019; Tomlinson & Imbeau, 2010); and
- organisational practices such as how teachers arrange and orchestrate the set-up of the classroom (Finkelstein et al., 2019).

Although the prevailing inclusive practices can be seen as an existing approach, it was found that the implementation of inclusive education in practice is not yet guaranteed (Lindner et al., 2019).

There are two inclusive pedagogical models from literature, namely, UDL and DI (Griful-Freixenet et al., 2020). Following is a discussion of both models.

2.4.1 Universal Design for Learning

The UDL framework is based on cognitive and neural perspectives on learning (Rose & Strangman, 2007). It was developed by the Centre for Applied Special Technology (CAST) as a framework of lesson planning to help teachers create inclusive lessons (CAST, n.d.) in order to provide learners with disabilities access to the general education curriculum (Griful-Freixenet et al., 2020).

2.4.1.1 Understanding Universal Design for Learning

UDL is a proactive approach which ensures access for all learners regardless of their needs and gives learners equal opportunity to succeed (CAST, n.d.; Lindner & Schwab, 2020; Morin, 2018). It offers flexibility in the way learners access material and shows what they know, thus learners can use their strengths to work on their weaknesses. UDL also has different ways of keeping learners motivated (CAST, n.d.; Morin, 2018). The UDL approach may be especially helpful to learners with learning and attention issues (CAST, n.d.). As the learners have a variety of options, UDL does not single out the few learners with disabilities who receive accommodations (CAST, n.d.; Morin, 2018).

The UDL consist of three principles, namely *multiple means of: engagement*; *representation*; and *action and expression* (CAST, n.d.).

- *Multiple means of engagement*: This refers to the *WHY* of learning (Dalton et al., 2012) and includes recruiting interest; sustaining effort and persistence; and self-regulation. Learners can be motivated by: making choices; having to do assignments that feel relevant to their lives; and having opportunities to get up and move around (Dalton et al., 2012; Morin, 2018). Teachers need to implement different classroom strategies that empower their learners; providing choices for the learners; reducing learner anxiety; and rewarding their efforts (Navarro et al., 2016).
- *Multiple means of representation*: This refers to the *HOW* of learning (Dalton et al., 2012) and includes perception; language expressions and symbols; and comprehension. Teachers must learn how to present educational resources through a variety of modalities (visual, auditory or tactile) and methods such as videos, websites, pictures etc. (Navarro et al., 2016; Rose & Strangman, 2007). For example, the teacher can provide a worksheet along with: audio (even as simple as saying the written directions out loud); video (showing how to solve a problem); and hands-on learning (Morin, 2018).
- *Multiple means of action and expression*: This refers to the *WHAT* of learning (Dalton et al., 2012) and includes physical action; expression and communication; and executive function. Teachers are required to provide learners with a variety of options to practice tasks, communicate and demonstrate what they have learned, which allow learners to capitalise on their special abilities or talents (Navarro et al., 2016; Rose & Strangman, 2007). For example, the learners might choose between taking a pencil-and-paper assessment; giving an oral report; making a video or a comic strip; and

doing a group project (Morin, 2018). That is why a UDL classroom needs to have flexible work spaces for the learners, spaces for quiet individual work; small and large group work; and group instruction (CAST, n.d.).

UDL encourages teachers to construct accessible curricula and learning environments for the widest range of learners by lessening the number of barriers to learning at the beginning (Griful-Freixenet et al., 2020; Roos, 2019; Takala & Sume, 2018). Thus, focussing on the learning environment rather than a specific learner (Rose & Meyer, 2002). The Centre for Applied Special Technology (CAST) admits that UDL takes careful planning and preparation by the teachers (CAST, n.d.; Morin, 2018) as teachers are encouraged to design accessible curricula and learning environments for the widest range of learners by minimising the number of barriers to learning at the outset (Griful-Freixenet et al., 2020).

2.4.1.2 Universal Design for Learning during the ERT requirements

Due to the COVID-19 pandemic, many schools moved to distance learning, as discussed in Paragraph 2.6. The principles of UDL can be helpful, as seen in the best practices for distance learning with UDL that include (Rappolt-Schlichtmann, 2020):

- *Explicitly teach expectations and engagement*: Teachers should express expectations for how learners should interact in this learning environment and explicitly and methodically teach how to use new instructional tools (Rappolt-Schlichtmann, 2020).
- *Allow for asynchronous learning:* teachers can record a video of live instruction and upload it to a space like Google Classroom, so learners can access it later (Rappolt-Schlichtmann, 2020).
- *Assign note-takers:* Many learners find it hard to “watch” instructions via video. Teachers can assign learners to take notes for the class using Google Classroom applications. All learners can benefit from good notes, along with transcripts and recordings (Rappolt-Schlichtmann, 2020).
- *Make materials accessible:* Images and digital documents should also be accessible to learners. Teachers can create brief text descriptions of images and videos, but should avoid PDFs for handouts and other digital materials (Rappolt-Schlichtmann, 2020).
- *Embrace your students as teachers:* Teachers may have preliminary ideas about how virtual instruction might function, but they can create tasks and let learners provide feedback – give the learners an opportunity to co-create what remote teaching and learning will look like (Rappolt-Schlichtmann, 2020).

- *Actively build a supportive community:* With remote teaching it is not easy to monitor the emotional and physical well-being of learners. Teachers need to build time into their teaching and learning to reduce social isolation and enhance feelings of belonging. This can be done with applications such as the break-away rooms of Zoom (Rappolt-Schlichtmann, 2020).

As mentioned earlier, the influence of the COVID-19 pandemic will be discussed in full in Paragraph 2.6. Next is a discussion on DI.

2.4.2 Differentiated instruction

"Quite simply, the classroom teacher is an irreplaceable leader in moving differentiation from an abstract idea on paper or in a professional development session to a fundamental way of life in the classroom." (Tomlinson & Imbeau, 2010, p. 10)

DI is grounded in the belief that diversity exists in any group of learners (Coubergs et al., 2017; Griful-Freixenet et al., 2020; Tomlinson & Imbeau, 2010). It can be seen as a way of teaching that accommodates the diversity of learners by: coping with learner diversity; embracing a specific teaching strategy; having a variety of learning activities; monitoring individual learner needs; pursuing optimal learning outcomes (Coubergs et al., 2017; Griful-Freixenet et al., 2020; Suprayogi & Valcke, 2016; Tomlinson & Imbeau, 2010); offering personalised scaffolding (Carolan & Guinn, 2007; Graves & Braaten, 1996); and teachers not only knowing the landscape of their subject matter, but also showing multiple ways to navigate it (Carolan & Guinn, 2007; Tomlinson & Imbeau, 2010).

The model of DI was developed by Carol Ann Tomlinson (Tomlinson, 2000) who states that "whenever a teacher reaches out to an individual or small group to vary his or her teaching in order to create the best learning experience possible, that teacher is differentiating instruction" (Tomlinson, 2000, p. 2). Teachers can differentiate a minimum of four classroom elements based on the learners' *affect* (how learners' emotions and feelings affect their learning); *readiness* (a learners' proximity to particular knowledge, understanding, and skills); *interest* (the attention, curiosity, and involvement of a learner)*;* or *learning profile* (how the learner prefers to take in, explore or express content) (Tomlinson, 2000; Tomlinson & Imbeau, 2010).The four elements, namely *content*; *process*; *products*; and *learning environment* are discussed next (Tomlinson, 2000; Tomlinson & Imbeau, 2010):

1. *Content*: What the learner needs to learn or how the learner will gain access to the information. Examples include reading materials at different readability levels; having text materials such as audio; presenting ideas through both auditory and visual means; and working in small groups to re-teach struggling learners, or to extend the thinking or skills of advanced learners (Bešić et al., 2017; Tomlinson, 2000; Tomlinson & Strickland, 2005); and teachers knowing how to use different learning styles and levels (Carolan & Guinn, 2007).

2. *Process*: Activities in which the learner engages to grasp and master the content. Examples include the use of "tiered activities through which all learners work with the same important understandings and skills, but proceed with different levels of support, challenge, or complexity" (Tomlinson, 2000, p. 2); offering manipulatives or other hands-on support for learners in need; and varying the duration of the tasks in order to provide additional support for a learner who struggles or to encourage an advanced learner to explore multiple perspectives on topics (Lindner & Schwab, 2020; Tomlinson, 2000; Tomlinson & Strickland, 2005).

3. *Products*: culminating projects asking the learner to rehearse, apply and extend the knowledge gained in a unit. Examples include the use of rubrics that match and extend learners' varied skills levels; learners can work alone or in small groups; give learners choices of how to express the required learning, such as a puppet show, or writing a letter; and encourage learners to develop their own product assignments with the necessary components (Carolan & Guinn, 2007; Tomlinson, 2000; Tomlinson & Strickland, 2005).

4. *Learning environment*: how the classroom works and feels. Examples include having places in the classroom where learners can work quietly and without interruptions as well as inviting places for learner collaboration; providing materials reflecting a variety of cultures and home settings; developing routines allowing learners to get help when teachers cannot help them immediately (Bešić et al., 2017; Lindner & Schwab, 2020; Tomlinson, 2000); and creating a safe environment where differences are turned into assets (Carolan & Guinn, 2007; Tomlinson, 2005).

Teachers using DI do not see themselves as custodians and disseminators of knowledge anymore, but rather as collaborators with learners and as "organisers of learning opportunities" (Tomlinson, 2017, p. 34). They focus less on having all the answers and more on 'reading' and guiding their learners and giving learners as much responsibility for learning as they can

deal with – these teachers consistently teach learners to deal with a little more responsibility (Tomlinson, 2017; Tomlinson & Imbeau, 2010).

Following is a table to explain what DI is and what it is NOT (Tomlinson, 2017; Tomlinson & Imbeau, 2010):

Table 2.2

What Differentiated Instruction is and what it is NOT

What Differentiated Instruction is NOT	What Differentiated Instruction is
DI is not: • 'Individualised instruction', • Chaotic, • Another way to provide equal, homogeneous grouping, • Just 'tailoring the same suit of clothes', and • Just for outliers.	DI is: • Proactive, • More qualitative than quantitative, • Grounded in assessment, • Taking multiple approaches to content, process, and product, • Learner centred, • A combination of whole-class, small-group, and one-on-one instruction, and • 'Organic' and dynamic.

For effective differentiation, teachers ensure safe and challenging learning environments; routines for teaching and learning which involve providing individual, small-group, and whole-class attention; clearly designated and pursued learning goals to ensure focus on the fundamental knowledge, understanding, and skill in a topic; regular formative assessment influences the teachers' instructional plans; the flexible use of time, space, manipulatives, and instructional strategies to address varied learner needs; and classrooms become communities of learning where learners share responsibility for respect, maximum operation, and optimum individual growth with the teacher (Tomlinson, 2005; Tomlinson & Imbeau, 2010).

Tomlinson (2017) is of the opinion that differentiation does not imply that a teacher can be all things to all learners all the time, but it does require that a teacher creates a reasonable range of approaches to learning in order for most learners to learn most of the time. These teachers improve in their ability to assess learner readiness through different ways; obtain and interpret learner clues about interests and learning preferences; develop different ways learners can

interact with information and ideas; develop varied ways learners can explore 'own' ideas; and present diverse channels learners can use to express and expand understanding (Tomlinson, 2017).

Even though practicing DI and coordinating teaching to the needs of each individual learner will cause diversity to blossom (Carolan & Guinn, 2007), high school teachers are more resistant to the implementation thereof compared to middle school teachers (Grades 5 – 7 teachers) (Burns, 2005). The teachers appreciate the importance of teaching learners at their own level and pace, however, having higher learner involvement and interest; knowing the learners' needs; recognising different learning styles; and having different activities for learners to choose from, many of the teachers have trouble incorporating these positive aspects into their teaching (Burns, 2005). Although high school teachers acknowledge that planning DI lessons has become easier, most do not have time to do it (Burns, 2005).

Teachers first need to make a paradigm shift before they can offer DI (Tomlinson, 2017), however, Burns (2005) is of the opinion that DI will not work at high school level with reasons including top-down initiatives not being well received by teachers; the comprehensive high school is not a good setting for changes such as reducing class size, block scheduling and team teaching; and due to many tertiary institutions using traditional lecture-format instruction and not differentiating, learners coming from DI will not know how to succeed in a tertiary environment.

2.4.3 Interrelationship between UDL and DI models

In the discussions above it can be seen that UDL and DI are related to each other, but what is the relationship?

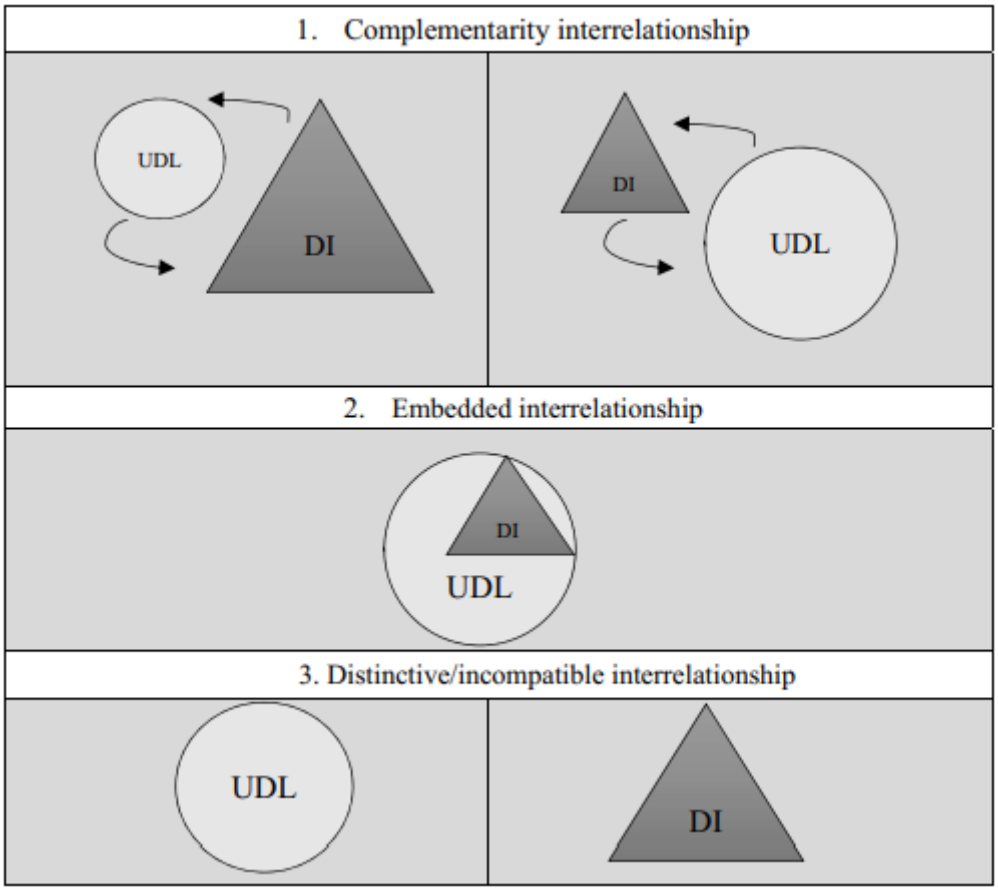
Griful-Freixenet et al. (2020) identified three conceptual interpretations of the UDL and DI interrelationship from literature, namely:

1. The complementary interrelationship between UDL and DI, which tends to diminish the status of either UDL or DI to an inferior category;
2. The embedded interrelationship of DI within UDL, which appears as a consequence of interpreting DI as the act of differentiating; and
3. The incompatible interrelationship between UDL and DI, in which the studies tend to ignore the most recent theoretical developments when contrasting both models. (p. 1)

The next figure is a graphical representation of the three interrelationships between UDL and DI from literature as concluded by Griful-Freixenet et al. (2020, p. 16).

Figure 2.4

Graphical Representation of the Three Interrelationships between UDL and DI



Source: Griful-Freixenet et al., 2020, p. 16

Griful-Freixenet et al. (2020) remark that currently UDL and DI may possibly refer to the same content and concepts, simply using different terminology and perhaps with only a slightly different emphasis. Therefore, they recommend that both models should be tested scientifically and tapped directly into the three interrelationships as the interrelationships between UDL and DI have only been discussed in literature on a theoretical level (Griful-Freixenet et al., 2020).

2.4.4 South Africa's response to diversity

White Paper 6 of the South African Department of Education (DoE, 2001) mentions that terms used such as "*learners with special education needs* and *learners with mild to severe learning difficulties"* (p. 12), are used in the approach that learning disabilities arise from within the learner. However, White Paper 6 (DoE, 2001) advocates for the terminology 'barriers to learning and development' to be used and that there should be consistency between the inclusive approach that is embraced, namely that learning barriers exist primarily within the learning system.

There are a conglomeration of learning needs among any learner population and learners may fail to learn effectively or even be excluded from the learning system (DoE, 2001). Different learning needs arise from factors such as physical, mental, sensory, neurological and developmental impairment, however, they may also arise because of:

- Negative attitudes to and stereotyping of differences;
- An inflexible curriculum;
- Inappropriate languages or language of learning and teaching;
- Inappropriate communication;
- Inaccessible and unsafe built environments;
- Inappropriate and inadequate support services;
- Inadequate policies and legislation;
- The non-recognition and non-involvement of parents; and
- Inadequately and inappropriately trained education managers and educators. (DoE, 2001, pp. 17-18)

Part of implementing inclusive education in South Africa is with the use of full-service/ inclusive schools. "Full-service/ inclusive schools … are first and foremost mainstream education institutions that provide quality education to all learners by supplying the full range of learning needs in an equitable manner" (DBE, 2010). Not all mainstream (ordinary) schools will become full-service/ inclusive schools. The DoE (2001) wants to convert 500 out of 20 000 primary schools into full-service schools over a period of 20 years. Even though there were only eight schools country-wide that had completed their transition to full-service/ inclusive school in 2010 due to the slow identification and establishing, in 2014, however, 510 full-service schools

had been established (Engelbrecht et al., 2015). Basic Education Minister Angie Motshekga, reported in November 2021 that by the end of 2018, 848 full-service schools were designated, not only in 30 education districts as required in the White Paper 6, but in all education districts (SAnews.gov.za, 2021).

DBE (2010) states that a full-service/ inclusive school:

- Must have the resources and assistance necessary to meet a wide range of educational demands;
- Strives to be inclusive in its organisational structure, policies, practises, pedagogy, and culture;
- Recognises that barriers to learning can be systemic and cultural as well as intrinsic to learners;
- Should have more support systems in place for learning and teaching;
- Is prepared to investigate and handle issues that arise in day-to-day school operations through ongoing institutional development and the development of educator capacity;
- Should be aware that in order for learning and growth to occur, activities that exclude learners must be addressed, eliminated, or decreased;
- Works to ensure that every local child who is old enough to go to school goes to school;
- Is a school with good leadership;
- Is a location where both educators and learners can feel safe and supported;
- Is an orderly and well-kept school;
- Is a school with sound leadership;
- Adopts a cooperative philosophy when providing services; and
- Welcomes educators from schools in the area to learn new skills and ideas and may admit learners from neighbourhood schools for short periods of time.

According to the DoE, full-service schools will be supported and provided with the required physical and material resources, as well as professional development for staff (DoE, 2001). Unfortunately, schools experience limited administrative and financial support from the District offices assisting them in becoming functional inclusive schools (Engelbrecht et al., 2015) and thus believe it is better to have the learners with learning barriers in separate classes (Engelbrecht et al., 2016).

The DoE (2001) recommends in White Paper 6 that the “process of learning and teaching should be flexible enough to accommodate different learning needs and styles” (p. 20). According to the *Guidelines for responding to learner diversity in the classroom through*

curriculum and assessment policy statements some of the diverse learning needs of learners include (DBE, 2011):

- Learners who have difficulty in reading and writing;
- Learners with hearing, visual and coordination difficulties;
- Learners living in poverty;
- Learners with health and emotional difficulties;
- Learners experiencing difficulties in remembering what has been taught to them;
- Learners who need assistive devices and adapted materials, such as Braille. (p. 3)

The DBE suggested that the focus of the response to learner diversity in the classroom is on curriculum differentiation and differentiating assessment (DBE, 2011). Following is a discussion on both of the focus points.

2.4.4.1 Curriculum differentiation

Curriculum differentiation consists of three aspects, namely the "differentiating curriculum content; differentiating the learning environment; and differentiating teaching methods" (DBE, 2011, p. 4). These three aspects correlate with the elements that can be differentiated according to Tomlinson (2000), namely content; process; products; and learning environment.

Following is a discussion of the three aspects of curriculum differentiation (DBE, 2011).

1. *Differentiating curriculum content*
   Teachers are encouraged to modify the content and it can be done at three levels, namely abstractness; complexity; and variety (DBE, 2011). *Abstractness* refers to the fact that some learners may need to access content first at a concrete level; many aspects of the curriculum can be very *complex* and difficult to grasp; while *variety* indicates the expansion of the curriculum to prevent learners from getting bored (DBE, 2011).

2. *Differentiating the learning environment*
   There are two learning environments, the psychosocial learning environment and the physical environment (DBE, 2011). For the purpose of this study only the physical environment will be looked at and discussed with factors such as noise levels and seating arrangements, class size and resources – applicable to HI learners (Deafness

Foundation & Deaf Children Australia, 2005; Erbas, 2017). Tomlinson (2017, p. 43) states that in the learning environment “everyone feels welcome and contributes to everyone *else* feeling welcome”.

3. *Differentiating teaching methods*

Learning materials; methods of presentation; learning activities; and lesson organisation are all part of the differentiating of teaching methods (DBE, 2011) and therefore, teachers should adapt their instructional methods and materials to suit learners’ needs and abilities (Buli-Holmberg & Jeyaprathaban, 2016). Regardless of teacher education programmes and professional development, workshops and other offerings should be implemented that prepare teachers with strategies to increase visualisation skills to improve HI learners' capacity to decode words and concepts from long-term memory (Lang & Pagliaro, 2007). *Learning materials* includes a wide range of materials – including e-learning – as well as materials that might need to be adapted (DBE, 2011). *Methods of presentation* refers to brief directions and verbal instructions; repetition of information; repetition of questions and answers from other learners; written notes on the board; and flexible grouping (DBE, 2011; Deafness Foundation & Deaf Children Australia, 2005; Erbas, 2017). The *learning activities* to be explored will be tiered assignments and the modification of the format of the task (DBE, 2011; Deafness Foundation & Deaf Children Australia, 2005; Erbas, 2017; Tomlinson, 2000) while *lesson organisations* refers to the use of multiple intelligences (DBE, 2011).

Howard Gardner created the theory of multiple intelligences, with the seven intelligences being, logical-mathematical; linguistic; musical; spatial; bodily-kinaesthetic; intrapersonal; and interpersonal (Gardner & Hatch, 1989). When planning a lesson, the teacher should think of different activities related to the content of the lesson and the skills learners have to master by incorporating the different intelligences (DBE, 2011).

See the following example of questions teachers should ask when planning to address a specific intelligence:

- *Logical-mathematical*: How can I incorporate classification, computation, critical thinking, and the use of numbers?
- *Linguistic:* How can I incorporate writing, speaking, and reading?
- *Musical:* How can I incorporate dance, music, sounds, rhyme, and rhythms?
- *Spatial:* How do I add images, diagrams, colours, artwork, or graphs?

- *Bodily-kinaesthetic:* How can I incorporate art, craft, drama, and practical equipment?
- *Intrapersonal:* How can I give learners options and time for private study?
- *Interpersonal:* How can I incorporate debates, peer sharing, and group work?

In order for learners to achieve more and feel more engaged in school, teachers should ensure that what they differentiate is of a high-quality curriculum and instruction and that all the learners have respectful activities (Tomlinson, 2000). Differentiation is not a replacement for a high-quality curriculum, it is rather an extension of it (Tomlinson, 2005). “Curriculum differentiation is a key strategy for responding to the needs of learners with diverse learning styles and needs … within a differentiated curriculum, assessment of learners and their learning is integral to the teaching and learning process” (DBE, 2011, pp. 4,12).

2.4.4.2 Differentiating assessment

Too often teachers think of assessments as tests, while they should rather think about them as a road map for their thinking and planning (Tomlinson, 2017) as ongoing assessment regularly informs teachers’ instructional plans (DBE, 2011; Tomlinson, 2005). The key principles for assessment in a diverse classroom include, teachers having high expectations for all learners; assessment being supportive of teaching practices; no learner to be disadvantaged by the assessment strategy; and assessment informing teachers what the learner can do at a particular stage (DBE, 2011).

In answer to the question, “What do we assess?” the DBE (2011) replies with four answers, namely, assessing to find out about readiness and learner pre-skills; assessing progress with the curriculum; assessing learner interests; and assessing learner characteristics. There are alternate forms of assessment for learners with disabilities, especially HI learners such as alternate assessment based on modified attainment of knowledge and alternate assessment based on grade-level attainment of knowledge (DBE, 2011).

- *Alternate assessment based on modified attainment of knowledge*
  Due to disability the learner might need more time to master the content. Assess “learner’s mastery of grade-level content with reduced load/ more at functional level” (DBE, 2011, p. 19).
- *Alternate assessment based on grade-level attainment of knowledge*
  This involves learners with disabilities who need for example, additional time, readers and amanuensis because these “procedures provide them with equal opportunities to

demonstrate their attainment of content which is at the same grade-level as the general assessment" (DBE, 2011, p. 19).

Even though the DBE (2011) provides guidelines, it is important to investigate the current situation in South Africa. Next is a discussion of the current inclusive practices in South Africa.

2.4.5 Current inclusive practices in South Africa

To determine the current situation in South Africa, a systematic literature review was performed in order to evaluate and analyse all the available evidence relevant to inclusive practices, UDL and differentiation in South Africa. I searched for articles between 2012 and 2022 on WorldCat.org. When I used the keywords: *"South Africa", "inclusive practice*"* and *"*school*"* only 23 articles appeared, nine of which applied to the study. For the second search I used the keywords *"South Africa", "UDL"* and *"inclusive practice*"*. However, no results were produced so I omitted the phrase *"inclusive practice*"* as a keyword. With only "*South Africa*" and "*UDL*" as keywords, 68 articles were found, of which only four applied to UDL on school level in South Africa. For the third search I used the keywords *"South Africa", "differentiat*"* and *"inclusive practice*"*. Of the 24 articles, only 11 applied to differentiation as inclusive practice on school level in South Africa. However, five of the 11 were already identified during the first search. Thus, 19 articles were identified in total. Below is an overview of the articles.

Table 2.3

Overview of Articles on SA Inclusive Practices between 2012 and 2022

AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	FINDING	*JOURNAL*
Adnams, C., Abrahams, L., Mkabile, S., McKenzie, J., Hooper, A., Smith, P., Saptouw, M., Swartz, L., Capri, C., & Coetzee, O. (2018).	Intellectual disability rights and inclusive citizenship in South Africa: What can a scoping review tell us?	Literature on intellectual disability	Realisation of rights for people with intellectual disability includes encouraging inclusive practices, however there are still barriers to exercising these rights.	*African Journal of Disability*
Dalton, E. M., Ferguson, B. T., Lyner-Cleophas, M., & McKenzie, J. (2019).	Inclusion, universal design and universal design for learning in higher education: South Africa and the United States.	Two USA and two RSA universities.	Higher education institutions may not be appropriately supportive of inclusion due to lack of knowledge and training and lack of resources.	*African Journal of Disability (Online)*
Dalton, E. M., McKenzie, J. A., & Kahonde, C. (2012).	The implementation of inclusive education in South Africa: Reflections arising	13 Participants at a workshop on UDL. There were five occupational	Teachers should understand and address the range of diverse learners and not exclude them from the education system. Teachers should collaborate with therapists so learners can gain the most.	*African Journal of Disability*

AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	FINDING	*JOURNAL*
	from a workshop for teachers and therapists to introduce Universal Design for Learning	therapists, four teachers from special schools, two managers of inclusive education organisations and two speech therapists.	Thus, teachers require new abilities, instruction, and systemic support from the educational system.	
Dreyer, L. M. (2013).	Exploring the changing role of learning support teachers in the Western Cape, South Africa.	41 learning support teachers completed a questionnaire.	Learning support teachers withdrawing learners from mainstream classes. Mainstream teachers giving inadequate support to learners experiencing barriers. Learning support teachers compile resource files, including differentiated worksheets and activities, and assist teachers with differentiation. The mainstream teacher and the learning support teacher do not plan together.	*Perspectives in Education*
Dreyer, L. M. (2017).	Constraints to quality education and support for all: a Western Cape case.	41 learning support teachers and 165 mainstream teachers across all three phases in the West Coast Education District.	Participants working with learners with high-level support needs identified for Special School placement, such as those with physical disabilities or severe intellectual impairments. Inadequate support provided to learners that qualify for highly intense support.	*South African Journal of Education*

AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	FINDING	*JOURNAL*
			The majority of mainstream teachers do not feel confident enough to support learners with high-intensive needs in their classes and those learners are grossly neglected in mainstream classes. Teachers lack understanding of inclusive education and want the reinstitution of special classes.	
Engelbrecht, P., & Muthukrishna, N. (2019).	Inclusive education as a localised project in complex contexts: A South African case study.	Part of larger study. Key participants are the principal, members of the school-based support team and the learning support educator of this full-service primary school	Staff members feel it is important to be open to change and new learning, and to adapt to new roles and responsibilities. School wants to enhance inclusive practices, however, it still faces ongoing barriers to the implementation of the inclusive education policy. The particular barriers are a lack of funding, overcrowded classes, under-resourced classrooms and teacher shortages. Despite efforts to create ongoing professional opportunities, teacher professional development is still insufficient.	*Southern African Review of Education with Production*
Engelbrecht, P., Nel, M., Smit, S., & van Deventer, M. (2016).	The idealism of education policies and the realities in schools: the implementation of inclusive education in South Africa.	Teachers, principal and parents of a mainstream (ordinary) public primary school in rural South Africa being converted to a full-service school.	Learners experiencing learning barriers were in separate classes (ELSEN classes) and not included in mainstream classrooms. Teachers not trained to include learners with disabilities in their classrooms – refer learners to ELSEN classes. There is no defined monitoring and mentoring procedure in place regarding the further development of the school as a full-service school by the District Office. Demands to accommodate more learners with impairments and a variety of learning requirements are coming from the DoE and nearby schools.	*International Journal of Inclusive Education*

AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	FINDING	*JOURNAL*
			Lack of financial support and learning support material. There is a need for adequate support from the DoE. The tasks and responsibilities of full-service schools are not well understood by either ELSEN or mainstream teachers. Overcrowded classrooms with no plans to expand. Four years later little has changed. Teachers not trained; classes too big; lack of learning support material (including adapted reading material); and still limited financial support from DoE.	
Engelbrecht, P., Nel, N., Nel, M., & Tlale, D. (2015).	Enacting understanding of inclusion in complex contexts: Classroom practices of South African teachers.	49 teachers interviewed individually and in focus groups.	A lack of physical, financial and human resources. Overcrowded classrooms. Inadequate initial and continuing teacher education programmes. Fixed curriculum requirements through CAPS. General education support and well-skilled professional teachers are imperative for the implementation of inclusive education.	*South African Journal of Education*
Geldenhuys, J. L., & Wevers, N. E. J. (2013).	Ecological aspects influencing the implementation of inclusive education in mainstream primary schools in the Eastern Cape, South Africa.	28 participants from 7 schools, semi-structured interviews.	The implementation of inclusive education is hampered by factors both inside the school environment and throughout the overall ecological system of education. Teachers seldom make use of a variety of teaching strategies, thus no differentiation takes place. Huge lack of support from parents.	*South African Journal of Education*

AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	FINDING	*JOURNAL*
Herman, C., Meltz, A., & Pillay, V. (2014).	Inclusive education: A case of beliefs competing for implementation.	Teachers, parents, middle managers and top managers of an independent Jewish community school – 27 people in total.	Four different discourses competed for dominance at a Jewish school regarding inclusion: the medical deficit model; social model (equality of opportunity), pragmatic discourse (what are the practical implications?); and the community discourse (if you are Jewish you can attend). The different discourses caused fragmented change and those involved represented and implemented whatever they felt.	*South African Journal of Education*
Kathrada, N., & Moroe, N. (2016).	The long-term concerns post cochlear implantation as experienced by parents/caregivers of prelingually deaf children between the ages of 3 and 5 years in Gauteng Province, South Africa: Research.	5 parents/ caregivers of prelingually deaf children with cochlear implantations.	There is a need for continued support for parents and families of children with cochlear implants. The caregivers have concerns regarding the future education of their children.	*South African Journal of Child Health*
Laas, H. L. (2012).	Journey through the trials and triumphs of disability: Original research.	Teacher with a disability after a vehicle accident	When returning after the accident to the special school (for children with physical disabilities) she taught in she was greeted with “you’re one of us now”. Author became a mentor to the learners with personal problems. She wanted to actively promote inclusive education.	*African Journal of Disability*

AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	FINDING	*JOURNAL*
Magano, M. D., & Mapepa, P. (2018).	Support to address barriers to learning for learners who are deaf.	11 primary school teachers of learners who are deaf and using sign language were interviewed.	Limited curriculum support in special schools. Lack of support from the DBE regarding appropriate teaching or learning materials. Overcrowded classrooms.	*African Journal of Disability (Online)*
McKenzie, J. A., & Dalton, E. M. (2020).	Universal design for learning in inclusive education policy in South Africa.	Literature	UDL should be used as a framework in all teacher preparation programmes, both pre-service and in-service, to create classrooms that can accommodate the greatest variety of differences. It is best to think of curriculum support as the assistance teachers require in order to put UDL's concepts into practise.	*African Journal of Disability (Online)*
Selesho, J. M. (2012).	The challenges faced by student teachers towards inclusion of learners with special educational needs in the mainstream.	120 third-year B.Ed. students doing inclusive education in education module completed questionnaire.	Student teachers have positive attitudes towards inclusive education. It's critical for general education teachers and special education teachers to work together. A need for unambiguous guidelines for implementing inclusive education. Teaching future teachers how to manage a classroom of diverse learners requires more work.	*Journal of Educational Studies*
Theron, L., & Hall, A.-M. (2016).	How school ecologies facilitate resilience among adolescents with Intellectual	Secondary data 24 resilient adolescents with intellectual disability (ID) and 18 of their	Adolescents with ID revealed how their school ecologies mattered for resilience. Four themes emerged: namely provide space to be actively engaged in developmentally appropriate sporting activities; teachers provide differentiated academic activities and learning support; provide space for constructive peer attachments; and	*South African Journal of Education*

AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	FINDING	*JOURNAL*
	Disability: guidelines for teachers.	teachers from special schools	teachers offer safe relational spaces where adolescents with ID can confide in and learn about life." For learners with ID being accommodated in inclusive schools, teachers and school ecologies should pay attention to the themes from the article.	
Walton, E., & Lloyd, G. (2012).	From clinic to classroom: a model of teacher education for inclusion.	Approximately 22 in-service teachers doing B.Ed. Hons in Inclusive Education at a specific university in the pilot years of 2009 and 2010.	Effective training of teachers to meet diverse learning needs in their classroom is a challenge in South Africa. These included UDL and curriculum differentiation; co-operative learning; positive discipline and resilience; using the Concentrated Language Encounter; and Dialogic teaching. Students and lecturers experienced challenges associated with change. Teachers must acquire collaborative and classroom-based inclusive practise knowledge.	*Perspectives in Education*
Walton, E., & Rusznyak, L. (2016).	Approaches to assessing preservice teachers' learning in authentic and rigorous ways: The case of an inclusive education module.	A group of pre-service teachers in an inclusive education module at a university. Analysis of 3 assessment tasks.	Discussion on assessments and knowledge-for-practice (theoretically informed, knowledge-based practice); knowledge-in-practice (observing expert through apprenticeship); and knowledge-of-practice (relating to own practices).	*Perspectives in Education*

AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	FINDING	*JOURNAL*
Yoro, A. J., Fourie, J. V., & van der Merwe, M. (2020).	Learning support strategies for learners with neurodevelopmental disorders: Perspectives of recently qualified teachers.	Six recently qualified teachers (ages 22-28) from different mainstream schools teaching learners with neurodevelopmental disorders, such as ADHD. Semi-structured interviews, observations and critical incidents reports.	Cooperative learning, peer learning, ability grouping, comprehensive visual aids, and curriculum differentiation are just a few of the support techniques that teachers employ.	*African Journal of Disability (Online)*

It can be seen that researchers did not necessarily focus on a particular disability when discussing inclusive practices in South Africa, but rather on the diversity of the learners. Researchers found that teachers:

- do not understand inclusive education (Dalton et al., 2012; Dreyer, 2017; Engelbrecht et al., 2016; Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013; Herman et al., 2014);
- experience a lack of support from the DoE or District offices (Dreyer, 2017; Engelbrecht et al., 2016; Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013; Magano & Mapepa, 2018);
- need resources (Engelbrecht et al., 2015);
- have overcrowded classrooms (Engelbrecht et al., 2016; Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013; Magano & Mapepa, 2018); and
- need guidance regarding sound inclusive practices (Dreyer, 2017; Engelbrecht et al., 2016; Engelbrecht et al., 2015), such as UDL (McKenzie & Dalton, 2020) as they were not trained in inclusive education (Engelbrecht et al., 2016; Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013; Walton & Lloyd, 2012).

One important aspect seen in the literature is that the curriculum and assessment policy (CAPS) is in direct conflict with White Paper 6 (Engelbrecht et al., 2015; Geldenhuys & Wevers, 2013) and teachers focus more on adhering to the curriculum requirements rather than adapting their teaching strategies to address the barriers to learning (Engelbrecht et al., 2015).

Song (2016) finds that despite acknowledging the advantages of putting UDL's principles into practise, special school teachers in South African townships have difficulty applying this Western idea in their classrooms because of the particular socioeconomic circumstances of these schools. The teachers mention that there is a lack of insufficient resources, physical space, and assistive devices in the current educational structure which prevents teachers "from developing a flexible curriculum and implementing new strategies such as UDL in their teaching" (Song, 2016, p. 917). Although the teachers were not aware of the term *Universal Design for Learning* they instilled practices that are consistent with UDL philosophy in order to cater for the needs of the diverse learners (Song, 2016).

More recently, Engelbrecht and Muthukrishna (2019) report on the encouraging emerging practices of a full-service school, but there are still obstacles in the way of putting the inclusive education agenda into practise. The specific obstacles include a lack of money, overcrowded

classes, under-resourced classrooms, and a shortage of teachers. Unfortunately, despite efforts to create ongoing professional opportunities, teacher professional development is still insufficient (Engelbrecht & Muthukrishna, 2019).

Although literature indicates teachers have a lack of skills, training and knowledge and do not support learners with diverse needs, a new study done by Yoro *et al*. (2020) found that recently qualified teachers (between ages 22 and 28) make use of a variety of support strategies to support learners. Cooperative learning, peer learning, ability grouping, substantial visual aids, and curriculum differentiation are some of these strategies. However, it appears that the support strategies the teachers used, were not focused specifically on the disability at hand, namely neurodevelopmental disorder (including attention deficit hyperactive disorder), but were rather general teaching and learning strategies (Yoro *et al*., 2020).

Inclusive practices involve actions to overcome barriers to learning so learners with diverse abilities can learn in general classrooms. As seen earlier, the interrelationship between the UDL and DI models is still not clear, and with the DBE putting an emphasis on differentiation as a strategy to address the diversity in the classroom, understanding the relationship between UDL and DI can cause confusion. However, I tend to lean towards the embedded interrelationship of DI within UDL. After studying the literature, Lindner and Schwab (2020) conclude “that it seems to be unclear what exactly distinguishes inclusive teaching practice from general good teaching practice” (p. 18).

2.4.6 Summary of Inclusive practices

Inclusive practices are actions to overcome barriers to learning so learners with diverse abilities can learn in general classrooms. Teachers are responsible for good inclusive practices and can follow the UDL or DI approach, however, they should first make a paradigm shift. The South African DBE has guidelines for responding to learner diversity in the classroom, namely, curriculum differentiation and differentiating assessment and includes the recommendation that multiple intelligences should be incorporated in the different activities. Unfortunately, there are plenty of barriers, such as lack of support from the DBE preventing the execution of inclusive practices – especially in South Africa.

2.5 The hearing impaired learner and inclusion

The context of the study is the inclusion of oral (making use of spoken language) HI learners in the general mathematics classroom. In this study, learners who are HI are those who use

hearing aids and/or cochlear implants and have moderate to profound hearing loss in both ears. As the study focuses on *oral* HI learners, it indicates the learners are able to communicate orally. It is most likely that the percentage of HI learners in the general classroom will increase due to early identification of hearing loss as well as intervention techniques such as cochlear implants (Antia et al., 2009). Hearing loss can be detected as early as the first few days after birth due to modern technology (Pakulski, 2021). Next is a discussion of the degree of hearing loss; the barriers to learning that HI learners experience; and how to address these barriers.

2.5.1 Degree of hearing loss

The degree of hearing loss is based on how loud sounds need to be for you to be able to hear them (ASHA (American Speech-Language-Hearing Association), n.d.). Decibels, or dB, describe loudness. The following table gives a summary of the hearing loss range of the different degrees of hearing loss (ASHA (American Speech-Language-Hearing Association), n.d.).

Table 2.4

Hearing Loss Range of Different Degrees of Hearing loss

Degree of Hearing Loss	Hearing Loss Range
Normal	-10 to 15
Slight	16 to 25
Mild	26 to 40
Moderate	41 to 55
Moderately severe	56 to 70
Severe	71 to 90
Profound	91+

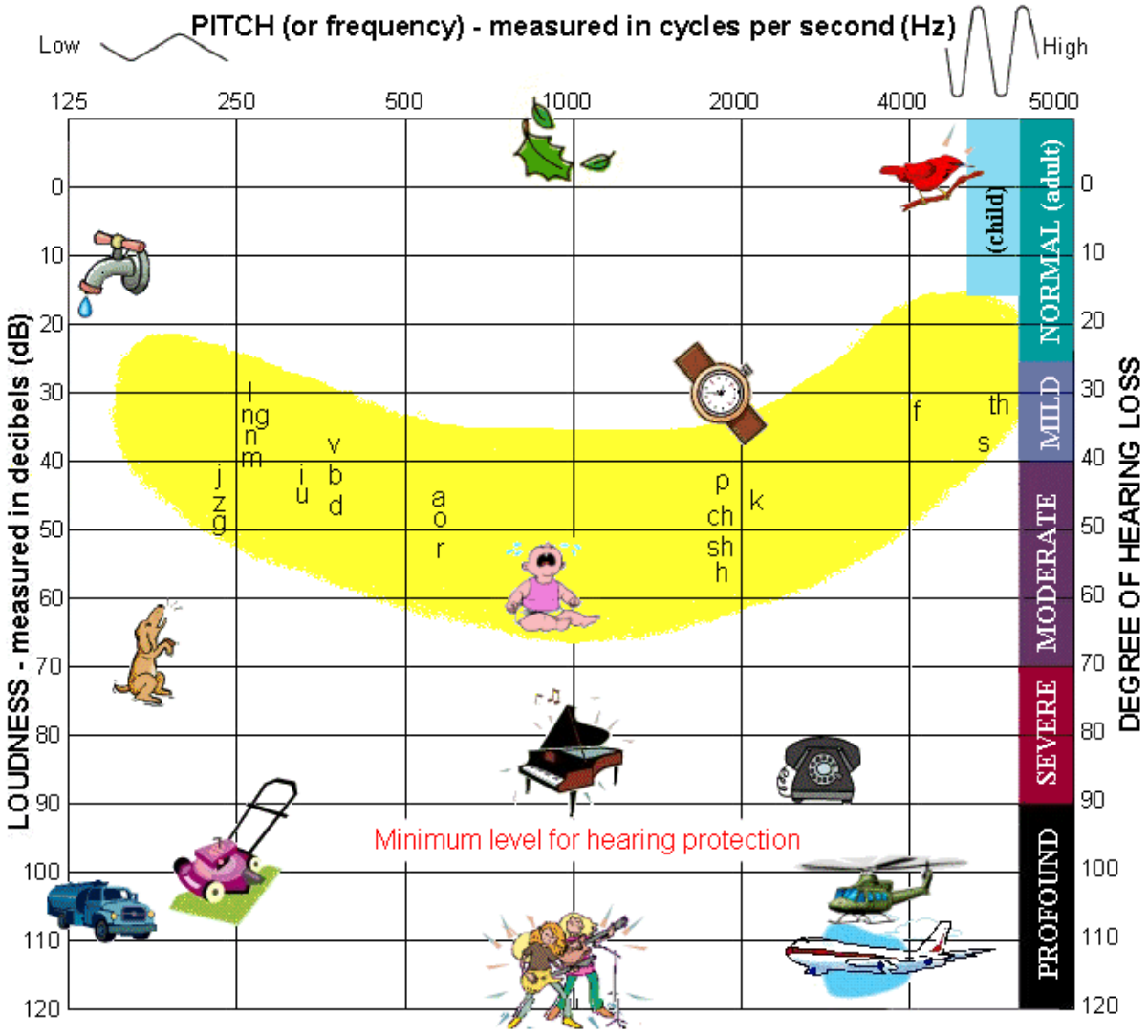
From Table 2.4 it can be seen that if a person can only hear sounds with a loudness of 16 dB onwards (louder), they have a slight hearing loss, while a person who can only hear sounds with a loudness of 60 dB onwards is in the moderately severe hearing loss range.

The following figure from the ACT Deafness Resource Centre (ACT Deafness Resource Centre, n.d.), the *Speech Banana Audiogram*, can be used to understand the implications of the degree of hearing loss better. The sounds we use to form everyday speech have

frequencies or pitch (on the horizontal axis) and decibels or loudness (on the vertical axis). The different pitches and loudness levels of the speech sounds fall on the audiogram in the shape of a banana, therefore the reference to *speech banana*.

Figure 2.5

The Speech Banana Audiogram



Source: ACT Deafness Resource Centre, n.d.

The severity of hearing loss is measured in two ways, namely, how loud something needs to be before one can hear it and which frequencies one struggles to hear (Clason, 2020). If a learner has good hearing, he can hear lots of sounds outside the speech banana such as the high frequency of birds chirping or the low frequency of a bass drum. Hearing loss often strikes the speech banana area, resulting in learners having trouble hearing and understanding speech (Ternes, 2017). A learner with a moderate hearing loss and having lost the ability to

hear high frequency sounds of 4000 Hz and greater, will only be able to hear sounds starting in the range of 41–55 dB and onwards, thus, they will not be able to hear leaves falling, birds chirping, a tap dripping or the clicking sound of a wrist watch. The learner will also find words that are spoken to him using “f”, “th”, and “s” such as “first”, “thirsty” and “months”, difficult to understand (Ternes, 2017). A learner with a profound hearing loss will not be able to hear any spoken sounds from the speech banana without amplification.

Professionals lacking experience might be tempted to think that learners with mild hearing loss have mild concerns and learners with severe to profound hearing losses have learning deficits – however, “achievement is not directly related to hearing thresholds” (Pakulski, 2021, para. 6).

2.5.2 Barriers to learning

Even though HI learners’ intellectual abilities parallel those of normal hearing learners (Salend, 2011) and their hearing loss was detected at an early stage, on average, HI learners’ achievements continue to lag behind their typical hearing peers (Pakulski, 2021). HI learners experience many barriers to learning including, listening; spoken language; comprehension; curriculum; learning material; and exhaustion (Alasim, 2018; Luckner et al., 2012; Salend, 2011; Uys & Selesho, 2017). HI learners entering high school have an average language delay of four-to-five years, thus, the HI learners would be unprepared for the language demands of the high school curriculum (Furlonger et al., 2010).

Classroom instructional practices can cause barriers for the HI learners, such as, the pace of instruction of the curriculum being too fast and not accommodating the HI learner (Alasim, 2018; Berndsen & Luckner, 2012; DoE, 2001; Uys & Selesho, 2017); a lecturing, non-interactive teaching style; lessons not being broken down into smaller sections and not being reinforced with activities; HI learners being unaware of the purpose of the lesson and when the connection to real life is not explained; lessons not being taught in a routine-like and sequential way (Uys & Selesho, 2017); a high number of speakers are involved in a conversation (Berndsen & Luckner, 2012); a lack of visual support (Erbas, 2017; Uys & Selesho, 2017); and unfamiliar vocabulary used by the teacher, as HI learners’ vocabularies are relatively limited (Erbas, 2017; Uys & Selesho, 2017).

2.5.3 Addressing the barriers

Following is a discussion on how these barriers to learning can be addressed. Continued work is required to maintain the gains of HI learners, and therefore support for HI learners should not be withdrawn when gaps are reduced (Pakulski, 2021).

Teachers need to have a positive stance towards the inclusion of HI learners in order for it to be successful, including "a basic amount of knowledge regarding language development and the impact of hearing loss on classroom participation and learning" (Eriks-Brophy & Whittingham, 2013, p. 20). Instructional strategies teachers can apply to overcome some of the barriers HI learners experience include:

- repetition of information in the classroom (Ayantoye & Luckner, 2016; Le Hanie, 2017; Simkiss, 2013);
- auditory highlighting by using the word "listen", followed by a three second pause to ensure the HI learner listens (Estabrooks, 1998; Uys & Selesho, 2017);
- clear speech (Takala & Sume, 2018; Uys & Selesho, 2017);
- vocabulary support including rephrasing[2] (Ayantoye & Luckner, 2016; Estabrooks, 1998; Le Hanie, 2017; Simkiss, 2013; Uys & Selesho, 2017);
- additional teaching such as pre- and post-teaching (Ayantoye & Luckner, 2016; Berndsen & Luckner, 2012; Le Hanie, 2017; Luckner et al., 2012; Powers, 2001; Simkiss, 2013);
- face the learners so they have the opportunity to lip-read (Eriks-Brophy & Whittingham, 2013; Luckner et al., 2012; Simkiss, 2013; Uys & Selesho, 2017);
- visual and technological support (Easterbrooks & Stephenson, 2006; Erbas, 2017; Le Hanie, 2017; Luckner et al., 2012; Magano & Mapepa, 2018);
- making use of gestures (Erbas, 2017; Le Hanie, 2017; Simkiss, 2013; Takala & Sume, 2018); and
- learners working in small group activities (Alasim, 2018; Powers, 2001; Takala & Sume, 2018).

Research suggests that teaching HI learners in general classrooms enables them to develop rich vocabulary knowledge as they practice their language skills with their hearing peers

[2] *Rephrasing* refers to the use of easier, more common language to explain certain phrases, words or concepts. *Rephrasing as a concession* refers to the adaptation of the language used in all written work, such as examination papers, tests or assignments, so that the language used is accessible and understandable for HI learners. (Uys, M., & Selesho, E. (Eds.). (2017). *Inclusive education for children with a hearing loss: a practical guide for parents and teachers*. Pretoria: BK.

(Erbas, 2017; Eriks-Brophy & Whittingham, 2013). Teachers should focus on DI that enhances fundamental neurocognitive abilities, such as executive function and metacognition (Mousley & Kelly, 1998; Pakulski, 2021). One's awareness and comprehension of one's own mental processes is referred to as metacognition, in other words *thinking about thinking,* whereas executive function skills are "neurocognitive processes necessary for cognitive flexibility, attention, working memory and impulse control" (Pakulski, 2021, para. 6). When teachers "think aloud" when reaching a decision or solving a problem, they make incidental learning intentional (Luckner *et al*., 2012; Pakulski, 2021).

It is of utmost importance that an HI learner's hearing devices are on and in working condition (Uys & Selesho, 2017) and that damaged or inadequate hearing technology receives immediate action (Luckner et al., 2012; Pakulski, 2021). HI learners need to make use of assistive listening devices, such as FM (frequency modulation) systems and Roger Dynamic Soundfield, to amplify the teacher's voice (Antia & Stinson, 1999; Crandell & Smaldino, 2000; Erbas, 2017; Gremp & Easterbrooks, 2018; Jacob et al., 2012; Le Hanie, 2017; Leigh & Crowe, 2020; Luckner et al., 2012; Simkiss, 2013; Takala & Sume, 2018). Classroom acoustics are important and a quiet classroom environment enhances hearing and listening (Antia et al., 2009; Berndsen & Luckner, 2012; Crandell & Smaldino, 2000; Gremp & Easterbrooks, 2018; Leigh & Crowe, 2020; Powers, 2001; Simkiss, 2013; Uys & Selesho, 2017). Effective seating arrangements ensure that the HI learner can see the teacher and follow classroom discussions easily (Berndsen & Luckner, 2012; Erbas, 2017; Leigh & Crowe, 2020).

HI learners in South Africa are eligible for differentiated assessment and accommodations in the National Senior Certification Examination in response to their learning barriers. The accommodations include, adaptation of questions; additional time of 20 minutes per hour for perusal/ formulating/ writing/ checking answers; computer/ voice to text/ text to voice; oral examination; reader; rest breaks; scribe; separate venue; spelling; and video/ DVD recorder/ Webcam (DBE, 2014, p. 80).

2.5.4 Summary of The hearing impaired learner and inclusion

More and more HI learners are attending general classrooms. To have a better understanding of who the HI learner is, there was a brief discussion on the degree of hearing loss and the direct implications thereof. Having a hearing loss results in certain learning barriers including listening; spoken language; comprehension; and curriculum. Strategies on how to address these learning barriers were also discussed.

2.6 The influence of the ERT requirement

As mentioned earlier, midway through the research the COVID-19 pandemic started and the study was adapted to incorporate the influence of the pandemic. Following is a discussion on the difference between online learning and emergency remote teaching (ERT); the general challenges during ERT; and the challenges HI learners experience during ERT. The discussion ends with an ERT environment framework.

2.6.1 Introduction

Reimers and Schleicher (2020) state that the COVID-19 pandemic is likely to be responsible for the biggest disruption in education worldwide in a generation. Institutions had to hastily respond to a sudden forced transition from face-to-face to remote teaching (Carrillo & Flores, 2020), as a primary strategy to slow down the infection rate consisting of social distancing (Mohmmed et al., 2020; Reimers & Schleicher, 2020).

Reimers and Schleicher (2020) created a checklist for an education response to the COVID-19 pandemic which includes the following points:

- Re-prioritise curriculum goals as the modes of delivery are disruptive. List what should be learned throughout the time of social isolation.
- Identify the delivery methods for education. Online learning should be used as a delivery method whenever possible because it offers the most flexibility and interaction opportunities.
- Clearly define what is expected of teachers in terms of how they will guide and aid learners' learning in the new situation. Wherever possible, it can be done through direct instruction or suggestions for self-directed learning.
- Boost learner participation and communication to promote group learning and wellbeing.
- Schools should develop a communication system with every learner including a form of daily check-in. That can happen in the form of texts from teachers.
- Schools should advise learners and families on how to use screens and online resources safely in order to maintain learner wellbeing and mental health.

In response to the pandemic many schools implemented remote learning (König et al., 2020; Morgan, 2020). Hodges et al. (2020) advocate the difference between online learning and

emergency remote teaching. Next is a discussion on *online learning* and *emergency remote teaching.*

2.6.2 Online learning versus ERT

Certain important terms associated with online communication are *synchronous* and *asynchronous*. *Synchronous* learning refers to direct interactions between learners and teachers at the same time using online platforms while *asynchronous* refers to an independent learning approach as learning occurs indirectly and is not happening at the same time (Rasmitadile et al., 2020). However, the teacher remains essential in steering learners' learning, in both synchronous and asynchronous modes (Reimers & Schleicher, 2020).

Hodges et al. (2020) are of the opinion that "well-planned online learning experiences are meaningfully different from courses offered online in response to a crisis or disaster" (p. 1) and suggest the term *emergency remote teaching.* Following is a discussion about *online learning* and *emergency remote teaching*.

2.6.2.1 Online learning

Online learning indicates learning over the internet offered synchronously and asynchronously (Rasmitadile et al., 2020) or some blend of both. In their book *Learning Online: What Research Tells Us about Whether, When and How*, Means et al. (2014) identify nine online learning design dimensions with each dimension having numerous options, emphasising the complexity of the design and decision-making process. The nine dimensions are: modality; pacing; student-instructor ratio; pedagogy; instructor role online; student role online; online communication synchrony; role of online assessments; and source of feedback. The following table shows example values for each dimension (Means et al., 2014, p. 27).

Table 2.5

Online Learning Design Dimensions

Dimension	Example values
Modality	Fully online Blended with over 50% online but at least 25% face-to-face (FTF) Blended with 25-50% online Web-enabled FTF

Dimension	Example values
Pacing	Self-paced (open entry and open exit)
	Class-paced
	Class-paced with some self-paced elements
Student-instructor ratio	≤ 35 to 1
	36 – 99 to 1
	100 – 999 to 1
	≥ 1 000 to 1
Pedagogy	Expository
	Practice environment
	Exploratory
	Collaborative
Instructor role online	Active instruction online
	Small presence online
	None
Student role online	Listen or read
	Complete problems or answer questions
	Explore simulation and resources
	Collaborate with peers
Online communication synchrony	Asynchronous and synchronous
	Asynchronous only
	Synchronous only
	None
Role of online assessments	Determine if a student is ready for new content
	Tell system how to support the student (basis for adaptive instruction)
	Provide student or teacher with information about learning state
	Input to grade
	Identify students at risk of failure
Source of feedback	Automated
	Teacher
	Peers

Source: Means et al., 2014, p. 27

However, according to Hodges et al. (2020) *online learning* can become a politicised term with different meanings depending on the view a person wants to advance. They are also of the opinion that online learning carries a stigma of being inferior to face-to-face learning, despite research showing the opposite (Hodges et al., 2020).

From research it is evident that effective online learning results from careful instructional design being designed and developed systematically, such as a fully online university course being planned, prepared and developed within the time frame of six to nine months (Hodges et al., 2020). Thus, due to the time constraints caused by the COVID-19 pandemic, many online learning experiences would not fully featured or necessarily well planned and would be the opposite to what many know as high-quality online education – therefore the term *emergency remote teaching* is used instead of *online learning* (Hodges et al., 2020).

2.6.2.2 Emergency remote teaching

Hodges et al. (2020, p. 6) define emergency remote teaching (ERT) as "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" providing a temporary access to instruction that could be set up quickly and is reliably available during a crisis or an emergency. There are various instructional delivery methods which are widely used in education, such as online lectures; recorded lectures; voiceover (narrated) PowerPoint slides (PPT); and MOOC (massive open online courses).

The following table illustrates the advantages and disadvantages of the abovementioned instructional delivery methods (Mohmmed et al., 2020):

Table 2.6

Advantages and Disadvantages of Some Instructional Delivery Methods

Instructional delivery method	Advantages	Disadvantages
Online lectures (synchronously)	Detailed explanation about topic. Students / learners have opportunities to ask questions.	The development of theoretical knowledge is prioritised over the acquisition of practical skills.
Recorded lectures (asynchronously)	Students / learners who struggle with internet connection or	Struggle to download complete lecture due to availability of data.

Instructional delivery method	Advantages	Disadvantages
	bandwidth have later opportunity to follow up.	Students / learners cannot ask questions.
Voiceover PPT	Provides concise hints about the lecture at each slide. The file size is small which uses minimal data.	With practical topics in mathematics, where the student may have trouble understanding the solution techniques, the theoretical sections cannot be explained with a voiceover.
MOOC (massive open online courses)	Excellently organised and structured lectures because they were planned and prepared in advance. Learning outcomes and objectives are typically covered in the material.	Not accessible for complete modules. Students / learners will have to pay for it. Another challenge is accessing the internet.

There is a stronger emphasis on asynchronous than synchronous learning as households with many family members and few devices have competing needs (Reich et al., 2020; Snelling & Fingal, 2020). Independent learning during ERT should be emphasised rather than compliance activities so learners can become self-learners (Mohmmed et al., 2020; Reich et al., 2020; Snelling & Fingal, 2020). As students and learners might not be able to attend to courses immediately, asynchronous activities might be more feasible than synchronous ones, however, younger learners benefit from the structure of required synchronous sessions (Hodges et al., 2020).

2.6.3 ERT in practice

The transitioning to ERT forced many teachers to learn new technologies and skills, thus, causing stress among teachers and learners (Smith, 2020). Teachers experience an increase and change in workload and that ERT can support learning for many learners, however, it should be carefully designed and individualised to not exacerbate inequality and social divides (Kaden, 2020). Teachers' self-efficacy is a definite resource for teachers compelled to adapt to ERT during COVID-19 school closures (König et al., 2020). ERT should be a human-centred approach (Karakaya, 2020). Even when ERT becomes the dominant mode, teachers do not

diminish – they are imperative in steering learners' learning, whether through direct instruction, providing guidance in self-directed learning and in synchronous or asynchronous modes (Reimers & Schleicher, 2020).

Teachers can look for free online resources on the internet that may create learning opportunities (Morgan, 2020), however, it is unreasonable to expect teachers to compile their own resources and advocate the facilitating of teacher professional collaboration and the presenting of access to resources so teachers can keep abreast of the speedily evolving challenges (Reimers & Schleicher, 2020).

The challenges of ERT can be classified as technological challenges; pedagogical challenges; and social challenges (Ferri et al., 2020). Following is a discussion on each.

2.6.3.1 Technological challenges

Technological challenges refer mainly to unreliable internet connections and the learners' lack of necessary electronic devices (Almanthari et al., 2020; Ferri et al., 2020; Hebebci et al., 2020; Reimers & Schleicher, 2020). Learners from remote areas have problems accessing online platforms (Mohmmed et al., 2020), thus, digital equity is crucial for successful ERT as every learner and teacher needs to have a device to work on as well as bandwidth (Reimers & Schleicher, 2020; Snelling & Fingal, 2020).

Addressing the technological challenges

The technological challenges can be addressed by developing a dependable network infrastructure; providing more affordable devices; and by using different modalities such as TV, radio, telecourses and online courses to provide accessible learning for learners in remote areas (Ferri et al., 2020). Teachers and learners should be trained in order to adapt to ERT and the necessary infrastructure support should be strengthened to erase technical problems (Hebebci et al., 2020).

2.6.3.2 Pedagogical challenges

Pedagogical challenges are primarily associated with the lack of digital skills of both teachers and learners; the shortfall of structured content compared to the abundance of online resources; learners' lack of interactivity and motivation; and the absence of teachers' social presence and their "ability to construct meaning through sustained communication within a community of inquiry" (Ferri et al., 2020, p. 1). Teachers and learners have difficulty adapting

to a new teaching and learning environment and find the redesigning of modules to suit the online platform in a short interval of time tedious and challenging (Mohmmed et al., 2020).

Hebebci et al. (2020) found in their study that more learners were dissatisfied with ERT as they do not understand the subject; experienced the teacher as inadequate; do not have enough time and there is a lack of infrastructure. This correlates with Lall and Singh (2020, as cited in Hebebci et al., 2020) who found that learners were not satisfied with ERT due to a lack of synchronous learning and a lack of communication. Teachers also feel that the lack of interaction is the biggest disadvantage in ERT and that ERT could never be as effective as face-to-face education, however, that might be because of the preference of asynchronous ERT rather than synchronous ERT (Hebebci et al., 2020).

Regarding inclusive practices, learners rarely experienced differentiated inclusive practices, however, if teachers implement some type of inclusive practice, it is in the form of open education (Letzel et al., 2020). Letzel et al. (2020) report on a parent that said:

> No, everyone gets the same tasks. The only difference is that in the maths book – that is a book for comprehensive schools – there are orange and green tasks, easier and difficult, and it is on the kids to choose six of them. I insist that she chooses the difficult ones, as I did it in classroom schooling. The other subjects do not differentiate at all. (p. 163)

Teachers responsible for ERT course activities have a huge responsibility in the process (Hebebci et al., 2020) and work non-stop – learning how to change and redesign their lessons (Donitsa-Schmidt & Ramot, 2020).

Addressing the pedagogical challenges

Teachers' and learners' technological skills should be improved through systematic training initiatives focussing on new emerging models and the effective use of online learning (Ferri et al., 2020). Learners' lack of online motivation and participation can be addressed with the use of technologies that use virtual and enhanced reality, however, then the technologies should be widely accessible (Ferri et al., 2020). For a wider range of learners with disabilities to access digital resources, more inclusive tools, platforms and devices need to be developed (Ferri et al., 2020). Ferri et al. (2020) also feel that the use of artificial intelligence needs to be

reinforced to boost personalised, inclusive and participatory online learning paths, but should then be integrated with the teachers' pedagogical methodologies.

Teachers face huge challenges in becoming digitally competent and maintaining basic communication with learners and assisting learners' learning and development (König et al., 2020). Therefore, they should have the educational opportunity to learn digital competence to be able to adapt to ERT during school closures (König et al., 2020). The lack of teachers' and learners' technological skills should be addressed through systematic training initiatives in order for effective use of online learning (Ferri et al., 2020). It is imperative to invest some time – even just a day or two – to prepare and get ready for ERT (Snelling & Fingal, 2020).

Teachers should become more conscious of the challenges their learners face and "implement a pedagogy that is more inclusive and sensitive to learner needs" (Karakaya, 2020, p. 4). A To maintain learners' interest, a clear and consistent plan should be created, offering structured and planned educational material, such as content, methodologies, and common goals, as well as better e-learning platforms using appropriate digital learning resources (video, animations, quizzes, and games) (Ferri et al., 2020). Learners are used to seeing and hearing their teachers (Morgan, 2020), however, now with the absence of eye contact, gestures, and classroom atmosphere can cause a lack of focus during ERT (Mohmmed et al., 2020). Learners tend to prefer video-based lessons and it can make a difference during ERT (Morgan, 2020), especially videos made by their own teachers as the learners love to hear their teachers' voices (Anderson, 2020).

2.6.3.3 Social challenges

The absence of human interaction between teachers and learners; and between learners and learners; as well as inadequate physical space at home to watch and participate in lessons and the lack of parental support as they are working remotely in the same location, are all social challenges (Ferri et al., 2020). The home atmosphere is not suitable for the teaching and learning process (Mohmmed et al., 2020) and low-income learners suffer disproportionately whenever schools are closed and education stops – resulting in ERT being less effective for these learners (Carmen, 2020).

Addressing the social challenges

Snelling and Fingal (2020) collected key practices from teachers all over the world for successful ERT and found that communication between administrators, teachers, parents and learners is more important than ever. Teachers should communicate frequently with learners

so that they do not feel lonely and confused (Ferri et al., 2020). Ferri et al. (2020) advocate for a blended approach whenever possible to boost a feeling of community belonging and improve social interaction between learners and between learners and teachers. Face-to-face lessons should complement online lessons and learners need face-to-face interactions (Ferri et al., 2020).

In order to maintain the sociality, inclusiveness and accessible education, policymakers, enterprises, experts, schools, learners and families should participate to develop accessible and smart learning environments (Ferri et al., 2020). Teachers and learners learn valuable methods during ERT that will make future school closings easier to manage (Morgan, 2020).

Hodges et al. (2020) advocate that once the COVID-19 pandemic is over, we should not simply return to our teaching and learning practices prior the pandemic and forget about ERT – the possible need for ERT must become part of a teacher's skill set and professional development programme. The COVID-19 pandemic will impact the livelihoods of individuals and the prospects of their communities (Reimers & Schleicher, 2020), as during the pandemic lockdown "people had to learn to organise communication and interaction in a new way" (König et al., 2020, p. 617).

2.6.3.4 Challenges faced by HI learners

There are only a few studies conducted on the challenges of HI learners during the COVID-19 pandemic (Krishnan et al., 2020). Teaching learners with disabilities during COVID-19 has had its own challenges and many learners were impacted physically and mentally, and their interactions might be hindered (Krishnan et al., 2020). Toquero (2020) advocates for the inclusion of provision for learners with disabilities into the education and legislative emergency preparedness plans. Teachers who lack technology training and resources experience many challenges when teaching learners with disabilities online (Smith, 2020), thus ERT is not as effective as the kind of education learners with disabilities receive at school (Morgan, 2020). Hardly any differentiation was implemented during ERT, thus, the equality of education cannot be guaranteed (Letzel et al., 2020).

Many learners with disabilities find an online learning schedule difficult as they need a more structured learning environment as well as interaction with their teachers and peers (Smith, 2020). If HI learners cannot follow the progress of the teacher, they may not learn effectively (Krishnan et al., 2020). During ERT teachers tend to mainly differentiate their instruction by means of tiered assignments (Letzel et al., 2020). Letzel et al. (2020) report that other inclusive

practices such as learner groups; tutoring systems; staggered learning aids; and mastery learning are seldom implemented. There was also less contact and feedback to learners, indicating that teachers make more use of asynchronous teaching (Letzel et al., 2020).

HI learners experience four main challenges during COVID-19, namely, hearing devices; not disrupting the lesson; unfamiliar with online devices; and being emotionally affected during online classes (Krishnan et al., 2020). Following is a discussion of each challenge:

- *Hearing devices:*
  During online lessons hearing devices are not able to pick up speech or sounds completely and accurately and HI learners rely heavily on lip reading (Krishnan et al., 2020).
- *Not disrupting the lesson:*
  HI learners have to format questions digitally during synchronous online lessons instead of voicing them to reduce disruptions, however, they experience a struggle when trying to type fast enough (Krishnan et al., 2020). HI learners favour face-to-face learning as they are able to intermingle with other learners and teachers, however, asynchronous learning will assist HI learners in understanding the content better (Krishnan et al., 2020).
- *Unfamiliarity with online devices:*
  HI learners are not familiar with laptops, Smartphones, Skype, Google Classroom, Zoom etc. and feel they are unable to use any of these – they need help with technology usage (Krishnan et al., 2020).
- *Emotional side-effects*
  HI learners experience emotional challenges – they feel it has ruined them, as they cannot anticipate how online classes will be and some cannot afford expensive gadgets (Krishnan et al., 2020). HI learners hamper their social interaction skills toward others during the COVID-19 pandemic (Krishnan et al., 2020).

“Teachers and parents play an important role in ensuring the learners’ auditory performance, education achievements, spoken communication skills and quality of life during the pandemic” (Krishnan et al., 2020, p. 112).

Addressing the challenges faced by HI learners

For learners with disabilities to overcome the difficulties they face, environmental and social barriers should be removed (Krishnan et al., 2020). Teachers need to keep in mind that the

cognitive developments of HI learners are a bit slower due to the delays in language development and that HI learners must be provided with sufficient time so they can process the content (Krishnan et al., 2020). Teachers can consider using the principles of UDL, especially for learners with disabilities to provide accessibility for all learners in an online instructional environment (Smith, 2020).

In the post-pandemic period, learners, especially those with special needs, can benefit from the online education method (Basilaia & Kvavadze, 2020). Google Hangout Meet is a videoconferencing platform on which live captions are available (McKee et al., 2020) and can be used.

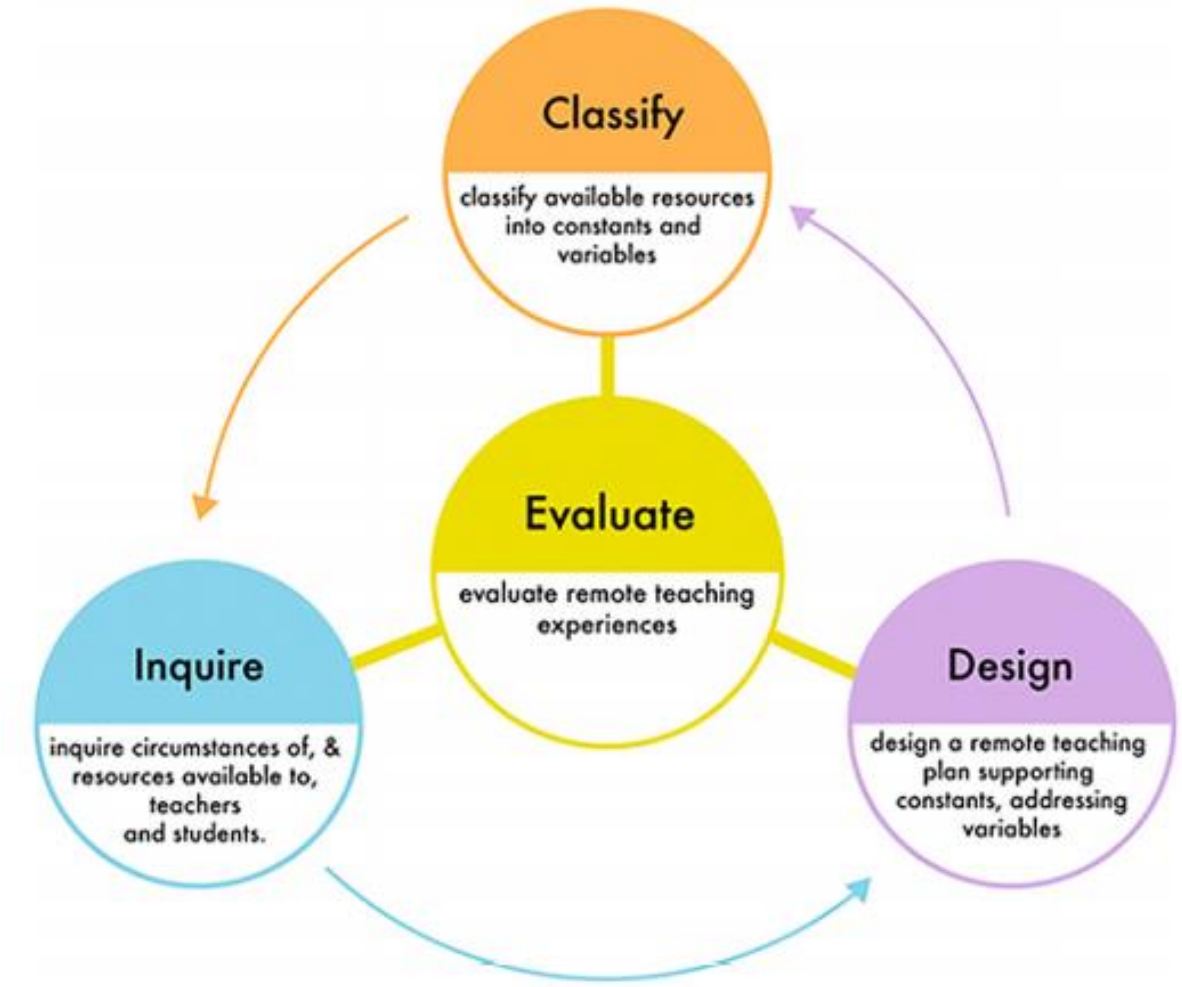
2.6.4 ERT environments framework

Policymakers in different countries should prioritise ERT (Reimers & Schleicher, 2020; Whittle et al., 2020). In order to grasp the emerging educational realities during the COVID-19 pandemic, education researchers need to rethink methodologies and theoretical frameworks (Khirwadkar et al., 2020). The role of the teacher cannot be underestimated and therefore it is crucial to facilitate teacher professional collaboration and learning, and give teachers access to online resources so they can support learning for their learners (Reimers & Schleicher, 2020).

Whittle et al. (2020) propose a framework for ERT environments to “address moments of crisis in which teaching environments can only be understood circumstantially and supported provisionally” (pp. 311-312). The framework is informed by the online learning design dimensions of Means et al. (2014) as discussed in Paragraph 2.6.2.1 (Whittle et al., 2020). See the framework below:

Figure 2.6

Emergency Remote Teaching Environment Framework



Source: Whittle et al., 2020, p. 315

The framework consists of three non-linear and iterative steps namely: inquiry, classifying available resources into constants and variables, and designing education experiences (Whittle et al., 2020). Following is a discussion of each step:

Inquiry: Teachers who believe their educational strategies are successful began by considering their own skills, technological knowledge, and availability. They also inquire about learners' health and safety, access to basic needs and technologies as well as the learners' collective resources (Whittle et al., 2020). By doing this, teachers check that the pedagogies they implement will be effective, and by returning to inquiry on a frequent basis, teachers stay informed of the resources that are available (Whittle et al., 2020)

Classify: Factors being identified in the *inquiry* step are grouped into *constants* and *variables* where constants are factors shared by all learners and teachers within the ERT environment and variables are factors only shared by some learners and teachers (Whittle et al., 2020). The focus on variables relating to the learners, can be interpreted as inclusive practice as it is caused by the diversity of the learners.

Design: Whittle et al. (2020) propose eight dimensions in the design step, namely, critical learning goals; ratio of teacher to learners; communication method; building agency; assessments; social role of the teacher; pedagogy and the learner social role; and feedback.

Critical learning goals

Teachers need to identify critical learning goals. These can be guided by constants or by variables (specific goals identified for specific learners). During the COVID-19 pandemic teachers focussed more on the method of delivering instruction than on the learning goals – that caused uncertainty around assessment for both teacher and learner (Whittle et al., 2020). Having clear goals is important (Carrillo & Flores, 2020).

Ratio of teacher to learners

The necessary differentiation and individual support are difficult to achieve in large classes (high ratio of learners), thus, wherever possible, learners with barriers (LSEN) should be taught in smaller classes (Blatchford & Webster, 2018). During ERT, the ratio concern was especially apparent once teachers considered their social presence in the classroom (Whittle et al., 2020).

Communication method

Once teachers had their learning goals, they had to decide between either synchronous or asynchronous learning strategies. Whittle et al. (2020) found that at first teachers felt synchronous teaching was best, however, it was demonstrated that asynchronous learning is beneficial when learners were engaged in activities not bound by classroom's time-constrains.

Building agency

Learners' ability to learn in their own homes and at their own pace, might give teachers the opportunity to engage learners on topics and approaches of particular interest, instead of general lessons and formats (Whittle et al., 2020). Kaden

(2020) found that learners experience a taste of more independence and take on new responsibilities for their learning.

Assessments

Assessments were deprioritised at the beginning of ERT as teachers saw assessment expectations as unfair during the COVID-19 pandemic (Whittle et al., 2020). Teachers felt that learners focussing on grades or teachers focussing on learner evaluations during the COVID-19 pandemic could result in more challenging crisis management as the goals of teachers and administrators would be in conflict (Whittle et al., 2020), however, it would be difficult for teachers to determine learners' needs and to create adequate lesson plans in the long run if they do not conduct online formative assessments (König et al., 2020). On the other hand assessment can be individualised using technology to showcase the learning and skills of learners and large-scale standardised testing may become outdated (Kaden, 2020).

Social role of the teacher

Teachers build relationships with parents to gain insight into the learners' needs and their environmental constraints. This parental connection provides "context for the social presence of the teacher" (Whittle et al., 2020, p. 317).

Pedagogy and the learner social role

A social-driven pedagogical approach to enhance learner engagement and participation (Whittle et al., 2020) can be achieved by employing a problem-posing pedagogical approach (Olawale et al., 2021).

Feedback

Learners need to receive feedback relating to progress and assessments, for example, teachers should make use of alternative feedback strategies, such as non-graded formative feedback, self-feedback and peer feedback (Whittle et al., 2020).

The proposed framework of (Whittle et al., 2020) also includes *evaluations*. The focus of the evaluation should not be on the learner or the teacher, but rather on the effectiveness of the approach taken and should not take place in a single session (Whittle et al., 2020). Whittle et al. (2020) recommend that teachers revisit and re-evaluate their learning design often.

2.6.5 ERT framework for HI learners

There is a lack of studies conducted regarding the challenges HI learners have faced during the pandemic, however, HI learners were neglected when the vital transition happened from face-to-face teaching to online learning during the COVID-19 pandemic (Krishnan et al., 2020). In order to overcome the challenges faced by HI learners interventions to remove the environmental and social barriers are required (Krishnan et al., 2020).

In the following table, the challenges faced by HI learners are connected to the applicable dimensions in the design step of Whittle et al. (2020). Remarks from Krishnan et al. (2020) are also included for the corresponding dimensions in the design step of Whittle et al. (2020) to gain a broader picture of how HI learners can overcome the challenges they faced during ERT.

Table 2.7

Addressing Challenges Faced by HI Learners during COVID-19

Dimensions in the Design step (Whittle et al., 2020)	**Overcoming challenges faced by HI learners** (Krishnan et al., 2020)	**Remarks** (Krishnan et al., 2020)
Critical learning goals	HI learners should be encouraged to read before each class to develop their reading skills.	There should be a special task force to facilitate HI learners: they plan particular guidelines for teachers to carry out during online learning; recording lessons, assessments and tasks.
Ratio of teacher to learners		
Communication method	Ensure learners use FM (frequency modulation) system if online classes are equipped with them – teacher needs to use hearing aid microphone and make sure the setting lessens background noise.	

Dimensions in the Design step (Whittle et al., 2020)	**Overcoming challenges faced by HI learners** (Krishnan et al., 2020)	**Remarks** (Krishnan et al., 2020)
	Record the lessons, distribute notes digitally to your learners. The preferred learning style for HI learners will generally be visual. Provide HI learners enough time to process the subjects being taught.	
Building agency	HI learners should be assisted to face the challenges caused by a pandemic such as COVID-19.	
Assessments		Examination centres should be improved with online capabilities for HI learners providing access to results.
Social role of the teacher	The parents need advice, knowledge and assistance in order for learners to be appropriately guided.	Institutions should provide health assistance, including managing anxiety (due to social distancing), counselling centres for online assistance if the need arises.
Pedagogy and the learner social role	Modify and customise teaching practices to cater for HI learners – focus more on visual learning style. HI learners struggle if the instructions are only expressed verbally. Make sure HI learners understand questions before answering them. HI learners need assistance with the use of technology.	HI learners' problems and needs differ from other learners with special needs, thus, teaching methods should differ. HI learners might not learn effectively if they struggle to follow the progress of the teacher.

Dimensions in the Design step (Whittle et al., 2020)	**Overcoming challenges faced by HI learners** (Krishnan et al., 2020)	**Remarks** (Krishnan et al., 2020)
Feedback	Teachers need to keep in mind that during online classes HI learners might seem to daydream; their talking is not clear; they may not understand the given instructions; and may have poor performance especially concerning language.	

As seen in the table, Krishnan et al. (2020) advocate that each institution should have a special task force to facilitate HI learners. The task force should plan precise guidelines for teachers to carry out online learning, recorded lessons, mid-term tests, tasks and undertakings (Krishnan et al., 2020, p. 112).

2.6.6 Summary of The influence of the COVID-19 pandemic

Due to the COVID-19 pandemic and the lockdown of schools, teachers had to make use of other means to teach, namely ERT. ERT is different from *online learning* as *online learning* refers to a careful instructional design being designed and developed systematically within a time frame of six to nine months. ERT on the other hand, is a temporary shift of instructional delivery due to a crisis. ERT in general practice has technological, pedagogical and social challenges, however, HI learners face their own additional challenges such as their hearing devices not picking up speech or sounds through the online devices. Whittle et al. (2020) propose a framework for ERT environments that include an inquiry; classify; and design step and recommend that teachers should revisit and re-evaluate their learning design often when making use of ERT.

2.7 Conceptual framework

The focus of the study is to determine the influence of mathematics teachers' beliefs on their inclusive practices for oral HI learners during face-to-face teaching and ERT. The conceptual framework is based on an amalgamation of the different views mathematics teachers can have

regarding the nature of mathematics according to Ernest (1989a)[3]; Ajzen's theory of planned behaviour as used by Vermeulen et al. (2012) regarding the beliefs of the inclusion of HI learners[4]; CAST's (n.d.) UDL approach as inclusive practice[5]; the DBE's (2011) *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements*[6]; and the design step of Whittle et al.'s (2020) ERT environment framework[7].

2.7.1 Explanation of my conceptual framework

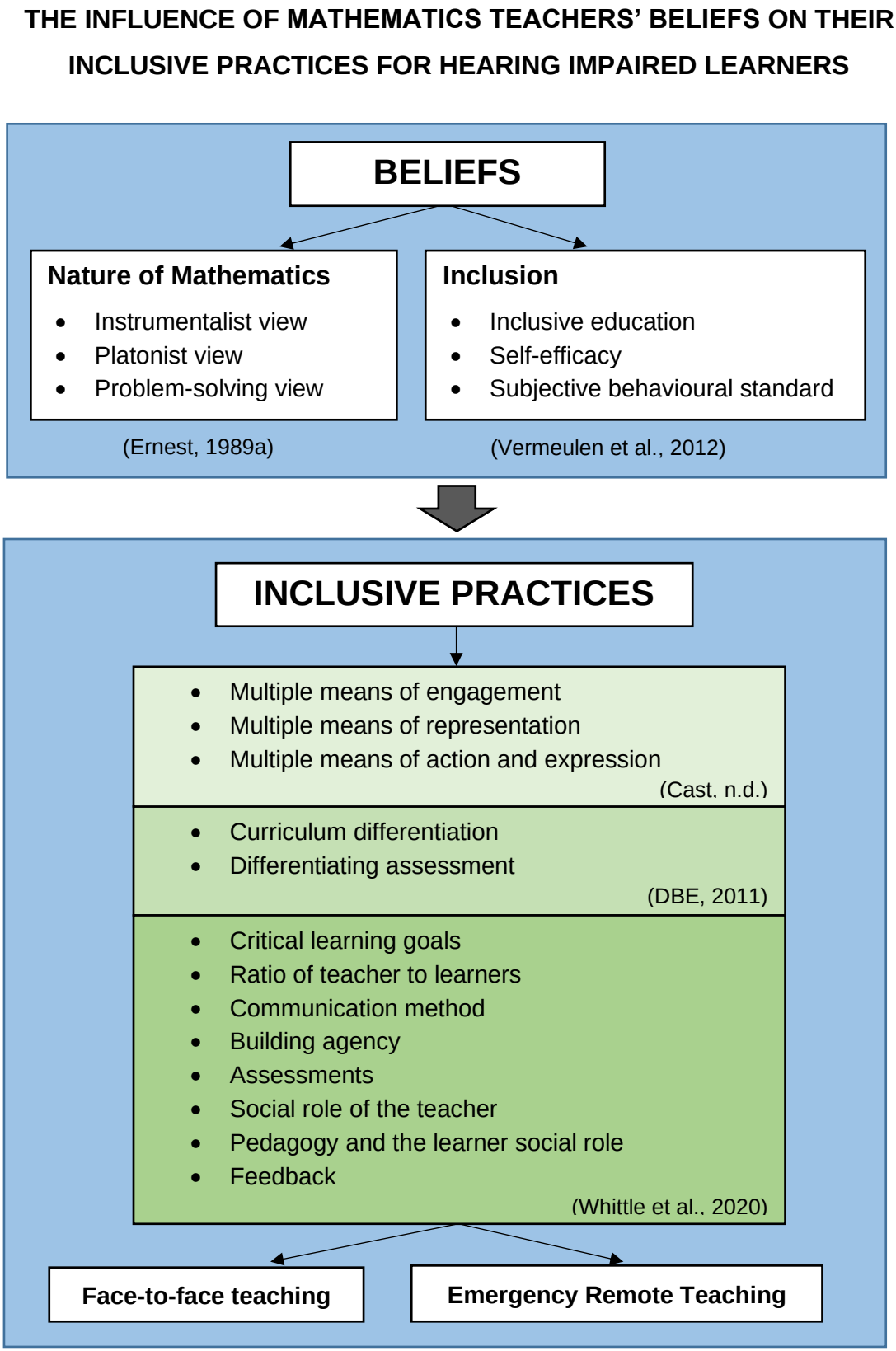
I believe that learners with learning barriers, like oral HI leaners, have the right to education and that teachers should adapt their teaching practices as such as to become inclusive practices, whether it is during face-to-face teaching or in the case of ERT caused by a pandemic such as COVID-19. Figure 2.7 illustrates the components of, and logic behind my framework.

The conceptual framework also gives me the opportunity to determine what approach/model of inclusive practice the teachers are following, during face-to-face teaching or ERT. Therefore I included the elements of the UDL approach (CAST, n.d.), namely *multiple means of engagement; multiple means of representation;* and *multiple means of action and expression*; the DBE's (2011) *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements*, namely *curriculum differentiation* and *differentiating assessment*; and the design step of Whittle et al.'s (2020) ERT environment framework with *critical learning goals; ratio of teacher to learners; communication method; building agency; assessments; social role of the teacher; pedagogy and the learner social role;* and *feedback* as dimensions. The rationale for this decision is that there are plenty of overlapping factors in the abovementioned three approaches.

[3] See Section 2.2.2: Teacher beliefs regarding mathematics.
[4] See Section 2.2.3: Teacher beliefs regarding inclusion.
[5] See Section 2.4.1: Universal Design for Learning.
[6] See Section 2.4.4: South Africa's response to diversity.
[7] See Section 2.6.4: ERT environments framework.

Figure 2.7

Conceptual Framework: Beliefs and Inclusive Practices Framework of Analysis



2.7.2 Teachers' beliefs about the nature of mathematics

"Beliefs about mathematics and the nature of mathematical tasks; and beliefs about oneself and others as doers of mathematics", not only "influence how one thinks about, approaches, and follows through on mathematical tasks but also because they influence how one studies mathematics and how and when one attends to mathematics instruction" (Garofalo, 1989, p. 502). Teachers' conceptions of the teaching and learning of mathematics reflect their beliefs about mathematics (Thomson et al., 2003) and their views (Ernest, 1989b).

Ernest (1989b) argues that apart from knowledge, beliefs could clarify the differences between mathematics teachers. He debates the possibility of two teachers with very similar knowledge having different approaches, one can teach mathematics with a problem-solving approach whilst the other follows a more didactic approach (Ernest, 1989b). A teacher with an *instrumentalist view* is an instructor with the mastering of skills with correct performance as an outcome, while a *Platonist view*-teacher is an explainer with the learner understanding of knowledge as an outcome (Ernest, 1989a). A teacher with *a problem-solving view* is a facilitator with the learner constructing understanding as an outcome (Ernest, 1989a). In this study mathematics teachers' beliefs are regarded as the driving force of their teaching practice.

2.7.3 Teachers' beliefs about inclusion

As the study focuses on the inclusion of HI learners, teachers' beliefs about inclusion regarding HI learners will be a main focus area. Ajzen's theory of planned behaviour was used by Vermeulen et al. (2012) to distinguish three types of beliefs regarding HI learners, namely, *beliefs about inclusive education*; *teachers' beliefs about their self-efficacy*; and *beliefs about the subjective behavioural standard regarding inclusion of students with SEN*.

Beliefs about inclusive education is the degree to which academic achievement of HI learners can be promoted by inclusive education settings (Vermeulen et al., 2012). "Teachers seem to develop an interlinked set of positive emotions and beliefs when they experience success with the inclusion" of a HI learner (Vermeulen et al., 2012, p. 180). *Teachers' beliefs about their self-efficacy* refers to teachers' beliefs about their capabilities to perform at designated levels exercising influence over events that affect their lives, thus, determining how people feel, think and motivate themselves as well as behave (Bandura, 1994). Factors increasing self-efficacy levels for inclusive practice are: experience or interaction with persons with disabilities; high levels of training; knowledge about policy related to inclusive education (Yada & Savolainen,

2017). The last belief, namely *Beliefs about the subjective behavioural standard regarding inclusion of students with special educational needs (LSEN)* (Vermeulen et al., 2012) refers to the perceptions of expectations of others like parents, colleagues, principals and the educational policies that teachers might have (Khamis, 2011; Vermeulen et al., 2012). When schools actively promote the implementation of inclusive policies, they expect teachers to be positive about inclusion and to work hard in realising inclusive practices (Vermeulen et al., 2012). These beliefs form the basis for the *Teachers' beliefs about inclusion* in my study.

2.7.4 Inclusive practices

As can be seen from the conceptual framework and explained earlier, all of the aspects of the UDL approach (CAST, n.d.), the *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements* (DBE, 2011) and the design step of the ERT environment framework (Whittle et al., 2020) in the inclusive practices were combined in this study. The rationale for including the ERT environment framework as an inclusive practice, is that during the *classify* step of the framework one needs to determine the factors that are *constants* and *variables*. And by doing so, it is none other than taking note of the diversity and applying that knowledge to one's practice. In other words, it becomes inclusive practice. UDL can also make use of videos and the DBE (2011) mentions that e-learning can be included as differentiated learning material in the *teaching method* aspect. Thus the reason for including the ERT environment framework as part of the inclusive practices.

As there is still uncertainty in the relationship between UDL and DI, both inclusive practices were inserted into the conceptual framework. DI will be looked at through the lens of the *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements* (DBE, 2011) as it is suggested that differentiation should take place within the curriculum and assessment.

2.7.4.1 UDL

The UDL consist of three principles, namely *multiple means of: engagement*; *representation*; and *action and expression* (CAST, n.d.).

- *Multiple means of engagement* refers to the *WHY* of learning (Dalton et al., 2012) and includes recruiting interest; sustaining effort and persistence; and self-regulation. Teachers need to implement different classroom strategies that empower their

learners; providing choices for the learners; reducing learner anxiety; and rewarding their efforts (Navarro et al., 2016).

- *Multiple means of representation* refers to the *HOW* of learning (Dalton et al., 2012) and includes perception; language expressions and symbols; and comprehension. Teachers must learn how to present educational resources through a variety of modalities (visual, auditory or tactile) and methods such as videos, websites, pictures etc. (Navarro et al., 2016; Rose & Strangman, 2007).
- *Multiple means of action and expression* refers to the *WHAT* of learning (Dalton et al., 2012) and includes physical action; expression and communication; and executive function. Teachers are required to provide learners with a variety of options to practice tasks, communicate and demonstrate what they have learned, which allow learners to capitalise on their special abilities or talents (Navarro et al., 2016; Rose & Strangman, 2007).

2.7.4.2 Differentiation

The DBE suggested that the focus of the response to learner diversity in the classroom is on curriculum differentiation and differentiating assessment (DBE, 2011).

Curriculum differentiation

Curriculum differentiation consists of three aspects, namely the differentiating of curriculum content; differentiating of the learning environment; and the differentiating of teaching methods (DBE, 2011). For each of the aspects, the study will focus on the elements applicable to HI learners.

- *Curriculum content*

  Teachers are encouraged to modify the content in curriculum differentiation and it can be done at three levels, namely abstractness; complexity; and variety (DBE, 2011). *Abstractness* refers to some learners that might need to access content first at a concrete level; many aspects of the curriculum can be very *complex* and difficult to grasp; while *variety* indicates the expansion of the curriculum to prevent learners from getting bored (DBE, 2011).
- *Learning environment*

  There are two learning environments, the psychosocial learning environment and the physical environment (DBE, 2011). For the purpose of this study only physical environment will be explored with factors such as noise levels and seating

arrangements, class size, classroom displays and resources – applicable to HI learners (Deafness Foundation & Deaf Children Australia, 2005; Erbas, 2017).

- *Teaching methods*

  Learning materials; methods of presentation; learning activities; and lesson organisations are all part of the differentiating of teaching methods (DBE, 2011) and will be explored. *Learning materials* includes a wide range of materials – including e-learning – as well as materials that might need to be adapted (DBE, 2011). *Methods of presentation* refers to brief directions and verbal instructions; repetition of information; repetition of questions and answers from other learners; written notes on the board; and flexible grouping (DBE, 2011; Deafness Foundation & Deaf Children Australia, 2005; Erbas, 2017). The *learning activities* to be explored will be tiered assignments and the modification of the format of the task (DBE, 2011; Deafness Foundation & Deaf Children Australia, 2005; Erbas, 2017) while *lesson organisations* refers to the use of multiple intelligences (DBE, 2011).

Differentiating assessment

There are alternate forms of assessment for learners with disabilities, especially HI learners, such as alternate assessment based on modified attainment of knowledge and alternate assessment based on grade-level attainment of knowledge (DBE, 2011). *Alternate assessment based on modified attainment of knowledge* can be seen in the assessment of the learner's mastery of grade-level content with reduced load or more at a functional level. *Alternate assessment based on grade-level attainment of knowledge* refers to learners with disabilities who need, for example, additional time, readers and amanuensis as these procedures provide them with "equal opportunities to demonstrate their attainment of content which is at the same grade-level as the general assessment" (DBE, 2011, p. 19).

2.7.4.3 ERT environment framework

The design step of the ERT environment framework of Whittle et al. (2020) with its eight dimensions also forms part of inclusive practices. The eight dimensions are *critical learning goals; ratio of teacher to learners; communication method; building agency; assessments; social role of the teacher; pedagogy and the learner social role; and feedback*. As mentioned earlier, the rationale for including the design step of the ERT environment framework as an inclusive practice, is that during the *classify* step of the framework, one needs to determine the factors that are *constants* and *variables*. And by doing so, it is none other than taking note of the diversity and applying that knowledge to one's practice. In other words, it becomes inclusive practice. UDL can also make use of videos and the DBE (2011) mentions that e-

learning can be included as differentiated learning material in the *teaching method* aspect. Thus the reason for the ERT environment framework. As the study is about oral HI learners, the eight dimensions of the design step will be looked at through a lens applicable to HI learners.

2.7.5 Summary

The conceptual framework is based on an amalgamation of the different views mathematics teachers can have regarding the nature of mathematics according to Ernest (1989a); Ajzen's theory of planned behaviour as used by Vermeulen et al. (2012) regarding the beliefs of the inclusion of HI learners; CAST's (n.d.) UDL approach as inclusive practice; the DBE's (2011) *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements*; and the design step of Whittle et al.'s (2020) ERT environment framework.

2.8 Conclusion

Apart from exploring teacher beliefs regarding mathematics and inclusion, Chapter 2 explored international and South African views on inclusion as well as inclusive practices. Teachers are responsible for good inclusive practices and can follow the UDL or DI approach, however, they should first make a paradigm shift. The South African DBE (2011) has guidelines for responding to learner diversity in the classroom, namely, curriculum differentiation and differentiating assessment, and includes the recommendation that multiple intelligences should be incorporated in the different activities. Unfortunately, there are plenty of barriers, including lack of support from the DBE, preventing the execution of inclusive practices – especially in South Africa (Engelbrecht et al., 2015). The COVID-19 pandemic changed the way of teaching globally and teachers made use of ERT to be able to continue with teaching. However, ERT has its own challenges causing learners with learning barriers, such as HI learners, to be neglected (Krishnan et al., 2020). Chapter 3 provides the layout of the study's methodology.

Chapter 3

Methodology

3.1 Introduction

In Chapter 3 I discuss the chosen research paradigm and the assumptions through which I view the world. I also explain the rationale for choosing qualitative research as the approach and an exploratory case study as the design for this research. Following a detailed description of the research site, sample selection and data collection methods, the data analysis approaches are discussed. In my final section, I also go over important topics including the study's trustworthiness and validity as well as any relevant ethical issues.

3.2 Research paradigm and assumptions

How I carried out qualitative research and obtained knowledge and understanding of the phenomenon being studied, depended upon a range of factors. Ormston et al. (2013) mention aspects such as ontology (the nature of the social world and what there is to know about it), and epistemology (the nature of knowledge and how it can be acquired). But how I personally carry out qualitative research also depends on my knowledge and skills in terms of qualitative research methods, methodology, and theories and paradigms that underpin qualitative research (Nieuwenhuis, 2016b). The next section discusses the research paradigm as well as the ontological, epistemological, and methodological assumptions of my work.

3.2.1 Research paradigm

Nieuwenhuis (2016b) clarifies the concept *paradigm* as “a set of assumptions or beliefs about fundamental aspects of reality which gives rise to a particular world view” (p. 52). In education, qualitative research is notably appropriate in the following cases (Erickson, 2012):

- When we want detailed information about implementation;
- To identify the nuances of subjective understanding that motivate various participants in a setting; and
- To identify and understand change over time. (p. 1451)

The fundamental purposes of qualitative research are to document in detail the behaviour of everyday occurrences and the meanings that those occurrences have for those who take part in them and for those who witness them (Erickson, 2012). Interpretivism is the main philosophical tradition underpinning qualitative research and it is argued that "human experience can only be understood from the viewpoint of people" (Morgan & Sklar, 2012, p. 73). Nieuwenhuis (2016b) concludes that an interpretivist perspective is based not only on the assumption that "human life can only be understood from within" but also on the assumptions that "social life is a distinctively human product; the human mind is the purposive source or origin of meaning; human behaviour is affected by knowledge of the social world; and the social world does not 'exist' independently of human knowledge" (pp. 61-62).

Social constructivism as research paradigm underpinned this study and is often combined with interpretivism (Creswell & Creswell, 2018). Interpretivists believe that reality is not objectively determined, but socially constructed and therefore there is a greater opportunity to understand the perceptions people have of their own activities when they are studied in their natural environment (Nieuwenhuis, 2016b).

Ormston et al. (2013) combined researchers' views on interpretivism and constructionism and found that:

- Knowledge is produced by exploring and understanding the social world of the people being studied, focusing on their meanings and interpretations.
- Researchers also construct meanings and interpretations based on those of participants.
- The research process is considered to be largely inductive in the sense that interpretation is grounded in the data, though it is also recognised that observations are 'theory-laden' because they are mediated by ideas and assumptions.
- Reality is affected by the research process, facts and values are not distinct and objective value-free research is impossible.
- The methods used in the natural sciences are not appropriate for studying the social world because the social world is not governed by law-like regularities; rather, it is mediated through meaning and human agency.

- Social reality cannot be captured or portrayed 'accurately' because there are different (and possibly competing) perceptions and understandings, though some researchers still aim to 'represent' participants' meanings as faithfully as possible (knowledge is provisional and fallibilistic, according to the consensus theory of truth). (p. 12)

Interpretivism is integral to the qualitative tradition and the related movement of 'constructionism' asserts that human beings construct knowledge actively, rather than passively (Ormston et al., 2013).

3.2.2 Paradigmatic assumptions

The nature of the study can be described in terms of three assumptions, namely the ontological, epistemological and methodological assumptions. The ontological position taken for this study is *idealism.* As Nieuwenhuis (2016b) states, "idealism … asserts that reality is only knowable through the human mind and through socially constructed meanings" (p. 58). Regarding the epistemological assumption, I believe that the voice of the insiders should be heard – "taking into account what people say, do and feel, and how they make meaning of the phenomena under investigation" (Nieuwenhuis, 2016b, p. 67). The main way in which the knowledge is acquired for this study is through deductive logic. Deductive logic involves a top-down approach to knowledge as "it starts with a theory from which a hypothesis is derived and applied to observations about the world" (Ormston et al., 2013, p. 7). And as I believe that human experience can only be understood from people's views, this study holds an interpretive position. The study demands an idiographic methodological preference which aims to "identify patterns of behaviour within the person across a population of experiences or situations" (Conner et al., 2009) and where individual analysis is emphasised (Bhagwatwar, 2017) .

3.3 Research approach and design

A qualitative approach was deemed appropriate, with a case study being the best choice for an in-depth investigation of the influence of mathematics teachers' beliefs on their inclusive practices. The following table provides a synopsis of the research methodology components of the research.

Table 3.1

Synopsis of Methodology

Research approach	**QUALITATIVE**		
Research design	**Exploratory case study** The case study consists of two mathematics teachers from an inclusive school as a group, teaching HI learners during face-to-face teaching and during the COVID-19 pandemic, with the use of ERT. I observed their inclusive practices and determined the nature of their beliefs in order to explore the influence their beliefs have on their inclusive practices.		
Research methods	Two semi-structured interviews per teacher, one before the observations of the face-to-face teaching lessons and one after the implementation and use of ERT. Observations (four per teacher) Recordings of interviews and lessons Documentation such as PP slides, worksheets, tests, planning and videos made during ERT.		
Primary research question	**What influence do mathematics teachers' beliefs have on their inclusive practices for oral HI learners during face-to-face teaching and ERT?**		
Secondary research questions	**Question 1** What is the nature of inclusive schools' mathematics teachers' beliefs?	**Question 2** What practices are used during face-to-face teaching and ERT to include HI learners in the general mathematics classroom?	**Question 3** How are these practices influenced by the teachers' beliefs about the nature of mathematics and inclusivity?
Objectives of the secondary questions	To explore the teachers' beliefs about the nature of mathematics and inclusion.	To explore the inclusive practices of the mathematics teachers during face-to-face teaching and ERT.	To explore the influence teachers' beliefs have on their inclusive practices.

Participants	Two high school mathematics teachers from one inclusive school teaching HI learners during face-to-face teaching and ERT.		
Data collection techniques	**During face-to-face teaching** • One semi-structured, face-to-face interview per teacher. • Four observations per teacher. The first two lessons were the same planned lesson with the difference of HI learner(s) being part of the class in one of the lessons while in the other lesson there were no HI learners in the class. The same applied for the last two observed lessons. Again, the same planned lesson taught to a class with HI learners and then a class without HI learners. • Documentation: All documentation that the teachers had to put on Google Classroom since the beginning of 2020. **During ERT** • Documentation: I had access to all the documentation and videos the two teachers put on Google Classroom during the first ERT period. • One semi-structured, Zoom interview per teacher at the end of the first ERT period.		
Techniques per question	Interviews Observations	Interviews Observations Documentation	Interviews Observations Documentation
Data analysis	**DEDUCTIVE-inductive approach for data analysis** • Establish units of analysis of the data. • Create a 'domain analysis'. • Using ATLAS.ti 9 to analyse the video and audio data as well as the documentation. • Establish relationships and links between the domains. • Making speculative inferences. • Summarising.		

3.3.1 Research approach

A qualitative research approach with a case study was followed in order to answer the research questions. Creswell (2014) recommends when doing qualitative research, researchers should "choose from among the possibilities, such as narrative, phenomenology,

ethnography, case study, and grounded theory" (p. 187). Timmons and Clairns (2010) are of the opinion that "in education research, using the case study approach not only creates knowledge and understanding but also sets a standard for good teaching practices" (p. 2) and that "case study research is a logical approach to researching many aspects of inclusive education" (p. 6). The setting of the study is within inclusive schools, as the study describes inclusive schools' mathematics teachers' inclusive practices – during face-to-face teaching and ERT; their beliefs regarding mathematics and inclusion; and the influence their beliefs have on their inclusive practices. By doing so "greater understanding of a phenomenon" (Nieuwenhuis, 2016b, p. 55) is gained and good teaching practices can be described.

3.3.2 Research design

A research design is a plan of how a particular task can be accomplished and provides structure that informs the researcher of the basis of the study in terms of theories, methods and instruments (Seabi, 2012). When doing qualitative research there are generally three types of designs, namely, exploratory; descriptive; and "philosophically/theoretically grounded qualitative research" (Nieuwenhuis, 2016b, p. 54). This is an exploratory case study where the focus of the study has already been decided on and explained in the conceptual framework.

VanWynsberghe and Khan (2007) suggest seven common features in a prototypical case study, namely:

1. *Small sample size* as "efforts to perform broad analyses with large numbers of participants can reduce the effectiveness of a case study as it might come at the expense of detailed description" (p. 83);
2. *Contextual detail* as "case studies aim to give the reader a sense of being there" (p. 83);
3. *Natural settings* "where there is little control over behaviour, organization, or events" (p. 84);
4. *Boundedness* as "attending to place and time brings context to the structures and relationships that are of interest" (p. 84);
5. *Working hypotheses and lessons learned* as "researchers can generate working hypotheses and learn new lessons based on what is uncovered or constructed during data collection and analysis in the case study" (p. 84);
6. *Multiple data sources* as "case study routinely uses multiple sources of data" (p. 84); and
7. *Extendibility* as "case studies can enrich and potentially transform a reader's understanding of a phenomenon" (p. 84).

“The case study offers a means of investigating complex social units consisting of multiple variables of potential importance in understanding the phenomenon” (Merriam, 1998, p. 41). Timmons and Clairns (2010) state that case studies in education research not only create knowledge and understanding, but also set a standard for good teaching practices. This happens through two main means, namely, “development and implementation of policy, and gaining experience through exposure to a particular phenomenon” (Timmons & Clairns, 2010, p. 2). The case-study design provides researchers with opportunities to triangulate data so that research findings and conclusions can be strengthened as one uses various data-collection methods and analysis techniques (Nieuwenhuis, 2016a).

The *units* in this study are the inclusive school’s mathematics teachers and how their beliefs regarding mathematics and inclusion influence their inclusive practices, during face-to-face teaching and ERT. The data analysis advances knowledge of the phenomenon, which will be represented in a practise framework that is inclusive, appropriate for the South African setting, and useful for theory development.

3.4 Research site and sampling

In the beginning of the study I planned to do research in inclusive schools, exploring six mathematics teachers’ inclusive practices regarding HI learners, from at least three inclusive schools in Gauteng. However, the COVID-19 pandemic broke out and I had to adapt my study to the new circumstances as I could not visit public schools

The research site is an inclusive private high school in Gauteng, South Africa, where oral HI learners are included and taught alongside their hearing peers. Since HI learners are included completely and take part in the same classes and lessons as their hearing counterparts, the school was specifically chosen for its inclusion strategy. Purposive sampling was used in order to create an in-depth description and to help "understand the problem and the research question" (Creswell & Creswell, 2018, p. 262).

The sample consists of two mathematics teachers, each teaching at least two classes of the same grade where one class includes HI learners and the other class does not include HI learners. I chose to observe the teachers teaching both classes so that I could determine the teachers’ inclusive practices when teaching HI learners in one of the two classes. The one teacher teaches Grade 10 learners and the other teacher teaches Grade 9 learners. The applicable classes were either English or Afrikaans speaking. The low number of available

teachers may be a disadvantage of the proposed sampling. The chosen school only has three mathematics teachers responsible for mathematics Grades 8-12. The third teacher was excluded as she did not teach two classes of the same grade with one class having HI learners and the other class not having HI learners. Useful data was gathered regarding the beliefs and inclusive behaviours of the mathematics teachers in the inclusive schools.

3.5 Data collection techniques

Nieuwenhuis (2016c) mentions that the tools applicable to qualitative methodology, for example interviews, observation, and documents will ensure that "the issue is not explored through one lens, but rather a variety of lenses, which allows for multiple facets of the phenomenon to be revealed and understood" (p. 83). When a researcher takes field notes on the behaviour and activities of individuals at the research site, the researcher is busy with qualitative observation and when a researcher conducts qualitative interviews the researcher asks a few generally open-ended questions that intend "to elicit views and opinions from the participants" (Creswell & Creswell, 2018, p. 263). The researcher may also collect qualitative documents as well as qualitative audio-visual and digital materials as other data collection forms (Creswell & Creswell, 2018)

3.5.1 Data collection process

Creswell and Creswell (2018) mention that researchers can include data collection types that go beyond typical observations and interviews. For this study, data was collected through semi-structured interviews, observations and document analysis from the teachers' planning, tests and worksheets. I also had access to both teachers' Google Classroom portals where they provided the learners with digital material before the COVID-19 pandemic and on a much greater scale during ERT.

Each data collection type has options, advantages and limitations. Creswell and Creswell (2018, p. 264) made a summary of the qualitative data collection types, options, advantages, and limitations. See the following table.

Table 3.2

Qualitative Data Collection Types, Options, Advantages, and Limitations

Data collection types	Options within types	Advantages of the type	Limitations of the type
Observations	• Complete participant – researcher conceals role • Observer as participant – role of researcher is known • Participant as observer – observation role secondary to participant role • Complete observer – researcher observes without participating	• Researcher has a first-hand experience with participant. • Researcher can record information as it occurs. • Unusual aspects can be noted during observation. • Useful in exploring topics that may be uncomfortable for participants to discuss.	• Researcher may be seen as intrusive. • Private information may be observed that researcher cannot report. • Researcher may not have good attending and observing skills. • Certain participants (e.g. children) may present special problems in gaining rapport.
Interviews	• Face-to-face – one-on-one, in person interview • Telephone – researcher interviews by phone • Focus group – researcher interviews participants in a group	• Useful when participants cannot be directly observed. • Participants can provide historical information. • Allows researcher control over the line of questioning.	• Provides indirect information filtered through the views of interviewees. • Provides information in a designated place rather than the natural field setting. • Researcher's presence may bias responses.

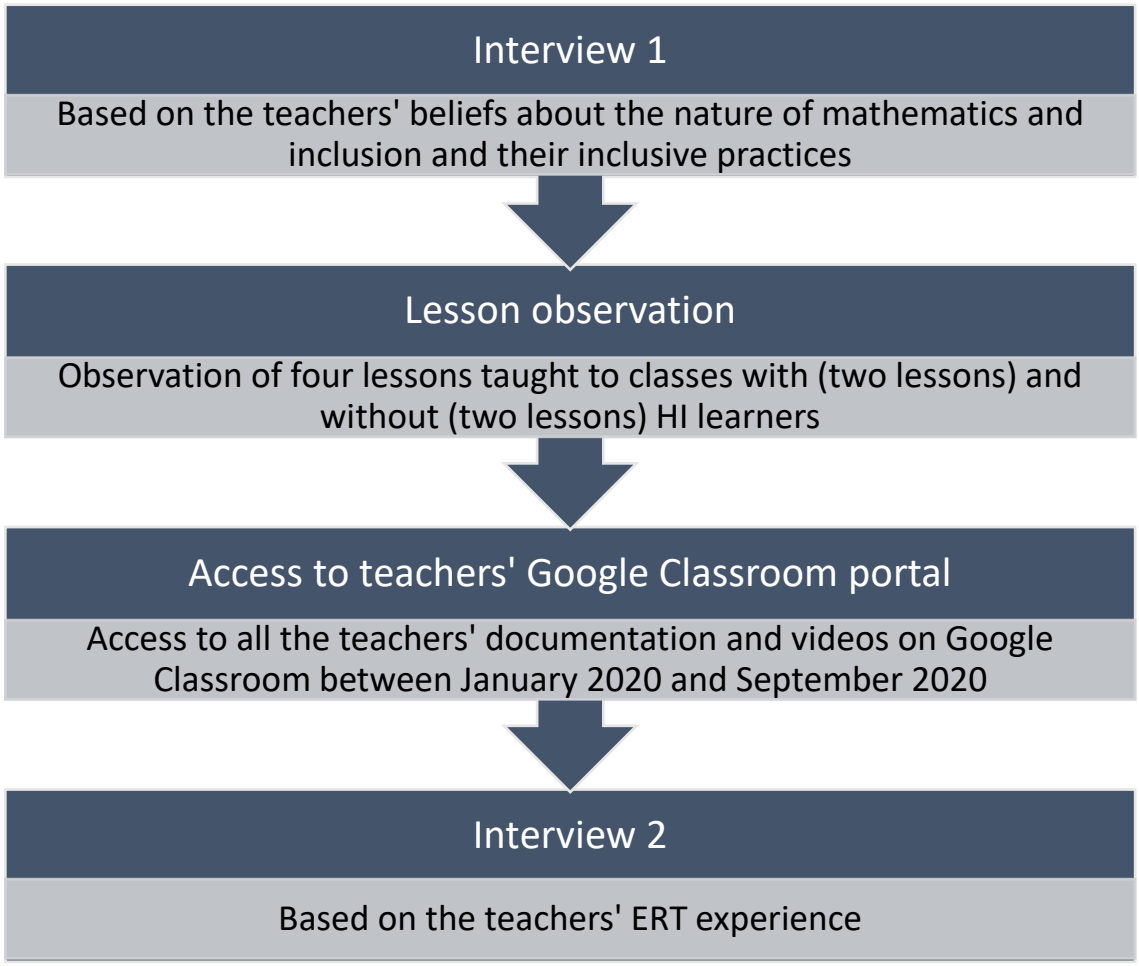
Data collection types	Options within types	Advantages of the type	Limitations of the type
	• E-mail Internet interview		• Not all people are equally articulate and perceptive.
Documents	• Public documents – minutes of meetings or newspapers • Private documents – journals, diaries, or letters	• Enables a researcher to obtain the language and words of participants. • Can be accessed at a time convenient to researcher – an unobtrusive source of information. • Represents data to which participants have given attention. • As written evidence, it saves a researcher the time and expense of transcribing.	• Not all people are equally articulate and perceptive. • May be protected information unavailable to public or private access. • Requires the researcher to search out the information in hard-to-find places. • Requires transcribing or optically scanning for computer entry. • Materials may be incomplete. • The documents may not be authentic or accurate.
Audio-visual digital materials	• Photographs • Videotapes • Art objects • Computer messages • Sounds • Film	• May be an unobtrusive method of collecting data. • Provides an opportunity for participants to directly share their reality. • It is creative in that it captures attention visually.	• May be difficult to interpret. • May not be accessible publicly or privately. • The presence of an observer (e.g., photographer) may be disruptive and affect responses.

Source: Creswell & Creswell, 2018, p. 264

The following figure represents the data collection process for the interviews, observations and access to documentation and ERT material.

Figure 3.1

The Data Collection Process



Data collection via face-to-face teaching took place during February 2020. I initially contacted the director and the school principal via e-mail during January 2020. The study was explained to them and their participation was requested. Originally the private school was one of six inclusive schools, however, as explained earlier, due to the COVID-19 pandemic I changed the focus of my study[8]. The principal referred me to the mathematics Head of Department, who set up a meeting between me and the Deputy Principal responsible for the HI learners. Once the meeting was held, the Head of Department contacted me with dates that suited the

[8] See Section 3.4.

teachers from who I could collect my data. Two participants[9] were identified and they both gave me consent to do the research. Francis was the Grade 10 mathematics teacher and Debbie was the Grade 9 mathematics teacher.

3.5.2 Observations

The type of observation used was that of observer as participant. The researcher's role was known and field notes "on the behaviour and activities of individuals at the research site" (Creswell & Creswell, 2018, p. 262) were documented. An observation protocol was compiled in advance to cover the predetermined aspects of inclusive practices and contained the demographic information about the time, place and date of the field setting (Creswell & Creswell, 2018). The purpose of the classroom observations was to describe the inclusive school's mathematics teachers' inclusive practices for oral HI learners. Four lessons per teacher were observed. The first two lessons were the same lesson taught to two different classes. One class had HI learners in and the other class was without HI learners. The third and fourth lessons were based on the same principle, one class had HI learners while the other class did not have HI learners.

The first and third lessons I observed with Francis were with an English speaking Grade 10 class with no HI learner, while the second and fourth lessons were with an Afrikaans speaking Grade 10 class with one HI learner. All of Debbie's observed lessons were taught in English to Grade 9 learners. The first and third observed lessons with Debbie were in a class with supposedly no HI learners. However, I saw a learner with two cochlear implants in the class and asked Debbie to confirm if there were no HI learners in the class. Debbie confirmed that there were no HI learners in the class. When I enquired about the situation, the school said that there was a request from that learner's parents that the learner should not be seen as part of the hearing impaired learners' cohort.[10] In the second and fourth observed lessons there was one HI learner.

Video recordings of the lessons were made to assist with the data analysis afterwards. The recordings were transcribed verbatim and coded afterwards by myself.

[9] Pseudonyms were used for ethical purposes.
[10] See Table 4.7: Exclusion criteria for coding the data.

3.5.3 Interviews

I made use of an interview protocol for the semi-structured interviews. The interview protocol was prepared in advance and used consistently in all of the interviews as suggested by Creswell and Creswell (2018). In this study two semi-structured interviews[11] per teacher were conducted, one face-to-face interview during face-to-face teaching and before any observations and a second Zoom-interview conducted after the first ERT period in 2020. The duration of the first interviews for Debbie and Francis were 36 minutes and 46 minutes respectively and were conducted after school hours. The purpose of the interviews was to gain insight into the inclusive school's mathematics teachers' beliefs about the nature of mathematics and inclusion as well as their inclusive practices. The duration of the second interviews for Debbie and Francis were 40 minutes after school, and one hour during a free period respectively. The purpose of the interviews was to gain insight into the inclusive school's mathematics teachers' ERT as a response to the total lockdown due to the COVID-19 pandemic.

Audio recordings of the interviews were made to assist with the data analysis. The recordings were transcribed verbatim whereafter I coded the transcriptions. The following table provides clarification of the character of the interviews.

Table 3.3

Clarification of the Character of the Interviews

INTERVIEW 1
A semi-structured, face-to-face interview conducted prior to any lessons observed
Purpose of the interview To gain insight into the inclusive school's mathematics teachers' beliefs about the nature of mathematics and inclusion as well as their inclusive practices.
Examples of the content of interview questions • How the teachers view mathematics as a subject, • Their perceptions of the type of mathematics teachers that they are, • Their beliefs about inclusion, and • Their beliefs about the inclusion of HI learners in their classes.

[11] See Appendix E and F

INTERVIEW 2

A semi-structured, Zoom interview conducted after the ERT period

Purpose of the interview

To gain insight into the inclusive school's mathematics teachers' ERT as response to total lockdown due to the COVID-19 pandemic.

Examples of the content of interview questions

- The expectations they had to adhere to during ERT,
- Their inclusive practices due to ERT, and
- The challenges regarding ERT.

3.5.4 Documentation and audio-visual digital materials

As stated by Creswell and Creswell (2018) documents "enable a researcher to obtain the language and words of participants" (p. 264) and audio-visual digital materials "provide an opportunity for participants to directly share their reality" (p. 264). The participants shared their reality directly with me through the access that was given to their Google Classroom portals. The portals were active from January 2020 and I had access to all the data there up to the end of September 2020. I had documentation and audio-visual digital materials, for example worksheets and the lessons the teachers recorded during ERT, for the entire period of research. By analysing them the teachers' inclusive practices during face-to-face teaching and ERT could be determined.

The final aim was to integrate the findings from the observations, interviews, documentation and audio-visual digital materials to make sense of the reality and the complexity of the phenomenon, in other words to determine the influence of the inclusive school's mathematics teachers' beliefs about the nature of mathematics and inclusion, on their inclusive practices – during face-to-face teaching and ERT.

In Table 3.4 a timeline is given indicating the dates both participants' lessons were observed, documentation was collected and interviews were conducted.

Table 3.4

Time Line of the Data Collection Process

Data gathering instrument	Participant[12]	Date in 2020
Interview 1	Francis	5 February
Interview 1	Debbie	5 February
Lessons 1 and 2	Francis	10 February
Lessons 1 and 2	Debbie	10 February
Lessons 3 and 4	Francis	19 February
Lessons 3 and 4	Debbie	19 February
Access to all the teachers' documentation and videos on Google Classroom between January 2020 and September 2020	Francis and Debbie	14 – 30 September
Interview 2	Francis	19 November
Interview 2	Debbie	19 November

The video and audio-taped data was transcribed verbatim and the Afrikaans data was translated into English. Where certain Afrikaans words were deemed untranslatable in the context, the word/s were kept as part of the translation. I typed up all the hand-written field notes as well as insights that were thought of afterwards which had not been noted. The transcripts of the interviews were sent to the participants for member checking. Neither of the participants made any corrections. I read the transcripts of the observations afterwards to ensure true adherence to the actual observations. When uncertainties emerged, I watched the recordings of the lessons again. I took photographs of documents I received from the participants that were not in a digital format.

3.6 Data analysis strategies

As I made use of multiple data collection methods in the case study, I had the opportunity to "triangulate data in order to strengthen the research findings and conclusions" (Nieuwenhuis, 2016a, p. 107) and as Nieuwenhuis (2016a) states, "the approach used in analysis encourages researchers to move beyond initial impressions to improve the likelihood of

[12] Pseudonyms were used to protect the participants' true identities.

accurate and reliable findings" (p. 107). Creswell and Creswell (2018) urge researchers to "look at qualitative data analysis as a process that requires sequential steps to be followed" (p. 268). The suggested five-step data analysis in qualitative research from Creswell and Creswell (2018, pp. 268-270) was applied as follows:

Step 1: *Organise and prepare the data for analysis*

This is where the transcribing of interviews takes place, the typing up of field notes and the cataloguing of all of the visual material as well as the sorting and arranging of the data into different types.

Step 2: *Read or look at all the data*

This step provides the researcher with a general sense of the information. The researcher can also reflect on the overall meaning of the information.

Step 3 and 4: *Start coding all of the data* and *generating descriptions and themes*

The data is organised by bracketing chunks or categories. In the study DEDUCTIVE-inductive qualitative data analysis was used. In other words, the analysis will initially be deductive and then inductive. Deductively, as predetermined codes from the conceptual framework (Figure 2.7) have been used to set up a qualitative codebook (Table 3.6) and grouped into code families (Table 3.5). The transcriptions of the observations and interviews as well as the given documentation and audio-visual digital material from each participant were coded in the ATLAS.ti 9 computer program. This program allows for codes to be easily accessed, sorted and merged.

When coding the data, I followed a deductive approach based on the conceptual framework[13]. According to the conceptual framework, three themes, namely, 1) Teachers' beliefs about the nature of mathematics; 2) Teachers' beliefs about inclusion; and 3) Teachers' inclusive practices, were identified and set up as code families. Members of the code families (Table 3.5) were allocated based on literature from CAST (n.d.); DBE (2011); Ernest (1989a); Vermeulen et al. (2012) and Whittle et al. (2020) (as discussed in Section 2.7).

[13] See Section 2.7.

Table 3.5

List of Code Families and their Members

Code Family (Theme)	Code (Sub-theme)
Beliefs about the nature of mathematics	• Instrumentalist view • Platonist view • Problem-solving view
Beliefs about inclusion	• Inclusive education • Self-efficacy • Subjective behavioural standard
Inclusive practices	• Multiple means of engagement • Multiple means of representation • Multiple means of action and expression • Curriculum differentiation • Differentiating assessment • Critical learning goals • Ratio of teacher to learners • Communication method • Building agency • Assessments • Social role of the teacher • Pedagogy and the learner social role • Feedback

Step 5: *Representing the description and themes*

Narrative passages and tables were used to convey the information.

The following research questions guided my analysis process:

1. What is the nature of inclusive schools' mathematics teachers' beliefs?
2. What practices are used during face-to-face teaching and ERT to include HI learners in the general mathematics classroom?
3. How are these practices influenced by the teachers' beliefs about the nature of mathematics and inclusivity?

Although exploratory qualitative studies tend to be primarily inductive (Nieuwenhuis, 2016b), a deductive approach as set out in the conceptual framework (Figure 2.7) was used. Sub-themes (codes) for each of the themes (code families) were created using ATLAS.ti 9. I created networks for these sub-themes and indicated the connections between the different codes assigned to the families.

In Table 3.6 the codes (sub-themes) are described and the descriptions were used in coding the data. I made certain conclusions from the analysis and discussed them in Chapter 6.

Table 3.6

Codebook used in the Deductive Approach

Code (sub-theme)	Comment
Instrumentalist view	The teacher is an *instructor*, a strict follower of a text or scheme, with the mastering of skills with correct performance as an outcome (Ernest, 1989a).
Platonist view	The teacher with a Platonist view has "a global understanding of mathematics as consistent, connected and objective structure" (para. 7) and is an *explainer* with the learner understanding knowledge as an outcome (Ernest, 1989a). The teacher will modify the textbook approach and supply additional problems and activities as enrichment (Ernest, 1989a).
Problem-solving view	The teacher is a *facilitator* with the learner constructing understanding as an outcome (Ernest, 1989a). This teacher is confident in posing and solving problems and is constructing the mathematics curriculum (Ernest, 1989a).
Inclusive education	This is the degree to which academic achievement of HI learners can be promoted by inclusive education settings (Vermeulen et al., 2012). "Teachers seem to develop an interlinked set of positive emotions and beliefs when they experience success with the inclusion" of a HI learner (Vermeulen et al., 2012, p. 180).
Self-efficacy	Teachers' beliefs about their capabilities to perform at designated levels exercising influence over events that affect their lives, thus, determining how people feel, think and motivate themselves as well as behave (Bandura, 1994). Factors increasing self-efficacy levels for inclusive practice are: experience or interaction with persons with disabilities; high levels of training; and knowledge about policy related to inclusive education (Yada & Savolainen, 2017).
Subjective behavioural standard	This belief refers to the perceptions of expectations of others like parents, colleagues, principals and the educational policies that teachers might have (Khamis, 2011; Vermeulen et al., 2012).

Code (sub-theme)	Comment
Multiple means of engagement	This refers to the *WHY* of learning (Dalton et al., 2012) and includes recruiting interest; sustaining effort and persistence; and self-regulation. Teachers need to implement different classroom strategies that empower their learners; providing choices for the learners; reducing learner anxiety; and rewarding their efforts (Navarro et al., 2016).
Multiple means of representation	This refers to the *HOW* of learning (Dalton et al., 2012) and includes perception; language expressions and symbols; and comprehension. Teachers must learn how to present educational resources through a variety of modalities (visual, auditory or tactile) and methods such as videos, websites, pictures etc. (Navarro et al., 2016; Rose & Strangman, 2007).
Multiple means of action and expression	This refers to the *WHAT* of learning (Dalton et al., 2012) and includes physical action; expression and communication; and executive function. Teachers are required to provide learners with a variety of options to practice tasks, communicate and demonstrate what they have learned, which allow learners to capitalise on their special abilities or talents (Navarro et al., 2016; Rose & Strangman, 2007).
Curriculum differentiation	Differentiating the curriculum content, the learning environment, and the teaching methods such as learning materials, methods of presentation and learning activities and making use of multiple intelligences (DBE, 2011).
Differentiating assessment	Alternate assessment based on modified attainment of knowledge (assess learner's mastery of grade-level content with reduced load/ more at functional level); and alternate assessment based on grade-level attainment of knowledge (this involves learners with disabilities who need for example, additional time, readers and amanuensis) (DBE, 2011).
Critical learning goals	Teachers need to identify critical learning goals. These can be guided by constants or by variables (specific goals identified for specific learners) (Whittle et al., 2020). Having clear goals is important (Carrillo & Flores, 2020).

Code (sub-theme)	Comment
Ratio of teacher to learners	The necessary differentiation and individual support are difficult to achieve in large classes (high ratio of learners), thus, wherever possible, learners with barriers (LSEN) should be taught in smaller classes (Blatchford & Webster, 2018).
Communication method	Once teachers had their learning goals, they had to decide between either synchronous or asynchronous learning strategies (Whittle et al., 2020).
Building agency	Learners' ability to learn in their own homes and at their own pace, might give teachers the opportunity to engage learners on topics and approaches of particular interest, instead of general lessons and formats (Whittle et al., 2020).
Assessments	Assessments can be individualised using technology to showcase the learning and skills of learners and large-scale standardised testing may become outdated (Kaden, 2020).
Social role of the teacher	Teachers build relationships with parents to gain insight into the learners' needs and their environmental constraints. This parental connection provides "context for the social presence of the teacher" (Whittle et al., 2020, p. 317).
Pedagogy and the learner social role	A social-driven pedagogical approach to enhance learner engagement and participation (Whittle et al., 2020) can be achieved by employing a problem-posing pedagogical approach (Olawale et al., 2021).
Feedback	Learners need to receive feedback relating to progress and assessments, for example, teachers should make use of alternative feedback strategies, such as non-graded formative feedback, self-feedback and peer feedback (Whittle et al., 2020).

Using ATLAS.ti 9, networks of the code families were created. Following are the different networks of the themes.

3.6.1 Theme 1: Teachers' beliefs about the nature of mathematics

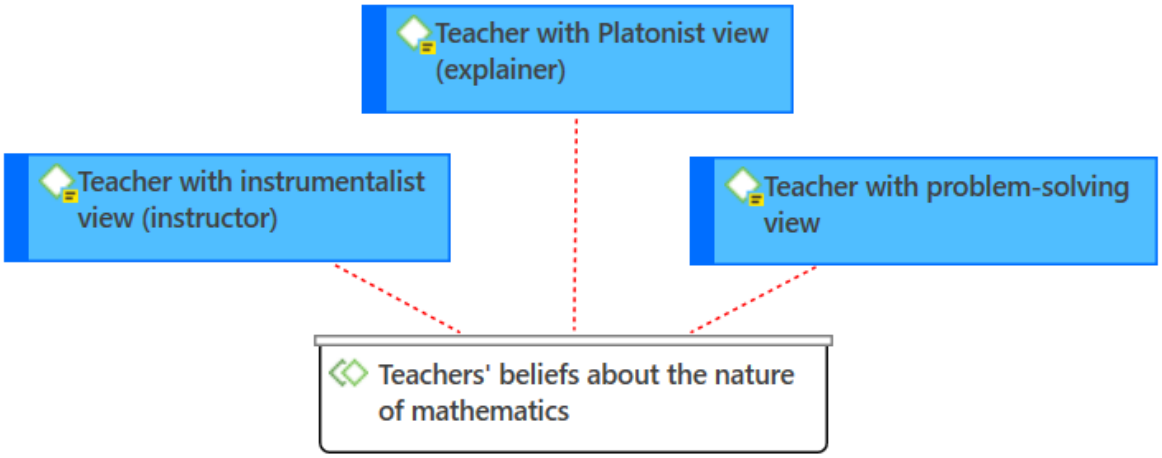
The three sub-themes that were ascribed to the theme of the teachers' beliefs about the nature of mathematics (Ernest, 1989a) were:

- Instrumentalist view;
- Platonist view; and
- Problem-solving view.

The teachers' beliefs about mathematics' network is illustrated in the following figure. The broken line (in red) indicates the different sub-themes being linked to the code family: **teachers' beliefs about mathematics**.

Figure 3.2

Teachers' Beliefs about the Nature of Mathematics



3.6.2 Theme 2: Teachers' beliefs about inclusion

The three sub-themes that were ascribed to the theme of the teachers' beliefs about inclusion (Vermeulen et al., 2012) were:

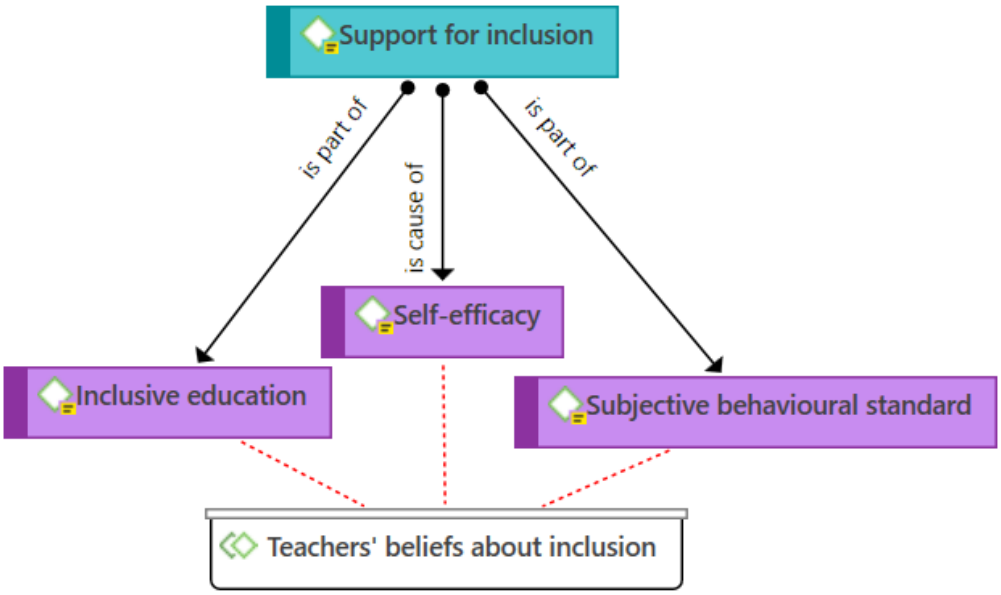
- Inclusive education;
- Self-efficacy; and
- Subjective behavioural standard.

The data was collected from the interviews, observations and documentation. While coding, another code emerged from the data, namely **support for inclusion.** The new code refers to any support, apart from training, the teachers receive regarding including HI learners in their classes.

The teachers' beliefs about inclusion's network are illustrated in Figure 3.3. The broken line (in red) indicates the different sub-themes being linked to the code family: **teachers' beliefs about inclusion** while the solid line arrows indicate a certain link between the sub-themes and the emerging code, *Support for inclusion*.

Figure 3.3

Teachers' Beliefs about Inclusion



3.6.3 Theme 3: Teachers' inclusive practices

The 13 sub-themes that were ascribed to the theme of the teachers' inclusive practices (CAST, n.d.; DBE, 2011; Whittle et al., 2020) were:

- Multiple means of engagement;
- Multiple means of representation;
- Multiple means of action and expression;
- Curriculum differentiation;
- Differentiating assessment;
- Critical learning goals;

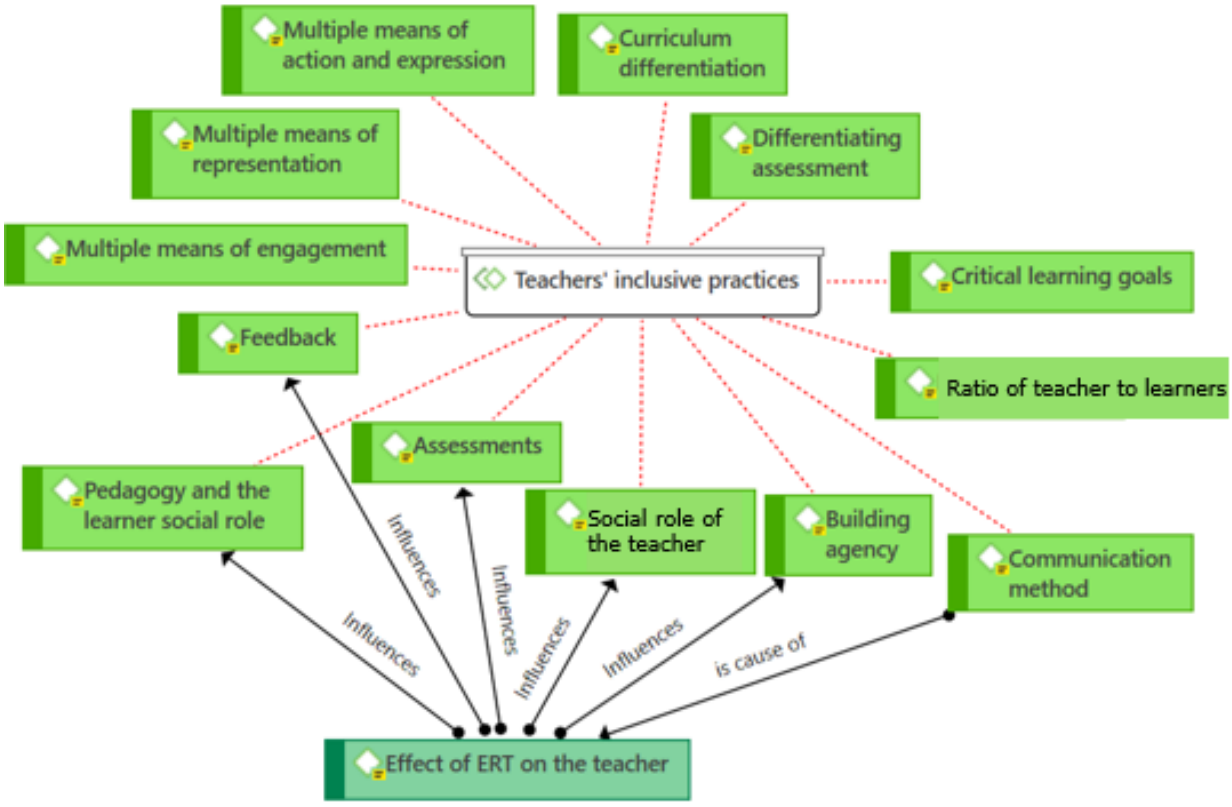
- Ratio of teacher to learners;
- Communication method;
- Building agency;
- Assessments;
- Social role of the teacher;
- Pedagogy and the learner social role; and
- Feedback.

The data was collected from the interviews, observations and documentation. While coding, another code emerged from the data, namely **effect of ERT on the teacher**. The new code refers to the way the teacher experienced ERT.

The teachers' inclusive practices' network is illustrated in Figure 3.4. The broken lines (in red) indicate the different sub-themes being linked to the code family: **teachers' inclusive practices** while the solid line arrows indicate a certain link between the sub-themes and the emerging code.

Figure 3.4

Teachers' Inclusive Practices



3.6.4 Inclusion criteria for coding the data

The sample consists of two mathematics teachers from an inclusive high school. The teachers were purposefully selected as they teach at least two classes of the same grade where one class includes HI learners and the other class does not include HI learners. I chose to observe the teachers teaching both classes so that I could determine the teachers' inclusive practices when teaching HI learners in one of the two classes. Table 3.7 is a summary of the inclusion criteria used for coding the data.

Table 3.7

Inclusion Criteria used for Coding the Data

Teachers' beliefs about the nature of mathematics	
Code (sub-theme) information	**Description**
Instrumentalist view	The teacher is an instructor, a strict follower of a text or scheme, with the mastering of skills with correct performance as an outcome (Ernest, 1989a).
Platonist view	The teacher with a Platonist view has "a global understanding of mathematics as consistent, connected and objective structure" (para. 7) and is an explainer with the learner understanding knowledge as an outcome (Ernest, 1989a). The teacher will modify the textbook approach and supply additional problems and activities as enrichment (Ernest, 1989a).
Problem-solving view	The teacher is a facilitator with the learner constructing understanding as an outcome (Ernest, 1989a). This teacher is confident in posing and solving problems and is constructing the mathematics curriculum (Ernest, 1989a).
Teachers' beliefs about inclusion	
Code (sub-theme) information	**Description**
Inclusive education	This is the degree to which academic achievement of HI learners can be promoted by inclusive education settings (Vermeulen et al., 2012). "Teachers seem to develop an interlinked set of positive emotions and beliefs when they experience success

	with the inclusion" of a HI learner (Vermeulen et al., 2012, p. 180).
Self-efficacy	Teachers' beliefs about their capabilities to perform at designated levels exercising influence over events that affect their lives, thus, determining how people feel, think and motivate themselves as well as behave (Bandura, 1994). Factors increasing self-efficacy levels for inclusive practice are: experience or interaction with persons with disabilities; high levels of training; knowledge about policy related to inclusive education (Yada & Savolainen, 2017).
Subjective behavioural standard	This belief refers to the perceptions of expectations of others like parents, colleagues, principals and the educational policies that teachers might have (Khamis, 2011; Vermeulen et al., 2012).
Additional theme	**Description**
Support for inclusion	Any support, apart from training, the teachers receive regarding including the HI learners in their classes.
Teachers' inclusive practices	
Code (sub-theme) information	**Description**
Multiple means of engagement	This refers to the *WHY* of learning (Dalton et al., 2012) and includes recruiting interest; sustaining effort and persistence; and self-regulation. Teachers need to implement different classroom strategies that empower their learners, providing choices for the learners, reducing learner anxiety, and rewarding their efforts (Navarro et al., 2016).
Multiple means of representation	This refers to the *HOW* of learning (Dalton et al., 2012) and includes perception, language expressions and symbols, and comprehension. Teachers must learn how to present educational resources through a variety of modalities (visual, auditory or tactile) and methods such as videos, websites, pictures etc. (Navarro et al., 2016; Rose & Strangman, 2007).
Multiple means of action and expression	This refers to the *WHAT* of learning (Dalton et al., 2012) and includes physical action, expression and communication, and executive function. Teachers are required to provide learners with a variety of options to practice tasks, communicate and demonstrate what they have learned, which allow learners to

	capitalise on their special abilities or talents (Navarro et al., 2016; Rose & Strangman, 2007).
Curriculum differentiation	Differentiating the curriculum content, the learning environment, and the teaching methods such as learning materials, methods of presentation and learning activities and making use of multiple intelligences (DBE, 2011).
Differentiating assessment	Alternate assessment based on modified attainment of knowledge (assess learner's mastery of grade-level content with reduced load/ more at functional level); and alternate assessment based on grade-level attainment of knowledge (this involves learners with disabilities who need for example, additional time, readers and amanuensis) (DBE, 2011).
Critical learning goals	Teachers need to identify critical learning goals. These can be guided by constants or by variables (specific goals identified for specific learners) (Whittle et al., 2020). Having clear goals is important (Carrillo & Flores, 2020).
Ratio of teacher to learners	The necessary differentiation and individual support are difficult to achieve in large classes (high ratio of learners), thus, wherever possible, learners with barriers (LSEN) should be taught in smaller classes (Blatchford & Webster, 2018).
Communication method	Once teachers had their learning goals, they had to decide between either synchronous or asynchronous learning strategies (Whittle et al., 2020).
Building agency	Learners' ability to learn in their own homes and at their own pace, might give teachers the opportunity to engage learners on topics and approaches of particular interest, instead of general lessons and formats (Whittle et al., 2020).
Assessments	Assessments can be individualised using technology to showcase the learning and skills of learners and large-scale standardised testing may become outdated (Kaden, 2020).
Social role of the teacher	Teachers build relationships with parents to gain insight into the learners' needs and their environmental constraints. This parental connection provides "context for the social presence of the teacher" (Whittle et al., 2020, p. 317).
Pedagogy and the learner social role	A social-driven pedagogical approach to enhance learner engagement and participation (Whittle et al., 2020) can be

	achieved by employing a problem-posing pedagogical approach (Olawale et al., 2021).
Feedback	Learners need to receive feedback relating to progress and assessments, for example, teachers should make use of alternative feedback strategies, such as non-graded formative feedback, self-feedback and peer feedback (Whittle et al., 2020).
Additional theme	**Description**
Effect of ERT on the teacher	The way the teacher experienced ERT.

3.6.5 Exclusion criteria for coding the data

While coding the observations and documentation, some of the discourse, activities and documentation were irrelevant to the study and did not form part of the conceptual framework. These were excluded when the data was coded. I also saw a learner with two cochlear implants in Debbie's one class that was supposedly without HI learners. Debbie confirmed that there were no HI learners in that particular class. When I enquired about the situation, the school said that there was a request from that learner's parents that the learner should not be seen as part of the hearing impaired learners' cohort. Therefore, I analysed the data of that particular class from the viewpoint that that class did not contain an HI learner.

During the interviews the participants sometimes did not stick to the questions being asked and elaborated on irrelevant topics. The exclusion criteria as well as examples of excluded text are listed in Table 3.8 below.

Table 3.8

Exclusion Criteria for Coding the Data

Exclusion criteria	Discussion / Examples of text excluded from coding
The class of Debbie with no HI learners in actually had an HI learner with two cochlear implants.	I saw a learner with two cochlear implants in one of Debbie's classes that was supposedly without HI learners. Debbie confirmed that there were no HI learners in that particular class. When I enquired about the situation, the school said that there

Exclusion criteria	Discussion / Examples of text excluded from coding
	was a request from the learner's parents that the learner should not be seen as part of the hearing impaired learners' cohort. Therefore, I analysed the data of that particular class with the view that that class did not contain an HI learner.
Teachers' expectations from learners.	**How will you describe a good mathematics teacher?** *… I think that the minute a child feels that you will bite his head off or you think he is stupid, then he will not ask you. Then it makes you a bad teacher – I think so. So, as an example, I allow my children to eat in class, because you cannot do mathematics if you are hungry. Hmm. You need to ask if you do not understand. Interrupt me if there is something you do not know…* (ITI, 2:101)[14]
Elaboration on irrelevant topics	**According to you, what is the purpose of mathematics?** *…but I also think to give people an indication that not all of us will become engineers, all of us will not become doctors. Some of us should become attorneys, and others will go, you know, in a language direction or whatever. Uhm … I think it separates that, that career choices for the future.* (ITI, 2:114)
One question not asked to both participants.	The question **How does the assessment of HI learners influence your inclusive practice** from the first interview was not posed to Francis as it was overlooked.
Questions and answers from the second interview relating to face-to-face teaching **after** ERT.	I excluded the answers to questions from the second interview that refer to post lockdown face-to-face teaching. Questions such as[15]: • How did wearing a mask affect your teaching in class? Please elaborate. • According to you, how does the wearing of a mask (you as teacher and the hearing impaired learner) influence the hearing impaired learner? • How do you accommodate the hearing impaired learner now in the post lockdown situation in school?

[14] See paragraph 4.4 for an explanation on the reference method.
[15] In Appendix F the questions being excluded are crossed out.

Exclusion criteria	Discussion / Examples of text excluded from coding
Teachers talking mathematically incorrectly.	For example, Francis said that the numerator should be multiplied with a one and then she elaborated with “multiply with nothing, multiply with one”.

3.7 Quality assurance criteria

I am aware that different researchers use different terminology (trustworthiness, validity and reliability), however, I used the terms interchangeably as all these terms refer to relevant aspects of quality assurance applicable to my qualitative study. The Hawthorne and Halo effect were also kept in mind as part of the quality assurance.

3.7.1 Trustworthiness of the study

“Trustworthiness is of the utmost importance in qualitative research” (Nieuwenhuis, 2016a, p. 123) and refers to the method in which data is collected, sorted and classified (Di Fabia & Maree, 2012). “When qualitative researchers speak of research ‘validity and reliability’ they are usually referring to research that is ‘credible and trustworthy’” (Nieuwenhuis, 2007, p. 80).

The trustworthiness of the study is enhanced when multiple data collection strategies such as multiple observations, interviews, documentation and audio-visual digital materials are used. On the other hand, having a small number of participants and a small number of lessons observed during face-to-face teaching, are factors that affect the trustworthiness of the study.

3.7.2 Validity and reliability of the study

Gibbs (2018) explains the terms *validity* and *reliability* of results in simple terms when he says results are, “*Valid* if the explanations are really true or accurate and correctly capture what is actually happening and *reliable* if the results are consistent across repeated investigations in different circumstances with different investigators” (p. 2). The core of validation “lies in the open and transparent nature of the research procedures, and in leaving a clear ‘audit trail’ of decisions and interpretations made during the course of the research process” (Nieuwenhuis, 2016a, p. 122).

Patton (2002) is of the opinion that “quality and credibility are connected in that judgments of quality constitute the foundation for perceptions of credibility” (p. 542). He also speaks of credibility instead of validity and reliability:

The credibility of qualitative inquiry depends on three distinct but related inquiry elements (Patton, 2002):

- *Rigorous methods* for doing fieldwork that yield high-quality data that are systematically analysed with attention to issues of credibility;
- The *credibility of the researcher*, which is dependent on training, experience, track record, status, and presentation of self; and
- *Philosophical belief in the value of qualitative inquiry*, that is, a fundamental appreciation of naturalistic inquiry, qualitative methods, inductive analysis, purposeful sampling, and holistic thinking. (pp. 552-553)

These three criteria are relevant to the research of this study, as I believe, like Timmons and Clairns (2010), that the phenomenon of inclusive education can only be effectively investigated using a case study within a qualitative design. During the fieldwork, effort was made to maintain rigorous standards when collecting and analysing the data. I tried my best to handle the data as honestly as possible and did not look for evidence to support my position. As Creswell (2014) mentions, “the experiences may cause researchers to lean toward certain themes, to actively look for evidence to support their positions, and to create favourable or unfavourable conclusions about the sites or participants” (p. 188).

Creswell and Creswell (2018, p. 274) advocate for researchers to actively incorporate validity strategies, such as, triangulation; member checking; the use of a rich, thick description; and the clarification of the bias the researcher brings to the study. I incorporated the four validity strategies in my study.

Triangulation involves elements such as the use of different sources of information, methods, and types of data (Di Fabia & Maree, 2012). I collected data from two participants in the form of interviews, observations and all their Google Classroom documentation. I asked the same questions to both teachers and, after the interviews, as part of member checking, they were given a summary of my interpretation of their answers in order for them to verify or change their answers. I used rich, thick descriptions to convey the findings and to clarify any bias. I, as an example, also indicated how my interpretation of the findings was shaped by my background. I avoided seeking answers to support my preconceived ideas so the validity could be enhanced and I maintained objectivity as much as I could. The study focused especially

on interpretative and descriptive validity. My approach was kept consistent to enhance the reliability of the study.

3.7.2.1 The Hawthorne effect

The Hawthorne effect, also known as placebo, refers to the "distortions in behaviour that occur when participants change their behaviour because they are being observed" (Seabi, 2012, p. 86). While collecting data, I took the Hawthorne effect into consideration as it might occur where teachers perform differently due to being observed. To reduce this effect, four lessons per teacher were observed and I emphasised the fact that I was interested in the uniqueness of each teacher and how each teacher handles the inclusion of HI learners. I was there to learn from them and not to criticise. I made audio and video recordings of all the observed lessons and also took field notes to enhance the trustworthiness of the observations. To enhance the trustworthiness of the interviews, the same interview schedules, including the same questions and sequence thereof, were used for both of the interviewees. I made use of short and concise questions to avoid confusion or misunderstandings.

3.7.2.2 The Halo effect

The Halo effect is generally defined as "the influence of a global evaluation on evaluations of individual attributes of a person" for example "nice people tend to have nice attributes and less nice people have less nice attributes" and "a person's appearance may be more attractive if we like the person than if we do not" (Nisbett & Wilson, 1977, p. 250). I avoided the impulse to seek answers that would have supported my preconceived ideas in order to enhance the trustworthiness of the data analysis. I kept to the framework as informed literature, however, I kept myself open for new insights.

3.8 Ethical considerations

As researcher, I have "the obligation to respect the rights, needs, values, and desires of the informant(s)" (Creswell & Creswell, 2018, p. 287). I obtained permission from the Ethics Committee at the University of Pretoria to ensure that the study adhered to research ethics requirements. In the research ethics application, aspects such as the research approach, design and methodology, voluntary participation, informed consent, anonymity and risk were addressed.

After I had explained the focus of my research to the private schools' director and high school principal through email, consent was given by them that I could continue with my research at

the school. I then had a discussion with the Mathematics HOD and the Deputy Principal responsible for the HI learners. Once the participants were invited to take part in the study, they were informed of the purpose of the study and their role as participants. The teachers had a choice to participate and knew they could withdraw at any stage. The mathematics teachers and the parents of the learners gave consent in the form of signed letters, while the learners gave assent themselves in the form of signed letters. The limited number of available teachers was taken into consideration and dealt with in the most ethical way possible.

The teachers were not forced to participate in the planned study and they had the assurance that they would be protected. In order to accomplish confidentiality and anonymity, a pseudonym was assigned to each participant. It is highly unlikely that either of the participants were physically or psychologically harmed during this research. However, the participants might have experienced invasion of privacy when I recorded their lessons and they might have felt anxiety and discomfort in sharing their knowledge and beliefs during the recorded interviews. To lower the level of discomfort during the second, Zoom-interview, I provided the participants with the questionnaire beforehand. By doing so, they had sufficient time to think about their answers. I also assured them that if they were not willing to answer a specific question, they did not have to and that I would make use of pseudonyms, thus their identity was protected. Neither the name of the school nor the participants' names were mentioned during the dissemination phase of the study.

The ethical considerations of working with disabled learners were considered due to the smaller sample size. The small number of HI learners in the private inclusive high school is a vulnerable population and was addressed with all the ethical requirements. Video recordings were not made with the HI learners' faces visible. Only the teachers' faces were visible as the recordings were done from the back of the classroom.

3.9 Conclusion

In this chapter, I discussed the research paradigm, namely social constructivism with an interpretivism position. A qualitative research approach with an exploratory case study was used as research design. The research site was a private inclusive high school in Gauteng, South Africa, where HI learners learn alongside their peers. The sample consisted of two mathematics teachers. Two semi-structured interviews and four observations per teacher were used as well as documentation and audio-visual digital material in the form of the teachers' Google Classroom portals. The teachers' planning, tests and worksheets were also analysed. ATLAS.ti 9 was used to analyse the interviews, and video and audio data. Lastly

the trustworthiness of the study as well as the ethical considerations that were taken into consideration were discussed. The following chapter consists of the presentation of the findings.

Chapter 4

Presentation of the findings

4.1 Introduction

In this chapter the coding of the data will be described in detail. Based on my conceptual framework (as seen in Figure 4.1), the findings from each participant are thematically presented. The three themes are 1) Teachers' beliefs about the nature of mathematics, 2) Teachers' beliefs about inclusion, and 3) Teachers' inclusive practices.

The research questions are:

Primary research question:

What influence do mathematics teachers' beliefs have on their inclusive practices for oral HI learners during face-to-face teaching and ERT?

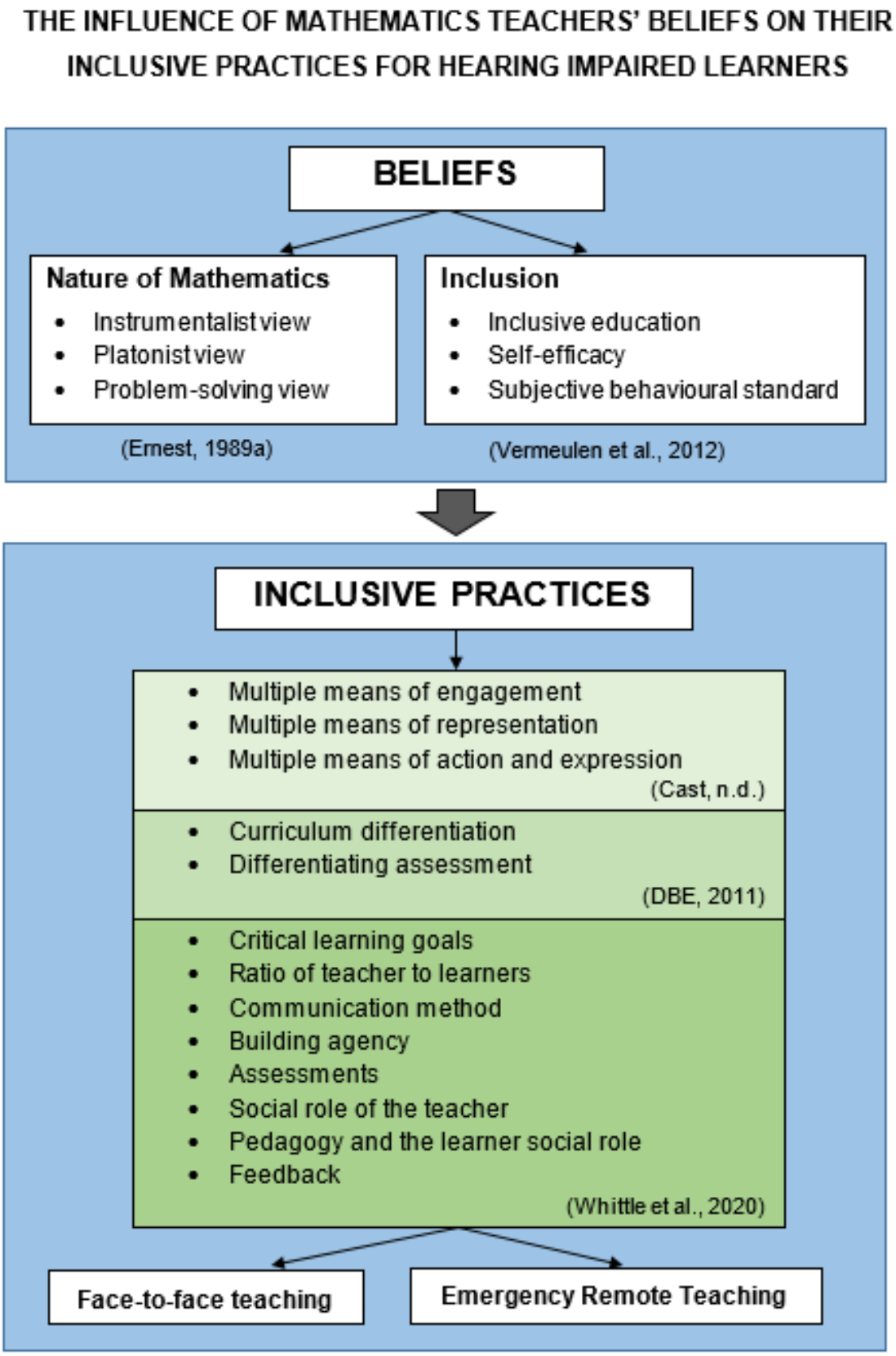
Secondary research questions:

1. What is the nature of inclusive schools' mathematics teachers' beliefs?
2. What practices are used during face-to-face teaching and ERT to include HI learners in the general mathematics classroom?
3. How are these practices influenced by the teachers' beliefs about the nature of mathematics and inclusivity?

Following is the conceptual framework as discussed previously.

Figure 4.1

Conceptual Framework: Beliefs and Inclusive Practices Framework of Analysis



4.2 Information regarding the two participants

The next section contains biographical information regarding the two participants, Francis and Debbie. It also includes some background information regarding the observed lessons. Pseudonyms were used to protect the participants' identities.

Quotations are referenced as indicated in the following table.

Table 4.1

Referencing Method of Quotations

Abbreviation of referencing quotations	Meaning of abbreviations
ITI	Initial Teacher Interview
STI	Second Teacher Interview
TO	Transcription of observation (recorded/video lessons)
1W	Lesson 1 with an HI learner in class
1W/O	Lesson 1 without an HI learner in class
2W	Lesson 2 with an HI learner in class
2W/O	Lesson 2 without an HI learner in class

For example, ITI, 2:114 refers to an initial teacher interview, primary document 2 line 114. All quotations are presented exactly as they were recorded in the interviews, so grammar errors have not been corrected, unless meaning became unclear. In the case of Francis' interviews and some of her lessons, I translated the original Afrikaans quotations as closely as possible into English with the same grammar and word order, unless the meaning became unclear.

4.2.1 Francis

Francis is a 37 year old female with 14 years' experience as a mathematics teacher. She matriculated in 2001, after which she took a year "off". During that year she attended a Life College where they focused on determining her *purpose of creation*. They suggested a career in teaching for Francis, even though she did not feel called to become a teacher. "I did not experience a lightbulb moment"[16] (ITI, 2:80)[17]. However, the following year she started

[16] The interview was conducted in Afrikaans. I translated the interview into English.
[17] The quotation comes from Initial Teacher Interview, prime document 2, line 80.

studying a B.Ed. Senior Phase degree at the University of Pretoria with mathematics and English as majors. After more than 10 years' teaching, she achieved a B.Ed. Honours degree in mathematics education. Throughout her teaching career she has taught mainly Grade 10, 11 and 12 mathematics in Gauteng and in the Western Cape. She previously taught an HI learner at another private school, where the learner handed Francis her Roger microphone[18] to hang around Francis' neck. She did not receive any training regarding HI learners and the Roger microphone at her previous school. For the first time, a school, in this case the private inclusive high school where she is currently employed, expects her to attend training sessions regarding the teaching of HI learners and their devices.

Some days Francis regrets becoming a teacher and that she did not go into the banking business, for instance, as she could have still used mathematics in that career. Many days she thinks of working for herself – giving extra classes. "Teaching consists of plenty of administration. You cannot just stand in front of the class. I don't know if you have any exp… Look at my desk! You have so much admin and administration…" (ITI, 2:84). "Yes, actually is the fact that standing in front of the class, is not your only work. And I think it gets one down" (ITI, 2:86).

4.2.2 Debbie

At 25, Debbie has two years' formal experience as a mathematics teacher. However, during her Grade 12 year and four years of study, she tutored Grade 8-12 learners as well as first year students. In 2016 she completed her BSc Mathematics degree, followed by a PGCE degree in FET (Further Education and Training) and Senior Phase Mathematics. Her first year of teaching was at a private school in Gauteng, after which she began working at the current private inclusive high school. She has taught Grades 8-11 mathematics.

Debbie has wanted to be a teacher since nursery school, but it was only in Grade 11 that she decided that she wanted to become a mathematics teacher. She went to university to study BSc Mathematics and did a PGCE afterwards instead of studying B.Ed. "So PGCE wasn't an afterthought, it was always part of the plan of what I was going to do" (ITI, 4:41).

[18] Roger microphones reduce background noise and transmit the speaker's voice directly to hearing aids or cochlear implant sound processors Phonak for Professionals. (n.d.). *Roger wireless technology*. phonakpro.com. Retrieved 19 April 2022 from https://www.phonakpro.com/us/en/about-phonak/technologies/roger-wireless.html#:~:text=Roger%20microphones%20have%20been%20developed,or%20cochlear%20implant%20sound%20processors..

Debbie enjoyed mathematics in high school, but not in primary school. She also enjoys teaching it as it is just "part of my life" (ITI, 4:53). According to her, her mathematics teachers were the influences in her becoming a mathematics teacher, especially her Grade 11 teacher.

> "She was … it was just … she made me feel comfortable in class, you know, she left … you had your own space … but she still … she taught so well, you just … I just clicked, ever since then it was … I don't know, now I just clicked … I love it. I don't know what else I would do." (ITI, 4:43)

To summarise, the most relevant information (as gathered in 2020) appears in Table 4.2.

Table 4.2

Biographical Information of the Two Participants

	Francis	Debbie
Age (years)	37	25
Qualifications	• B.Ed. Senior Phase • B.Ed. Hons Mathematics Teaching	• BSc Mathematics • PGCE in FET and Senior Phase Mathematics
Mathematics teaching experience (years)	14	2
Mathematics teaching experience for HI learners	• Two years at another private school • Four weeks at the current private inclusive high school	• One year and four weeks at the current private inclusive high school

4.3 Theme 1: Teachers' beliefs about the nature of mathematics

"Beliefs about mathematics and the nature of mathematical tasks; and beliefs about oneself and others as doers of mathematics", not only "influence how one thinks about, approaches, and follows through on mathematical tasks but also because they influence how one studies mathematics and how and when one attends to mathematics instruction" (Garofalo, 1989, p.

502). Teachers' conceptions of the teaching and learning of mathematics reflect their beliefs about mathematics (Thomson et al., 2003) and their views (Ernest, 1989b).

In this section the findings are presented from the observations, interviews and documentation analysis of Francis and Debbie. All discussions on the sub-themes **instrumentalist view, Platonist view, and problem-solving view** are structured strictly according to the specific order of the sub-themes (codes) as indicated in Table 3.7[19].

4.3.1 Francis' beliefs about the nature of mathematics

Francis believes that mathematics can sometimes be easy and sometimes be difficult. At school level, Francis had a very good teacher and she enjoyed mathematics – it was one of her favourite subjects. "But I did well and I think if you do well and understand it, then automatically you will enjoy it"[20] (ITI, 2:97). She mentioned in her first interview that it was not a passion for mathematics that caused her to become a mathematics teacher, however, she described a good mathematics teacher as "someone with a passion for the subject and a passion for a child that does not understand" (ITI, 2:101).

She is of the opinion that mathematics really opens doors for one. "But the value of mathematics, I think it is what the child makes for himself. If you feel mathematics is important and I want to make something with it, it is valuable to you" (ITI, 2:118). She also said that not everybody can do mathematics and many times the parents forced the learners to take mathematics, however, "they can't remember what I just said and what I made you write in your book and he does not even know where to look for" (ITI, 2:114).

When asked, during the first interview, which of the three types of mathematics teachers (instructor; explainer; facilitator) she is, Francis responded that she is all three of them. However, when the same question was asked during the second interview, nine months later and after ERT, she responded that she was the first two. That means during face-to-face teaching she viewed mathematics from an instrumentalist, Platonist, and problem-solving viewpoint, and after ERT she viewed mathematics only from an instrumentalist and Platonist viewpoint.

[19] Table 3.7 is discussed under Section 3.6.4: Inclusion criteria for coding the data.
[20] The interview was conducted in Afrikaans. I translated the interview into English.

4.3.1.1 Instrumentalist view

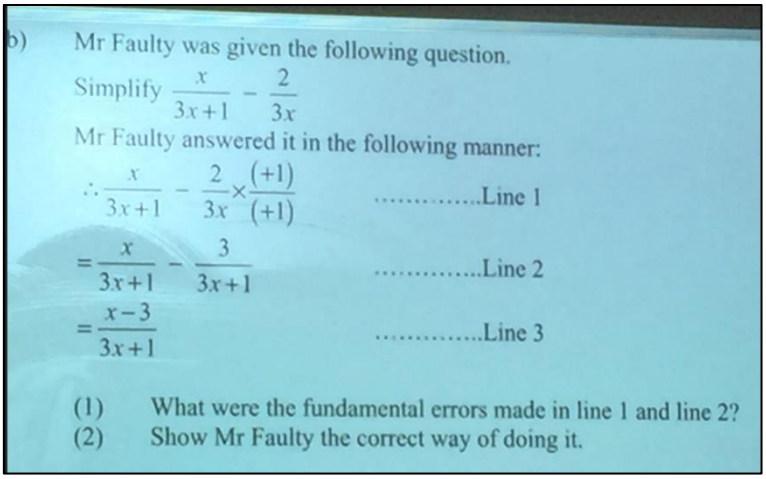
Francis believes she is an instructor as she needs to instruct the learners so they can develop a skill and do a sum. The learners need to understand when she gives an instruction. She needs to explain in such a way that the learners can understand the information. “Because, how will he apply that information in a test or how will he apply the skills in a test if he does not understand what I said in class?” (ITI, 2:130). She states that, “I work constantly through exam papers, through books, try in the class to show the children different ways how something can be asked …” (ITI, 2:123). Again this is evident of a mathematics teacher with an instrumentalist view, as she focussed on “mastering of skills” (Ernest, 1989a).

As seen in the face-to-face observations, most of the times, in both classes[21], Francis instructs the learners and emphasises certain procedures and methods the learners need to follow. When she marked the factorisation homework, Francis told the learners it is too late to take out another common factor in the last step of the calculation. If the learners did that, they would be penalised. The learners should take out the common factors in the first two steps of the calculation.

When marking a problem-solving question, Francis provided the answers herself. See the following snapshot and quotation.

Figure 4.2

Snapshot of a Problem-Solving Question


b) Mr Faulty was given the following question.

Simplify $\frac{x}{3x+1} - \frac{2}{3x}$

Mr Faulty answered it in the following manner:

$\therefore \frac{x}{3x+1} - \frac{2}{3x} \times \frac{(+1)}{(+1)}$ .....Line 1

$= \frac{x}{3x+1} - \frac{3}{3x+1}$ .....Line 2

$= \frac{x-3}{3x+1}$ .....Line 3

(1) What were the fundamental errors made in line 1 and line 2?
(2) Show Mr Faulty the correct way of doing it.

[21] The class containing an HI learner and the class without an HI learner.

This is how Francis dealt with the problem-solving question she marked during lesson 2W/O (TO, 11:500-515). No facilitation was evident.

F: *What are the fundamental errors here? In line one?*

(Learner answers inaudible)

F: *Say again*

(Learner answers inaudible)

F: *Yes, he wanted to make an equivalent fraction, did you see? But then first of all his LCD is wrong. It should have been* $3x + 1$ *and* $3x$ *… you see? Now look how wrongly … ah … incorrectly he's multiplying with a 1. Do you see why? He thinks only* $3x + 1$ *should be the LCD because* $3x$ *can go into* $3x + 1$ *but then we taught you it can't be, right? You need to take one of each, cause they mean different values. So over here he thinks … uhm … To get from* $3x$ *to* $3x + 1$*, I'm just in short of a* $+1$*, you see? Is that right?*

L: *Nope*

F: *Okay* (she opens up the answer on the PP slide). *So you need to tell me line one his LCD was wrong, LCD was wrong and line two where he wants to get to* $3x + 1$ *he's adding a* 1 *and that's not equal.*

4.3.1.2 Platonist view

A good mathematics teacher, according to Francis, is someone that can explain over and over and over again. She feels she is an explainer. She believes that mathematics is not only about sums and feels that one should "explain to a learner where they will use it – how it integrates with other things they will still be doing" (ITI, 2:104). "We try to see mathematics in art or we try to see mathematics in ordinary patterns" (ITI, 2:118). However, according to Francis, "many of the sections in mathematics are quite abstract. I cannot explain where everything we do fits in, but if I can, I will do that and explain where everything fits in" (ITI, 2:104). Francis feels it is important for learners to make the information their own and to be able to answer other types of questions than the examples she did in class.

During the face-to-face observations it was evident that the learners in the class with the HI learner asked so many questions because they wanted to clarify that what they were doing was correct. The interaction with these learners forced Francis to be more of an explainer than an instructor in that particular class compared to the other class, without an HI learner. It was visible in both Francis' Afrikaans and English ERT videos that she would just tell and instruct

the learners what to do, rarely giving them the opportunity to process the information and construct understanding.

4.3.1.3 Problem-solving view

For Francis, the purpose of mathematics is assisting analytical thinking and enhancing abstract thinking. “I think it helps children to think more abstractly. So, I think it enhances abstract thinking” (ITI, 2:114). Francis believes she is also a facilitator, as:

> “I have to facilitate in class… when I have finished explaining I have to walk around the class and see what is going on in their books, and I have to be able to see whether they have understood, and that concept, which is often a new concept, whether they made it their own and they can now apply it with a random sum and do that sum in their book …” (ITI, 2:130)

Her focus, visible in the quotation above, is for the learners to master a skill and have the correct performance. This is an instrumentalist view, a teacher being an instructor, and not a teacher being a facilitator, as she does not let learners construct their own understanding.

Francis viewed mathematics in all three ways and to the same degree. However, it was evident from the observations that Francis tended to be more of an instructor (instrumentalist view) than an explainer (Platonist view) and that she was not a facilitator. These findings are consistent for both classes – one with HI learners and one without HI learners.

4.3.2 Debbie’s beliefs about the nature of mathematics

Debbie views mathematics as “the best subject in the world” (ITI, 4:53). According to her, mathematics is “fantastic … great … awesome … but difficult as well” (ITI, 4:55). It was visible that Debbie has a passion for mathematics. She believes mathematics opens doors, but the purpose of mathematics is “also to see what real life things have maths” (ITI, 4:57). She feels learners struggle with mathematics as:

> “They don’t know how it’s been used in the real world. They don’t understand why they are doing it … and I think that is important for them to look outside and say … that’s a circle, oh and I just learned about a circle today and what is the equation of a circle.” (ITI, 4:57)

When she described herself as mathematics teacher, she used phrases like *fun and crazy, young*, and *weird*. Debbie let the learners feel comfortable in the mathematics class, "… cause that's how I felt when I was in math … so that is how I am as a math teacher" (ITI, 4:61).

Debbie sees herself as both an explainer and facilitator, having a Platonist and problem-solving view. However, during ERT she realised that the videos did not allow for her to be a facilitator, as she spent most of the time explaining the concepts, "So, a lot was more explaining, there was no time, no opportunity to facilitate and to see how the learners are doing, do they understand, because you would just upload the video" (STI, 1:432). Thus, ERT forced her to only view mathematics from a Platonist viewpoint.

4.3.2.1 Instrumentalist view

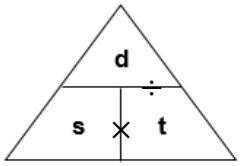
Debbie does not see herself as an instructor during face-to-face teaching nor ERT, however she contradicts herself when she gives the example in the first interview of how she would explain *difference of two squares*:

> "Then I break it up, what does 'difference' mean in normal English? So, I first try to break it up for them so that they understand the concept of it, and then I do it … write an example on the board, and I do it with them slowly so that they can see what I am doing. Then the next example I write on the board, they have to complete it themselves first." (ITI, 4:144)

Debbie believes that showing learners how to do a calculation first and then letting them do another example, is a way of facilitating. The way in which she responded to the learners' attempts was not that of a facilitator, but rather of an instructor.

When learners asked Debbie a question during face-to-face teaching, while they were doing their homework, Debbie tended to tell them what to do. She did not guide their thinking process so they could understand why they should do something. In the next extract, in lesson 1W, Debbie gave the learners the *speed, distance, time triangle* and expected the learners to use that to determine the answers (TO, 5:86-98).

The following diagram is a presentation of what was on the board at the end of the extract.



D: *Does everyone know how the triangle works? L1? Okay, so how the triangle works, is … If I am looking for distance, it's speed multiply with time.* (She inserts the multiplication sign between the s and the t). *If I'm looking for speed, it's distance divided by time.* (She briefly covers the s and then shows with her right hand to the d then she inserts the division sign.) *Okay.* (12 seconds passing). *Everyone okay? Yes, L1?*

L1: *Ma'am, if you're looking for time?*

D: *Again, you cover time and it's distance divided by speed.* (Covers the t and indicates to the d and s.) *So, this whole line here means divide* (Indicates to the horizontal line inside the triangle.) *This whole line means multiply* (Indicates to the vertical line inside the triangle.) *Okay?*

Learner 1 wanted to know how to determine *time* then. That was evidence that the learner did not understand the triangle and did not construct her own understanding as she was fixed to the formulae given by Debbie.

During lesson 2W, when Debbie explained how to deal with negative exponents, one learner tried to construct her own understanding. Unfortunately, it was not based on the understanding of *why* she could do something, but rather on the *how*. See the following extract (TO, 6:150-160). Debbie's acknowledgement of the learner's incorrect construction did not help and could only cause more confusion.

D: *So when I move an exponent either up or down the fraction it becomes negative or positive. The sign changes. If I move a positive exponent down it becomes negative. Okay.*

L: *So is it like similar to when if you switch things over the equal sign?*

D: *Basically. But only if the exponent changes, nothing else. And you only move the base that has the negative exponents. Everything else you leave there.*

Even though Debbie believes she is an explainer and facilitator, she instructed the learners in both classes, irrespective of the class containing an HI learner or not.

4.3.2.2 Platonist view

Debbie sees herself as an explainer because there are plenty of new concepts that need to be explained and "you can't construct the understanding until they really grasped the concept" (ITI, 4:69). She wants the learners to understand that there are many ways of doing

calculations and in both classes (with a HI learner and without a HI learner) she asked if there were learners who did the calculations differently and wanted to share their methods with the rest of the class.

It was evident during the face-to-face observations that Debbie rarely made use of scaffolding to assist the learners who struggled. She just told them the method or the next step. Debbie would make use of *procedures* or *steps* to show the learners how certain calculations should be done. During lesson 1W she also told the learners, “I think I taught you this last year as well. You divide up and you multiply across … and that will give you this answer” (TO, 5:302-304). She did not let the learners construct their own understanding in either class, and it was evident in some of the learners’ answers that there was a considerable amount of uncertainty in their minds in this regard. When a learner in 1W asked Debbie, “Ma’am, how do you convert ma’am, kilometres per hour to metres per second?” (TO, 5:551) she quickly replied with, “You have to change the kilometres into metres and the hours into seconds” (TO, 5:553) without letting the learner think for himself.

Debbie realised that during ERT she could not facilitate that much and had to explain more. However, it was evident that she instructed more than she explained.

4.3.2.3 Problem-solving view

For Debbie, a good mathematics teacher is someone that allows the learners to investigate and to guide the learners where necessary and not to instruct them what the method was, without the possibility of another method. “Allowing the children to figure out that there might be another way of doing, that is still mathematically correct, so that … just allowing them to experience … to actually discover what is going on” (ITI, 4:51).

Debbie sees herself as a facilitator and loves the side of mathematics where she does not teach the learners, but where she can challenge them. “I just give them a sum on the board and just say go for it. Try it. I know you think it’s going crazy, but at least try it” (ITI, 4:51) and “Throwing them in the deep end saying go for it, try it, we can always sort things out at the end …” (ITI, 4:69). And when she later showed them how it could be done, the learners realised that it was actually easy.

She does not only enjoy investigations, she loves them. “When I have to teach a concept, then I teach a concept, but if I know I can have a little bit of fun with it … then I definitely …

investigation" (ITI, 4:69). Unfortunately, no investigation was observed during face-to-face teaching.

She wants the learners to understand that there are many ways in doing calculations.

> "So, I think just allowing the children to make their own perception out of math, because there are such a stigma against it that no one … You can't do it. It is either for you or it's not for you. It's very difficult … but allowing the children to actually experiment and see what it's like … to make that decision for themselves and say no, but it is actually nice and I enjoy it." (ITI, 4:51)

During the face-to-face observations, in both classes (with a HI learner and without a HI learner) she asked the learners to share other methods they might have with the class. Debbie then explained to the class what the two different learners did and complimented the learners on their methods.

For Debbie, mathematics "is actually used for every day. Not just because you have to do it as a subject as it is" (ITI, 4:57). She feels that mathematics does not limit one, it opens up one's mind and then one starts understanding other subjects as well, "So, it is a holistic view" (ITI, 4:57).

4.3.3 Summary of participants' beliefs about the nature of mathematics

The following table is a summary of the two participants' beliefs about the nature of mathematics.

Table 4.3

Summary of the Teachers' Beliefs about the Nature of Mathematics

	Summary of the teachers' beliefs about the nature of mathematics
Francis	During the first interview, Francis said she was all three types of mathematics teachers, namely, an instructor, explainer, and facilitator – viewing mathematics in all three ways and to the same degree. When the same question was asked nine months later after ERT, she responded that she was an instructor (instrumentalist view) and an explainer (Platonist view). It was, however, evident from the observations that Francis tended to be more of an instructor than an

	Summary of the teachers' beliefs about the nature of mathematics
	explainer and that she is not a facilitator. These findings are consistent for both classes – one with HI learners and one without HI learners. For Francis it is important that the learners master the skills and demonstrate this with correct performance. Although she tried to explain how mathematics integrates with other things, due to the abstract nature of mathematics she could not explain where everything fits in.
Debbie	Debbie saw herself as both an explainer (Platonist view) and a facilitator (problem-solving view) and not as an instructor (instrumentalist view), however, the example she gave in the interview was from an instrumentalist view. During the observations it was also visible that she instructed the learners. She wanted the learners to understand that there are many ways of doing calculations, thus she is not a strict follower of a text or scheme. In both classes (with a HI learner and without a HI learner) she asked the learners to share other methods they might have with the class. She loves to investigate and challenge the learners, however, this problem-solving view was not evident during the observations. Debbie feels mathematics opens up ones' mind and enables one to understand other things better. Even though Debbie believes she is an explainer and even more a facilitator, she instructed the learners in both classes, irrespective of the class containing an HI learner or not – contradicting her beliefs. Debbie was not textbook bound as the examples she did with both classes were not consistent. During ERT she realised that the videos did not allow for her to be a facilitator, as she spent most of the time only explaining the concepts.

4.4 Theme 2: Teachers' beliefs about inclusion

In this section the findings are presented from the observations, interviews and documentation analysis of Francis and Debbie. All discussions on the sub-themes **inclusive education, self-efficacy, and subjective behavioural standard** were structured strictly according to the

specific order of the sub-themes (codes) as indicated in Table 3.7[22] The additional code **support for inclusion** is discussed under the relevant sub-themes.

4.4.1 Francis' beliefs about inclusion

Francis defines inclusion as:

> "In terms of a deaf learner, not to exclude him from a mainstream school or in a class environment where I present a normal lesson and he feels he cannot attend because he has a hearing problem. I think with technology that child's hearing can be repaired in such a way that he, with the best technology or required technology, can be involved in the current situation in the current class and can become part of the class … in a normal way, without having to stand out or in a … weird is or in a different school has to be or whatever, yes"[23]. (ITI, 2:134)

4.4.1.1 Inclusive education

In answer to the question, *'Do you believe inclusion is a desirable educational practice?'*, Francis admitted it was a catch-22 situation. She agrees with inclusion if a learner has a cochlear implant, can function with his hearing peers, and his parents had detected the hearing problem at a young age and helped the learner in every possible way. On the other hand, she feels that if a learner's hearing problem was only detected at a much later age, such as 10 years, a cochlear implant cannot be afforded and the learner cannot hear, then she does not agree with inclusion.

> "So … I believe in inclusivity if you can hear me and you have all the technology at your disposal. But I'm one person in the class or you may have an assistant, I cannot help you if you cannot hear me. And if you … because sometimes it is accompanied by a very serious speech problem also … that sometimes you cannot hear what they are saying … so … it depends. Yes, I believe in it because it works at this school." (ITI, 2:142)

Francis does not feel that most learners with disabilities can be educated in regular classrooms. It depends on the disability.

> "Disability is too wide for me. Is it a hearing disability? Is it a wheelchair disability? What? Is it a sight … what is the disability? If we are only talking about hearing-impaired

[22] Table 3.7 is discussed under Section 3.6.4: Inclusion criteria for coding the data.
[23] The interview was in Afrikaans and I translated it to English.

> children, yes, I believe in… if you have a cochlea[24] implant and you can hear me and you can understand me and whatever, but **not** if that is not the case." (own emphasis) (ITI, 2:145)

Francis mentioned that the HI learners have to keep up with the pace of the curriculum. Implying thus that the HI learners need to achieve academically. She cannot work slower and if the learners cannot hear properly, they must go and see her. The previous time she had an HI learner in her class was at another school for only one year, and she only had to wear the Roger microphone around her neck, nothing else was expected of her.

It is thus the HI learners' responsibility to keep up with the pace. The school has made extra classes available for all the learners[25] on Tuesdays, Wednesdays and Thursdays for two hours each afternoon. As all of the mathematics teachers are available, the learners can choose whose extra class they would like to attend. Francis feels if the HI learners does not hear in class, they must attend the extra classes so that someone can explain the work again. Even though Francis was only teaching for four weeks at the particular inclusive school at the time of the interview, she had positive beliefs about inclusive education, provided that the HI learners had academic success. After the first observation she showed me the HI learner's class test for which he achieved 70%.

4.4.1.2 Self-efficacy

Francis is of the opinion that inclusive education does not have a huge effect on her as a teacher, apart from having to wear the Roger microphone around her neck, "…because the children fitted in so well that you do not actually notice they are deaf" (ITI, 2:151).

Currently she is of the opinion that inclusive education does not have any effect on her, except for "the fact that you may have to give more attention to a child in a class after you have explained something, but at this stage it is not so much for me that it bothers me, yes" (ITI, 2:151). The inclusion of HI learners in her class does not make her work difficult as they are keeping up with the work and the pace. According to her she does not have to adapt her way of teaching. She feels she has the necessary skills to teach HI learners "because they can hear me, yes. But I do not have the skills for a child that cannot hear me, because I cannot do

[24] Francis used the word *cochlea* instead of *cochlear.*
[25] Hearing learners and HI learners.

sign language" (ITI, 2: 214). It is evident from Francis' comments that she did not yet understand the barriers HI learners have and how these should be addressed.

If she has to advise another teacher about inclusion, Francis would tell the teacher to make sure the HI learners understand, and to always keep an eye on them and check whether they copy from the board and work at the same pace as the other learners.

When asked about the needed instructional modifications for HI learners, Francis commented that she is able to make these, as sometimes the HI learners will ask you to rephrase something so that the HI learner can also understand what the instructions are. She explained *rephrasing* as follows:

> "Uhm …you say for example *simplify the following* then they will say *what is simplify?* This means that if you see it, a short summary, you have to multiply[26]. What you see you have to multiply and make it bigger. Uhm … *factorise, what does it mean?* It means make smaller, use your factorisation methods, look, is there a highest common factor, look, is it a difference of two squares? So, to factorise we make smaller again."[27] (ITI, 2:240)

The example Francis gave above to explain how she would rephrase something, is not an appropriate example. It made me wonder whether she actually understood what rephrasing is.

It is required for staff at the inclusive school to attend training on inclusive education. As the interview was in the fourth week of the academic school year of Francis' first year of teaching there, she had only received training two days prior regarding the Roger microphone[28] she had to wear around her neck and the Soundfield system[29] and how everything worked. Another training session on inclusion was scheduled for three days after the first interview.

> "But actually … if you start here, your colleagues help you with how everything works and as the year progresses they include you in all kinds of training. There is not always

[26] In the Afrikaans the word was *uitmaal*.
[27] The interview was in Afrikaans and I translated it to English.
[28] Roger microphones reduce background noise and transmit the speaker's voice directly to hearing aids or cochlear implant sound processors Phonak for Professionals. (n.d.). *Roger wireless technology*. phonakpro.com. Retrieved 19 April 2022 from https://www.phonakpro.com/us/en/about-phonak/technologies/roger-wireless.html#:~:text=Roger%20microphones%20have%20been%20developed,or%20cochlear%20implant%20sound%20processors..
[29] The Roger Dynamic Soundfield amplifies the teacher's voice. It is like a speaker. See https://www.phonak.com/com/en/hearing-aids/accessories/roger-dynamic-soundfield.html

time in the beginning of the year to do that … and yes … so what you need to know before you stand in front of the class the first day, you know."[30] (ITI, 2:139)

Regarding the question on whether she had read documentation from the South African Department of Education regarding inclusive education and/or guidelines for inclusive education, Francis answered as follows. "Uhm … yes, I must say we worked a bit on that when I did my Honours last year and the year before that … in … with inclusive education, but … yes … it is now actually the one school where you are confronted with it the whole time" (ITI, 2:217). She explained that they basically read articles for a topic she had to research, but it was not a pertinent topic. Thus, she does not know about the policy related to inclusive education.

4.4.1.3 Subjective behavioural standard

As Francis has not read the DBEs *Guidelines for responding to learner diversity in the classroom*, she does not know about the expectations within the South African policy related to inclusive education.

According to Francis, the role players when including HI learners are the teachers, the other learners in the class, the school, the director, and the people that go out of their way to ensure these children are not left behind. "Uhm … yes, everyone who actually feels, you know what, it does not bother me, have the child in the class, let him sit between the other people, other children in the class" (ITI, 2:247). When I reminded her that she spoke of speech therapy sessions earlier, she remembered other role players, such as the audiology department, and the teachers' assistants that help with the testing of the hearing aids in the mornings. Francis mentioned that one of the deputy heads is primarily responsible for the HI learners in the school.

Later on, in the interview Francis also mentioned the parents as role players as well. "I also feel that a parent should make sure that that child understands, maybe he has an extra mathematics *tannie*[31]*,* an extra science *oompie*[32] … something that might help the child" (ITI 2:275). According to Francis' last comment, it was evident that she feels the parents should

[30] The interview was conducted in Afrikaans. I translated the interview into English.
[31] *Tannie* is the Afrikaans word for aunt. However, in this case Francis refers to a lady offering extra mathematics lessons.
[32] *Oompie* is the Afrikaans word for uncle. However, in this case Francis refers to a gentleman offering extra science lessons.

make sure the HI learner understands and achieves academically. Thus, it seems that she feels the parents cannot expect from her to ensure that the HI learners achieve academically.

Francis clearly stated regarding the expectations HI learners might have of her, that they should realise they are not the only learners in the class and that she has to attend to other learners as well. “And … you know … you are not stupid because you are deaf. You are not stupid, you just have to … you might just need a little something extra that I have to tell you whatever and then you go on” (ITI, 2:273). As seen from her comments it seems that Francis believes there are other people taking responsibility for the HI learners - the responsibility is not hers.

4.4.1.4 Support for inclusion

Francis felt that inclusion works well in her class as there is support for the HI learners, the HI learners can hear her clearly through the Roger and Soundfield system, their implants are of a high quality, they attend speech therapy at the school, and they have very supportive parents.

Francis mentioned that the HI learners have people that write for them during tests. During her second interview in November 2020, at first she was not sure whether the HI learner she taught received any accommodations, then later she confirmed that the learner received rephrasing for the end-of-the-year examination. The HI learners, like any other learner, could attend extra classes three afternoons a week, on Tuesdays, Wednesdays and Thursdays, for two hours per session. The school also had daily academic lessons for additional exercises in mathematics to ensure that the learners were able to keep up. The academic lessons were for the whole school and their purpose was to help embed knowledge, but during that time Francis could separate the HI learners from the group and work individually with them if they were behind with the work.

When asked about the support she received in teaching the HI learners, Francis responded that there are teachers’ assistants. “We sometimes have ISASA[33] students who come, who study mathematics or science, who then … also act as an assistant teacher in the classroom, so that they can also provide the extra assistance. Uhm … yes …” (ITI, 2:259). During the face-to-face observations, Francis never had an assistant teacher in her classroom.

[33] ISASA refers to The Independent Schools Association of Southern Africa.

4.4.2 Debbie's beliefs about inclusion

Debbie feels strongly about the inclusion of HI learners in terms of social interaction. "And for me it's the social thing. They get to be in an ordinary social situation and it's not … the rest of the school doesn't exclude them. I think sometimes the deaf learners have more friends than other people" (ITI, 4:84). She believes that the HI learners will also benefit from the inclusion at school in their future work place. "I think for them to go into a work place it is easier for them to adapt as if they were completely excluded in a just deaf school, or something like that" (ITI, 4:84).

She feels inclusive education also has a big effect on the non-disability learners. As society teaches non-disability learners from a young age to exclude people with disabilities and that those people should attend special schools, non-disability learners being in an inclusive school realise that the disabled learners are not that different.

> "And now having them in their classrooms from such a young age, all the way up to high school…they realise that there is not actually much difference between them and that learner, the only thing different is that they don't wear hearing aids. So I think it takes that stigma away of 'you should be in a special school'." (ITI, 4:94)

4.4.2.1 Inclusive education

When asked what is inclusion / inclusive education, Debbie answered as follows:

> "So for me it's to not separate that child from an ordinary environment, ordinary main stream school just because they have hearing loss. They are involved in the class … in the class dynamic … part of the teaching … it's not a specific way of teaching specifically for them or … it's all round … they get the same teacher teaching them this as an ordinary child as the same teacher teaching them in the exact same way for the deaf learner. So for me it really is just being involved in everything … not being excluded because of their hearing loss – actually being included because of their hearing loss. Yes." (ITI, 4:72)

It is evident from Debbie's response above, that she believes she does not have to adapt her way of teaching for the HI learners in her class. Thus, she confused *inclusion* with *integration*.

Debbie has positive beliefs about inclusive education as she has seen videos of progress and success over the years of some HI learners.

> "We have seen a huge difference in … often when we go to audiology … they show us the video of the deaf learner in the beginning when they can't even say a word, and then when they are in matric. And it is absolutely amazing … some of them you don't even know … you wouldn't know they are deaf if they didn't have their hearing aids on." (ITI, 4:84)

Debbie worries about the academic achievement of HI learners as the pace of the academic curriculum can cause difficulties for them as she feels the HI learners work at a slower pace. Unfortunately, the curriculum does not allow for a slower pace.

> "The curriculum is like 'this day you need to do this, this day you have to finish it. And sometimes it's not possible and it's not only the deaf learners, it's normal learners as well. The pace is just too fast for them. And … I don't know if you can change the curriculum … hopefully people can look at that, but the pace is definitely the problem." (ITI, 4:96)

Although Debbie believes *the pace of the curriculum* causes difficulties for the HI learners, during the observation of a lesson, Debbie gave the learners the last 15 minutes of the lesson to do their calculations and during that time she sat behind her desk.

4.4.2.2 Self-efficacy

When asked whether she believes most learners with disabilities can be educated in regular classrooms, she admitted that this was a difficult question as the answer can be positive or negative. Her main concern was having learners with disabilities other than a hearing impairment. "But in Grade 8, I am not sure if I would be able to teach a deaf learner as well as a blind learner and all the ordinary learners in one class" (ITI, 4:86). Thus, Debbie does not believe she will be able to teach in an inclusive school accommodating more than one type of disability.

Debbie feels quite capable of teaching HI learners and that having HI learners in her class does not make her work difficult. "Because they … they … I don't need to make a specific worksheet for them or anything. They work off the same thing. That's the whole point of inclusion" (ITI, 4:119). She acknowledged that sometimes the HI learners might need a little bit more help. Wearing her Roger[34] around her neck doesn't bother her and it is "not much

[34] Roger microphones reduce background noise and transmit the speaker's voice directly to hearing aids or cochlear implant sound processors Phonak for Professionals. (n.d.). *Roger wireless technology*. phonakpro.com. Retrieved 19 April 2022 from https://www.phonakpro.com/us/en/about-

effort putting it on in the morning and taking it off in the afternoon. So for me I don't feel like there's any extra that we do at all" (ITI, 4:119).

Debbie is of the opinion that inclusion works well in her class as the learners have fun with everyone else. "It's not a … 'did you hear me? Did you hear me?'… It's a normal class. I don't …. I feel that they feel that they are part. We don't really say 'deaf' or 'not deaf'" (ITI, 4:90).

As this is the second year for Debbie teaching at the private inclusive high school, she had received training the whole of the previous year. She learned a lot during training and felt it was a definite need when teaching HI learners. The training focussed on the technology used to include the HI learners. She also attended training at the nearby Ear Institute where she was exposed to different factors, such as where hearing loss comes from, different diseases that cause it, how the ear looks, and how the hearing aids get moulded specifically for each child.

She also received training in terms of therapy:

> "If a deaf learner asks questions then we have to repeat it or if another learner asks a question we have to repeat it before answering. Because often the deaf learner sits in the front … they can't necessarily hear people behind them so then we often need to repeat. So we get training on how to include them into the classroom without excluding them … if it makes sense." (ITI, 4:74)

During the previous year, training had taken place every Saturday in the first term "and then it becomes like afternoons, two till five, so at least once a month last year we had some sort of training, and especially if you are a new staff, then you have to go on all these trainings" (ITI, 4:106). Even if she had received training the previous year, she would still attend ongoing training and refresher courses, now and then on Monday afternoons. "Like this Monday that has just past, we had a refresher course on our technology … we must remember that the learners need to sit in a specific spot. So we have refreshers just to keep us fresh, but *ja*[35]…" (ITI, 4:106). The head of audiology and all the audiologists were responsible for the training.

Debbie also received a course on *rephrasing* from the head audiologist at the school. She explained *rephrasing* as:

---

phonak/technologies/roger-wireless.html#:~:text=Roger%20microphones%20have%20been%20developed,or%20cochlear%20implant%20sound%20processors..

[35] *Ja* is the Afrikaans word for 'yes'.

> "So rephrasing is basically … they have learners with deaf … with hearing impairments actually struggle a lot with vocabulary and speech because there were such a delayed process for them when they were younger. They … their comprehension is limited. So when they read a sentence they don't read it in context, they read it as 'she has a dog' not as 'she has a dog because she went to adopt one'. So then we have rephrasing where we just change the word for them. If it says the … 'Concept as tertiary education' it's very difficult for the person to understand. It might be too complex for them and then we would rephrase and say 'the topic at university was difficult'. So we don't change the question or give them the answer … we literally just say it in a simpler manor for them to understand. Yes, and every deaf learner gets rephrasing." (ITI, 4:78)

The example of rephrasing which Debbie gave above, is not an appropriate example. It is interesting that Debbie did not provide a mathematics phrase that she could rephrased and it makes me wonder whether Debbie actually applied the rephrasing correctly in the mathematics class.

Debbie has had to adapt her way of teaching due to the HI learners in the class.

> "For instance turning your back towards the learners, not at all. You can't do that at all. I am a relatively fast speaker, so I had to learn how to slow down, make sure that they can see me and … cause some of them still read lips … make sure that they can see me and that they understand, that they stay concentrated. So, when I … my first year of teaching … when I wasn't teaching deaf learners, it was just go on the board, let's get it done. We now actually need to slow down, and to make sure everyone's on the right place … need to check that those learners are ok … so." (ITI, 4:123)

Debbie believed that she had the necessary skills to teach HI learners due to all the training she had received. According to her, being an inclusive teacher taught Debbie patience, a lot of caring, empathy, and respect. Debbie felt capable of making the necessary instructional modifications for the HI learners, however, she found that they were quite independent. "So they will often put up their hands and say, '*Ma'am, can you please help me, I don't understand what the questions are asking'*. So it isn't necessarily that you need to give a different instruction" (ITI, 4:146).

If Debbie were to give advice to other teachers on how to handle inclusive education, she would tell them, "Have patience. It changes you, you learn a lot" (ITI, 4:98). She saw herself as a lifelong learner and the more she could learn, the better. "And it also gives you experience. So if you want to go overseas one day or you want to go work at a special school

someday … you say but I worked with these learners, I know what these learners can do" (ITI, 4:98).

Debbie has never read the DBEs *Guidelines for responding to learner diversity in the classroom*. Thus, she does not know about the South African policy related to inclusive education.

4.4.2.3 Subjective behavioural standard

Debbie does not know of the expectations within the South African policy related to inclusive education, as she was not aware of the DBEs *Guidelines for responding to learner diversity in the classroom*.

Debbie mentioned that the school had a daily extra academic period:

> "Every day, lesson four is always extra academic period. So then the other learners are in a separate class, and then we do a worksheet, the deaf learner gets the same worksheet, except they get rephrasing with it ... so they go specifically with one person and they sit … they work through it slower. So we don't carry on with new work, it's just extra work. Just an extra worksheet just to help them get it." (ITI, 4:133)

During my observations, Debbie never used that academic period to assist the HI learners individually. She received different classes for the extra academic period each day, not necessarily the classes that she taught daily. "Another maths teacher could also have the Grade 8s. So *Monique*[36] can take the Grade 8s today and I can take the Grade 9s today. So then we end up seeing them twice a week. The school does not allow for the teachers to continue with the syllabus during the extra academic period. Currently with the curriculum it is an enrichment class to help them understand what we've done the previous week" (ITI, 4:139).

4.4.2.4 Support for inclusion

The private high school has certain technology available for the HI learners. When the HI learners walk into the classroom, they would automatically be synchronised with the class' frequency and the frequency the teacher's Roger microphone is on, as they walked past the *wall pilot*[37] in the doorway. The audiologists would, even in the mornings and during the school

[36] Pseudonym for the other mathematics teacher at the school.
[37] A wall-mounted device that automatically connects Roger™ Receivers to the classroom's hearing augmentation network Hearingloop.com.au. (n.d.). *Roger Wall Pilot*. Retrieved 25 July 2022 from https://www.hearingloop.com.au/shop/phonak-equipment/roger-wall-pilot/#.

days, walk around and check to make sure the HI learner sits at the right place and the technology is working.

The rephrasing happens officially when the HI learners are writing tests. There are small rooms available on the school premises for the rephrasing and certain staff are involved. For the IEB matric examination, the HI learners get rephrased papers, as the IEB does not allow persons to do the rephrasing of the papers. “So the paper itself is already been rephrased” (ITI, 4:80). Debbie saw some of those papers the previous year. However, mathematics does not contain a lot of wording, apart from word sums. “But if it says calculate this … eh … there’s no really other rephrased word for calculate this. So it is not that hectic in math as what it is in the languages when they write language or comprehension tests” (ITI, 4:82).

According to Debbie, the role players in the inclusion of HI learners are one of the Deputy Principals, the teacher, the therapist and the audiologists. Then, also the Phase Heads and HODs, but the person primarily responsible for the HI learners is a Deputy Principal. Her door is always open and she is willing to assist any time and come up with suggestions or contact the school’s audiology department.

> “She’ll say ‘I’ve contacted audiology, they are on their way to you, something like that for instance, when the learner’s hearing aid’s broken. I … I don’t necessarily know how to fix it. That’s a problem because now he can’t hear in class so then I contact *Hope*[38] immediately and the next thing the audiologist is in my class and they are fixing it.” (ITI, 4:152).

Debbie believes she is not primarily responsible for the HI learners in her class, but this responsibility instead lies with one of the Deputy Principals.

4.4.3 Summary of participants’ beliefs about inclusion

See the following table for a summary of the teachers’ beliefs about inclusion.

[38] A pseudonym is used for the Deputy Principal.

Table 4.4

Summary of the Teachers' Beliefs about Inclusion

Summary of the teachers' beliefs about inclusion	
Francis	***Inclusive education*** Francis agrees with inclusion under the following circumstances, if the HI learner has the necessary hearing devices, can function with his or her hearing peers, his or her hearing loss was detected at a young age and if the parents assist the learner. She has positive beliefs about inclusive education, provided that the HI learners have academic success. She feels she cannot work slower, it is the HI learner's responsibility to keep up. ***Self-efficacy*** Francis previously had experience with an HI learner at another school where she just wore the learner's Roger microphone around her neck and carried on teaching as usual. She believes she has the necessary skills to teach HI learners and believes she does not have to adapt her way of teaching. It is evident from Francis' comments that she does not yet understand the barriers HI learners have and how these should be addressed. Francis feels she is able to rephrase difficult words or phrases, however, the example she gave to explain how she would rephrase something is not an appropriate example. As her colleagues assisted her briefly on how everything works before she attended formal training, she felt she was ready to stand in front of the class the first day of school. Even though Francis had to read articles on inclusive education for her honours degree, she never read the DBEs *Guidelines for responding to learner diversity in the classroom*, thus she does not know about the South African policy related to inclusive education. ***Subjective behavioural standard*** Francis is not aware of the expectations within the South African policy related to inclusive education. It was evident that she feels the parents should make sure the HI learner understands and achieves academically. Thus, it seems that she feels the

Summary of the teachers' beliefs about inclusion	
	parents cannot expect from her to ensure the HI learners achieve academically. Francis believes there are other people taking responsibility for the HI learners - the responsibility is not hers. ***Support for inclusion*** As she was a new teacher, Francis had not yet received formal training on how to deal with HI learners in the classroom. Before the first day of school, her colleagues assisted her on how everything works before she attended formal training. From the interview it was evident that there was plenty of support for inclusion, namely, the technology that included the Roger and Soundfield system and high quality hearing aids/implants; speech therapists at the school; as well as very supportive parents. When writing tests, the HI learners also received accommodations in the form of amanuensis and rephrasing. Francis mentioned that the school had teacher students that acted as assistants in the classroom, however, during my observations she did not have a student in her classroom. The school provided opportunity for extra academic support to the learners in the form of extra classes three afternoons a week, and a daily additional academic lesson where learners could do extra exercises to keep up and embed knowledge. These were available for all the learners, but during the daily additional academic lesson Francis could withdraw the HI learners and work separately with them.
Denise	***Inclusive education*** Debbie confuses *inclusion* with *integration* as she believes there is not a specific way of teaching HI learners. Debbie has positive beliefs about inclusive education as she has seen videos of progress and success over the years of some HI learners. The pace of the academic curriculum can cause difficulties for the HI learners to achieve academic success as Debbie feels that HI learners work at a slower pace, and unfortunately, the curriculum does not allow it.

Summary of the teachers' beliefs about inclusion

Self-efficacy

Debbie feels quite capable of teaching HI learners and she is of the opinion that inclusion works well in her class as the learners have fun with everyone else. She also believes she is capable of making the necessary instructional modifications for the HI learners. She had to learn and practise not to turn her back to the learners while talking as well as not to talk while writing on the board.

Debbie believed that she had the necessary skills to teach HI learners due to all the training she had received. She received training on numerous occasions the previous year that included a training session on rephrasing. Unfortunately, the rephrase example Debbie provided did not focus on mathematics and was not clear and helpful in understanding the concept of *rephrasing.* Debbie understands the learning barriers HI learners have relating to vocabulary and speech.

Debbie has never read the DBEs *Guidelines for responding to learner diversity in the classroom*, thus she does not know about the South African policy related to inclusive education.

Subjective behavioural standard

Debbie is not aware of the expectations within the South African policy related to inclusive education.

Debbie believes she is not primarily responsible for the HI learners in her class, but that this responsibility lies with one of the Deputy Principals instead.

Support for inclusion

The private high school has Roger and Soundfield systems available for the HI learners for supporting inclusion. In the mornings and during the school day the audiologists walk around and check to make sure that the HI learners sit in the right place and that the technology is working.

The rephrasing happens officially when the HI learners are writing tests. There are small rooms available on the school premises for the rephrasing and certain staff are involved. For the IEB matric examination, the HI learners get rephrased papers, as the IEB does not allow persons to do the rephrasing of the papers.

Summary of the teachers' beliefs about inclusion	
	Debbie believes she is not primarily responsible for the HI learners in her class, but that one of the Deputy Principals is responsible instead, and their door is always open for assistance.

4.5 Theme 3: Teachers' inclusive practices

In this section the findings are presented from the observations, interviews and documentation analysis of Francis and Debbie. All discussions on the sub-themes **multiple means of engagement, multiple means of representation, multiple means of action and expression, curriculum differentiation, differentiating assessment, critical learning goals, ratio of teacher to learners, communication method, building agency, assessments, social role of the teacher, pedagogy and the learner social role, and feedback** were structured strictly according to the specific order of the sub-themes (codes) as indicated in Table 3.7[39] The additional code **effect of ERT on the teacher** is discussed under the relevant sub-themes.

4.5.1 Francis' inclusive practice

Francis acknowledges that there are different styles when it comes to teaching and "you need to do what works for you" (ITI, 2:101). It is important to her that a good teacher realises that not all learners learn in the same way. "They do not understand at the same rate" (ITI, 2:101). Francis believed that what made her teaching inclusive was having the Roger[40] and the Soundfield[41] for the learners with their hearing aids, and that she had the HI learners sit in the front of the class. She ensured their work was up to date, and she also made use of the daily academic lessons as well as the optional extra classes after school.

I observed four of Francis' mathematics face-to-face lessons to two classes. The first and third lessons I observed were with an English speaking Grade 10 class with 16 learners and with no HI learner in the class, while the second and fourth lessons were with an Afrikaans speaking

[39] Table 3.7 is discussed under Section 3.6.4: Inclusion criteria for coding the data.
[40] Roger microphones reduce background noise and transmit the speaker's voice directly to hearing aids or cochlear implant sound processors Phonak for Professionals. (n.d.). *Roger wireless technology*. phonakpro.com. Retrieved 19 April 2022 from https://www.phonakpro.com/us/en/about-phonak/technologies/roger-wireless.html#:~:text=Roger%20microphones%20have%20been%20developed,or%20cochlear%20implant%20sound%20processors..
[41] The Roger Dynamic Soundfield amplifies the teacher's voice. It is like a speaker. See https://www.phonak.com/com/en/hearing-aids/accessories/roger-dynamic-soundfield.html

Grade 10 class with 13 learners and one HI learner in the class. The topic of the first two lessons was *factorising: grouping*, while the topic of the third and fourth lessons was *fractions*.

The following table shows a summary of the different lessons observed in Francis' class and how I will refer to them onwards.

Table 4.5

Summary of Francis' Analysed Face-to-Face Lessons

Lesson	With HI or without	Topic	Reference
Lesson 1	Without	Factorising: grouping	1W/O
Lesson 2	With	Factorising: grouping	1W
Lesson 3	Without	Fractions	2W/O
Lesson 4	With	Fractions	2W

I analysed 12 ERT videos that Francis created and uploaded over the course of ERT, between 15 April 2020 and 22 June 2020; six videos for the English class and the corresponding six videos for the Afrikaans class. They were the same PP slides, but with an Afrikaans voiceover. The topics of the videos were, *Hire purchase*; *Population growth*; *Distance formula*; *Union and intersection*; *Venn diagram – extension*; and *Five number summary*. Looking at the analysed videos, Francis recorded the video, *Hire purchase* in English first, before recording the Afrikaans video. For the other five topics' videos, she recorded the Afrikaans videos first and then the English videos. The first half of the 12 videos were recorded with bilingual PP slides, where the other half had the PP slides in the language of the voiceover.

The following table shows a summary of the analysed ERT videos Francis recorded and is discussed in Section 4.5.1.8, Communication method.

Table 4.6

Summary of Francis' Analysed ERT Videos

Video	Week	Order of recording	Duration of video	Language of PP slides
(4) LESSON 2_FINANCE_HIRE PURCHASE_ENG	1	1	07:53	Both
(4) LESSON 2_FINANCE_HUURKOOP_AFR	1	2	06:53	Both
POPULASIE GROEI	3	1	03:05	Both
(12) LESSON 6_POPULATION GROWTH	3	2	03:00	Both
AFSTAND FORMULE	4	1	16:43	Both
DISTANCE FORMULA	4	2	18:28	Both
VERENIGING EN SNYDING_VIDEO	6	1	13:45	Afrikaans
UNION AND INTERSECTION_VIDEO	6	2	13:14	English
VENN DIAGRAMME_VERDERE TEORIE_VIDEO	7	1	09:43	Afrikaans
VENN DIAGRAM_EXTENSION_VIDEO	7	2	10:09	English
VYF-GETAL-OPSOMMINGS_VIDEO	9	1	08:42	Afrikaans
FIVE NUMBER SUMMARY_VIDEO	9	2	08:56	English

4.5.1.1 Multiple means of engagement

This refers to the *WHY* of learning (Dalton et al., 2012) and includes recruiting interest, sustaining effort and persistence, and self-regulation. Teachers need to implement different classroom strategies that empower their learners, providing choices for the learners, reducing learner anxiety, and rewarding their efforts (Navarro et al., 2016).

Face-to-face teaching

Francis is a well-prepared teacher that makes use of her projector and PP slides with the questions and/or answers. She has her fixed classroom strategy and does not implement

different strategies. All the learners[42] have to do the same work and do not have any choices. During the observed lessons, there was no evidence of Francis letting the learners experience the work as something relevant to their lives.

During ERT

All of Francis' videos followed the same recipe. She would greet the learners, told them what the video was about, explained a couple of examples and told them what the homework was. She did not apply different strategies nor did she provide choices for the learners. When there were definitions or new formulae, she would first read the definitions or formulae and then tell the learners how important the definitions or formulae were. She never aroused interest in the learners by showing the relevance of the more abstract work to real-life situations.

4.5.1.2 Multiple means of representation

This refers to the *HOW* of learning (Dalton et al., 2012) and includes perception, language expressions and symbols, and comprehension. Teachers must learn how to present educational resources through a variety of modalities (visual, auditory or tactile) and methods such as videos, websites, pictures etc. (Navarro et al., 2016; Rose & Strangman, 2007).

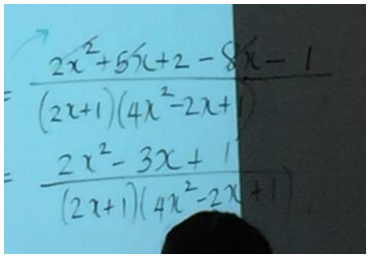
Face-to-face teaching

Francis presented her lessons in the same way to both classes[43]. She made use of her projector and PP slides. Sometimes she showed the typed answers of the questions on the PP slides. Often she projected the questions on the board and then did the calculations with a white board marker underneath the questions. This can be distracting as some of the answers needed more space and then she ended up writing in the luminous area of the board as well as in the dark part. See the following snapshot.

[42]Hearing and HI learners.
[43] One class containing an HI learner and the other class without an HI learner.

Figure 4.3

Snapshot Showing Francis Writing Both in the Luminous Area of the Board as well as in the Dark Part



Francis repeated everything verbally that she wrote on the board. Although she had a Mimio Teach[44] attached to her white board, Francis never used it.

During ERT

During ERT, Francis had to make videos where she explained the work through visual and auditory modalities. She did not use images, other than the required diagrams, in her videos. For the majority of the PP slides used in the videos, Francis managed to make use of the *animation*[45] tool properly. She organised a few Google Meet opportunities for learners to attend. Francis inserted her email address on the planning rosters and urged learners to contact her any time if they had questions. During ERT, from 15 April 2020 until 19 June 2020, Francis scheduled a meeting with the learners on Google Meet on four occasions, 13, 14 and 29 May 2020 and 5 June 2020. However, both English and Afrikaans learners were scheduled to attend at the same time. The focus of the Google Meet occasions during the month of May 2020, was to mark certain calculations, while the Google Meet occasion on 5 June 2020 was scheduled for the learners to ask questions on probability.

4.5.1.3 Multiple means of action and expression

This refers to the *WHAT* of learning (Dalton et al., 2012) and includes physical action, expression and communication, and executive function. Teachers are required to provide learners with a variety of options to practice tasks, and communicate and demonstrate what

[44] A wireless interactive whiteboard system that uses the dry erase board and projector touchboards.com. (n.d.). *Mimio Teach - Wireless interactive whiteboard system*. Retrieved 18 July 2022 from https://www.touchboards.com/mimio-teach-portable/mobile-devices/. The dry erase board can be wiped clean without the use of solvents.
[45] *Animations* are visual effects in PP where one, for example, can set the specific moment in the PP when the information should appear or disappear.

they have learned, allowing learners to capitalise on their special abilities or talents (Navarro et al., 2016; Rose & Strangman, 2007).

Face-to-face teaching

During the observed lessons, there was no evidence in either class that Francis made use of multiple means of action and expression. The learners had to do homework from either a worksheet or the textbook and did not have a variety of options to practice tasks, communicate or demonstrate what they had learned.

During ERT

Francis did not provide a variety of practice tasks per activity or for practicing the knowledge gained. The learners could not choose what to do, as everyone had to do the same tasks. The tasks were mainly exercises from the textbook that Francis would also inserted into the videos. In the case of assessments, the questions Francis gave them were mainly from old examination papers. Francis uploaded the PP slides she used to make the videos onto Google Classroom as well as the memoranda of the homework.

4.5.1.4 Curriculum differentiation

Curriculum differentiation implies differentiating the curriculum content, the learning environment, and the teaching methods such as learning materials, methods of presentation and learning activities and making use of multiple intelligences (DBE, 2011).

Face-to-face teaching

Francis' classroom contained a Soundfield to amplify her voice. Sometimes she forgot to mute the Soundfield when she explained to an individual learner at his/her desk. Francis wore a Roger Dynamic around her neck so that the HI learners could hear her through a frequency modulation system. The HI learner in her class sits in the second row from the front, directly in front of the board. Most of the time Francis talked while writing on the board. Nearly everything she wrote on the board, she repeated aloud with her back to the learners while writing, making lip-reading challenging. She wrote the daily homework on the board as well as upcoming assessments. She indicated to the notification of the upcoming assessment written on the board while facing the learners. She announced it more than once.

The chairs and tables had rubber tips on the legs, but when the learners moved their chairs they made a lot of noise. As the classroom is close to the road, the noise of the cars driving

by was highly audible. Francis' class had a few mathematics posters on the wall, but nothing related to the work Francis did with the learners during the observed lessons.

Francis tended to give more time for the class with the HI learner to answer and participate in comparison with the class without the HI learner. In doing so, the class without the HI learner (lesson 1W/O and 2W/O) had done "more" in a lesson than the class with the HI learner (lesson 1W and 2W). In both classes Francis repeated what the learners said or asked and would explain to the class if a learner did the calculation differently, but still mathematically correctly. At times, when Francis only revealed the answers in typed form on a PP slide, the discussion of that particular calculation went quicker in comparison with when she wrote the answers step-by-step.

Sometimes, in both classes, Francis called learners by name to answer and when their answers were correct, she praised them. She urged her learners to make use of different colours when doing the calculations in their books. She also used different colours when explaining. During lesson 2W she made use of more colouring pens than during lesson 2W/O. Francis gave all the learners the same differentiated worksheets that she had copied from another textbook to complete – other than the learners' main textbook.

During ERT

When Francis was asked to explain her adaptation process from being a face-to-face teacher and becoming a video recorded teacher, she responded that she explained the work in the same way, even though she could not write on a board. She made the remark that the explanation process might have been a bit slower, "like how you insert the animations and make sure the children understand, so you may have adapted your examples so that the child has a better idea of what you actually want to say or explain in the chapter" (STI, 31:336).

Francis stated that she did not do any extra accommodation for the HI learner during ERT, and that the HI learner coped well. "I think they only have those earphones or something that can help. I mean they can hear us most of the time with their cochleas[46] anyway, so you know, they were actually fine" (STI, 31:313).

Again, all of Francis' videos followed the same style. She would greet the learners, told them what the video was about, explained a couple of examples and told them what the homework was. One could only hear her as she never inserted her face into the videos. When I wanted

[46] Francis did not speak of a cochlear implants, she spoke of *cochleas*.

to confirm that she did not do anything special for the HI learner, she replied with, “Nothing, nothing” (STI, 31:319). Francis did not explain or rephrase words such as *versekeringspremie*[47], *oorvleuel*[48], *alternatiewelik*[49] and *willekeurig*[50]. Those were all words that could have caused confusion for HI learners.

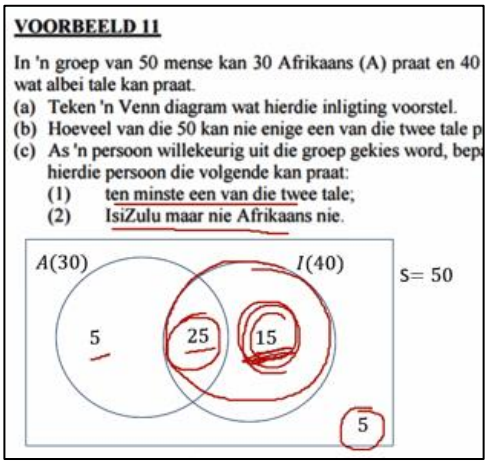
In the videos, Francis spoke quite clearly and slowly enough for the learners to follow. For the first six videos I analysed, Francis used bilingual slides with only the voiceovers in the separate languages. It was quite confusing seeing the bilingual slides and trying to figure out where on the slide she was referring to. While recording the different language voiceovers, Francis made markings with her mouse[51].

While she went through the PP slides, Francis would instruct the learners what to do, while rarely giving them the opportunity to process the information. When I compared the English videos (for the class without an HI learner) with the Afrikaans videos (for the class with an HI learner), I found mainly the same content and presentation, with minor differences of markings[52] here and there. See the following snapshot showing the differences in markings.

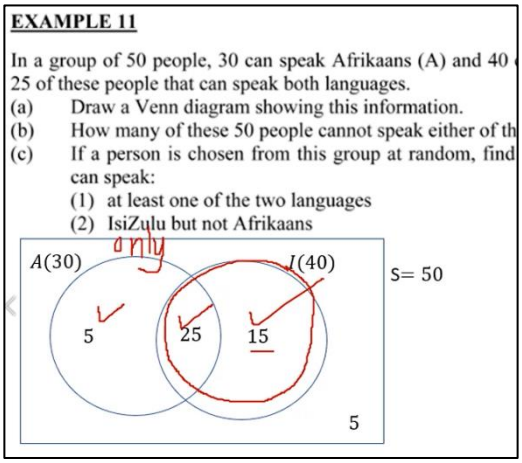
Figure 4.4

Snapshot from Afrikaans and English Videos Showing the Difference in Markings Made by Francis

Afrikaans slide



English slide



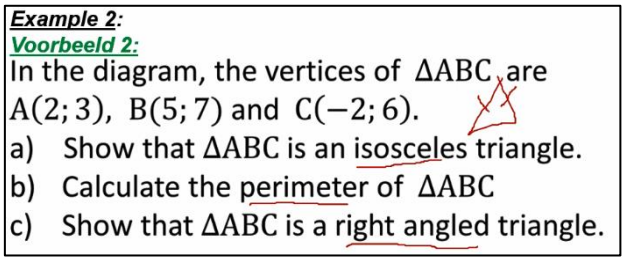
[47] The Afrikaans word for *insurance premium*.
[48] The Afrikaans word for *overlap.*
[49] The Afrikaans word for *alternatively.*
[50] The Afrikaans word for *randomly.*
[51] Additional writing from Francis on the PP slides.

Interestingly enough, for the first two videos I analysed, *Hire purchase* in English and then in Afrikaans, Francis recorded the English voiceover first. However, for the other 10 videos I analysed, Francis recorded the Afrikaans voiceover versions first. This resulted in her explaining more in depth on certain occasions in the English video compared to the Afrikaans video. She did not do additional rephrasing for the Afrikaans videos that the HI learner would have watched.

On many occasions in her videos, Francis made use of differentiated examples. When explaining the examples, Francis instructed the learners what they should do for each question. She did not give them the opportunity to think for themselves. For example 2, as can be seen in the snapshot series above, she told the learners they should use the distance formula in Question (a) to get two sides equal to each other. In the English video she drew a small isosceles triangle to remind the learners what it was, however, she did not draw it on the Afrikaans video she recorded first.

Figure 4.5

Snapshot of the English Slide Where an Isosceles Triangle Was Drawn



The homework calculations were from the textbook and mainly differentiated. When she instructed the learners to do a worksheet, the worksheet was also differentiated. Sometimes Francis made videos, in both languages, marking the homework calculations and other times she only uploaded the memoranda in PDF format. The PDF memoranda were either handwritten or typed answers.

4.5.1.5 Differentiating assessment

Alternate assessment based on modified attainment of knowledge (assess learner's mastery of grade-level content with reduced load/ more at functional level); and alternate assessment based on grade-level attainment of knowledge (this involves learners with disabilities who need for example, additional time, readers and amanuensis) (DBE, 2011).

Face-to-face teaching

For the question, '*How are HI learners assessed?'*, Francis responded with a "at this stage not much" (ITI, 2:217) as it was only the first month of the new academic year.

During the first two observed lessons, 1W/O and 1W, Francis handed the learners' assessments back to them. The assessment contained the four levels of mathematics questions, namely, knowledge, routine procedure, complex procedure, and problem-solving.

During ERT

Due to the lockdown and ERT, the learners did not write the traditional June examinations. However, they had to complete certain assessments. Francis gave all the Grade 10 learners the same four assessments to complete during the ERT period. Assessments 1–4 were given in Weeks 2, 3, 5 and 8 respectively. The assessments were on PP slides. The first two assessments were given on a bilingual PP, while the last two assessments were given separately. One for the English learners and one for the Afrikaans learners. The HI learner had to do the same assessment as the other learners.

4.5.1.6 Critical learning goals

Teachers need to identify critical learning goals. These can be guided by constants or by variables (specific goals identified for specific learners) (Whittle et al., 2020). Having clear goals is important (Carrillo & Flores, 2020).

Face-to-face teaching

Francis was well prepared for all her lessons with the necessary PP slides. When there was a scheduled double lesson on the time table, the second of the two lessons was always used for geometry. So, each period was a new lesson that she had planned containing new goals.

She was aware that there were different ability learners in her class and mentioned there could be a high ability learner sitting in front of her and doing something in advance "and then you sit there and you cannot necessarily answer the question or something like that. So, it is a … it's a constant preparation race that you need to run, yes" (ITI, 2:123).

During ERT

The private inclusive school's first term ended 20 March 2020, six days before the total lockdown. Thus, the learners did not miss out on any academic activities planned for the first

term. On 16 April 2020, the private inclusive school started with its ERT. During the first two weeks (16 – 24 April 2020), Francis' planning was as such that the learners had to do something new every day. They either had to watch a video, do homework or mark the homework calculations. It was a strict roster, typed in both English and Afrikaans. From Week 3, the rosters were separated. One for the English class and one for the Afrikaans class. According to her planning, all the learners had to do the same work. It was evident that she allowed more time for the learners to watch the videos and do the homework. Sometimes she would give the same work for two consecutive days.

During Week 6 and 7 (25 May 2020 – 5 June 2020) the rosters only contained work to be done for three days each, while in Week 8 there was again homework for each of the five days. As the learners' comeback to school was phased in, Francis had to teach Grade 11 learners face-to-face while she still had to do ERT with the Grade 10 learners for two weeks.

As Francis already had PP slides for face-to-face teaching, she had to break them down for the PP videos during ERT. She had to plan how she was going to do this, and by doing so, she determined the critical learning goals for her lessons. "So, you had to just break down the work, the whole chapter into smaller, smaller lessons obviously, because you cannot load the whole chapter at once" (STI, 31: 45).

The school had certain requirements regarding the videos, including a front page and a prescribed font and size. Originally there was no time limitation set by the school for the videos, however, the children started to complain about the data. Francis had to adapt and kept her lessons to approximately 15 minutes each. She had to determine what her goal with each lesson was. "Then you still have to, the following day, upload a PP or a type of PDF where they can mark their homework from" (STI, 31:196). She uploaded the video as well as the PP she used to make the video onto Google Classroom.

Francis explained the process of making videos as follows:

> "Well, you decide on, let say on a thing you need to explain. Like, just say you need to do probability. Now you start at the basic starting point and now you cannot, like in class, scribble like you want to and so on. So, you need to start at the basic theory. So now you need to make a PP lesson of what is the basic lesson of probability and then you need to insert a couple of basic examples into PP and everything may not show at once, like when you talk, the animations should come in. It should kind of come in while you talk, understand? And then you can actually also write on the PP as you teach and then it can actually be recorded on the video. If there is something important what I say and

would like to emphasise, then I would write on the PP itself and then they can see it while watching the video and so on." (STI, 31:172)

All of Francis' videos followed the same recipe. She would greet the learners, tell them what the video was about, explain a couple of examples and tell them what the homework was. When I wanted to confirm that she did not do anything special for the HI learner, she replied with, "Nothing, nothing" (STI, 31:319).

Francis said that she could only do three or four examples per video, as there was not enough time for more. She felt the learners would be able to do similar questions to the examples she did, because they could do them according to her examples. Unfortunately, the homework might contain types of questions she did not do in the video, however, she expected the learners to make the information their own. "But there are maybe three other sums I did not do on the board, and so he must … the information I said, make his own … *oh yes, ma'am said it, so this is the same here* … "[53] (ITI, 2:130).

It is evident that Francis did not always translate all the English words to Afrikaans words for the Afrikaans videos. So even though her critical learning goal was for the Afrikaans learners to see explanations in Afrikaans, there were times when that was not the case.

4.5.1.7 Ratio of teacher to learners

The necessary differentiation and individual support are difficult to achieve in large classes (high ratio of learners), thus, wherever possible, learners with barriers (LSEN) should be taught in smaller classes (Blatchford & Webster, 2018).

Face-to-face teaching

The first and third lessons I observed were with an English speaking Grade 10 class with 16 learners and with no HI learner in the class, while the second and fourth lessons were with an Afrikaans speaking Grade 10 class with 13 learners and with one HI learner in the class. Both classes were small classes.

She was aware that there were different ability learners in her class and mentioned there could be a high ability learner sitting in front of her and doing something in advance "and then you

[53] The interview was conducted in Afrikaans. I translated the interview into English.

sit there and you cannot necessarily answer the question or something like that. So, it is a … it's a constant preparation race that you need to run, yes" (ITI, 2:123).

During ERT

Even though Francis only taught two classes Grades 10s and 11s during the face-to-face teaching, she was tasked with taking responsibility for all the Grade 10s and 11s during ERT to prevent teachers from sharing Grades during ERT. This resulted in her getting one Grade 10 and one Grade 11 class additionally that were the HOD's classes. Thus she had approximately 60 learners for each Grade that she was responsible for.

4.5.1.8 Communication method

Once teachers had their learning goals, they had to decide between either synchronous or asynchronous learning strategies (Whittle et al., 2020).

Face-to-face teaching

Since the beginning of the year and before the lockdown, the teachers had access to Google Classroom where they could upload worksheets and the learners could access them asynchronously. It was not as intense. "We uploaded things like a worksheet or a date. Those were not submissions of assessments and stuff like that" (STI, 31:81). Francis was already familiar with Google Classroom, however, during lockdown "we just integrated it more" (STI, 31:89).

During ERT

At the beginning of total lockdown, March 2020, the school expected the teachers to upload videos for the learners. "But the school was just … uhm … they only had the opinion that we teach online, but actually in the form of videos" (STI, 31:45). As the private school already had holidays, the principal contacted the teachers and let them know to start making video lessons as soon as possible.

Francis clearly stated that there is a difference between live videos and *online*. "We did not really teach online, well I did not. So, there was never, if I may say so, a live class on my part. Never" (STI, 31:103). She interpreted *online* as synchronous teaching. During ERT the method of communication she applied was asynchronous. "So, we had to make videos that we had to upload onto Google Classroom" (STI, 31:45). "And yes, the videos … we had to make a hell of a lot of videos. So, between 12 and 16 a week" (STI, 31:52). When recording the videos, she had to find a quiet place. "Then you start recording the video. You insert your voice and

then there is something interrupting you and then you have to record it again and then there is something that interrupts you again" (STI, 31:188).

For Francis, the whole process was to first plan, then do the lesson and give homework, and then the following day upload the next lesson and the answers of the previous day's homework. Then the learners needed to mark it and "then you have to contact them on Google Classroom if they have any questions" (STI, 31:196).

The following table shows a summary of the analysed videos Francis recorded.

Table 4.7

Summary of Francis' Analysed ERT Videos

Video	Week	Order of recording	Duration of video	Language of PP slides
(4)LESSON 2_FINANCE_HIRE PURCHASE_ENG	1	1	07:53	Both
(4) LESSON 2_FINANCE_HUURKOOP_AFR	1	2	06:53	Both
POPULASIE GROEI	3	1	03:05	Both
(12) LESSON 6_POPULATION GROWTH	3	2	03:00	Both
AFSTAND FORMULE	4	1	16:43	Both
DISTANCE FORMULA	4	2	18:28	Both
VERENIGING EN SNYDING_VIDEO	6	1	13:45	Afrikaans
UNION AND INTERSECTION_VIDEO	6	2	13:14	English
VENN DIAGRAMME_VERDERE TEORIE_VIDEO	7	1	09:43	Afrikaans
VENN DIAGRAM_EXTENSION_VIDEO	7	2	10:09	English
VYF-GETAL-OPSOMMINGS_VIDEO	9	1	08:42	Afrikaans
FIVE NUMBER SUMMARY_VIDEO	9	2	08:56	English

From the table, it can be seen that Francis only recorded the first topic's video with English voiceover before the Afrikaans voiceover video[54]. From there on, the Afrikaans videos were recorded before the English videos per topic. For the first six videos, Francis made use of a bilingual PP to record and did not always differentiate between the different languages with colour. However, for the last six videos, Francis made separate PP slides for each language.

When Francis recorded the *Hire purchase* video, she did the English voiceover first. Then, when she recorded the Afrikaans voiceover afterwards, she spoke a bit faster and almost as if she was in a rush. Similarly, when she recorded the English videos after the Afrikaans videos, she talked a bit faster. It seemed that she was then more familiar with the recording and more comfortable with the content appearing at certain stages in the videos. However, for the videos *Distance formula; Venn diagram_extension;* and *Five number summary*, the second recordings were longer. During those videos, Francis explained in a bit more detail, as can be seen in the following example from the *Distance formula* video.

Figure 4.6

Snapshot of Where Francis Explained in More Depth during the English Recording

Slide from Afrikaans video

$$k^2 - 10k + 9 = 0$$
$$(k-9)(k-1) = 0$$
$$k = 9 \quad \text{or} \quad k = 1$$

Slide from English video

$$k^2 - 10k + 9 = 0$$
$$(k-9)(k-1) = 0$$
$$k = 9 \quad \text{or} \quad k = 1$$

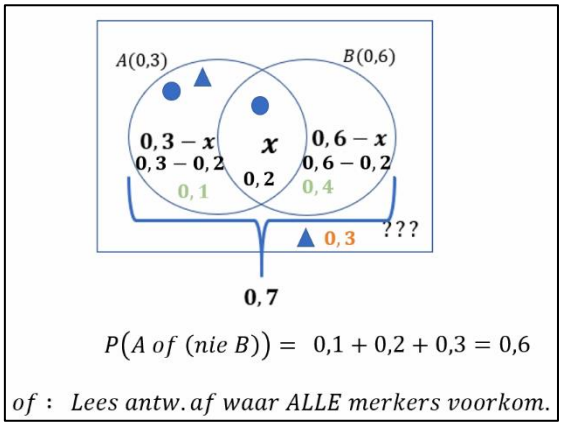
Francis reminded the English learners how to factorise the quadratic trinomial of $k^2 - 10k + 9 = 0$, but she did not remind the Afrikaans class. She only gave the answer.

Francis said that when she wanted to emphasise certain things, she had to write with the mouse and it came out a bit wobbly. However, at the end of lockdown someone told her about animations that she could have used that she was not aware of. Luckily Francis could have typed the mathematical symbols when she inserted *equations*. She could have even inserted Venn-diagrams or she could have drawn them herself, but it was quite time consuming.

[54] The English videos were for the class without an HI learner, while the Afrikaans videos were for the class containing the HI learner.

Figure 4.7

An Example of a Venn-diagram from the Afrikaans Video Francis Created and Inserted



In the beginning Francis watched the videos before she uploaded them, however, “at one stage I was so pushed for time, I sent them through the way they looked. There was nothing fancy or so, but time was one’s greatest, greatest enemy” (STI, 31:220).

When asked to describe a perfect online lesson, Francis responded with:

> “I think where all the children have internet, where all the children have self-discipline to engage punctually in the lesson. You know if you know your meeting is 10:00, or your lesson is 10:00, then you are not going to turn on your laptop at 10:00. You know. And I think with the right technology where I as a teacher might have a visualiser, where the children can see my hand and I can share that screen with them where they sit in their homes and there is feedback, understand.” (STI, 31:690)

At the end of the second interview, Francis said that she wondered whether she would have been less stressed if they did synchronous teaching instead of asynchronous teaching. “But then you sit again with children who do not engage, lessons you have to repeat, parents who drive you crazy” (STI, 31:873).

4.5.1.9 Building agency

The building of agency refers to the learners’ ability to learn in their own homes and at their own pace, and might give teachers the opportunity to engage learners on topics and approaches of particular interest, instead of general lessons and formats (Whittle et al., 2020).

Face-to-face teaching

All the lessons Francis taught were general lessons and all the learners in Francis' class had to do the same work. She did not use topics and approaches of particular relevance to the learners' lives with a view to engaging them in the lesson content.

During ERT

Francis noted that the whole ERT process required self-discipline from the learners' side as it was their responsibility to watch the videos, do the homework and contact her on Google Classroom if they had any questions. She also told me:

> "But yes, the other thing, there was obviously no feedback from a child, because they, they are, you do not even know when they are watching the video. So, you do not know when, or they really understand what you said, because there is not a child in front of you who can say … do you understand or whatever." (STI, 31:336)

Francis did not use ERT as an opportunity to engage learners on topics and approaches of particular interest. Her videos were general lessons.

4.5.1.10 Assessments

Assessments can be individualised using technology to showcase the learning and skills of learners and large-scale standardised testing may become outdated (Kaden, 2020).

Face-to-face teaching

During the last two observed lessons, 2W/O and 2W, Francis handed the learners' assessments back to them. The assessments contained the four levels of mathematics questions, namely, knowledge, routine procedure, complex procedure, and problem-solving and the learners had to write the answers on the given paper.

While teaching, Francis referred to questions that the learners might see in a test again and on one occasion she showed the learners where they would get marks in a particular calculation. Francis taught the learners in such a way that they would be able to follow correct procedures in a test. When the learners had to factorise $3x^4 - 3x^2 - 27x^2 + 27$, she said:

> "Uhm … not a really nice sum, because can you see there are actually like terms there. So, this won't happen in a test or an exam, you see? There won't be like terms that you can add or subtract or such…" (TO, 9:84-86)

She did not realise that the calculation could be done with a different method as well.

During ERT

Francis was responsible for all the Grade 10 and 11 assessments as the other teacher (the HOD) that originally shared the Grades with her during face-to-face teaching, gave Francis her classes to manage.

In between the making of the videos, the learners had to do assessments. Every two to three weeks when she was done with a chapter, the learners would get an assessment to complete. The assessments were worksheets that she uploaded on Google Classroom. She would allow the learners two or three days to complete these and then they had to submit their answers via Google Classroom. The way they did this was to write their answers on a piece of paper, scan it and upload it on Google Classroom. Then Francis would mark the assessments and upload the marks.

The marking of the assessments was quite a cumbersome and time consuming process. As the learners uploaded their assessments, Francis saw these as PDF documents on a computer that she could not mark on her computer screen. She did not print the learners' assessments because, "Who is going to pay for all that ink now?" (STI, 31:363).

She explained her method of marking the assessments:

> "I just sat with an A4 paper next to me, then I just write the child's name on top, now say it is finances they had to do, then it's just like there you now have one point less. Then I just write on the A4, minus one at question 1.1, then it's at question 3.3, minus two, and then I just tried to keep up with what they did incorrectly and then I just give them their marks and at the end I write but you made a mistake at 1.1, you swopped *a* and *p*. You made a mistake at 3.3, you never multiplied with a 100 and changed to percentage or something like that. Understand? It was incredibly time consuming, because when assessments come in then you can just know you are out all day for any other task or something, because then all those 10s or 11s submit their work. Then you still have to keep track of everyone's children and marks and stuff and then you still have to read it onto your own spreadsheets and you have to write a short personal report for each child on how, what, where did they go wrong, because otherwise they pester you all the time, what did I do wrong, where did I lose marks, you know." (STI, 31:344)

All the learners had to do the same assessments. The first two assessments were given on a bilingual PP, while the last two assessments were given separately, one for the English

learners and one for the Afrikaans learners. It is evident that Francis made use of images from old examination papers on the prescribed PP slides that she converted to a PDF document.

4.5.1.11 Social role of the teacher

Teachers build relationships with parents to gain insight into the learners' needs and their environmental constraints. This parental connection provides "context for the social presence of the teacher" (Whittle et al., 2020, p. 317).

Face-to-face teaching

In the first interview Francis said that, "I also feel that a parent should make sure that that child understands, maybe he has an extra mathematics *tannie*[55], an extra science *oompie*[56] … something that might help the child" (ITI 2:275). After handing out the learners' class tests (during 2W/O and 2W), Francis requested from the learners that the parents sign the tests.

Francis was comfortable with the learners. She knew the names of the learners in her class and would sometimes call their names to participate in the lesson. She tended to ask more learners by name in the class with the HI learner compared to the class without the HI learner. When learners wanted to show Francis their methods, she went to their desks and looked at the learners' work.

During ERT

The school expected from the teachers to often be in contact with the learners and as Francis did not receive emails on her phone, "our computers had to be on the whole time, your phone had to be close. If the school was looking for you, you had to be available. That was just the arrangement" (STI, 31:229).

Francis said the HOD of Mathematics at the school assisted the mathematics teachers regarding contact with the learners. Although the HOD mainly contacted the learners, Francis had to write emails to the parents now and then from her side, but the HOD would still have done the final follow-up.

[55] *Tannie* is the Afrikaans word for aunt. However, in this case Francis refers to a lady offering extra mathematics lessons.
[56] *Oompie* is the Afrikaans word for uncle. However, in this case Francis refers to a gentleman offering extra science lessons.

> "But our HOD also took over most of the contact. You know where children had to be contacted personally, she did it. Children that did not, for example … you know … submitted work or something like that, she did the contact. (STI, 31:52)

Francis stated that she did not do any extra accommodation for the HI learner during ERT, and that the HI learner coped well. "I think they only have those earphones or something that can help. I mean they can hear us most of the time with their cochleas[57] anyway, so you know, they were actually fine" (STI, 31:313). When asked whether all the learners had access to the internet and if not, how the school handled it, Francis replied that she did not think everyone had internet in the first week, however, the learners made plans – even if they had to go to their family's homes. "Then here and there, there was an individual child that we just sorted out. Me, I was not actually involved in it, but we did not print anything or so" (STI, 31:305). Francis also reported on parents emailing her saying "Sorry, the child cannot submit the work, because they have internet problems, or they do not have electricity[58], or the child will only watch the videos over the weekend and the week after that submit the work" (STI, 31:123). The learners used their night time data to download the videos. Francis experienced chaos when keeping track of all the learners and their apologies.

4.5.1.12 Pedagogy and the learner social role

A social-driven pedagogical approach to enhance learner engagement and participation (Whittle et al., 2020) can be achieved by employing a problem-posing pedagogical approach (Olawale et al., 2021).

Face-to-face teaching

During lessons 1W/O and 2W/O, the learners barely participated and Francis just continued with her explanation. Francis did not necessary wait for the learners to answer her questions. She would ask a question and immediately give the answer. During lesson 1W and 2W, on the other hand, the learners asked so many questions and participated to such an extent that Francis could not complete the same amount of work as she had in the other class. In both classes Francis did the same content, with barely any problem-solving approach that would get the learners to construct their own understanding.

[57] Francis did not speak of a cochlear implants, she spoke of *cochleas*.
[58] The lack of electricity was due to *load shedding.* This occurs in South Africa when the demand for electricity exceeds the available supply. It is controlled by a rotating schedule of deliberate shutdown of electric power in parts of the power-distribution system.

During ERT

Francis reported that children were less engaged in their learning.

> "There were constantly parents emailing and saying, sorry, the child cannot submit the work, because they have internet problems, or they do not have electricity, or the child will only watch the videos over the weekend and the week after that submit the work." (STI, 31:123)

Francis did not know whether Google Classroom could monitor which learner opened a video to watch it. She was not sure if they did their work and if there was something they did not understand. She mentioned that they copied many of the assessments from others and that was hard to determine whether all the learners understood what was going on, as she did not see them. Due to ERT, the learners did not write a mid-year examination during June 2020.

4.5.1.13 Feedback

Learners need to receive feedback relating to progress and assessments, for example, teachers should make use of alternative feedback strategies, such as non-graded formative feedback, self-feedback and peer feedback (Whittle et al., 2020).

Face-to-face teaching

When Francis was requested to elaborate on her teaching methods, she mentioned that, "I walk through the class all the time to make sure everyone understands what I said – everyone can do the homework and so on" (ITI, 2:229). She commented during lesson 1W/O that she saw some gaps at certain questions when she walked through the class to check the learners' homework. She urged the learners to test whether their grouping of the terms was correct, as there should be a common bracket. Francis was not shy to compliment learners when they answer something correctly and she also wrote some comments on the learners' assessments.

During ERT

The feedback Francis gave her learners, were their marks and a short report for their assessments. She also mentioned that she had to answer the learners' questions on Google Classroom.

4.5.1.14 Effect of ERT on the teacher

Francis reflected on the ERT process as, “Yes, it was quite rough, you hear. I'm not going to lie to you, it was rough, it was very rough, yes” (STI, 31:73). To be able to make videos, Francis had to have a laptop, knowledge of the PP computer programme, knowledge of how to actually do a voiceover on a PP, and how to convert the PP to a video as well as how to upload the video. “I had to learn everything myself” (STI, 31:140) and with the help of *Google* she gained the knowledge on how to make and upload a video herself.

She was quite pleased with herself.

> “I'm proud of those, of the lessons. I'm proud of how they actually improved, versus you know closer to the end. I think, yes, I look back, I do not know where I got the time, well obviously I slept very little … uhm … but I cannot, I cannot think, I cannot believe I, actually pulled it together, yes. It was for me actually, I cannot believe I made it. I'm proud of the lessons, they are not all perfect, but many of them I think, sherbet, if I could have watched something like that at school, you know you always think ooh, then I would have understood. Uhm … yes I think the, I think the lessons came together well at the end of the day.” (STI, 31; 767)

The implementation of ERT was not smooth. They had trouble with learners not having data or the learners not being able to log in. The learners used their night time data to download the videos. Francis experienced chaos when keeping track of all the learners and their apologies. During lockdown she was quite stressed as she did not know whether she would be able to finish the syllabus and “do the children understand … what are you going to have to repeat again, you know” (STI, 31:650).

Francis wished she received some training.

> “It was difficult with COVID, because you cannot call everybody together and say, come quickly, an online … let us quickly have a training session. But I feel there might have been opportunities for them to tell us, you know what, 10:00 tomorrow morning everybody sits with their laptops – we are going to give you a crash course while someone from the IT department share their screens and teach you how to do the basic things. But yes, it never happened like that, so I googled everything myself, looked it up and so on” (STI, 31:148).

When asked about the challenges Francis experienced during ERT, she responded that the learners did not have data and it was a challenge for her to find time to make the videos. She

also struggled to find a quiet place where she could record the videos. Francis could not stay ahead to buy data, and during ERT they changed their internet package at home to being *uncapped*. “Yes, ag[59], and I think that my biggest problem was that the school forgot that you had your own life at home” (STI, 31:229). It was difficult for Francis, apart from recording the videos, answering questions on Google Classroom, and being available for communication from the school, to make time for her own children and her household. At a stage she felt that if she was in a position to resign, she would have, “because it was extremely rough, yes” (STI, 31:229).

Finding time for assisting her own children with their school work was quite difficult for Francis and many times she could only spend time with them in the late afternoons. There was a time where she had to ask her mother to help. “I had to tell my mom, you have to help now. I, I have to upload six videos tomorrow and I have only made two” (STI, 31:259).

Francis said she did not enjoy working from home during ERT, “I struggled a lot to keep all the … juggled all the glass balls the whole time. It was quite rough” (STI, 31:840). At one stage her laptop’s fan was making such a noise that she had to drive to one of the directors’ houses to fetch another laptop so she could continue with her duties. She wished that she had access to all the apps that are available to assist with ERT. “I mean now there are apps coming out that you did not even know of and then you think to yourself, good mercy if I only knew about that” (STI, 31:690).

Francis is not planning to make use of online learning post lockdown. “I hope not. I do not like technology. Yes, it is… it scares me” (STI, 31:712). She also felt that after ERT she was fine with the technology, however, she wished for, “Maybe a little more training in terms of Google Classroom, maybe. Maybe just a nice, just a nice detailed training, but yes” (STI, 31:814). Francis felt that although lockdown forced one to work in a different way, one would go back to teaching the same as before.

4.5.2 Debbie’s inclusive practices

When Debbie was asked to describe her inclusive practices, she mentioned rephrasing, the extra academic period and tutorials. She explained what tutorials were when she said, during tutorials learners “get specific help on the subject that they need help on. So some of them are very week in their languages so they get extra help in their languages, because of their

[59] An Afrikaans word expressing a sigh.

comprehension problems" (ITI, 4:131). She did not mention how she applied mathematics tutorials.

I observed four of Debbie's mathematics face-to-face lessons to two classes. All of Debbie's observed lessons were taught in English and for Grade 9 learners. The first and third observed lessons of Debbie were to a class of 23 learners with supposedly no HI learner. However, I saw a learner with two cochlear implants in the class and asked Debbie if there were no HI learners in the class. Debbie confirmed that there were no HI learners in the class. When I enquired about the situation, the school said that there was a request from the learner's parents that the learner should not be seen as part of the hearing impaired learners' cohort[60]. The second and fourth observed lessons included one HI learner from a class of 21 learners. The topic of the first two lessons was *Rate*, while the topic of the third and fourth lessons was *Exponents: law 6, negative exponents*.

The following table shows a summary of the different lessons observed with Debbie and how I will refer to them onwards.

Table 4.8

Summary of Debbie's Analysed Face-to-Face Lessons

Lesson	With HI or without	Topic	Reference
Lesson 1	Without	Rate	1W/O
Lesson 2	With	Rate	1W
Lesson 3	Without	Exponents: law 6, negative exponents	2W/O
Lesson 4	With	Exponents: law 6, negative exponents	2W

For the duration of ERT, the teachers had to make videos and "… there was a certain time table that was set up by management on which days you would then have to upload these videos" (STI, 1:29). As the HI learner was in the English class and the class without an HI learner was also an English class, I analysed six ERT English videos from Debbie that she uploaded over the course of ERT, from 15 April 2020 to 22 June 2020. All the English speaking learners (hearing and HI) had to watch these videos. The topics of the videos were: *Revision*

[60] See Table 3.8: Exclusion criteria for coding the data.

of geometry; *The theorem of Pythagoras*; *Surface area and the volume of cube and rectangular prism*; *Organising data; Interpreting graphs*; and *Compound events and tree diagrams*.

The following table shows when Debbie recorded the analysed ERT videos and their duration.

Table 4.9

Summary of Debbie's Analysed ERT videos

Video	Week	Duration of video
Revision of geometry grade 9 video 1	1	05:47
The theorem of Pythagoras grade 9 video 3	2	07:52
Surface area and Volume of cube and rectangular prism grade 9 video	4	13:49
Organising data grade 9 video	5	07:50
Interpreting graphs	6	06:29
Compound events and tree diagrams	8	16:38

4.5.2.1 Multiple means of engagement

This refers to the *WHY* of learning (Dalton et al., 2012) and includes recruiting interest, sustaining effort and persistence, and self-regulation. Teachers need to implement different classroom strategies that empower their learners, provide choices for the learners, reduce learner anxiety, and reward their effort (Navarro et al., 2016).

Face-to-face teaching

Debbie said she likes to explain reality to the learners and make use of real-life examples, such as for financial mathematics. "… going to the shop … you see the TV? The TV costs R14 000, but then it says R233 a month for 24 months. Let's work out what it's going to cost you …" (ITI, 4:144). By doing so, she arouses interest in the learners. When analysing the face-to-face lessons, it occurred that Debbie gave real-life examples when explaining *Rate*, however, not all of them were realistic. During lesson 1W[61], she changed the example from lesson 1W/O of "a car travels at 200 km/h in 2 hours' time" (TO, 12:137) to "I ran 200 km in 2

[61] Refer to paragraph 4.7.2 regarding the reference method. E.g. 1W refers to lesson 1 for the class with an HI learner and 1W/O refers to lesson 1 for the class without an HI learner.

hours" (TO, 5:101) and added "I wish" (TO, 5:101). When I asked her why she changed the examples, she said she does not have set examples. She just goes as she teaches and makes up similar examples, and sometimes she cannot always remember the exact example she used in the previous class.

Debbie prefers for the learners to try doing examples themselves before she tells them what to do. First she will write the question on the board, then often she will read the question to the learners and ask them to try to solve it. Sometimes she does not read the question to the learners. However, at times during the observed lessons, she started guiding the learners just a couple of seconds after she instructed them to try the calculations themselves. Debbie never provided the learners with choices.

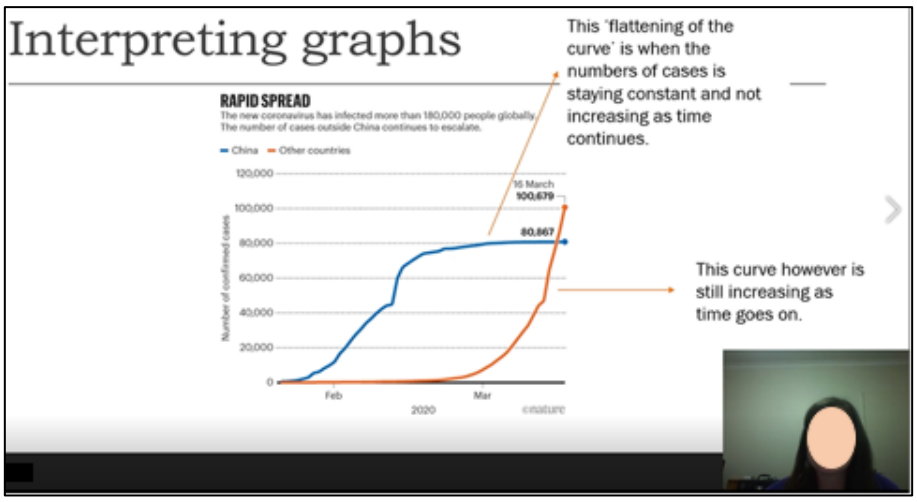
During ERT

In her videos, Debbie tried to keep the learners' interest by referring to every day, real-life situations and how mathematics related to other subjects. She used the example of a swimming pool to explain the difference between area, perimeter and volume. She said the area was when one would tile the bottom of the swimming pool, the perimeter would be all around the swimming pool, and the volume will be the amount of water to fill the swimming pool. Debbie did not show an image of a swimming pool indicating the differences between area, perimeter and volume.

Another example of how she referred to everyday situations, was when she did the video *Interpreting graphs.* She discussed the importance of being able to interpret a graph and referred to graphs in Life Orientation and Life Science. She also told the learners that even they were interpreting data daily. For example, when a friend came to school agitated, you are interpreting the data to determine how you will react on the information you received. Then she showed them a graph of the rapid spread of the COVID-19 virus and discussed what it meant when a curve was flattening or when it was still increasing as time went on. See the next snapshot

Figure 4.8

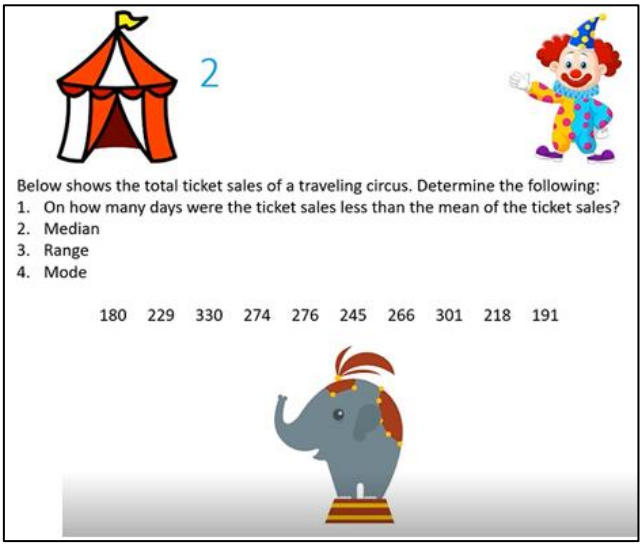
Snapshot of a Relevant Graph to get the Learners' Interest



Debbie often made use of images on her slides and different background colours. See the following snapshot.

Figure 4.9

Snapshot of 'Fun' Images Relating to the Work



By inserting 'fun' images, as seen in the previous snapshot, Debbie may have reduced learner anxiety.

4.5.2.2 Multiple means of representation

This refers to the *HOW* of learning (Dalton et al., 2012) and includes perception, language expressions and symbols, and comprehension. Teachers must learn how to present educational resources through a variety of modalities (visual, auditory or tactile) and methods such as videos, websites, pictures etc. (Navarro et al., 2016; Rose & Strangman, 2007).

Face-to-face teaching

During the observed lessons, Debbie mainly made use of the white board and white board markers – even though there was a *Mimio Teach*[62] attached to the white board. When explaining Law 6 of exponents, namely negative exponents, Debbie made use of a story to explain the law, showing $a^{-m} = \frac{1}{a^m}$. For 2W/O she said (TO, 7:40-69):

D[63]*:* *You will never leave your answer in a negative exponent. You will always have to change it to a positive exponent. And this is the law that you use* (indicates at $a^{-m} = \frac{1}{a^m}$ written on the board). *So, it seems very confusing, but I am going to tell you a little story. That's correct right? That's the same as a to the power of negative m* (indicating to $\frac{a^{-m}}{1}$ she just wrote on the board). *Okay. So now this is the ground floor of an apartment* (indicates the 1 written in the denominator) *and this is the top, first floor of the apartment* (indicates the a^{-m} written in the numerator). *So now Apple over here is very unhappy* (indicates the a) *because now he's living on the first floor and he's not allowed to have pets. Because where are the pets gonna go do their business? Okay. So, when he's unhappy at the top* (circles the negative exponent in the numerator), *he wants to move down to the ground floor* (draws an arrow from the numerator to the denominator). *When he moves down to the ground floor he becomes?* (Writes $\frac{1}{a^m}$ on the board.)

L[64]*:* *Positive*

D: *Happy, because now he's living where he wants to live. Okay. What if I have something like this?* (Writes $2x^{-2}$ on the board). *Now I want to change this negative exponent to a positive exponent. Right? But I know this whole thing is actually over one* (writes the 1 in the denominator). *But now living on the first floor is 2 … and* x^{-2} *they both live on*

[62] A wireless interactive whiteboard system that uses the dry erase board and projector touchboards.com. (n.d.). *Mimio Teach - Wireless interactive whiteboard system*. Retrieved 18 July 2022 from https://www.touchboards.com/mimio-teach-portable/mobile-devices/.
[63] ***D*** refers to Debbie speaking.
[64] ***L*** refers to a learner speaking.

the first floor. The 2 is happy because it has a positive exponent (indicates the 2). *Two is happy living upstairs. But this x is unhappy living upstairs* (circles x^{-2}). *So I move him to ground floor which then gives me …* (draws an arrow to the denominator's position and writes $\frac{2}{x^2}$ on the board). *So, I make it happy. So you only move the base that has a negative exponent.*

Later the day, Debbie told 2W the following (TO, 6:100-130):

D: *So the way you must think about it … is this* (writes a^{-m} on the board) *the same as this* (writes $= \frac{a^{-m}}{1}$ on the board next to a^{-m})

Ls[65]: *Yes*

D: *Yes, because anything over one is just itself. Correct? Now, I don't want negative exponents. Let's think about it this way. The one, this is seen as the ground floor of a complex* (indicates at the denominator with the 1). *And this is seen as the first floor* (indicates the numerator).

Ground floor, first floor (indicates again the separate positions while talking). *Now Apples on top here* (indicates the a in the numerator)*, is very unhappy, because Apples wants a dog. But now Apples can't have a dog because Apples is on the first floor. That is why Apples is unhappy … negative exponent* (indicates the negative exponent while she talks)*, Apples is unhappy. So in order to make Apples happy we're going to move him to the ground floor so that he … uhm … can have a dog. So I just move that to the bottom* (draws an arrow from the numerator to the denominator). *Is it fair to say that there's a 1 here* (draws a broken line 1 in front of the a^{-m} in the numerator). *There is a 1 there?*

Ls: *Yes*

D: *So I leave the 1 there, because the 1 is happy. And there's not actually anything there, so it becomes 1 over* (writes $\frac{1}{a^m}$ while she talks). *It becomes positive because now Apples is happy that this … he is on the ground floor. Cause now she can have a dog. Right. Please be careful when I say "I moved downstairs". I didn't switch the two around. I didn't switch the fraction. It might look like I switched the fractions but I just moved from the top to the bottom.*

At a later stage, during lesson 2W, Debbie gave the learners another example to try first, namely $-4y^{-2}$. The explanation then continues as follows (TO, 6:177-194).

[65] ***Ls*** refers to learners answering simultaneously.

D: *Okay, it's fair to say this is over 1?* (She draws an "over 1" underneath and now the calculation looks like this: $\frac{-4y^{-2}}{1}$)

Ls: *Yes*

D: What is unhappy?

HIL[66]: *The negative four and the y.*

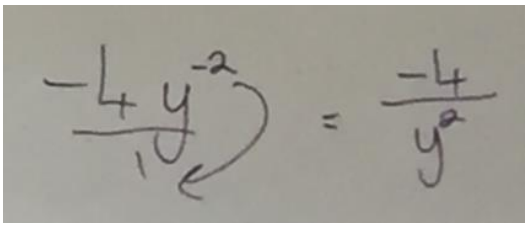
D: *No*

Ls: *The y.*

D: *Only the y with the negative 2. I said, move only the base with a negative exponents.* (She talks slowly and with emphasis.) *Not a coefficient … exponents. Negative four still has a positive exponent. It's happy there.* (Indicates to the -4.) *The only thing that has a negative exponent is the y* (Indicates to the y.) *So that is what I then move to the bottom.* (Draws an arrow from the y^{-2} in the numerator to the 1 in the denominator.) *So then I have -4 left on top and then y² at the bottom*. (Writes on the board while speaking.) *You only move what has the negative exponents. Everything else … it stays where it is.*

Figure 4.10

Snapshot of What Debbie Explained on the Board



Debbie did not realise that the story she used as an explanation was flawed. The learners did not grasp what she wanted them to know and were not able to apply regarding negative exponents.

After doing examples on how to deal with negative exponents with 2W/O, Debbie projected a worksheet on Law 6 of exponents, negative exponents, on the white board. The worksheet was from *2011 Kuta Software LLC* that Debbie got from the internet. She instructed the learners to first copy the questions before doing so, as she needed to move the content up,

[66] Refers to the HI learner.

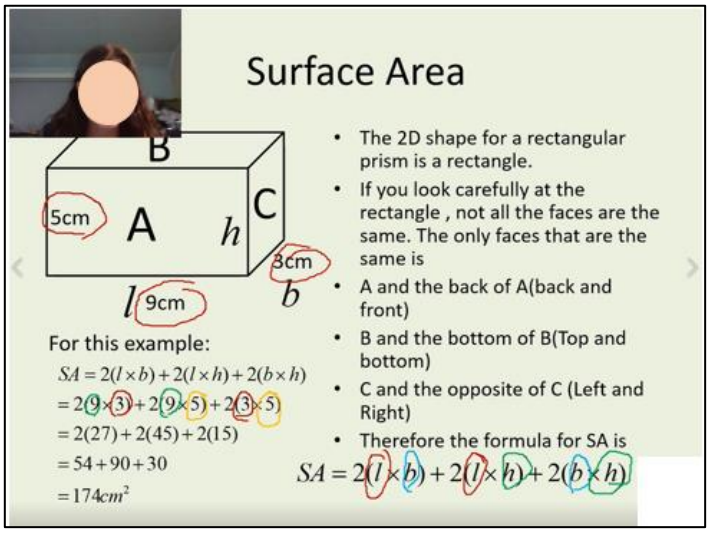
and not all the calculations were visible at once. Later the day with 2W, Debbie handed out the copied versions of the worksheet.

During ERT

During ERT, Debbie had to make videos where she explained the work through visual and auditory modalities. In some videos, Debbie inserted her face as part of the video feed and used the opportunity to show learners manipulatives as she would have done during face-to-face teaching. She also inserted images into her PP to assist in her explanation. See the following snapshot.

Figure 4.11

Snapshot of an Inserted Image to Assist Explanation



The information on the PP slides Debbie made, did not appear at once. She made use of the *animation*[67] tool in PP.

Debbie also organised a few Google Meet opportunities where the learners could ask questions.

> "… we would have something called Google Meet because we would use Google Classroom. It also has like for instance a zoom function and that would be just for when the learners asked questions, stuff like that, it wouldn't be a live class where I was for instance explaining a topic." (STI, 1:35)

[67] *Animations* are visual effects in PP where one, for example, can set the specific moment in the PP when the information should appear or disappear.

4.5.2.3 Multiple means of action and expression

This refers to the *WHAT* of learning (Dalton et al., 2012) and includes physical action, expression and communication, and executive function. Teachers are required to provide learners with a variety of options to practice tasks, communicate and demonstrate what they have learned, which allow learners to capitalise on their special abilities or talents (Navarro et al., 2016; Rose & Strangman, 2007).

Face-to-face teaching

According to Debbie, sometimes she makes a game out of the mathematics lesson.

> "So for instance when it comes to terms … how many terms are in an expression … then I know some of them might get five and others might get six. Then I say ok, who got five? Everyone go to that side of the classroom, who got six? Everyone else go to the other side of the classroom. Then I say, you have to elect one person to explain how you got to your answer. Then it actually causes a debate between the two, because this one knows they got six and this one knows they got five … to eventually … it's healthy competition to … and then I say 'drum roll please' and then I say 'no, it is six terms' and everyone just goes crazy and … so I just try to involve everything … try to make the examples fun, not necessarily sit in the class and write down examples. Then I show them where they went wrong, and if they got it right, how they got it right … and I think that helps a lot … yes." (ITI, 4:144)

During the observed lessons, there were no evidence that Debbie made use of multiple means of action and expression. All the learners in both classes[68] had to do the same homework from either a worksheet or the textbook and did not have a variety of options to practice tasks, communicate and demonstrate what they have learned.

During ERT

Although Debbie made use of different types of practice tasks, she did not provide a variety of practice tasks per activity or for practicing the knowledge gained. The learners could not choose what to do, as everyone had to do the same tasks. Debbie uploaded the PP slides she used to make the videos onto Google Classroom as well as the memoranda of the homework.

[68] The class containing an HI learner and the other class without an HI learner.

Debbie set three quizzes during the course of ERT where the Grade 9 learners had to choose the best answer. All three quizzes were multiple-choice questions and created on Google Forms. She also made use of worksheets she got from a website, *Math-Aids.com*, questions from other websites as well as the exercises from the textbook.

4.5.2.4 Curriculum differentiation

Differentiating the curriculum content, the learning environment, and the teaching methods such as learning materials, methods of presentation and learning activities and making use of multiple intelligences (DBE, 2011). Debbie acknowledged that teachers have different teaching styles and the way they presented things.

Face-to-face teaching

The classroom contains a Soundfield to amplify the teacher's voice. Debbie does not always mute the Soundfield when she explains to an individual learner at his/her desk. Debbie wears a Roger Dynamic around her neck so that the HI learners can hear her through a frequency modulation system. The HI learner in her class sits in the front row, directly in front of the board. Most of the time Debbie does not talk while writing on the board, however, she tends to walk around in the front of the class while talking, making lip-reading difficult. The chairs and tables contain rubber tips, but when the learners move their chairs they make a big noise. As the classroom is close to the road, one could hear the noise of the cars driving by. The few geometry posters on display in the classroom were not applicable to the topics she covered. She even had posters of Marilyn Monroe on the wall and plenty of one-sentence sayings from people.

According to Debbie, she would make use of rephrasing in the class, for example when doing *Difference of two squares,* she would first ask the learners what does *difference* mean in normal English and explain it, before carrying on with the lesson. Debbie rarely rephrased during the observed lessons, for example during lesson 2W, she talked about *coefficients* without rephrasing or recapping what they were. She wrote the definition of *rate* on the board for the learners to copy. Sometimes Debbie repeated what the learners said, but not consistently. She never wrote the homework on the board. She only gave it verbally during lesson 1W/O, giving the page number and exercise number twice and telling the learners not to do number c twice, as that was one of the examples she did. During lesson 1W, she only said it once. Later on, the HI learner asked her what page the homework was on and she told him 20.

In the class without the HI learner, Debbie tended to call learners by name to tell their answers. She would call up to seven learners' names to provide their answers for a specific question. However, in the class with the HI learner, she rarely called any learner's name. She told me later that she does this as the learners in the class without the HI learner tend to sit and wait for her to show and do the answer, while the learners in the class with the HI learner are eager to answer and put their hands up. When explaining the examples, Debbie took the opportunity in both classes for learners to show other methods on the board than the ones' she used.

Debbie makes use of stories[69] in her class to explain the work to the learners. Unfortunately, the particular story focussed on a way to remember the particular law and not the reason to the law.

Sometimes Debbie explained, instructed and emphasised more in the class with the HI learner than in the class without the HI learner. This might be because of the HI learner in the class, or, she elaborated as this was the third time she presented the lesson and she was more comfortable with its content. For example, during lesson 1W, Debbie elaborated on one of the examples she gave the learners (TO, 5:342-349), but she did not give the same elaboration during lesson 1W/O. She did not say *five comma nine*, but *five point nine*. Referring to the decimal symbol as a "point" happened on two other occasions as well.

D: *Please be careful, these answers are normally realistic. So if you are getting something like 15 000 litres … I think there's a problem there. Okay. So they're normally quite linked to real life situations. Okay. This is a real life situation. In a Bakkie[70] you get 8 litres per kilometre … In my car I get 5.9 litres per 100 kilometres. So this is quite realistic.*

Debbie said she allows for the learners to listen to music in the class as she was "young … so we listen to music if we want to listen to music" (ITI, 4:61).

During ERT

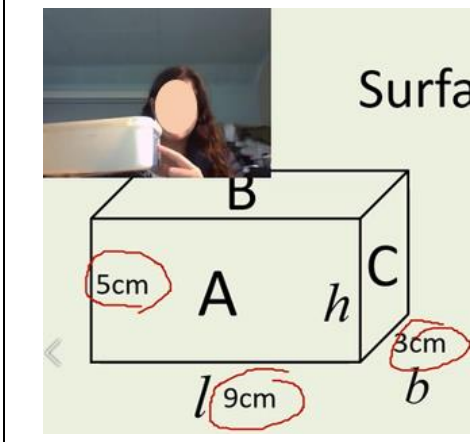
When asked how Debbie accommodated the HI learners during the lockdown period, whether she did something special for them, she responded with "no, it was basically like I would normally teach in class" (STI, 1:228). However, she explained that for very difficult lessons, she actually inserted her face on the video "so that they can see me explaining and not just hear me explaining it" (STI, 1:228). When asked whether it was for the HI learners to be able

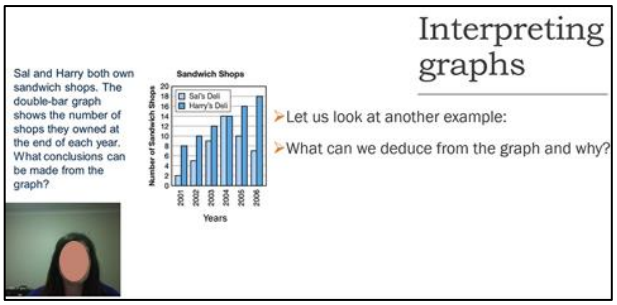
[69] Refer to paragraph 4.5.2.2 where the story was given.
[70] In South Africa a utility vehicle with an open load area is called a *Bakkie*. It is similar to a pickup truck.

to lip-read, she responded positively. That was the only thing she did with the HI learner in mind during ERT. Debbie tried to look straight into the camera, as if making eye-contact with the learners. She always kept her mouth visible for the learners, especially when she used manipulatives in explaining *surface area and volume*, as can be seen in the first snapshot. Only in two of the six videos I analysed, Debbie inserted her face.

Figure 4.12

Snapshots of Debbie's face Showing on Difficult Videos



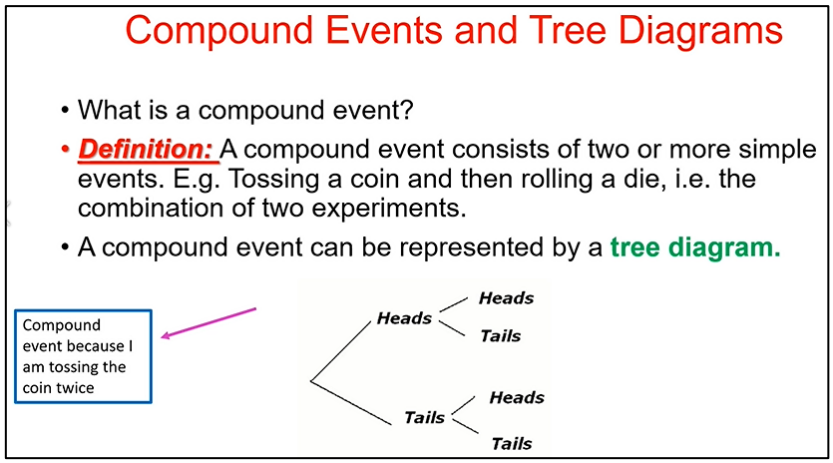


Debbie did not write down difficult words with their explanations to assist the HI learners, even though it might have been content they had already done. For example, the first video Debbie recorded was with her iPad and on *Revision of geometry*. She spoke about the different types of triangles, namely, equilateral, isosceles, and scalene. However, she never wrote the words or drew the images. In the video *Surface area and volume of cube and rectangular prisms*, Debbie said that *prisms* can also be called *cuboids*, however, again she did not write the word on the video so that the HI learners could see it.

Debbie tried to make mathematics classes fun, including the videos - she added colour to the slides and plenty of images (some of which were not relevant to the content). On many occasions in her videos she made use of differentiated examples. Debbie made use of questions while she was explaining. Unfortunately the learners were not able to answer as it was a video. Debbie sometimes made use of questions as her slide started with a typed question and not only just a definition.

Figure 4.13

Debbie Made Use of Questions in Her Videos



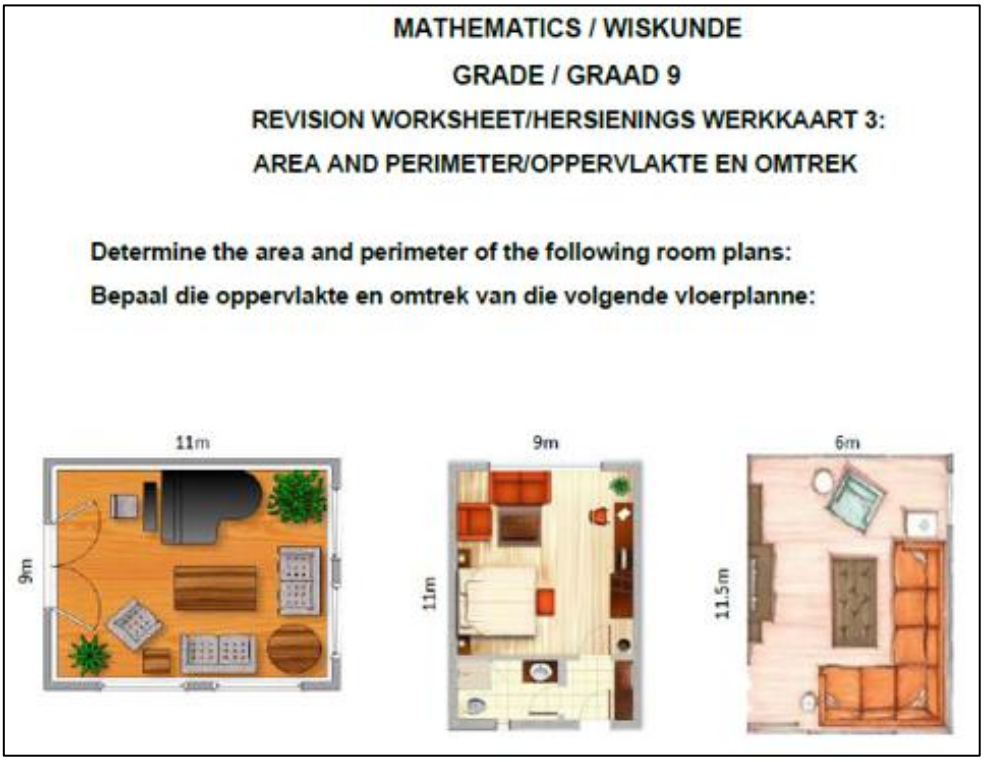
There were times when she would instruct the learners to pause the video and do the calculations first before they continue with the video. Debbie tended to change the PP slides in the video too soon after she made a comment or explained. That did not allow time for the learners to process the information.

At the end of the videos, Debbie never told the learners what their homework was. She only referred them to the weekly planning that was sent out at the beginning of the week as the homework was stipulated on there.

As Debbie aimed to make mathematics related to the lived experience of the learners, she incorporated real-life situations in her worksheets. Many of her worksheets were bilingual. The following is an extract from a revision exercise she gave the learners at the end of ERT.

Figure 4.14

Extract From a Real-Life, Bilingual Revision Worksheet



4.5.2.5 Differentiating assessment

Alternate assessment based on modified attainment of knowledge (assess learner's mastery of grade-level content with reduced load/ more at functional level); and alternate assessment based on grade-level attainment of knowledge (this involves learners with disabilities who need for example, additional time, readers and amanuensis) (DBE, 2011).

Face-to-face teaching

According to Debbie, the HI learners received exactly the same test for their assessments as the other learners. "Same testing, except they get rephrasing on their tests. So it does not give answers away, it just rephrases the word" (ITI, 4:158). In the matric final examination, the Grade 12 learners receive a rephrased paper. In Grade 10, the school starts to introduce the HI learners to rephrased papers. "So by the time they get to matric, they are not confused on what type of paper this is … so from Grade 10 we start introducing them by making our papers rephrased" (ITI, 4:164).

To the question, '*How does inclusion affect the assessment of the HI learner?'*, Debbie responded that it is the language part of the assessment, the comprehension and the

understanding of the question and word sums. They "struggle a lot because of that understanding of the vocabulary … the word 'product', the word 'sum', the word 'quotient' … it's a very big word for them, so we have to try and break it down for them" (ITI, 4:154). She said she would break *quotient* down by saying "Something that you divide by…divide…quotient means divide" (ITI, 4:156).

As the face-to-face lessons were observed in the beginning of February 2020, the learners had not completed an assessment yet. They were supposed to write a test the day following the last observations.

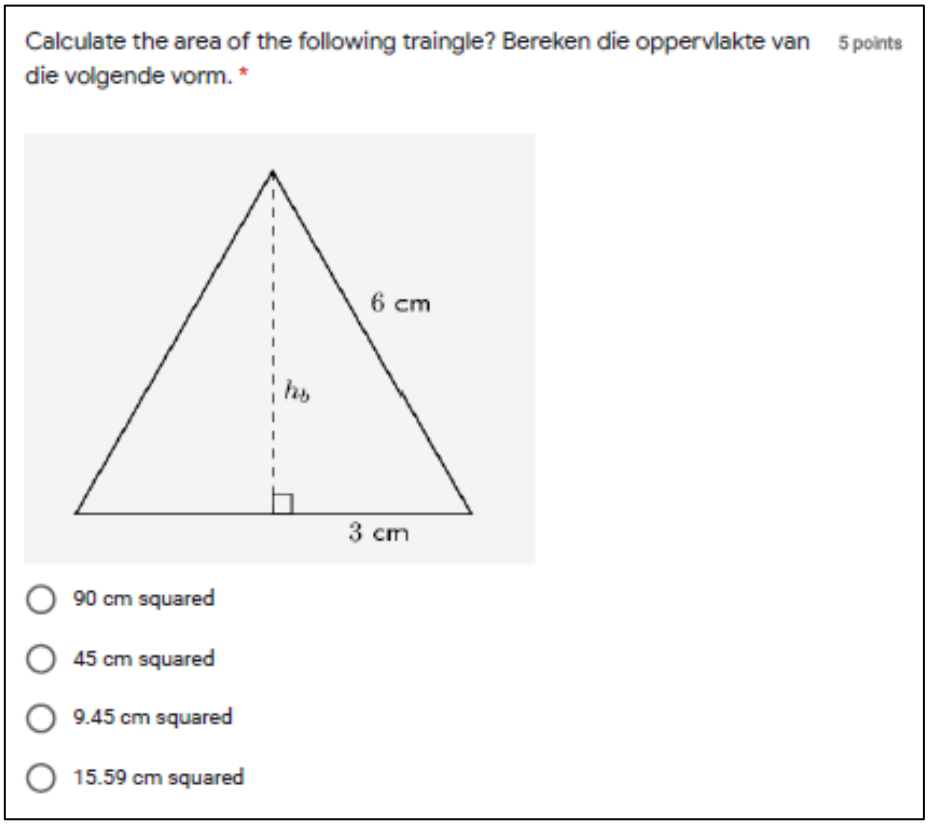
During ERT

Due to the lockdown and ERT, the learners did not write the traditional June examinations. However, they had to complete certain assessments. Debbie set three quizzes as assessments. During the second week, Debbie gave the learners their first quiz that she created on Google Forms. The second quiz was done in the fourth week and the third and last quiz was due for the end of Week 6. The three quizzes Debbie set were multiple-choice questions that Google Forms marked itself. Although the learners could only choose one option as their answer, the mark allocation alternated between one and five marks, depending on the complexity of the question.

Unfortunately Google Forms also had some limitations for mathematics teachers. Typed fractions and equations cannot be inserted into Google Forms. In the following picture, it is visible that the symbol "squared" cannot be typed or inserted. Therefore Debbie wrote it in words.

Figure 4.15

A Question from the Second Quiz Worth Five Points



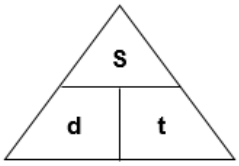
Regarding the quizzes the HI learners had to complete during ERT, Debbie said she was not sure whether there was someone at the HI learners' houses to help them with the assessments – meaning someone that could do rephrasing. "I don't know what the home situation was like" (STI, 1:409).

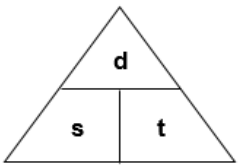
4.5.2.6 Critical learning goals

Teachers need to identify critical learning goals. These can be guided by constants or by variables (specific goals identified for specific learners) (Whittle et al., 2020). Having clear goals is important (Carrillo & Flores, 2020).

<u>Face-to-face teaching</u>

Debbie knew what she wanted to teach in the observed lessons, however, it seemed that she was not well-prepared for the lessons. During the first lesson I observed, 1W/O, Debbie started explaining *rate* by referring to the *speed (s), distance (d), time (t)* triangle the learners learn in physical sciences. Unfortunately, during lesson 1W/O, she wrote the triangle incorrectly.

She completed it as 

instead of 

No learner corrected her. The incorrect triangle caused confusion later on in the lesson. Only then did a learner said something (TO, 12:102-111):

***L**: Ma'am, isn't distance … isn't speed distance over time?*
***D:** That's what I was thinking.*
***L:** But because that's why it's kilometres per hour.*
***D:** Yes. That's what I was saying. Thank you. I knew this triangle looked funny. I'm so sorry. Sorry*

She then checked in the textbook to make sure of the correct formula and corrected the triangle on the board (TO, 12:117-125):

***D:** Yes, sorry. I made a mistake. Yeah sorry the distance is on top.*
***L:** Ma'am its speed times time?*
***D:** Yes, distance is speed times time. Sorry. Okay, but the whole point is, it cannot change the units to ever be the same. That's why it's known as rate.*

When Debbie taught *Law 6, negative exponents*, she did not have copies of the worksheet and the learners in 2W/O had to copy the questions before they could start doing the calculations. On the other hand, during lesson 2W, she had the copies of the worksheet and she handed them out for the learners to complete.

<u>During ERT</u>

The private inclusive school's first term ended 20 March 2020, six days before the total lockdown. Thus, the learners did not miss out on any academic activities planned for the first term. On 16 April 2020, the private inclusive school started with its ERT. When planning and preparing her PPs, Debbie tried "to do as much as I would do on how I would explain it on the board in the classroom and trying to just relate that into a PP" (STI, 1:68). At the beginning of every week she uploaded the week's planning for the learners to see. The first two weeks the learners had to do something new every day while it was not necessarily the case for the rest of the duration of ERT.

In the beginning of all six analysed videos[71], Debbie started by telling the learners what the specific video was all about. The first two weeks of ERT, Debbie made use of her iPad and the application *Doceri* to create the videos. This application allowed her to write with her stylus (*Apple* pen) as if she was writing on the board. She could also record her voice. By making the videos this way, Debbie had to determine beforehand what her critical learning goals of each lesson were as she was only writing on an empty slide while she was explaining.

It seemed that Debbie was not that well prepared when she recorded the videos with her iPad. She made spelling mistakes, she sounded hesitant, and she gave an incorrect formula. Words like *hypotenuse, straight* and *theorem* were spelled incorrectly, as visible in the following snapshot.

Figure 4.16

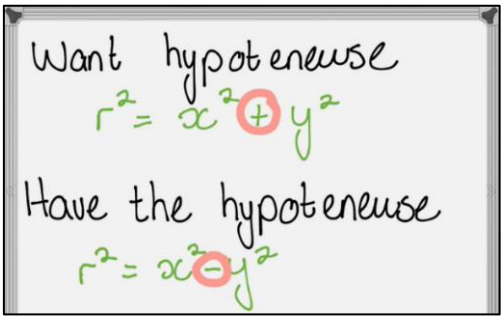
Visible Spelling Errors

At the end of the *theorem of Pythagoras* video (the third video she made for the Grade 9s during ERT), she gave a summary of what to remember when and how to use Pythagoras. However, the formula that the learners should use when they had the hypotenuse was incorrect and the word *hypotenuse* was spelt incorrectly. Again, it seemed that she was not properly prepared.

[71] As the HI learner was in the English class, I only analysed the English videos. So, the HI learner received exactly the same information as the other learners.

Figure 4.17

Snapshot Showing a Spelling Mistake and an Incorrect Formula



From the third week onwards, her videos were PP slides with voice recording and the whole PP presentation was prepared before the recording of a video. The critical learning goals were better thought through, due to the PP slides being made beforehand.

4.5.2.7 Ratio of teacher to learners

The necessary differentiation and individual support are difficult to achieve in large classes (high ratio of learners), thus, wherever possible, learners with barriers (LSEN) should be taught in smaller classes (Blatchford & Webster, 2018).

Face-to-face teaching

The two English classes Debbie taught consisted of 23 and 21 learners and can be seen as still relative small. The class with 23 learners had supposedly no HI learner in. However, I saw a learner with two cochlear implants in the class and asked Debbie if there were no HI learners in the class. Debbie confirmed that there were no HI learners in the class. When I enquired about the situation, the school said that there was a request from that learner's parents that the learner should not be seen as part of the hearing impaired learners' cohort[72]. In the class of 21 learners, there was one HI learner.

Debbie is very comfortable with the learners and she controls the situation well. The amount of learners in the class did not hinder her teaching.

During ERT

During ERT, Debbie was asked to take over the other Grade 8 class from Francis. Thus, they did not share a Grade anymore, causing Debbie to have two English Grade 8 classes and one

[72] See Table 4.7: Exclusion criteria for coding the data.

Afrikaans Grade 8 class. “So I took all the Grade 8s and all the Grade 9s, even though I share Grade 8 with Francis. I took all the 8s, so I did everything for 8s, Afrikaans and English and planning, everything” (STI, 1:178). She was already responsible for all the Grade 9 learners, so she did not get any additional Grade 9 learners during ERT. The number of learners did not influence the making of the videos, however, it had an effect on the amount of learners Debbie had to manage.

4.5.2.8 Communication method

Once teachers had their learning goals, they had to decide between either synchronous or asynchronous learning strategies (Whittle et al., 2020). The teaching prior to the COVID-19 pandemic and ERT was face-to-face (equivalent to synchronous).

Face-to-face teaching

The teaching prior to the COVID-19 pandemic and ERT was face-to-face (equivalent to synchronous). Interestingly enough, after the lockdown period between 15 April 2020 and 19 June 2020, the learners could choose whether they would like to return to school at the scheduled time or whether they preferred to stay longer at home. This caused Debbie to teach both face-to-face and upload photos from her board, upload worksheets, homework and the memoranda of the homework onto Google Classroom for the learners at home.

During ERT

In the beginning of the April-holidays the private inclusive high school officially started with online classes / videos on Google Classroom on 16 April 2020. “Nothing was really elaborated about online school, it was just said that we would do online school, we would do videos and then yes that’s it” (STI, 1:23). Debbie had to make sure the videos included full explanations, with examples, with voiceovers and be ready to be uploaded.

Debbie made use of asynchronous teaching strategies, by making videos and uploading them. However, she also mentioned that learners could have asked questions on Google Meet which was live. “No, the Google Meet is live but it’s just for questions, it’s not for explanations” (STI, 1:46).

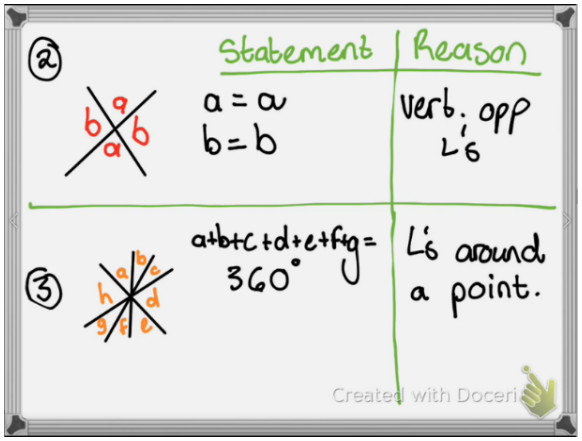
The first thing Debbie mentioned that she needed to be able to start with the online teaching (thus, the making of the videos) was silence and then she mentioned a good place to work. “So yes, I needed a lot of quietness and space. Quite a big desk for me to work on and so on”

(STI, 1:78). Even though her computer was sufficient, she preferred to work on her personal iPad. She chose her iPad as it was more technological advanced than her laptop.

The first two weeks of ERT, Debbie made use of her iPad and the application *Doceri* to create the videos. This application allowed her to write with her stylus[73] as if she was writing on the board. She could also record her voice. It was evident that Debbie was quite comfortable with the iPad and the application. She changed colours quickly and inserted straight lines just as quickly.

Figure 4.18

Snapshot from Debbie's First Lesson Where She Used Her iPad



In the first video Debbie made, the footage appeared later than Debbie's voice and it was difficult to follow her. At one stage she said she had made an error – nearly six seconds before one could see the error appeared on the screen. This could have caused confusion. It was notable that she spoke quite fast during the first video, while the second video was better, with less discrepancy between the time the footage was seen and when her voice was heard.

Debbie tried to keep her teaching style the same as when she taught face-to-face, however, it was a very long process of adapting. "The way that I would explain it in class, I try to portray it the best way possible onto the video. To not lose them and try to keep their attention to it" (STI, 1:243). Debbie asked questions in the videos, but as the learners could not answer, she gave the answers immediately.

[73] Debbie's *Apple* pen.

After the second week of ERT, Debbie adhered to the school's requirements regarding the videos, namely a video made from PP slides. It seemed that Debbie was more prepared in the later videos where she had to use PP slides as the basis for the videos. For inserting equations into the PP, Debbie made use of the software, MathType. According to her, the mathematics department purchased it at the beginning of the year to use when setting tests and to do everything they needed to do.

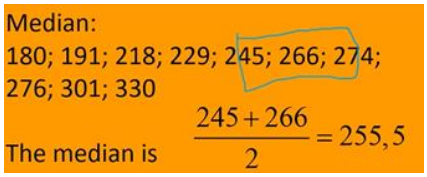
She sometimes instructed the learners to pause the video and try the calculations themselves before they continued to watch the video. As an introduction to her lesson *Surface area and volume of cube and rectangular prism*, Debbie instructed the learners to pause the video and first determine the area of three shapes, a rectangle, triangle and a kite. She then immediately carried on and revealed the answers to the calculations.

The videos were not all made with the same precision. Lesson 3 started recording in the middle of a sentence as the first couple of seconds were not recorded and too often Debbie jumped too quickly between slides, therefore, not giving enough time for the learners to process the information. The endings of the videos were often abrupt, for example, the video I analysed from Week 4 ended with "… centimetre cubed, and that's that".

Sometimes the PP did not come out as intended. In the following pictures from a video uploaded in Week 5, the correct numbers were not circled. In the first picture the median of 79 was supposed to be circled, and in the second picture the numbers 245 and 266 were supposed to be circled. If the learners did not listen to what she has said, but only looked at the PP slide, then this could have caused confusion.

Figure 4.19

Snapshots of the Correct Numbers Not Circled

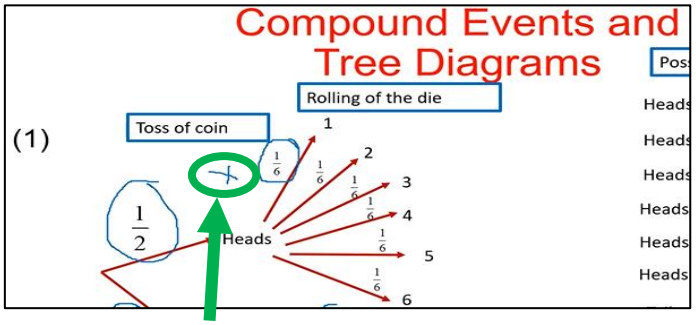


Writing with her mouse during the recording of the video caused some problems as it did not come out as Debbie intended. In the next snapshot the sign between the half and sixth

(indicated with a green circle and arrow by me) was supposed to be a multiplication sign, however, it looked like an addition sign.

Figure 4.20

A "Multiplication" Sign Ended up Looking Like an "Addition" Sign



Debbie ended only one of the six videos with a reminder that the learners should do their homework. She uploaded memoranda for the homework the learners had to do. She did not make videos explaining the answers. Some of the memoranda Debbie uploaded onto Google Classroom were apparently copies from the textbook's answer book or teacher's guide. Unfortunately it seemed that she only had the Afrikaans' answers, or she had chosen to only copy from the Afrikaans' book, whereby she inserted the English words by hand. Sometimes not all the answers were uploaded.

To the question, '*Will you make more use of online learning in the future if everything is back to normal?',* Debbie explicitly said that she preferred face-to-face teaching.

4.5.2.9 Building agency

The building of agency refers to the learners' ability to learn in their own homes and at their own pace, and might give teachers the opportunity to engage learners on topics and approaches of particular interest, instead of general lessons and formats (Whittle et al., 2020).

Face-to-face teaching

Debbie gave real-life examples applicable to *rate.* During lesson 1W/O, Debbie told the learners they were going to do *rate* and that, "Rate is also the horrible part of the question when it says … It takes six men to paint … it takes six men eight days to paint a house. If there were four men, how many days does it take to paint the house?" (TO, 12:126-129). The

learners did not react to this. She also told the other class' learners later during lesson 1W[74] (TO, 5:224-228):

D: *Rate is often the most difficult one between ratio, rate and proportion. Because the … because it's often in word sums, that's why. It says … if it takes six men eight days to paint a house, how many days does it take for four men to paint the house? And then you guys just like … wow, what's going on? Just because it's a word sum.*

One particular learner was quite fascinated by this example, and after Debbie went through the planned examples, that did not include this indirect proportion question, the learner spoke to Debbie (TO, 5:421-423):

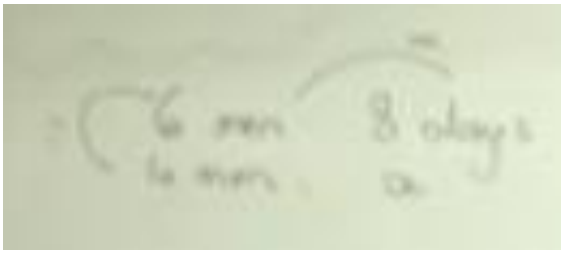
L: *Ma'am, can you show us the paint … painting sum?*
D: *I just made it up in my head, I don't even know if it works out.*

Debbie then went to the board and wrote the following on the board while talking (TO, 5:428-438):

D: *So I said it takes six men eight days to paint the house. Then I said what if you have four men … Divide up … times across. What do you get?*
L1[75]***:*** *Ma'am, isn't it six days ma'am? No.*
L2: *12*
L3: *19*
D: *It should be a bigger number*

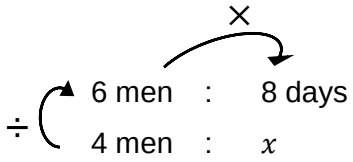
Figure 4.21

Snapshot of the Indirect Proportion Question Debbie Tried to Solve



[74] The class containing the HI learner.
[75] Refers to Learner 1.

Following is a typed version of what she wrote on the board, as the picture is unclear.



Later on Debbie recognised that this method did not work and she *googled* the answer.

During ERT

Debbie did not use ERT as an opportunity to engage learners on topics and approaches of particular interest. Her videos were general lessons that everyone had to follow.

4.5.2.10 Assessments

Assessments can be individualised using technology to showcase the learning and skills of learners and large-scale standardised testing may become outdated (Kaden, 2020).

Face-to-face teaching

At the time of the first interview, the Grade 9 learners had not done an assessment yet. Debbie, however, gave me a Grade 8 assessment that all the learners (hearing and HI) had done on a given paper. The assessment contained the four levels of mathematics questions, namely, knowledge, routine procedure, complex procedure, and problem-solving.

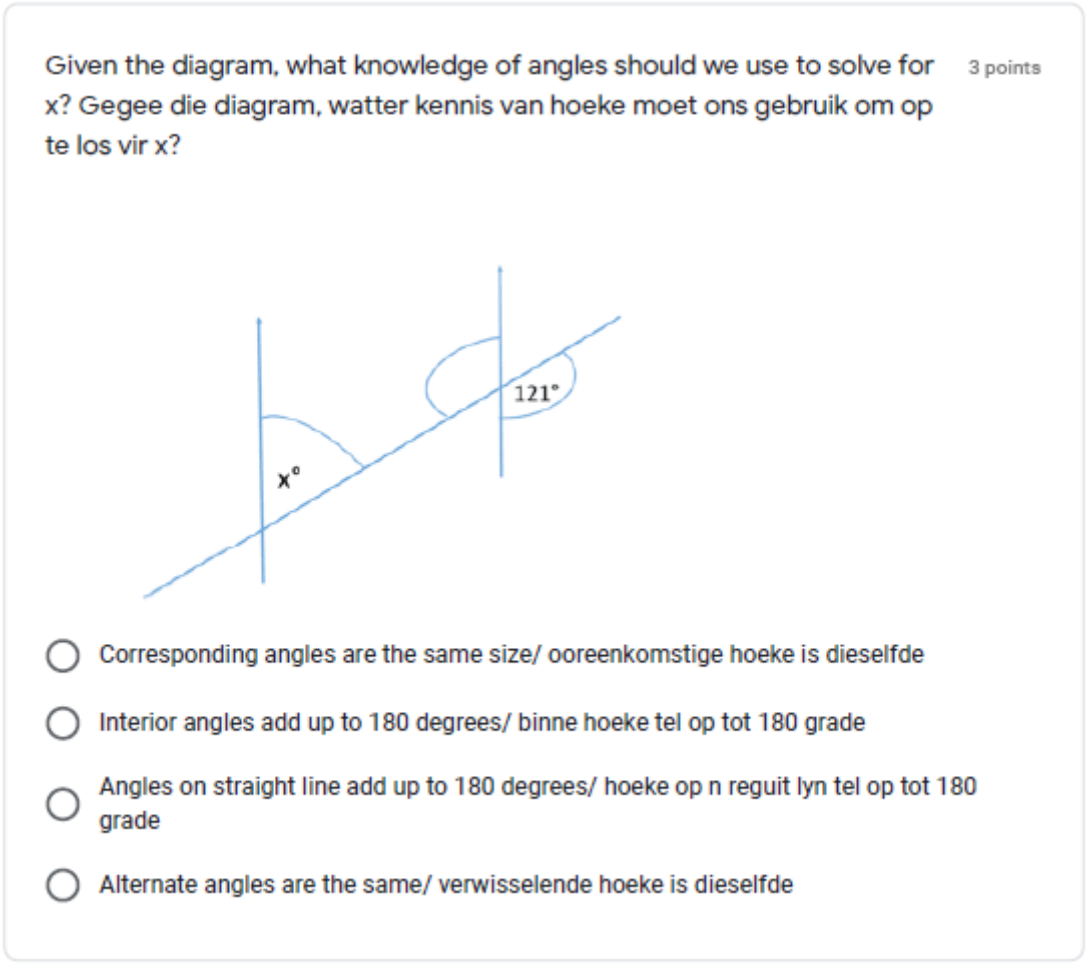
During ERT

Regarding assessment during ERT, Debbie did not individualise the assessments with the help of technology. The learners had to do the same assessments. “There’s an option of quizzes, set up a quiz. It can be a multiple choice, it can be a short answer it can be a long answer quiz. So it’s like assess, but it’s online” (STI, 1:255). She usually did this for her Grade 9 classes, while the Grade 8 classes had to do worksheets.

Debbie usually sent out the assessments on a Tuesday, and “then by Friday midnight it had to be uploaded and completed again” (STI, 1:290). During the second week, Debbie gave the learners their first quiz that she created on Google Forms. The second quiz was done in the fourth week and the third and last quiz was due for the end of Week 6. The three quizzes Debbie set were multiple-choice questions that Google Forms marked itself. Although the learners could only choose one option as their answer, the mark allocation differed depending on the complexity of the question.

Figure 4.22

An Extract from the First Quiz Debbie Gave the Grade 9 Learners to Do



The Grade 8 learners had to do the worksheets in their workbooks and upload them onto Google Classroom. Debbie allowed them to take pictures of their answers and upload those. Then she marked them on her iPad with her *Apple* pen, using the application *Notability*. By marking the answers this way, Debbie saved a lot of time. The Grade 9s did the quizzes that Google Forms marked itself. “Yes, so then I enter the marks onto Google Classroom and they can see it immediately what their mark is, personally. It doesn’t show what everyone’s mark is, just send you your mark back” (STI, 1:284).

4.5.2.11 Social role of the teacher

Teachers build relationships with parents to gain insight into the learners' needs and their environmental constraints. This parental connection provides "context for the social presence of the teacher" (Whittle et al., 2020, p. 317).

Face-to-face teaching

As this was the second year Debbie had taught the learners, she already knew more about them and their circumstances. However, she did not realise (know) that the class that presumable did not contain an HI learner, actually had one[76]. Debbie was very comfortable with the learners and knew how to handle them. When she gave the learners homework to start doing in class, she went and sat behind her desk. She did not walk through the class to see whether the learners were coping. A couple of times learners would ask her how to do something and then she would tell them what to do – mostly from sitting behind her desk. Debbie knew the names of the learners in her class and would call their names to answer a question. She tended to ask more learners by name in the class without the HI learner, as, like she explained, the learners in that particular class did not answer by themselves. They would sit and wait and see what Debbie did. While the learners in the class of the HI learner, tended to put up their hands and were eager to answer.

During ERT

Even though Debbie was aware that not all the learners had access to the internet, she said there was nothing she could do. "I just did what I was supposed to do and *ja*[77]" (STI, 1:216). She was not even sure whether the school sent a letter to the learners' parents telling them what the learners should have during the ERT period. Some learners complained that there were not enough devices at home. "We knew that not all the learners have access, not all the learners have everything. And it makes it difficult" (STI, 1:167). "Not all the learners had access to the internet but there was nothing I could do. I couldn't do anything" (STI, 1:216). Regarding the assessments the HI learners had to complete during ERT, Debbie said she was not sure whether there was someone at the HI learners' houses to help them with the assessments. "I don't know what the home situation was like" (STI, 1:409). This was evident that she did not have social contact with the learners during ERT.

[76] See Section 3.6.5, *Exclusion criteria*.
[77] An Afrikaans word meaning *yes*.

On the other hand, she used her videos to talk to the learners, however not in direct social contact. In the first video, *Revision of geometry*, Debbie sounded quite similar to how she sounded during face-to-face teaching. She told the learners that she hoped the learners were staying safe and inside. In the *Surface area and volume of cube and rectangular prism* video, Debbie referred to the previous year where she showed the learners her Rubik's cube as an example of the cube, however, one learner broke it. She reminded the learners thereof and even mentioned the learner's name. This is evident that she was really comfortable with the learners and she continued acting as if she was in the class.

In the video recorded in Week 6 of lockdown, Debbie said she missed the learners and missed teaching. She missed seeing them every day, as they made her smile, and she really missed that.

Debbie mentioned that once the videos were uploaded she was not sure whether the learners understood. "You would just upload the video and if there were no questions about it, then that was it and you moved on" (STI, 1:432).

4.5.2.12 Pedagogy and the learner social role

A social-driven pedagogical approach to enhance learner engagement and participation (Whittle et al., 2020) can be achieved by employing a problem-posing pedagogical approach (Olawale et al., 2021).

Face-to-face teaching

Debbie tried to get everyone to work. She knew the names of the learners in her class and would call their names to answer a question. She tended to ask more learners by name in the class without the HI learner, as, like she explained, the learners in that particular class did not answer by themselves. They would sit and wait and see what Debbie did. While the learners in the class of the HI learner, tended to put up their hands and were eager to answer. In both classes Debbie did the same content, with barely any problem-solving approach that would get the learners to construct their own understanding.

During ERT

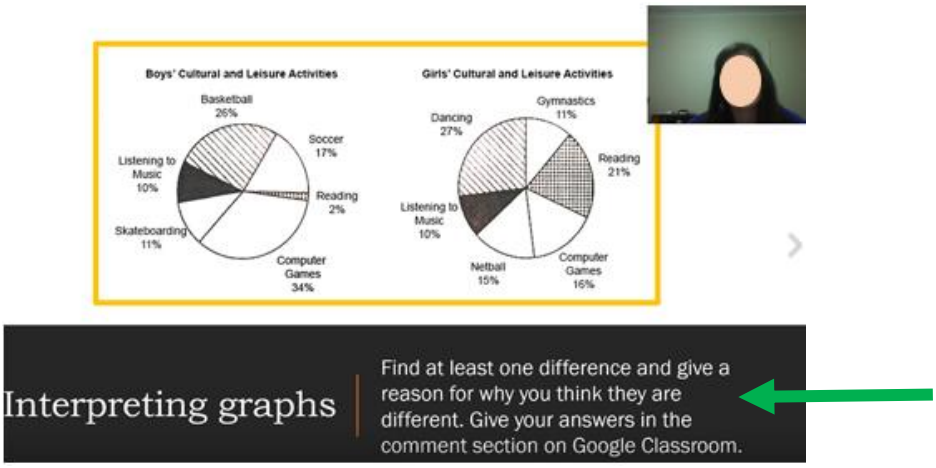
The school sent a weekly proposed timetable for the learners to guide them during ERT on the academic expectations from the school and so that the learners did not fall behind. "They were guided as best as possible as what we could during online time" (STI, 1:163). According to Debbie, most of the children did not actually watch the videos. "So, you put all this effort in

and they don't respond to it or they didn't do anything" (STI, 1:129). The only time Debbie came into social contact with the learners was during the sporadic Google Meet sessions. However, those sessions were not enough time for her to explain, but rather to listen to the learners' questions.

Debbie urged the learners in her videos to contact her if they had any problems. They could have emailed her or asked the questions on Google Classroom as long as they made sure they understood. At the end of the video she recorded in Week 6, she explicitly told the learners to give their answers to a question in the comment section of that particular video on Google Classroom. By doing that, she could determine the learner engagement with learning. See the next snapshot where I indicated the instruction with the use of a green arrow.

Figure 4.23

Snapshot where Debbie Instructed Learners to Answer on Google Classroom



4.5.2.13 Feedback

Learners need to receive feedback relating to progress and assessments, for example, teachers should make use of alternative feedback strategies, such as non-graded formative feedback, self-feedback and peer feedback (Whittle et al., 2020).

Face-to-face teaching

When Debbie taught, she instructed the learners to try examples that she had planned first, before she just showed them the answers. Sometimes she would walk through the class to see what the learners were doing, while other times she would stand at her board and wait for them to do the calculations. When she asked the learners to answer by name, she tended to

repeat their answers, however, she would not always tell them whether their answers were correct or not. See the following extract from lesson 1W/O (TO, 12:373-417):

D: *L1, are you done with the first one?*

L1: *Yes ma'am but like different opinions.* (Two learners answered simultaneously – therefore the reference to "different opinions")

D: *Okay. We'll sort that out right now. Okay, so L1 what did you get for the first one?*

L1: *Ma'am I got 3 200 … I took away the zeros which makes it 32 litres.*

D: *Okay 32. L2, what did you get?*

L2: *3 200*

D: *Litres?*

L2: *Yeah, sure*

Learners laughing.

D: *Okay I'm not quite sure which car can take so many litres but okay. Uhm … L3, what did you get?*

L3: *I'm still writing cause I….*

D: *Sorry. L4, what did you get?*

L4: *32 litres*

D: *32 litres. L5?*

L5: *32 litres*

D: *32 litres*

L6: *I told you, I told you*

L7: *What?*

D: *3 200?*

L2: *Ma'am that's the answer*

D: *Okay we'll do it now, we'll do it now. Let's check.*

She did not ask the learner how he got 3 200 litres, she only went to the board and explained it as a ratio calculation. She did not give feedback to the learner who got 3 200 litres and explain to him what he did incorrectly. She then called other learners, who did other methods, to the board to share their methods with the class. Debbie explained to the class what the two different learners did and complimented the learners on their methods.

<u>During ERT</u>

The feedback Debbie gave her learners was their marks for their assessments and answering questions. Once Debbie entered the learners' marks onto Google Classroom, they could see it immediately. "Yes, so then I enter the marks onto Google Classroom and they can see it

immediately what their mark is, personally. It doesn't show what everyone's mark is, just send you your mark back" (STI, 1:284).

4.5.2.14 Effect of ERT on the teacher

Debbie experienced the whole process of preparing a video recorded lesson as very difficult, time consuming and a lot of work. She stated that she could not work and record the videos in her bedroom. "I need to have a completely different room that is, that if I walk into that room it is worktime" (STI, 1:78). "It took extremely long time, especially mathematics because it's equations and it is different programs that you have to use to put the equations in, it's not just typing and then it's done with" (STI, 1:98). After the video was made, she still had to record a voiceover that explained the presentation. While recording the voiceover, she also used the mouse "so that you could point to what you're explaining and maybe highlight key words and so on" (STI, 1:98). She had to do the voiceover twice, first in English and then in Afrikaans.

> "So it was a very long process after that you have to convert that PP into an mp4 video, then you had an English video and you had to do an Afrikaans video. And then you have to upload that onto Google Classroom on certain dates and certain time." (STI, 1:98)

She used the same PP for both the English and Afrikaans learners. She only changed the language used on the PP and recorded another voiceover in the other language. She recognised that as mathematics contains fewer words than other subjects, thus, it was slightly easier to make the videos. "... There's not a lot of words on the PP but when you, you have to redo the whole video, to redo the voiceover because then you have to explain in Afrikaans as well. So it's two different things" (STI, 1:103).

The school expected her to do all her videos in PP. "And you need to create this PP presentation that reflects good explanation and everything. So that means being able to explain and put in certain equations and know how to use PP" (STI, 1:98). Luckily PP has an option to record a voiceover. Debbie also had to answer the questions from the learners as soon as she could "which was basically, there was no set, like at school there is a set time, between eight and three o'clock the learners are at school and then you go home and it's your home time" (STI, 1:136).

Debbie experienced the whole ERT as challenging.

> "It was one of the most difficult times, a very big learning curve. Even for me who understands technology I still learned a whole new world of it, how to insert new things and our videos had to follow strict guidelines and those where the challenges. Often

> your teaching style didn't fit in with the guidelines that where given to you, and then often you had to change the video, which means you need to go back and retrace all your steps and go through the whole process again and those where the challenges." (STI, 1:129)

It was a challenge for Debbie to find a balance between work, home and resting. "It was just constant work, go, go, go, go the whole time" (STI, 1:136). During the lockdown period, South Africa also had *load shedding*[78] a couple of days, so "another challenge is having constant internet all the time, having power the whole time and being in a place that's accessible to have your laptop with you and so on" (STI, 1:129). Debbie experienced online teaching as becoming "a 24 hour job because it is online which is 24 hours" (STI, 1:130). The learners could ask questions any time of the day. "I often spend working until early hours in the morning trying to finish everything" (STI, 1:130).

Debbie felt that the situation could have been addressed differently.

> "You know you can come up with sets and solutions, for instance that timetable that is sent out, having a time limit on there saying teachers will only be able to answer your questions between this time and this time. You know and trying to adapt the guidelines per subject – not per school, because each subject entails something completely different … Yes, so for instance PP might be easy to use for history teacher who just have to type facts, but there might be other applications that might make it easier for mathematics teachers to use rather than … uhm … having to type everything out." (STI, 1:141)

Even though the school had their requirements for the videos, Debbie made use of her iPad in the first two weeks, where she used an application that allowed her to write and make a video as she was writing with the specific *Apple* pen. That allowed her to write equations and use different colours, making it easier than typing.

> "So, there are many different apps, and some … most of these apps are free that you could use, but unfortunately … there were guidelines given and we had to follow these guidelines. So, there are definitely solutions but it is, it was the first time that anything like this happened and I suppose you learn from the mistakes." (STI, 1:146).

[78] An interruption of the electricity supply due to limited generation capacity. It is usually for periods of at least two hours at a time.

At another opportunity, Debbie again spoke about how challenging it was for her to keep to the requirements of the videos from the school. "…it was more following the guidelines, making sure everything is right. Trying to figure out how to use PP properly and how to put … it was a lot of challenges for me, not challenges in teaching" (STI, 1:243). Debbie taught herself how to use PP. She practiced, going over and over again. "Going round googling, doing research how to do something. I don't know how to change the background colour, go on to Google, how to change background colour for PP. Watch a video and you learn" (STI, 1:249).

Debbie experienced plenty of support from her boyfriend and his family as she was staying there. They brought her lunch and coffee while she was working. At midnight they even told her to switch off the computer and go to bed.

When her computer broke during ERT, she had to go into school to have it fixed. During that time she used her iPad and she had access to other spare laptops at her in-laws. She described herself as, "I was very lucky" (STI, 1:204). She also said that the only reliable technology she had, was her personal technology, her iPad with all the necessary applications on there already. She would now and then look around or stumble across other useful applications, but if it was too expensive, she would not get it. "I manage to master the applications that I have and those applications are constantly upgrading and coming up and they … the apps themselves are introducing new functions and new ways to do things" (STI, 1:487).

To answer the question, '*What support do you still need with technology and online teaching?'*, she replied with "I need the appropriate technology, laptops that are functional, but don't break, things like that. Reliable technology is what I need" (STI, 1:471).

In the end, Debbie was quite proud of herself that she made it through the ERT, the online teaching journey. "I survived it" (STI, 1:457). Her biggest challenge was to follow the guidelines given by the school. Being a teacher during the COVID-19 pandemic "was very difficult and it's not something I would like to do anytime soon again" (STI, 1:493).

4.5.3 Summary of the teachers' inclusive practices

See the following table for a summary of the teachers' inclusive practices.

Table 4.10

Summary of the Teachers' Inclusive Practices

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
Multiple means of engagement	Face-to-face teaching	Francis is a well-prepared teacher that makes use of her projector and PP slides with the questions and/or answers on, however, she did not give choices to the learners. Francis did not show the relevance of the work done in class to the learners' lives.	Debbie sometimes makes a game out of the mathematics lesson and makes use of real-life examples. She instructed her learners to try the examples before she explained them. She sometimes changed the examples she did in the one class to other examples as she could not always remember the exact example she had used in the first class. The first class (without an HI learner) had to copy the worksheet from the projected image on the board before doing that, while, for the class containing the HI learner she handed out copies of the worksheet.
	ERT	Her videos followed the same recipe: greet the learners, share the topic of the video, share definitions and formulae when necessary, do examples, and give homework. She did not arouse learner interest and never showed the relevance of the work.	Debbie tried, where possible, to make the work relevant to the learners' lives. She does not always show images of what she is talking about. She inserted fun images, but did not give choices to the learners.
Multiple means of	Face-to-face teaching	Francis made use of her projector and PP slides and repeated everything verbally that she wrote on the board. Although she has a Mimio Teach attached to her white board, Francis never used it.	Debbie only made use of the white board and the white board markers. Although she has a Mimio Teach attached to her white board, she never used it. The story Debbie told to both classes to explain negative exponents was flawed as the learners did not grasped what she

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
			wanted them to know and were not able to apply it regarding negative exponents.
	ERT	Francis explained the work through visual and auditory modalities, but did not make use of images other than the diagrams applicable to the lesson. She used the PP *animation* tool to manage the appearance and disappearance of the information on the slides and organised Google Meet opportunities.	She explained the work through visual and auditory modalities. Some videos had Debbie's face and she also used the video feed to show manipulatives to the learners. She used the PP *animation* tool to manage the appearance and disappearance of the information on the slides and organised Google Meet opportunities.
Multiple means of action and expression	Face-to-face teaching	During the observed lessons, there was no evidence in either class that Francis made use of multiple means of action and expression. The learners had to do homework from either a worksheet or the textbook and did not have a variety of options to practice tasks, communicate and demonstrate what they had learned. Francis uploaded the PP slides she used to make the videos onto Google Classroom as well as the memoranda of the homework.	During the observed lessons, there was no evidence that Debbie made use of multiple means of action and expression. All the learners from both classes had to do homework from either a worksheet or the textbook and did not have a variety of options to practice tasks, communicate and demonstrate what they had learned. Debbie uploaded the PP slides she used to make the videos onto Google Classroom as well as the memoranda of the homework.
	ERT	Francis did not use a variety of practice tasks per activity. All the learners had to do the same practice tasks.	Debbie did not use a variety of practice tasks per activity. All the learners had to do the same practice tasks.
Curriculum	Face-to-face teaching	The learning environment contained a Soundfield and Francis wore a Roger Dynamic around her neck. Sometimes she forgot to mute the Soundfield when she explained to an individual	The learning environment contained a Soundfield and Debbie wore a Roger Dynamic around her neck. She did not always mute the Soundfield when helping an individual learner. The HI

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
		learner at his/her desk. The HI learner was positioned correctly. Francis wrote the daily homework on the board as well as upcoming assessments. Francis tended to give more time for the class with the HI learner to answer and participate in comparison with the class without the HI learner. Sometimes Francis called learners by name to answer and when their answers were correct, she praised them. She urged her learners to make use of different colours when doing the calculations in their books. She also used different colours when explaining. Francis gave the learners differentiated worksheets to do, that she copied from another textbook.	learner was positioned correctly. Most of the time Debbie would not talk while writing on the board. During the observed lessons, Debbie rarely rephrased words or phrases. She did not write the homework on the board. During the lessons without the HI learner, Debbie called learners by name to give their answers, while in the class with the HI learner, she rarely called any learner's name as they participated enthusiastically. Debbie explained, instructed and emphasised more in the class with the HI learner than in the class without the HI learner. It seemed that she was then more comfortable with the lesson, as it was the third time that day she presented it. Debbie would make use of *procedures* or *steps* to show the learners how certain calculations should be done.
	ERT	Francis did not do anything special or different for the HI learners and did not rephrase difficult words often, such as *versekeringspremie*[79]. She mainly instructed learners what to do and spoke quite clearly and audible. The second recording of the lesson in the language other than the first recording, she spoke a bit faster, but still audibly and clearly. For second recordings, she sometimes added things to enhance the	Debbie did not do anything special or different for the HI learners. She inserted her face as a video feed for difficult videos where her mouth was always visible. By doing so, the HI learners could lip-read. Sometimes Debbie only said difficult words verbally with no visual explanation. She inserted images and colour to the PP slides as she was a fun mathematics teacher. She made use of differentiated examples in her

[79] The Afrikaans word for *insurance premium.*

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
		explanation. The first videos she made, she used bilingual PP slides, and later on she made PP slides for each language. She made use of differentiated examples in her explanations, but never showed the relevance of the work. Francis sometimes recorded the marking of the homework instead of just giving the answers on PDF.	explanations. Debbie sometimes inserted real-life examples in her worksheets. Many of her worksheets were bilingual.
Differentiating assessment	Face-to-face teaching	During the last two observed lessons, Francis handed the learners' assessments back to them. The assessments contained the four levels of mathematics questions, namely, knowledge, routine procedure, complex procedure, and problem-solving.	According to Debbie, the HI learners received exactly the same test for their assessments as the other learners. They, however, have someone rephrasing for them. As the face-to-face lessons were observed in the beginning of February 2020, the learners had not completed an assessment yet.
	ERT	The learners did not write a June examination. Francis gave the learners four assessments to do, some consisting of old examination papers. The HI learner had to do the same assessment as the other learners.	The learners did not write a June examination. Debbie gave the learners three quizzes created with *Google Forms* to do with differentiated questions. Although the learners could only choose one option as their answer, the mark allocation alternated between one and five marks depending on the complexity of the question. *Google Forms* marked the questions itself. She did not know whether someone assisted the HI learners at home to understand the quizzes.
Critical learning	Face-to-face teaching	Francis is well prepared for all her lessons with the necessary PP slides. When there is a scheduled double lesson on the timetable, the second of the two lessons is always used for	Debbie knew what she wanted to teach in the observed lessons, however, it seemed that she was not that well prepared for the lessons. She did not have copies of a worksheet ready for 1W/O

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
		geometry. So, each period is a new lesson that she had planned containing new goals. She is aware that there were different ability learners in her class	and they had to copy the homework questions from the board before doing them.
	ERT	Francis had to change the PP slides that she used for face-to-face teaching. She had to break them down for the ERT videos. She incorporated the *animation* tool from PP well and most of the time the information was revealed in the correct order. All of her videos followed the same recipe: greet the learners, share the topic of the video, share definitions and formulae when necessary, do examples, and give homework. The first videos she made, she used bilingual PP slides, and later on she made PP slides for each language.	Debbie started her videos by informing the learners what the specific video was about. The first two weeks' videos were not well prepared as they contained spelling mistakes and an incorrect formula. From Week 3, the critical learning goals per video were better thought through as Debbie had to make the PP slides before the recording of the videos.
Ratio of teacher to learners	Face-to-face teaching	The Grade 10 class without an HI learner, had 16 learners and the other class with an HI learner in the class, had 13 learners. Both classes were small classes. Francis was aware of the mixed ability group of learners in both classes.	The two English classes Debbie taught consisted of 23 and 21 learners. She was very comfortable with the learners and she controlled the class situation well. The amount of learners in the class did not hinder her teaching.
	ERT	Francis had to take over the responsibility for one additional class in both Grades 10 and 11, resulting in approximately 60 learners in each Grade. The increased number of learners played a huge role in the marking of the assessments.	Debbie still had the three Grade 9 classes she was responsible for during face-to-face teaching, but had to take over the responsibility for one additional Grade 8 class.
Communication	Face-to-face teaching	The teaching prior to the COVID-19 pandemic and ERT was face-to-face (equivalent to synchronous). From the beginning of the year and before the lockdown, the teachers had access to	The teaching prior to the COVID-19 pandemic and ERT was face-to-face (equivalent to synchronous).

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
		Google Classroom where they could upload worksheets and the learners could access them asynchronously.	
	ERT	Francis mainly made use of asynchronous teaching as she made and uploaded videos. Sometimes she organised a synchronous Google Meet opportunity with the learners. The second recording of the lesson in the language other than the first recording, she spoke a bit faster, but still audibly and clearly. For second recordings, she sometimes added some things to enhance the explanation. She would write with the mouse to emphasis certain things. In the beginning of ERT, Francis would watch the videos before she uploaded them. However, due to time constraints she would later upload the videos without watching them first. A few times the PP slides changed too quickly. After ERT Francis wondered if she would have been less stressed if she taught synchronously instead of asynchronously. For a perfect online lesson, Francis preferred all the learners having internet and self-discipline to engage. She would like to use a visualiser[80] to write and explain to the learners, while they were sitting in their homes and where there was feedback.	Debbie mainly made use of asynchronous teaching as she made and uploaded videos. Sometimes she organised a synchronous Google Meet opportunity with the learners. The first two weeks she made the videos on her iPad using an application, named *Doceri*, where after she made the videos with PP. She tried to keep her teaching style the same and portray it the best way possible in the videos. Debbie is quite skilful when it comes to technology, however, there were still a few issues with the videos. o In one video the voiceover was 6 seconds in front of the video feed. o She would go on to the next slides too quickly. o When she made drawings with the mouse, they appeared in the incorrect place. For a perfect online lesson, Debbie would like it to be basically a face-to-face lesson where she can write everything out and the learners can ask questions while she is writing. She still preferred face-to-face teaching above online teaching.
Building	Face-to-face teaching	All the lessons Francis taught were general lessons and all the learners in Francis' class had to do the same work. She did not	Debbie gave real-life examples applicable to *rate* and one particular learner was very interested in the example and

[80] Also known as a document camera. It is a camera mounted on a stand that connects to a projector and/or a computer.

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
		use topics and approaches of particular interest to engage the learners.	wanted Debbie to show her how to solve the indirect proportion question. At first Debbie did not know how to do the calculation and had to consult the internet.
	ERT	Francis did not use ERT as an opportunity to engage learners on topics and approaches of particular interest. Her videos were instructed lessons where she explained new formulae or methods to the learners.	Debbie did not use ERT as an opportunity to engage learners on topics and approaches of particular interest. Her videos were instructed lessons where she explained new formulae or methods to the learners.
Assessments	Face-to-face teaching	The learners received their marked assessments. The assessments contained the four levels of mathematics questions, namely, knowledge, routine procedure, complex procedure, and problem-solving and the learners had to write the answers on the given paper. While teaching, Francis referred to questions that the learners might see in a test again.	At the time of the first interview, the Grade 9 learners had not done an assessment yet. Debbie, however, gave me a Grade 8 assessment that all the learners (hearing and HI) had done on a given paper. The assessment contained the four levels of mathematics questions, namely, knowledge, routine procedure, complex procedure, and problem-solving.
	ERT	Francis did not individualise the assessments. All the learners had to do the same assessments. She gave the learners four assessments to do. These were ordinary question with some from old examination papers. Francis followed quite a cumbersome and time consuming process when marking as she did not print the learners' assessments and therefore could not make ticks on the PDFs. She made notes on an A4 paper and kept track of the learners' marks. Afterwards she would write a short personal report for each learner.	Debbie did not individualise the assessments. She gave the learners three quizzes to do. The quizzes were multiple-choice questions. Although the learners could only choose one option as their answer, the mark allocation differed depending on the complexity of the question.

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
Social role of the teacher	Face-to-face teaching	After handing out the learners' class tests, Francis requested from the learners that the parents sign the tests. She also mentioned that the parents should make sure that the learners understood the work. Francis is comfortable with the learners. She knows the names of the learners in her class and would sometimes call their names to participate in the lesson. When learners wanted to show Francis their methods, she went to their desks and looked at the learners' work.	As this was the second year Debbie had taught the learners, she already knew more about them and their circumstances. However, she did not realise (know) that the class that presumable did not contain an HI learner, actually had one. When she gave the learners homework to start doing in class, she went and sat behind her desk. She did not walk through the class to see whether the learners were coping. Debbie knew the names of the learners in her class and would call their names to answer a question.
	ERT	The school expected from the teachers to be in contact with the learners. The HOD assisted with the communication with the learners and parents. Sometimes Francis had to write emails to the parents. Francis mentioned that the HI learner coped well as she thought he had earphones that would help him. She did not know whether the learners had access to the internet during the first week of ERT and assumed they made plans. She was not involved with sorting out the learners' access to devices and internet. Parents emailed her during ERT saying their child could not submit the work due to certain circumstances.	Even though Debbie was aware that not all the learners had access to the internet, she said there was nothing she could do. Once the videos were uploaded, she was not sure whether the learners understood. She also was not sure what the home situation of the HI learner was, whether there was someone at his house that could assist him. Debbie had the minimum of social contact with the learners. She told the learners in the first video that they should stay safe. In two other lessons she told the learners how much she missed seeing them. She also said they made her smile during face-to-face teaching and she missed that.
Ped ago	Face-to-face teaching	The learners in the class without an HI learner barely participated and Francis just continued with her explanation.	Debbie tried to get everyone to work. She knew the names of the learners in her class and would call their names to answer a

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
		Francis will not necessarily wait for the learners to answer her questions. She would ask a question and immediately give the answer. On the other hand, the learners in the class with the HI learner, asked so many questions and participated to such an extent that Francis could not complete the same amount of work as she did in the other class. In both classes Francis did the same content, with barely any problem-solving approach that would get the learners to construct their own understanding.	question. She tended to ask more learners by name in the class without the HI learner, as, like she explained, the learners in that particular class did not answer by themselves. They would sit and wait and see what Debbie did. While the learners in the class of the HI learner, tended to put up their hands and were eager to answer. In both classes Debbie did the same content, with barely any problem-solving approach that would get the learners to construct their own understanding.
	ERT	Francis did not have a social-driven approach with the learners during ERT. Francis reported on the learners being less engaging with learning. It was hard for Francis to determine whether the learners understood, as they copied so many of the assessments from others and she did not see them.	Debbie did not have a social-driven approach with the learners during ERT. The only time Debbie came into social contact with the learners was during the sporadic Google Meet sessions. Debbie urged the learners in her videos to contact her if they had any problems. She made the remark that most of the learners did not even actually watch the videos. At the end of one video in Week 6, she requested the learners give their answers to the question in the comment section on Google Classroom.
Feedback	Face-to-face teaching	Francis is not shy to compliment learners when they answer something correctly and she also wrote comments on the learners' assessments. She commented during lesson 1W/O that she saw some gaps at certain questions when she walked through the class to check the learners' homework.	When Debbie asked the learners by name to answer, she tended to repeat their answers, however, she would not always tell them whether their answers were correct or not. Then she would explain how the calculation should have been done without giving feedback to the learners with the incorrect

Summary of the teachers' inclusive practices			
		Francis	**Debbie**
			answers. She gave opportunities for learners to show their methods in doing a calculation. Debbie then explained to the class what the learners did and complimented the learners on their methods.
	ERT	The feedback Francis gave her learners, was their marks and a short report for their assessments. She also mentioned that she had to answer the learners' questions on Google Classroom.	The feedback Debbie gave her learners, was their marks for their assessments and answering questions.
Effect of ERT on the teacher		For Francis, the ERT process was quite rough. In the process of making and uploading the videos, she had to teach herself to do that via *Google*. She would google "how to …". She was chuffed with herself for accomplishing this, however, she wished she had received some training. She was stressed that she would not be able to finish with the syllabus with the learners. As her husband and two children were also at home, she struggled to keep all the balls in the air. She felt that if she could have resigned, she would have. Francis does not plan to make use of online learning once everything is back to "normal" – technology scares her.	Following the school's requirements of the videos was extremely challenging and she had to change her way of teaching. She said the school could have adapt the guidelines per subject as PP is not necessarily the best option for mathematics. The whole process of making the videos was time consuming and she struggled to find a balance between work, home and resting. She learned new things on how to make the videos by *Googling* it. She experienced plenty of support from her boyfriend and his family. She would like to have reliable technology that did not break. Debbie's proudest moment of ERT was that she survived it.

Chapter 5

Discussion of the findings

5.1 Introduction

In this chapter the findings are thematically discussed based on my conceptual framework. The findings are then related to the literature and used to explain the identified trends. The three themes, based on face-to-face teaching and ERT, are, 1) Teachers' beliefs about the nature of mathematics; 2) Teachers' beliefs about inclusion; and 3) Teachers' inclusive practices.

5.2 Discussion of Theme 1: Teachers' beliefs about the nature of mathematics

Prior to the discussion, I conducted a comprehensive, advanced electronic search after presenting the data in order to establish a basis from which I could execute a literature control of my findings in this chapter. I searched for peer reviewed articles in English on WorldCat.org published since 2020. When I used the keywords: "teacher*", "beliefs", and "nature of mathematics", seven related articles appeared[81]. Of the seven articles, three focused mainly on pre-service teachers while a fourth made a comparison between the beliefs of pre-service teachers and in-service teachers, with the finding that in-service teachers have more firm beliefs (Vesga-Bravo et al., 2021). One article focused on the profiles of mathematics teachers' competence and another on the influence of students' abilities on teachers' beliefs – leaving me with one applicable article relating to my research findings. In the following section, I will conduct a literature control where the findings from this study are compared with the findings from related research studies referred to in Chapter 2[82] and the recent studies as indicated in Appendix H. The discussion is based on the three themes of teachers' beliefs about the nature of mathematics according to Ernest (1989a)[83].

[81] See Appendix H for the list of the articles.
[82] See Section 2.2.
[83] See the *Teachers' Beliefs about the Nature of Mathematics* in Table 3.7 under Section 3.6.4.

5.2.1 Instrumentalist view

During both interviews[84], Francis acknowledged that she was an instructor, having an instrumentalist view. I found that for Francis it was extremely important that the learners in both classes[85] master the skills and demonstrate this with correct answers and good performance. It was as if she 'coached' them for answering tests, being a strict follower of a text or scheme (Ernest, 1989a), encouraging the learners with an act of "here's the procedure, here's a few examples, now here's some for practice" (Garofalo, 1989, p. 504). This occurred during face-to-face teaching as well as ERT. In an ERT video Francis made, she even told the Afrikaans learners[86] to not overthink the distance formula, only wanting them to master the skill (Ernest, 1989a) of using the distance formula correctly – focussing on definitions, rules and proofs (Kilpatrick, 2001). Having an instrumentalist view, Francis said that she did "try in the class to show the children different ways how something can be asked" (ITI, 2:123), again providing the different methods, instead of giving the learners the opportunity to come up with other ways of doing the calculations and constructing their own understanding (Ernest, 1989a).

Debbie, on the other hand, did not see herself as an instructor (having an instrumentalist view) during face-to-face teaching or ERT, she believed she was rather an explainer and, even more, a facilitator. However, I found during the observations in both classes[87] and in the ERT videos, that she instructed the learners – contradicting her beliefs. The way in which she responded to the learners' attempts during face-to-face teaching was also not that of a facilitator, but rather of an instructor – someone following a scheme (Ernest, 1989a) or formula and wanting the learners to use it correctly.

5.2.2 Platonist view

Both teachers view themselves as explainers during face-to-face teaching and ERT, as they want the learners to understand (Ernest, 1989a). However, when observing Francis during face-to-face teaching, I found in both classes that the *learner understanding* she mainly wanted to achieve, was not the understanding of knowledge, but rather the understanding of certain definitions, procedures and formulae. She also tended to stick to the textbook. Luitel (2020) finds that teachers being textbook-oriented promote the Platonist view of mathematics and that a content-oriented curriculum results in teacher-centred pedagogy. In the class where

[84] One conducted prior to the observation of her face-to-face lessons and one after ERT.
[85] The class containing an HI learner and the other class without an HI learner.
[86] The class containing the HI learner.
[87] The class containing an HI learner and the other class without an HI learner.

an HI learner is present, the learners asked many questions to clarify that what they were doing was correct forcing Francis to be more of an explainer. Thus, she explained more in that class due to the participation of the learners and the number of questions and not due to the class having an HI learner in it. The videos Francis made during ERT were only intended for the learners to learn the formulae and rules and not to be able to understand the knowledge, thus she did not explain, only instructed.

Debbie was more of an explainer. During face-to-face teaching, she encouraged the learners of both classes to share different methods they used to do the calculations, and by doing so, share their own understanding (Ernest, 1989a). Debbie was not textbook bound and she appeared to have plenty of confidence as the examples she did with both classes were not consistent and she thought them spontaneously as she needed them (Stipek et al., 2001). It appeared as though she was unprepared – therefore the difference in examples. In the videos Debbie made during ERT, she instructed more than she explained.

5.2.3 Problem-solving view

Francis believed she was a facilitator and that a facilitator was someone who walked through the class and monitored whether the learners understood the work. She mentioned that, by doing so, she wanted to see if the learners made the new concepts their own and could apply them to other calculations. This is more the view of an explainer, to see whether the learners understood the knowledge and not with the focus on the learners constructing their own understanding (Ernest, 1989a). According to Luitel (2020), an approach of practice until a learner has memorised the work or knows the process or steps of solving specific problems, has an intention to control the mathematical activity and problem-solving through instrumental actions and is more likely to promote the instrumentalist view of mathematics. Debbie believed that showing learners how to do a calculation first and then letting them do another example on their own, was a way of facilitating. I found that in practice, neither Francis nor Debbie were facilitators, having a problem-solving view with learners constructing their own knowledge as an outcome (Ernest, 1989a). They did not facilitate the outcome with the learners constructing their own understanding in mind.

Both Francis and Debbie admitted that during ERT, they could not be facilitators. Debbie elaborated that she realised that the videos did not allow for her to be a facilitator, as she spent most of the time only explaining the concepts. Debbie saw herself as a facilitator during face-to-face teaching, however, it was not evident during my observations in both classes.

5.2.4 Summary of discussion on Theme 1

To summarise, during face-to-face teaching Debbie did not believe that she herself was an instructor, however, the evidence showed otherwise. Debbie was an instructor and an explainer during face-to-face teaching – and not a facilitator – irrespective of having an HI learner in her class or not. The same with Francis. I found that, irrespective of having an HI learner in her class or not, she was mainly an instructor, and an explainer only on a few occasions when the learners' questions forced her to one. Even though Francis believed she was a facilitator, the evidence showed otherwise. During ERT, both of them realised they could not facilitate and had to explain. In reality, Francis only instructed in both the Afrikaans and English videos while Debbie mainly instructed, while explaining only on a few occasions.

I agree with Ernest (1989b) and Liljedahl (2008b) that teachers may combine elements from more than one view and that some aspects are preferred over others. Thus, depending on the mathematics topic at hand, a teacher can have elements of an instrumentalist view and a Platonist view, while another teacher can have elements of a Platonist view and a problem-solving view. In my research study both teachers beliefs correspond with the ideas of Ernest (1989b) and Liljedahl (2008b) of having a combination of views, however, during the observations the views of the teachers did not correspond in totality with their practice.

5.3 Discussion of Theme 2: Teachers' beliefs about inclusion

In the following section, I will conduct a literature control where the findings from this study are compared with the findings from related research studies referred to in Chapter 2[88] and recent applicable studies published the past three years and indicated in Appendix I. I based the discussion on the three types of beliefs regarding HI learners (Vermeulen et al., 2012) as well as the additional theme of *Support for Inclusion* in this study[89].

5.3.1 Inclusive education

Both Francis and Debbie have positive beliefs about inclusive education. Debbie, on the one hand, has seen videos of the progress and success over the years of some HI learners, while Francis' beliefs are positive, provided that the HI learners' hearing loss was detected early

[88] See Sections 2.2 - 2.5.
[89] See the *Teachers' Beliefs about Inclusion* in Table 3.7 under Section 3.6.4.

(Khan & Joseph, 2020) and that they have academic success (Khamis, 2011; Vermeulen et al., 2012). Debbie feels that HI learners work at a slower pace, and unfortunately, the curriculum does not allow for this, while Francis believes it is the HI learner's responsibility to keep up with the pace as she cannot work slower (Alasim, 2018; Berndsen & Luckner, 2012; DoE, 2001; Uys & Selesho, 2017). Debbie confuses *inclusion* with *integration* as she believes there is not a specific way of teaching HI learners (Dalton et al., 2012; Dreyer, 2017; Engelbrecht et al., 2016; Engelbrecht et al., 2015). *Integration* means the learner must change in order to fit in while *inclusion* implies the system must change (DoE, 2001; Jenkins et al., 1990).

5.3.2 Self-efficacy

Francis and Debbie feel that they have the necessary skills to teach HI learners since, prior to 2020, both of them had experience with HI learners. Experience or interaction with persons with disabilities increases self-efficacy levels (Yada & Savolainen, 2017). Francis previously taught an HI learner at another school where it was only expected from her to wear the Roger microphone (Antia & Stinson, 1999; Crandell & Smaldino, 2000) around her neck in addition to her usual teaching. Debbie started teaching at the inclusive school in 2019 and underwent numerous training sessions (Khamis, 2011; Lissi et al., 2017; Yada & Savolainen, 2017) that better equipped her. She learned to talk slower and had to learn and practise not to turn her back to the learners while talking as well as not to talk while writing on the board (de Souza, 2020; Eriks-Brophy & Whittingham, 2013; Luckner et al., 2012; Simkiss, 2013; Uys & Selesho, 2017). As Francis' colleagues assisted her briefly on how everything worked before she attended formal training, she felt she was ready to stand in front of the class the first day of school.

Francis feels she does not have to adapt her way of teaching, while Debbie believes she is capable of making the necessary instructional modifications for the HI learners. She is aware that HI learners have vocabulary and comprehension barriers. I found that Francis did not yet understand the barriers HI learners have, such as the vocabulary and comprehension barriers, and how these should be addressed, while Debbie understood the learning barriers HI learners have relating to vocabulary and speech (Alasim, 2018; Erbas, 2017; Luckner et al., 2012; Salend, 2011; Uys & Selesho, 2017) as literacy is crucial for HI learners (Reed, 2020). Both Francis and Debbie explained what *rephrasing* was (Estabrooks, 1998; Le Hanie, 2017; Simkiss, 2013; Uys & Selesho, 2017), however, the examples both provided were inappropriate and not executed sufficiently. Neither of the two participants had read the DBEs *Guidelines for responding to learner diversity in the classroom*, thus they did not know about

the South African policy related to inclusive education and they were not aware of the different barriers to learning and how these could be addressed.

5.3.3 Subjective behavioural standard

Neither Francis nor Debbie were aware of the expectations within the South African policy related to inclusive education. Francis felt the parents should make sure the HI learner understood and achieved academically. Thus, it seemed that she felt the parents could not expect her to ensure the HI learners achieved academically. Francis believed there are other people taking responsibility for the HI learners - the responsibility was not hers. Debbie believed she is not the person primarily responsible for the HI learners in her class. It is rather the one Deputy Principal. Coviello and DeMatthews (2021) also find that a mind shift is necessary to coordinate teamwork and to dedicatedly focus on the needs of the learners with disabilities, however, it will not take hold immediately.

5.3.4 Support for inclusion

Before the first day of school, Francis' colleagues showed her how everything worked before she attended formal training. In contrast to the findings of a lack of support at other schools (Mazuruse et al., 2021), this private school provided plenty of support for inclusion of HI learners, the technology that included the Roger and Soundfield system and high quality hearing aids/implants and speech therapists (and/or audiologists) at the school. The audiologists walk around the school throughout the day and check to make sure the HI learner are sitting in the right places (Berndsen & Luckner, 2012; Erbas, 2017) and the technology is working, so that the HI learners do not feel isolated (Mays & Brevetti, 2020). The audiologists and teachers work in collaboration with each other (Karisa et al., 2022). There is a culture of support for the HI learners at the school (Reed, 2020).

The school also provided an opportunity for extra academic support to the learners in the form of extra classes three afternoons a week, and a daily additional academic lesson where learners did extra exercises to keep up and embed knowledge. These classes were available for all the learners, but during the daily additional academic lesson the teachers could withdraw the HI learners and work with them separately. I do not have evidence that Francis made use of this opportunity, however, I found that Debbie did not make use of this opportunity. When writing tests, the HI learners also received accommodations in the form of amanuensis and rephrasing as prescribed by DBE (2014).

5.3.5 Summary of discussion on Theme 2

To summarise, both teachers have positive beliefs about inclusive education provided certain conditions are met. The pace of the mathematics curriculum hinders the HI learners, as, according to Debbie, the HI learners work slower. Both teachers felt they have the necessary skills to teach HI learners. Francis believed she did not have to adapt her way of teaching as it was the HI learner's responsibility to keep up. Debbie believed she was capable of making the necessary instructional modifications for the HI learners as she realised their demands. Due to all the training Debbie received the previous year, she understood the learning barriers HI learners had relating to vocabulary and speech, while Francis did not yet understand the barriers HI learners had as she was a new teacher at the school.

Even though they were teaching at an inclusive school, neither of the participants had read the DBEs *Guidelines for responding to learner diversity in the classroom*, thus they did not know about the South African policy related to inclusive education. Both the participants believed that one of the Deputy Principals was primarily responsible for the HI learners, and not the teachers themselves. Francis also felt that the parents could not expect her to ensure the HI learners achieved academically in her class. The school is geared for HI learners due to the Roger and Soundfield systems mounted in the classrooms and audiologists and speech therapists on the school grounds.

5.4 Discussion of Theme 3: Teachers' inclusive practices

For the next discussion I again consulted recently published studies applicable to inclusive practices **during face-to-face teaching** in South Africa, I searched for new articles published in 2022 on WorldCat.org. When I used the keywords: *"South Africa", "inclusive practice*"* and *"*school*"* only one new applicable article appeared compared to the search I did earlier in 2022[90]. For the second search I used the keywords *"South Africa", "UDL"* and *"inclusive practice*"* and again searched for articles published since 2020, however, no results were produced so I omitted the phrase *"inclusive practice*"* as a keyword. With only "*South Africa*" and "*UDL*" as keywords, only one applicable article was found. For the third search I used the keywords *"South Africa", "differentiat*"* and *"inclusive practice*"* only one new applicable article appeared compared to the search I did earlier in 2022[91]. This specific article also appeared in

[90] See Table 2.3 in Section 2.4.
[91] See Table 2.3 in Section 2.4.

the first search, so in total, I found two additional articles apart from the search I did earlier in 2022[92].

Applicable to inclusive practices for HI learners during the COVID-19 pandemic, thus **during ERT**, I searched for articles in English on WorldCat.org. When I used the keywords: "hearing impair*", "covid", and "remote teaching", only two articles appeared. For the second search for articles in English, I used the keywords "hearing loss", "covid" and "remote teaching", again only two other articles appeared, one of which was irrelevant to my study[93]. Thus, there were only three applicable articles.

Part of the following section, is a literature control where the findings from this study are compared with the findings from related research studies referred to in Chapter 2[94] and the recent studies as indicated in Appendix J. I based the discussion on all of the aspects of the UDL approach (CAST, n.d.), the *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements* (DBE, 2011) and the design step of the ERT environment framework (Whittle et al., 2020) as they were the inclusive practices as well as the additional theme of *Effect of ERT on the teacher* in this study[95].

5.4.1 Multiple means of engagement

This refers to the *WHY* of learning (Dalton et al., 2012) and includes recruiting interest; sustaining effort and persistence; and self-regulation. Teachers need to implement different classroom strategies that empower their learners; providing choices for the learners; reducing learner anxiety; and rewarding their efforts (Navarro et al., 2016).

Face-to-face teaching

While Francis is a well-prepared teacher that makes use of her projector and PP slides with the questions and/or answers, Debbie seems to be unprepared as she sometimes changes the examples from class to class due to the fact that she cannot always remember the exact examples she used previously. Debbie requested the first class (with no HI learner) copy the homework questions from the projected image on the board before doing the questions, while later in the day, she handed out copies of the worksheet to the class containing the HI learners. I believe she did this, not because of the HI learner in the class, but because she was not

[92] See Appendix J for the two articles.
[93] See Appendix J for the three articles.
[94] See Section 2.4.
[95] See the *Teachers' Inclusive Practices* in Table 3.7 under Section 3.6.4.

prepared for the first class. The copies were not made and/or she had not collected them from the photocopier beforehand. The Centre for Applied Special Technology (CAST) admits that UDL takes careful planning and preparation by the teachers (CAST, n.d.; Morin, 2018) as teachers are encouraged to design accessible curricula and learning environments for the widest range of learners by minimising the number of barriers to learning at the outset (Griful-Freixenet et al., 2020). Karisa et al. (2022) are of the opinion that a UDL approach can guide planning and practice of teachers.

Debbie only wrote on the board with whiteboard markers. Neither of the two participants provided learners with any choices and the learners could not get up and move around (Dalton et al., 2012). All of the learners for each teacher had to do the same work – HI or not. Debbie mentioned that she sometimes made a game out of the mathematics lesson and made use of real examples (Dalton et al., 2012; Morin, 2018), however, it was not evident during the observations. She motivated her learners to try examples before she explained the work to them.

During ERT

All of Francis' videos (English and Afrikaans) followed the exact same recipe: she greeted the learners; shared the topic of the video; shared definitions and formulae when necessary; did examples; and gave homework. She never showed the relevance of the work, nor did she arouse the learners' interest. Debbie, on the other hand, tried to arouse her learners' interest by making the work relevant to the learners' lives. Unfortunately, there were still places in the videos where she could have inserted images related to her explanations for better understanding (Erbas, 2017; Uys & Selesho, 2017) – not only for the HI learner, but all the learners.

5.4.2 Multiple means of representation

This refers to the *HOW* of learning (Dalton et al., 2012) and includes perception; language expressions and symbols; and comprehension. Teachers must learn how to present educational resources through a variety of modalities (visual, auditory or tactile) and methods such as videos, websites, pictures etc. (Navarro et al., 2016; Rose & Strangman, 2007).

Face-to-face teaching

Both Francis and Debbie have a Mimio Teach attached to their white boards, however, neither of them made use of it during the observations. Francis made use of her projector and PP slides and repeated everything verbally that she wrote on the board, while Debbie only wrote

on the white board with the white board markers. Debbie made use of a story to explain how negative exponents should be dealt with, unfortunately, the story she used was flawed and the learners did not grasp what she wanted them to know and were not able to apply it to negative exponents.

During ERT

Both teachers explained the work through visual and auditory modalities. They made PP slide videos that the learners could watch asynchronously (Rappolt-Schlichtmann, 2020) and used the *animation* tool in PP to let the information appear at a certain time. Debbie's face was sometimes visible in some of the videos so the learners could see the manipulatives she used to explain (Morin, 2018) as well as for the HI learner to be able to do lip-reading. However, if she inserted her face mainly for the HI learner to do lip-reading, it was not clear why she did not do that for all of her videos.

5.4.3 Multiple means of action and expression

This refers to the *WHAT* of learning (Dalton et al., 2012) and includes physical action; expression and communication; and executive function. Teachers are required to provide learners with a variety of options to practice tasks, communicate and demonstrate what they have learned, which allow learners to capitalise on their special abilities or talents (Navarro et al., 2016; Rose & Strangman, 2007).

Face-to-face teaching

During the observed lessons of both teachers, there was no evidence that they made use of multiple means of action and expression. Both teachers' learners (HI or not) had to do homework from either a worksheet or the textbook and did not have a variety of options to practice tasks, communicate and demonstrate what they had learned (Dalton et al., 2012). The learners did not capitalise on their special abilities or talents (Navarro et al., 2016; Rose & Strangman, 2007) as no such opportunities were provided by the teachers.

During ERT

Neither of the two teachers made use of a variety of practice tasks per activity. All the learners, HI or not, had to do the same practice tasks. Both Francis and Debbie made materials, such as revision exercises, accessible to the learners (Rappolt-Schlichtmann, 2020). They uploaded the PP slides they used to make the videos onto Google Classroom as well as the memoranda of the homework. It was expected from the learners to do their homework and mark the calculations, however, the teachers did not check that the homework had been done.

The teachers albeit checked the assessment tasks the learners had to complete. Francis and Debbie organised a few Google Meet sessions where the learners could ask questions.

5.4.4 Curriculum differentiation

Differentiating the curriculum content, the learning environment, and the teaching methods such as learning materials, methods of presentation and learning activities and making use of multiple intelligences (DBE, 2011).

Face-to-face teaching

The learning environment contained technology support (Antia & Stinson, 1999; Easterbrooks & Stephenson, 2006; Erbas, 2017) in the form of a Soundfield and both teachers wearing a Roger Dynamic around their necks. Sometimes Francis and Debbie forgot to mute the Soundfield when assisting individual learners and all the learners could hear clearly what was said. In both teachers' classes the particular HI learner was positioned correctly (Eriks-Brophy & Whittingham, 2013; Simkiss, 2013; Uys & Selesho, 2017), more to the front and directly in front of the board.

Francis wrote the daily homework on the board and referred the learners in both classes repeatedly (Ayantoye & Luckner, 2016; Le Hanie, 2017; Simkiss, 2013) to the information on the board. Debbie, on the other hand only mentioned the homework and had to repeat it several times as the learners could not remember what she had said. In contrast to Francis, Debbie did not talk while writing on the board so the HI learner did not struggle to lip-read (Eriks-Brophy & Whittingham, 2013; Uys & Selesho, 2017). During the observations, neither of the participants rephrased words as part of vocabulary support for the HI learners (Ayantoye & Luckner, 2016; Estabrooks, 1998; Uys & Selesho, 2017).

Both participants' classes containing HI learners participated more actively during the observed lessons than the classes without the HI learners. Francis tended to give more time for the class with the HI learner (the Afrikaans class) to answer questions and participate in comparison with the class without the HI learner (the English class). She urged her learners to make use of different colours when doing the calculations in their books. She also used different colours when explaining. Francis gave the learners differentiated worksheets to do, that she copied from another textbook (DBE, 2011). Debbie explained, instructed and emphasised more in the class with the HI learner than in the class without the HI learner. It seemed that she was then more comfortable with the lesson, as it was the third time that day she had presented it. Debbie would make use of procedures or steps to show the learners

how certain calculations should be done. Neither of the two participants incorporated different intelligences as suggested by DBE (2011).

During ERT

Unfortunately, neither of the two teachers did anything special or different to assist the HI learners. Hardly any differentiation was implemented during ERT, thus, the equality of education cannot be guaranteed (Letzel et al., 2020). They did not rephrase unfamiliar or difficult words to assist the HI learners. Sometimes Debbie only said difficult words verbally with no visual explanation (Easterbrooks & Stephenson, 2006; Erbas, 2017). Both teachers mainly instructed learners what to do and spoke quite clearly and audible (Takala & Sume, 2018; Uys & Selesho, 2017).

In Francis' case, the second recording of the lesson in the language other than the first recording, she spoke a bit faster, but still audibly and clearly. For second recordings, Francis sometimes added things to enhance the explanation. I found that that was because she was more familiar with the content of the video and wanted to add something additional in reflection of the first recordings. The first videos she made, she used bilingual PP slides, and later on she made PP slides for each language. Francis sometimes recorded the marking of the homework instead of just giving the answers on PDFs. Both teachers made use of differentiated complexity examples in their explanations. Debbie inserted real-life examples in her teaching and worksheets (Uys & Selesho, 2017), where Francis did not let the learners experience the relevance of the work.

Debbie's face was visible as a video feed for difficult videos where her mouth was always visible. By doing so, the HI learners could lip-read (Krishnan et al., 2020). However, it was not clear why Debbie did not do this with all the videos. She inserted images and colour to the PP slides as she was a fun mathematics teacher. Many of her worksheets were bilingual.

5.4.5 Differentiating assessment

Alternate assessment based on modified attainment of knowledge (assess learner's mastery of grade-level content with reduced load/ more at functional level); and alternate assessment based on grade-level attainment of knowledge (this involves learners with disabilities who need for example, additional time, readers and amanuensis) (DBE, 2011).

Face-to-face teaching

Both Francis and Debbie said that the HI learners received exactly the same test for their assessments as the other learners. During the last two observed lessons, Francis handed the learners' assessments back to them. The assessments contained the four levels of mathematics questions, namely, knowledge, routine procedure, complex procedure, and problem-solving (DBE, 2011).

From past experience, Debbie mentioned that the HI learners have someone rephrasing the tests for them (DBE, 2011, 2014). As the face-to-face lessons were observed in the beginning of February 2020, Debbie's learners had not completed an assessment yet.

During ERT

Assessments were deprioritised during ERT as the learners did not write a June examination during ERT (Whittle et al., 2020). Both teachers gave the same assessments to the HI learners as the rest of the learners. The method of assessment for Francis and Debbie differed noticeable. Debbie set multiple-choice quizzes for the learners with the use of *Google Forms*. These consisted of differentiated questions and although the learners could only choose one option as their answer, the mark allocation alternated between one and five marks depending on the complexity of the question. Google Forms marked the questions itself. On the other hand, Francis provided the learners with four assessments on PP slides, traditional questioning with some consisting of old examination papers. Neither of the participants knew whether someone assisted the HI learners at home with the assessments.

5.4.6 Critical learning goals

Teachers need to identify critical learning goals. These can be guided by constants or by variables (specific goals identified for specific learners) (Whittle et al., 2020). Having clear goals is important (Carrillo & Flores, 2020).

Face-to-face teaching

Francis was well prepared for all her lessons with the necessary PP slides and it was evident that she knew what she wanted to achieve during each lesson – having clear goals was important (Carrillo & Flores, 2020). When there was a scheduled double lesson on the timetable, the second of the two lessons was always used for geometry. So, each period was a new lesson that she had planned containing new goals. Francis mentioned she was aware that there were different ability learners in her class.

Debbie knew what she wanted to teach in the observed lessons, however, it seemed that she was not that well prepared for the lessons. She sometimes did different examples with the Grade 9 classes and did not have copies of a worksheet ready for lesson 1W/O. The learners had to copy the homework questions from the board before doing them.

During ERT

Both teachers mentioned in the beginning of their videos what the topic of the videos were. Francis had to change her PP slides that she used for face-to-face teaching by breaking them down into smaller lessons for the ERT videos – having clear learning goals (Carrillo & Flores, 2020). The first two weeks' videos of Debbie were not well prepared as they contained spelling mistakes and an incorrect formula. From Week 3, the critical learning goals of Debbie's videos were better thought through as she had to make the PP slides before the recording of the videos. Both Francis and Debbie incorporated the animation tool from PP well and most of the time the information was revealed in the correct order.

During ERT, Francis changed her videos from being made with bilingual slides to videos made with separate languages. All of her videos followed the same recipe: greet the learners, share the topic of the video, share definitions and formulae when necessary, do examples, and give homework. Thus, she had clear critical learning goals for each video.

5.4.7 Ratio of teacher to learners

The necessary differentiation and individual support are difficult to achieve in large classes (high ratio of learners), thus, wherever possible, learners with barriers (LSEN) should be taught in smaller classes (Blatchford & Webster, 2018).

Face-to-face teaching

The Grade 10 class without an HI learner, had 16 learners and the other class with an HI learner in the class, had 13 learners. Both classes were therefore small classes (Blatchford & Webster, 2018). Francis was aware of the mixed ability group of learners in both classes. The two English classes Debbie taught consisted of 23 and 21 learners. She was very comfortable with the learners and she controlled the class situation well.

During ERT

Debbie had to take over one Grade 8 class from Francis, while Francis took over two classes from the HOD. For Francis, the increased number of learners played a huge role in the marking of the digital assessments[96] as she could not make ticks and provide feedback on the scripts.

5.4.8 Communication method

Once teachers had their learning goals, they had to decide between either synchronous or asynchronous learning strategies (Whittle et al., 2020).

Face-to-face teaching

The teaching prior to the COVID-19 pandemic and ERT was face-to-face (equivalent to synchronous). From the beginning of the year and before the lockdown, the teachers had access to Google Classroom where they could upload worksheets and the learners could access them asynchronously, however, this was not really utilised.

During ERT

As instructed by the school, both teachers made use of asynchronous teaching by making videos, even though Morgan (2020) felt it is unreasonable to expect teachers to compile their own resources. They also had a few synchronous Google Meet sessions where the learners could ask questions. The school focused more on the communication method than on the learning goals (Whittle et al., 2020) as they first decided on the communication method instead of letting the teachers determine each lesson's critical learning goals. On the other hand, asynchronous learning was beneficial when learners were engaged in activities not bound by a classroom's time-constraint (Whittle et al., 2020).

Debbie was quite skilful when it came to technology, however, there were still a few issues with the videos. It was evident from the errors made in the videos that she underestimated the recording of the videos at first and that she might have been a bit flabbergasted and out of her comfort zone (Gavrilean, 2022) during the recordings she made with her iPad and *Doceri*. It was not clear whether Debbie watched the videos and saw the mistakes and whether she just decided not to re-record the video. It was tricky reading what Debbie wrote in the first two videos while listening to what she said. This happened with the videos she made on her iPad. There was a definite improvement in the quality of the videos Debbie made over the duration of ERT, as the animations appeared at a more appropriate time. Debbie tried to ask questions

[96] As discussed in paragraph 5.4.10.

in videos, even though the learners could not answer. Francis, on the other hand, only provided the information - instructing. Both participants drew additionally with the mouse to emphasise certain procedures in the videos.

During the second recording of the lesson in the language other than the first recording, Francis spoke a bit faster, but still audibly and clearly. For second recordings, she sometimes added some things to enhance the explanation. This could have been caused by her realising she did not explain in full or that she felt more comfortable with the recording of the content. However, she did not re-record the first recordings, mainly the Afrikaans videos. At first, Francis would watch the videos before she uploaded them. However, due to time constraints she would later upload the videos without watching them first. Unfortunately, there were times both teachers went too quickly to the next slide. The learners did not have time to process the information, unless they paused the video and watched again.

Francis said she wondered if she would have been less stressed if she taught synchronously instead of asynchronously (Smith, 2020). For a perfect online lesson, Francis and Debbie preferred basically synchronous teaching where they could write and the learners could follow and ask questions. Even though Hodges et al. (2020) advocate that once the COVID-19 pandemic is over, we should not simply return to our teaching and learning practices prior to the pandemic and forget about ERT, it is evident that both Francis and Debbie prefer teaching similar to a face-to-face lesson. Thus, at least synchronously.

5.4.9 Building agency

The building of agency refers to the learners' ability to learn in their own homes and at their own pace, and might give teachers the opportunity to engage learners on topics and approaches of particular interest, instead of general lessons and formats (Whittle et al., 2020).

Face-to-face teaching

All the lessons Francis taught were general lessons and all the learners in Francis' class had to do the same work. She did not use topics and approaches of particular interest to engage the learners (Whittle et al., 2020). Debbie gave real-life examples applicable to rate and one particular learner was very interested in the example and wanted Debbie to show her how to solve the indirect proportion question. Unfortunately, at first Debbie did not know how to do the calculation and had to consult the internet.

During ERT

Neither of the teachers used ERT as an opportunity to engage learners on topics and approaches of particular interest. Their videos were instructed lessons where they explained new formulae or methods to the learners.

5.4.10 Assessments

Assessments can be individualised using technology to showcase the learning and skills of learners and large-scale standardised testing may become outdated (Kaden, 2020).

Face-to-face teaching

Neither of the participants individualised the assessments – all the learners had to do the same assessments. While teaching, Francis referred to questions that the learners might see in a test again. Francis handed out the Grade 10 assessments during the third and fourth observed lessons. The assessments were based on the four levels of mathematics questions, namely, knowledge, routine procedure, complex procedure, and problem-solving and the learners had to write the answers on a separately given paper. It was the same case with Debbie's Grade 8 learners, while her Grade 9 learners had not done an assessment yet.

During ERT

Neither of the teachers individualised the assessments. All the learners had to do the same assessments, HI or not. Debbie used technology and made use of quizzes and multiple-choice questions she created with Google Forms and which were marked by the computer itself. Although the learners could only choose one option as their answer, the mark allocation differed depending on the complexity of the question.

The assessments Francis gave the learners were ordinary questions with some from old examination papers and presented in the old-fashioned way. She followed quite a cumbersome and time-consuming process when marking as she did not print the learners' assessments and therefore could not make ticks on the PDFs. She made notes on an A4 paper and kept track of the learners' marks. Afterwards she would write a short personal report for each learner.

5.4.11 Social role of the teacher

Teachers build relationships with parents to gain insight into the learners' needs and their environmental constraints. This parental connection provides "context for the social presence of the teacher" (Whittle et al., 2020, p. 317).

Face-to-face teaching

At the time of the interview, Francis had only been teaching four weeks at the inclusive school and had limited time to have contacted the parents and gain insight into the learners' needs and environmental constraints. She mentioned that the parents should make sure that the learners understood, however, she did not state that she informed the parents thereof. After handing out the learners' class tests, Francis requested from the learners that the parents sign the tests. As this was the second year Debbie taught the learners, she presumably already knew more about the learners and their circumstances. However, she had not realised (known) that the class that presumable did not contain an HI learner, actually had one.

Both participants were comfortable with the learners and knew their names. At times both would call the learners by name to participate in the lesson. When learners wanted to show Francis their methods, she went to their desks and looked at the learners' work. When Debbie gave the learners homework to start doing in class, she went and sat behind her desk. She did not walk through the class to see whether the learners were coping.

During ERT

Francis mentioned the school expected from the teachers to be in contact with the learners often. The HOD assisted with the communication with the learners and parents. Sometimes Francis had to write emails to the parents. The parents also emailed her during ERT saying their child could not submit the work due to certain circumstances. Neither Francis nor Debbie were involved in sorting out the learners' access to devices and internet or following up to make sure the learners were coping during ERT. Francis assumed that the HI learner coped well as she thought he had earphones that would help him. This is evidence that Francis did not understand the barriers to learning the HI learners experienced. Debbie also was not sure what the home situation of the HI learner was, and whether there was someone at his house that could assist him or not. Although Debbie had the minimum of social contact with the learners, she spoke to the learners in some of her videos, telling them how much she missed seeing them. Learners preferred videos made by their own teachers as the learners loved to hear their teachers' voices (Anderson, 2020).

5.4.12 Pedagogy and the learner social role

A social-driven pedagogical approach to enhance learner engagement and participation (Whittle et al., 2020) can be achieved by employing a problem-posing pedagogical approach (Olawale et al., 2021).

Face-to-face teaching

The learners in the class without an HI learner barely participated and Francis just continued with her explanation. Francis would not necessarily wait for the learners to answer her questions. She would ask a question and immediately give the answer. It was more rhetorical questions. Both teachers experienced the classes containing the HI learners as more engaging and in Francis' case, she could not even complete the same amount of work as she did in the other class. Debbie tended to ask more learners by name in the class without the HI learner, as, like she explained, the learners in that particular class did not answer by themselves and she tried to get everyone to work. The learners would sit and wait and see what Debbie did, while the learners in the class of the HI learner, tended to put up their hands and were eager to answer. Again, this was not due to the presence of an HI learner, but rather due to the dynamics of the class. Neither Francis nor Debbie followed a problem-solving approach that would get the learners to construct their own understanding.

During ERT

Neither of the teachers had a social-driven approach with the learners. It was difficult for Francis to determine whether the learners understood, as they copied so much of the assessments from others and she did not see them. Debbie made the remark that most of the learners did not even actually watch the videos. At one stage, Debbie requested the learners to give their answers to the question in the comment section on Google Classroom. Debbie urged the learners in her videos to contact her if they had any problems. The lack of interaction was caused by the asynchronous approach (Hebebci et al., 2020).

5.4.13 Feedback

Learners need to receive feedback relating to progress and assessments, for example, teachers should make use of alternative feedback strategies, such as non-graded formative feedback, self-feedback and peer feedback (Whittle et al., 2020).

Face-to-face teaching

Francis was keen to compliment learners when they answered something correctly, while even though Debbie tended to repeat the learners' answers, she would not always tell them whether their answers were correct or not. Debbie would explain how the calculation should have been done without giving feedback to the learners with the incorrect answers. Francis wrote comments on the learners' assessments she handed back. She commented in class during lesson 1W/O that she saw some gaps at certain questions when she walked through the class to check the learners' homework. Debbie gave opportunities for learners to show their methods in doing a calculation. She then explained to the class what the learners did and complimented the learners on their methods. Francis also complimented learners' correct answers as it is necessary to motivate and encourage learners in mathematics (Luitel, 2020)

During ERT

The feedback Debbie gave her learners, was their marks for their assessments and answering questions, while Francis' feedback consisted of the learners' marks together with a short personal report for their assessments. Francis also mentioned that she had to answer the learners' questions on Google Classroom.

5.4.14 Effect of ERT on the teacher

For both Francis and Debbie the ERT process was quite rough. The making and uploading process of the videos was challenging. For Francis the challenge was how to make the videos, while for Debbie the challenge was to stick to the requirements set by the school. The whole process of making the videos was time consuming for Debbie and she struggled to have a balance between work, home and resting. Francis was stressed that she would not be able to finish the syllabus with the learners. Francis and Debbie learned new things on how to make the videos by *Googling* it and Francis was chuffed with herself for accomplishing this. Francis wished she had received some training on the technical procedures, while Debbie wished for reliable technology. Hebebci et al. (2020) feel that apart from teachers, learners should also receive training to adapt to ERT and the necessary infrastructure support should be strengthened to erase technical problems and Snelling and Fingal (2020) are of the opinion that it is imperative to invest some time – even just a day or two – to prepare and get ready for ERT. Both teachers experienced ERT as a 24-hour job (Donitsa-Schmidt & Ramot, 2020; Kaden, 2020).

The home situations for Francis and Debbie were quite opposite. As Francis' husband and two children were also at home, she struggled to keep all the balls in the air. Especially as the

household tasks should also had to be done and her own children had their own homework. Luckily, at some point she received help from her mother. Debbie on the other hand, experienced plenty of support from her boyfriend and his family where she stayed. They brought her lunch and coffee while she was working. At midnight they even told her to switch off the computer and go to bed.

Debbie's proudest moment of ERT was that she survived it, while Francis felt that if she could have resigned, she would have. She did not plan to make use of online learning once everything was back to "normal".

5.4.15 Summary of discussion on Theme 3

To summarise, neither of the two participants applied UDL with multiple means of engagement, representation, and action and expression. All the learners, HI or not, had to do the exact same work in the same way. During face-to-face teaching Francis seemed to be much more prepared than Debbie. During ERT both teachers had to make videos where Debbie was the only one to insert her face on some videos so that the HI learner could lip-read. It was unclear why she did not insert her face on all of the videos. The learning environment at the private inclusive high school contained technology support for the HI learners. Francis had more visual clues for the HI learners – actually for all the learners – when she wrote the homework and upcoming assessment days on the board in comparison with Debbie, who only said what the homework was. Neither Francis nor Debbie used rephrasing during the observed lessons.

In both participants' classes containing the HI learner, the learners participated more enthusiastically and asked more questions compared to the classes without the HI learners. It was evident during ERT that Francis was more comfortable with the second recording of the lesson in a different language as she spoke a bit faster and emphasised more things. Debbie expected her Grade 9 learners to answer multiple-choice questions on Google Forms, while Francis inserted ordinary questions from past papers onto PP slides. The computer marked the multiple-choice questions for Debbie, while Francis had to follow a tedious, cumbersome process to mark the assessments done by the learners. Neither Francis nor Debbie were involved in sorting out the learners' access to devices and internet or following up to make sure the learners coped during ERT. Francis assumed that the HI learner coped well as she thought he had earphones that would help him. This is evidence that Francis did not understand the barriers to learning the HI learners experienced. Debbie also was not sure

what the home situation of the HI learner was, whether there was someone at his house that could assist him or not.

Due to the asynchronous approach during ERT, neither of the teachers knew whether the learners actually understood the work and Debbie reported that most of the learners did not even actually watch the videos. Thus, the learners did not engage, while Francis reported on the learners copying from each other. For both Francis and Debbie the ERT process was quite rough. Their situations at home were vastly different. Debbie experienced plenty of support from her boyfriend and his family where she stayed, while Francis still had to attend to the household chores and the learning of her own children. Both teachers experienced ERT as a 24-hour job. Debbie's proudest moment of ERT was that she survived it, while Francis felt that if she could have resigned, she would have. She does not plan to make use of online learning once everything is back to "normal". It was found that the implementation of inclusive education in practice is not yet guaranteed (Lindner et al., 2019)

5.5 Findings, trends and explanations

An analysis of the discussions on Themes 1-3 was done and resulted in the following summary in which the findings, trends and explanations are presented.

- **Importance of formulae, skills and processes**

Both Francis and Debbie placed a huge focus on the mastering of skills and the demonstration of such with correct answers and good performance as an outcome (Ernest, 1989a). During face-to-face teaching and ERT, Francis would provide the method and formula as they were supposed to be used and expected from the learners not to overthink the formulae and methods, but just to be able to apply them correctly – especially in tests. It was like "here's the procedure, here's a few examples, now here's some for practice" (Garofalo, 1989, p. 504). That was also the case during Debbie's ERT. During face-to-face teaching Debbie provided the learners with a story to remember the method and formula, instead of the story explaining to them the reason for the method.

- **Positive beliefs about inclusive education**

Debbie has positive beliefs about inclusive education as she has seen videos of progress and success over the years of some HI learners, however, she felt that HI learners worked at a slower pace and the curriculum did not allow for that. Francis had positive beliefs provided

that the HI learners could cope and had academic success. She believed it was the HI learner's responsibility to keep up with the pace as she could not work slower.

- **Training imperative for successful inclusive education**

Even though Francis had more years of teaching experience, it was only her second month of teaching at this particular private inclusive school and up until this point she had not yet received any training from the school's audiology department. It was evident that she did not understand the barriers to learning HI learners experienced. She was of the opinion that if the HI learners could hear her through the Roger microphone, they would be fine. Debbie received training the previous year on how to teach HI learners. In comparison to Francis, she realised (and it was evident in her classroom practice) that she should not talk while writing on the board (de Souza, 2020), however, Debbie interpreted *integration* as *inclusion*. She believed there was not a specific way of teaching HI learners (Dalton et al., 2012; Dreyer, 2017; Engelbrecht et al., 2016; Engelbrecht et al., 2015). Neither of the two participants could provide applicable examples of *rephrasing* and I found that neither of them rephrased during observations or ERT. Francis and Debbie were unaware of the DBE's *Guidelines for responding to learner diversity in the classroom* where differentiation is discussed. Continuous training and follow-up by the audiologists and school is thus imperative for successful inclusive education. Policy documents should also be read and discussed.

- **The inclusive school provide support for inclusive education**

The school provided technology including the Roger microphones and Soundfield systems in the classes as well as a Mimio Teach (Antia & Stinson, 1999; Crandell & Smaldino, 2000). There were audiologists on-site for any support with the hearing devices. During the daily academic lessons, HI learners could be withdrawn from the regular classes to receive individual assistance. When writing tests, the HI learners also received accommodations in the form of amanuensis and rephrasing as prescribed by DBE (2014).

- **Lesson preparation in an inclusive school is even more vital**

Lesson preparation is vital in any school and classroom, however, being at an inclusive school it is even more vital to prevent the teaching of general lessons. Francis and Debbie taught general lessons applicable to all the learners, HI or not. Inclusive practices, such as UDL, take careful planning and preparation by the teachers (CAST, n.d.; Morin, 2018). Francis was prepared for her general lessons as she made use of PP slides during face-to-face teaching. Debbie on the other hand seemed unprepared for her face-to-face teaching. She did not make

use of the same examples and the photocopied worksheets were not ready for the first lesson and the learners had to copy the questions from the board.

- **Limited inclusive practices during face-to-face teaching**

Both teachers applied limited inclusive practices during face-to-face teaching. Neither of them made use of a UDL approach with multiple means of engagement, representation, and action and expression. During their teaching they also did not incorporate different intelligences as suggested by DBE (2011) and their assessments were the same for all the learners. Neither Francis nor Debbie did something special or different to assist the HI learners.

- **ERT did not allow the teachers to have a problem-solving view**

Both Francis and Debbie admitted, and it was evident from the videos, that during ERT, they could not be facilitators. Debbie said she realised that the videos did not allow her to be a facilitator, as she spent most of the time only explaining the concepts. Francis on the other hand spent most of the time explaining formulae and procedures. According to Luitel (2020), an approach of practice until a learner memorised the work or knows the process or steps of solving specific problems, has an intention to control the mathematical activity and problem-solving through instrumental actions and is more likely to promote the instrumentalist view of mathematics.

- **Assessments were deprioritised during ERT**

Assessments were deprioritised during ERT (Whittle et al., 2020). The learners did not write a mid-year examination as ERT occurred during that period. Debbie's assessment tasks were three multiple-choice Google forms that the learners had to complete, while Francis gave the learners four assessment tasks in the form of ordinary, content-based questions that the learners had to do on paper, scanned and uploaded onto Google Classroom.

- **HI learners neglected during ERT**

I found that the HI learners were neglected during ERT as both teachers admitted they had done nothing differently for the HI learners than for the rest of their class (Letzel et al., 2020). There was also less contact and feedback to and from learners, as the teachers made use of asynchronous teaching. Debbie inserted her face into certain videos that she classified as difficult. When asked, she acknowledged that it was for lip-reading for the HI learners, however, if it was primarily for the HI learners, I wondered why she did not insert her face into all of the videos.

- **In retrospect, the teachers would prefer a synchronous teaching style above an asynchronous teaching style during ERT**

Debbie missed the interaction between herself and the learners. She wished she could ask the learners questions and they could reply. Francis thought that synchronous teaching would have relieved the stress she had to make videos and she would have saved some time, as teaching during ERT became a 24-hour job. However, she realised that there would have been learners not attending the synchronous teaching, so the asynchronous teaching was the best option. Fernandez et al. (2022) report on a combination of synchronous and asynchronous learning leading to balanced education.

- **Lack of support during ERT**

Teachers' (and learners') technological skills should be improved through systematic training initiatives focussing on new emerging models and the effective use of online learning (Ferri et al., 2020). Francis and Debbie learned new things on how to make the videos by *Googling* it. Francis was pleased with herself for accomplishing this. The teachers did not receive any training. Francis wished she had received some training on the technical procedures, while Debbie wished for reliable technology and less strict requirements from the school regarding the appearance of the videos. She feels her teaching style did not fit in with the school's requirements.

- **Using teaching skills learned during ERT in post-pandemic times**

Hodges et al. (2020) advocate that once the COVID-19 pandemic was over, we should guard against simply returning to our teaching and learning practices prior the pandemic and forget about ERT – the possible need for ERT must become part of a teacher's skill set and professional development programme. However, to the question, *'Will you make more use of online learning in the future if everything is back to normal?',* Debbie explicitly said that she preferred face-to-face teaching and Francis said she did not plan to make use of online learning once everything was back to "normal".

- **Contradictions between the teachers' beliefs and their inclusive practices**

The following beliefs held by the teachers in my study were contradicted in their inclusive practices.

Table 5.1

Contradictions between the Teachers' Beliefs and their Inclusive Practices

Teacher	Belief	Practice
Francis and Debbie	During face-to-face teaching, both believed they had a problem-solving view resulting in them being facilitators and the learners constructing their own knowledge.	There was no evidence of them being facilitators with the outcome of learners constructing their own understanding.
Francis	Saw herself as an explainer, having a Platonist view.	Francis mainly focused on *learner understanding of definitions, procedures and formulae* and not *learner understanding of knowledge.*
Debbie	She did not see herself as an instructor, having an instrumentalist view.	During face-to-face teaching and ERT, Debbie instructed the learners – following a scheme.
Francis	She believed she had the necessary skills to teach HI learners.	She lacked skills and she did not understand the barriers HI learners faced.
Debbie	Debbie believed the pace of the curriculum was too fast.	She gave 15 minutes of her lesson for the learners to start with the homework.
Debbie	She felt that the pandemic did not change her way of teaching.	During ERT she tended to instruct and explain instead of focussing on problem-solving.

Teachers' beliefs should be influenced by their experience and training and it should be aligned with their inclusive practices.

5.6 Conclusion

In this chapter, I discussed the findings thematically based on the basis of a literature control. I also identified trends and possible explanations for the trends. In Chapter 6, the research questions are answered and I reflect on my research study. I also draw conclusions from the case study and discuss the limitations and significance of the study. Lastly, I make recommendations for further research.

Chapter 6

Conclusions and implications

6.1 Introduction

In Chapter 6 I provide a summary of Chapters 1 through 5; answer the research questions that guided this study and take time to reflect on my research. I discuss what I would have done differently and make provision for the fact that I may have been wrong in my interpretation of the teachers' beliefs and inclusive practices. This is then followed by the conclusion, recommendations and limitations of the study. I conclude the chapter with a final word.

6.2 Chapter summary

In Chapter 1 the research study was introduced and contextualised. The purpose of this study was to, by means of a case study, investigate the way teachers teach mathematics in an inclusive, face-to-face classroom containing a few oral HI learners with the view to establishing the influence of the mathematics teachers' beliefs about their inclusive practices. And secondly, to investigate the inclusive practices of the inclusive schools' mathematics teachers during ERT. Then I also discussed the problem and the rationale for the study, followed by the research questions, and ended with a discussion on the methodological considerations and the possible contributions of the study.

Chapter 2 presented an in-depth analysis of the findings in the relevant literature as well as the conceptual framework on which the study is based. I discussed *beliefs* in general, followed by a discussion on teacher beliefs about the nature of mathematics and about inclusion. This was followed by a discussion on inclusive education and practices and the HI learner. Attention was given to South Africa's response to diversity and the current inclusive practices in South Africa. Midway through the research the COVID-19 pandemic started and I discussed the pandemic and ERT. Lastly, I discussed the conceptual framework based on concepts and theories from relevant works in the literature.

Chapter 3 consisted of a description of the qualitative methodology used in the study. The research paradigm that underpinned this study was social constructivism combined with

interpretivism. This is an exploratory case study. I reported on the data collection process. Interviews were held to investigate the teachers' beliefs about mathematics and inclusion. Observations during face-to-face teaching and the analysis of documentation and videos made during ERT, were used to examine teachers' inclusive practices. I used Atlas.ti 9 to analyse the video and audio data with a DEDUCTIVE-inductive[97] approach to coding the data. I identified three themes: *Beliefs about the nature of mathematics*; *beliefs about inclusion*; and *inclusive practices.* The deductive phase of analysis was followed by an inductive analysis where the organised data was studied in order to explore new patterns and trends. Two sub-themes arose, namely *support for inclusion* and *effect of ERT on the teacher.* Lastly, I discussed the trustworthiness of the study and the ethical considerations that were taken into consideration.

In Chapter 4 I presented the findings from each participant thematically. The three themes presented were: 1) Teachers' beliefs about the nature of mathematics, 2) Teachers' beliefs about inclusion, and 3) Teachers' inclusive practices. At the end of each presentation I made a summary in table form[98] of the participants' data. Chapter 5 consisted of a discussion of the findings with relation to the findings in the literature. Trends were then identified and subsequently explained.

6.3 Verification of research questions

Based on the rationale of the implementation of inclusive education and my own experience as a teacher in an inclusive school, I decided to explore the influence mathematics teachers' beliefs about the nature of mathematics and about inclusion have on their inclusive practices. In order to do so, the following main research question was formulated: What influence do mathematics teachers' beliefs have on their inclusive practices for oral HI learners during face-to-face teaching and ERT? To address this main question, the following three secondary questions guided the enquiry:

1. What is the nature of inclusive schools' mathematics teachers' beliefs?
2. What practices are used during face-to-face teaching and ERT to include HI learners in the general mathematics classroom?
3. How are these practices influenced by the teachers' beliefs about the nature of mathematics and inclusivity?

[97] Uppercase indicates the preference given to the style of analysis.
[98] See Tables 4.3; 4.4 and 4.10.

Next, I will use social constructivism as a research paradigm to answer these questions. Social constructivism is often combined with interpretivism (Creswell & Creswell, 2018). Interpretivists believe that reality is not objectively determined, but socially constructed and therefore, there is a greater opportunity to understand the perceptions people have of their own activities when they are studied in their natural environment (Nieuwenhuis, 2016b).

Table 6.1 below regarding the two participants' beliefs about the nature of mathematics, their beliefs about inclusion, and their inclusive practices was prepared to facilitate the discussion on the answers to the research questions.

Table 6.1

Summary of the Participants' Information

Keys used in the table:			
Inclusive practices:	Evident: ✓	Somewhat evident: ●	Not evident/sufficient: ×
Beliefs versus inclusive practice:	Corresponds: ✓	Corresponds and contradicts: ●	Contradicts: ×

Paragraph numbers in the thesis are indicated in brackets.

Background information	**Francis**	**Debbie**
Age	37	25
Qualifications	➢ BEd Senior Phase ➢ BEd Hons Mathematics Teaching	➢ BSc Mathematics ➢ PGCE in FET and Senior Phase Mathematics
Experience as a mathematics teacher (years)	14	2
Duration of teaching mathematics for oral HI learners at private inclusive high school during first interview	4 weeks	1 year and 4 weeks

Inclusive practices	Face-to-face teaching	During ERT	Paragraph number in thesis	Face-to-face teaching	During ERT	Paragraph number in thesis
Multiple means of engagement	×	×	(4.5.1.1)	●	●	(4.5.2.1)
Multiple means of representation	×	●	(4.5.1.2)	●	✓	(4.5.2.2)
Multiple means of action and expression	×	×	(4.5.1.3)	●	×	(4.5.2.3)
Curriculum differentiation	●	●	(4.5.1.4)	●	●	(4.5.2.4)

Differentiating assessment	●	×	(4.5.1.5)	✓	×	(4.5.2.5)
Critical learning goals	●	●	(4.5.1.6)	●	●	(4.5.2.6)
Ratio of learners	✓	●	(4.5.1.7)	✓	●	(4.5.2.7)
Communication method	✓	✓	(4.5.1.8)	✓	✓	(4.5.2.8)
Building agency	×	×	(4.5.1.9)	●	×	(4.5.2.9)
Assessments	×	×	(4.5.1.10)	×	×	(4.5.2.10)
Social role of the teacher	×	●	(4.5.1.11)	×	●	(4.5.2.11)
Pedagogy and the learner social role	●	×	(4.5.1.12)	●	●	(4.5.2.12)
Feedback	✓	●	(4.5.1.13)	●	●	(4.5.2.13)

Beliefs versus inclusive practices	**Francis**		**Debbie**	
The nature of mathematics	Being an instructor during face-to-face teaching. (4.3.1.1)	✓	NOT being an instructor during face-to-face teaching (4.3.2.1)	×
	Being an explainer during face-to-face teaching. (4.3.1.2)	●	Being an explainer during face-to-face teaching. (4.3.2.2)	✓
	Being a facilitator during face-to-face teaching. (4.3.1.3)	×	Being a facilitator during face-to-face teaching. (4.3.2.3)	×
	Being an instructor during ERT. (4.3.1.1)	✓	NOT being an instructor during ERT. (4.3.2.1)	×
	Being an explainer during ERT. (4.3.1.2)	×	Being an explainer during ERT. (4.3.2.2)	●
	NOT being a facilitator during ERT. (4.3.1.3)	✓	NOT being a facilitator during ERT. (4.3.2.3)	✓

Inclusive education	If an HI learner can cope on his own he can be in her class. (4.4.1.1)	✓	Inclusion is not a specific way to teaching the HI learners. (4.4.2.1)	✓
	She has positive beliefs about inclusive education, provided that the HI learners have academic success. (4.4.1.1)	✓	The pace of the curriculum is too fast. (4.4.2.1)	×
Self-efficacy	She has the necessary skills to teach HI learners. (4.4.1.2)	×	Can teach HI learners due to the training she received. (4.4.2.2)	●
Subjective behavioural standard	Francis feels the parents cannot expect from her to ensure the HI learners achieve academically. (4.4.1.3)	✓	Debbie believes she is not primarily responsible for the HI learners in her class. (4.4.2.3)	✓

6.3.1 Question 1: What is the nature of inclusive schools' mathematics teachers' beliefs?

I looked at the nature of inclusive schools' mathematics teachers' beliefs from two perspectives. The first perspective was the inclusive teachers' beliefs about the nature of mathematics, and the second perspective was the inclusive teachers' beliefs about inclusion.

Teachers' beliefs about the nature of mathematics

Teachers' concept of the teaching and learning of mathematics reflect their beliefs about mathematics (Thomson et al., 2003) and their views (Ernest, 1989b). According to Ernest (1989a), a teacher with an *instrumentalist view* is an instructor with the mastering of skills with correct performance as an outcome. A *Platonist view*-teacher is an explainer with the learner understanding of knowledge as an outcome, while a teacher with *a problem-solving view* is a facilitator with the learner constructing understanding as an outcome (Ernest, 1989a). During face-to-face teaching, both Francis and Debbie had a Platonist and problem-solving view. Francis also had an instrumentalist view as, according to her, she was also an instructor. Debbie did not see herself as an instructor during face-to-face teaching – even though data showed otherwise.

ERT changed the teachers' views on the nature of mathematics. As the teachers had to make videos during ERT, neither of the teachers presented a problem-solving view. Debbie realised that the asynchronous teaching method did not allow her to have a problem-solving view as the learners could not answer questions. It was more important to provide the learners with the correct formulae, methods and skills and she believed she only had a Platonist view during ERT. Although Francis felt she had a Platonist view during ERT, she also focused mainly on the correct formulae, methods and skills and coached the learners in answering questions.

In conclusion, both teachers' beliefs correspond with the idea of Ernest (1989b) and Liljedahl (2008b) of having a combination of views, however, during the observations the views of the teachers did not correspond in totality with their practice, not during face-to-face teaching or ERT.

Teachers' beliefs about inclusion

As the study focused on the inclusion of HI learners, teachers' beliefs about inclusion regarding HI learners was the main focus area. Ajzen's theory of planned behaviour was used

by Vermeulen et al. (2012) to distinguish three types of teacher beliefs regarding HI learners, namely, *beliefs about inclusive education*; *beliefs about their self-efficacy*; and *beliefs about the subjective behavioural standard regarding inclusion of students with SEN*. Both Francis and Debbie have positive beliefs about inclusive education. Debbie, on the one hand, has seen videos of the progress and success over the years of some HI learners, while Francis' belief is positive, provided that the HI learners' hearing loss was detected early (Khan & Joseph, 2020) and that they had academic success (Khamis, 2011; Vermeulen et al., 2012). She feels if an HI learner can cope on his own he can be in her class. That is similar to Debbie feeling that the pace of the curriculum is too fast. Thus, the pace of the curriculum should not influence the HI learner, meaning the HI learner should be able to cope on his own.

Both of the participants believed they had the necessary skills. Francis was an experienced mathematics teacher with 14 years' experience, while Debbie had only started teaching in her third year. The main difference between Francis and Debbie was that the only requirement Francis came across when she taught an HI learner previously at another school, was that she had to hang the Roger microphone around her neck. Debbie on the other hand, had had a year's experience at the particular inclusive high school where she received training throughout the year. She knew what was expected from her, although she felt inclusion was not a specific way of teaching the HI learners. Neither of the participants felt they were primarily responsible for the HI learner in their class. Francis also felt that parents could not expect her to ensure the HI learners achieved academically.

The focus of the ERT videos was the correct formulae, methods and skills. Both teachers felt skilled at including HI learners in their face-to-face classes, however, for different reasons. An important thing was that the HI learner should be able to cope on his/her own. Thus, the teachers were referring to *integration* and not *inclusion*. Based on the interviews, it was evident that Francis did not understand the barriers to learning HI learners have. Thus, training was required to enhance her understanding. The training should be continuous and not only for the first year of teaching at the private inclusive high school as Debbie with her one year's experience still could not give a proper example of rephrasing in the mathematics classroom.

In conclusion, even though the school is geared for HI learners due to the Roger and Soundfield systems mounted in the classrooms and audiologists and speech therapists on the school grounds, both teachers' beliefs relate to the HI learners' abilities to cope on their own. Thus, they referred to *integration* and not *inclusion*. Continuous training is required to enhance the teachers' understanding of inclusion especially the barriers to learning that HI learners face.

6.3.2 Question 2: What practices are used during face-to-face teaching and ERT to include HI learners in the general mathematics classroom?

When I analysed the data, I used a combination of three frameworks. As can be seen from the conceptual framework and explained earlier, all of the aspects of the UDL approach (CAST, n.d.), the *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements* (DBE, 2011) and the design step of the *ERT environment* framework (Whittle et al., 2020) in the inclusive practices were combined in this study. The rationale for including the ERT environment framework as an inclusive practice, is that during the classify step of the framework, one needs to determine the factors that are constants and variables. And by doing so, it is none other than taking note of the diversity and applying that knowledge to one's practice. In other words, it becomes inclusive practice. UDL can also make use of videos and the DBE (2011) mentions that e-learning can be included as differentiated learning material in the teaching method aspect. Thus the reason for including the ERT environment framework as part of the inclusive practices

During face-to-face teaching

It was evident that the more experienced Francis was a well-prepared teacher knowing exactly what should be done in each lesson. She knew what method worked for her and was set in her ways. She had a specific approach to each lesson and went out of her way to 'coach' the learners in being able to complete a test. The younger Debbie, on the other hand, seemed unprepared at times as she made mistakes and did not do the same examples with all her classes. Neither of the two teachers approached the classes containing the HI learners differently.

The following table is a comparison of Francis' and Debbie's inclusive practices during face-to-face teaching.

Table 6.2

Comparison of the Participants' Inclusive Practices during Face-to-Face Teaching

	Evident ✓	Somewhat evident ●	Not evident/sufficient ✖
Francis	▪ Ratio of learners ▪ Communication method ▪ Feedback	▪ Curriculum differentiation ▪ Differentiating assessment ▪ Critical learning goals ▪ Pedagogy and the learner social role	▪ Multiple means of engagement ▪ Multiple means of representation ▪ Multiple means of action and expression ▪ Building agency ▪ Assessments ▪ Social role of the teacher
Debbie	▪ Differentiating assessment ▪ Ratio of learners ▪ Communication method	▪ Multiple means of engagement ▪ Multiple means of representation ▪ Multiple means of action and expression ▪ Curriculum differentiation ▪ Critical learning goals ▪ Building agency ▪ Pedagogy and the learner social role ▪ Feedback	▪ Assessments ▪ Social role of the teacher

Francis tended to give more feedback to the learners than Debbie, while Debbie was more aware of differentiating assessment. Although both of them applied curriculum differentiation, they had insufficient social roles. It can be seen from the table that there is more evidence of Debbie's practice being inclusive in comparison to Francis' practice. The reason for this could be the previous year's training Debbie received at the particular inclusive high school and her view of the nature of mathematics from a Platonist and problem-solving stance.

In conclusion, during face-to-face teaching the teacher with more experience in a general classroom had less inclusive practices than the teacher with more experience in an inclusive school. However, neither of the two teachers taught the classes containing HI learners differently from the classes without HI learners.

During ERT

The COVID-19 pandemic forced a switch to online instruction in the education sector. Hodges et al. (2020) suggest the term *emergency remote teaching*, where ERT can be defined as "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" (p. 6).

From Table 6.3, it is evident that both teachers tended to have less inclusive practices during ERT.

Table 6.3

Comparison of the Participants' Inclusive Practices during ERT

	Evident ✓	Somewhat evident ●	Not evident/sufficient ✖
Francis	▪ Communication method	▪ Multiple means of representation ▪ Curriculum differentiation ▪ Critical learning goals ▪ Ratio of learners ▪ Social role of the teacher ▪ Feedback	▪ Multiple means of engagement ▪ Multiple means of action and expression ▪ Differentiating assessment ▪ Building agency ▪ Assessments ▪ Pedagogy and the learner social role
Debbie	▪ Multiple means of representation ▪ Communication method	▪ Multiple means of engagement ▪ Curriculum differentiation ▪ Critical learning goals ▪ Ratio of learners	▪ Multiple means of action and expression ▪ Differentiating assessment ▪ Building agency ▪ Assessments

	Evident ✓	Somewhat evident ●	Not evident/sufficient ✖
		▪ Social role of the teacher ▪ Pedagogy and the learner social role ▪ Feedback	

An asynchronous communication method was instructed by the school. Neither of the teachers had multiple means of action and expression and focused on building agency. As assessments were not prioritised, they did not differentiate the given assessments. The teachers mainly focused on teaching the learners formulae, methods and skills in the videos – having an instrumentalist view. Debbie used a more social-driven pedagogical approach than Francis. She inserted her face and told the learners how much she missed them. On the other hand, Francis just instructed the learners in her Afrikaans and English videos. Both teachers tried to replicate their face-to-face teaching in the videos, as that was what they were familiar with.

In conclusion, during ERT both teachers tried to replicate their face-to-face teaching in the videos, as that was what they were familiar with. However, the asynchronous communication method hindered their practices and less inclusive practices were evident during ERT than during face-to-face teaching.

In summary of what practices are used during face-to-face teaching and ERT to include HI learners in the general mathematics classroom, my study seems to provide evidence that although a teacher is teaching at an inclusive school, it does not guarantee that the teacher demonstrates sound inclusive practices. An experienced teacher set in her own ways does not necessarily change her way of teaching to include the HI learner, especially if she does not understand the barriers to learning the HI learner has. On the other hand, a teacher with much less experience at a mainstream school and who received a full year of training at the inclusive school, does incorporate inclusive practices. However, the training should be ongoing and focused on the inclusive practices to have better and long-lasting results. According to the data, it was also evident that during ERT the teachers did not particularly focus on the HI learners. They only tried to survive. Thus, in possible future ERT situations, the school should not forget about the HI learners and their needs. The school should have a policy on how to deal with the HI learners during asynchronous teaching – this can include the

teachers reporting on how they plan to include the HI learners. Then again, the execution of the policy should be monitored by an experienced inclusive teacher or HoD.

6.3.3 Question 3: How are these practices influenced by the teachers' beliefs about the nature of mathematics and inclusivity?

I found trends in the correspondences and contradictions between the teachers' stated beliefs and their inclusive practices. A common belief was that the teachers did not have a problem-solving view, thus being a facilitator, during ERT and it reflected in their videos. Debbie mentioned that it was not possible due to the asynchronous teaching, as the learners could not respond when she asked questions.

The following contradictions were noted:

- Both teachers believed they incorporated problem-solving into their face-to-face inclusive practices, however, there was no evidence of them being facilitators with the outcome of learners constructing their own understanding. It was as if they did not understand what being a facilitator entailed.
- Both teachers believed they had the necessary skills to teach HI learners. Although Debbie applied more inclusive practices than Francis, neither of them could provide a proper example of *rephrasing* nor did they apply rephrasing in their lessons. A reason for them believing they had the necessary skills could be that they felt they had the necessary *mathematics* skills. And by having that, they would be able to teach HI learners. Thus, again it seems that neither of them understood the barriers to learning HI learners have to the fullest and expect the HI learners to cope on their own.

For a teacher to shift to a problem-solving approach to teaching requires a change in the teacher's belief system, especially the teacher's concept of the nature of mathematics and mental models of teaching and learning mathematics (Ernest, 1989a). Ernest (1989a) explains that "the teacher's conception of the nature of mathematics, is his or her belief system concerning the nature of mathematics as a whole" (para. 6). Liljedahl et al. (2007) conclude that "a belief that teaching mathematics is *all about telling how to do it* may come from a belief that learning mathematics is *all about being told how to do it*" (p. 279). Teacher beliefs determine planning, decision-making and the behaviour of teachers in the classroom (Zheng, 2009). Garofalo (1989) pleads that mathematics teachers should dispense less information and rather facilitate more and become more of a discussion leader. However, in order for a change in teachers' classroom practices to occur, it may be necessary to influence teachers'

beliefs (Green, 1971; Stipek et al., 2001). This may be possible through training and teachers gaining experience.

In summary of how these practices are influenced by the teachers' beliefs about the nature of mathematics and inclusivity, based on the findings of this study, I believe that there is enough evidence to assume that the teachers' stated beliefs about the nature of mathematics did not influence their inclusive practices. On the other hand, the teachers' beliefs about inclusion influenced their inclusive practices as they mainly believed inclusion was not a specific way of teaching HI learners and the HI learners should cope on their own. It is possible that the stated beliefs did not reflect the true beliefs of the teachers in this study. These findings will hopefully contribute to the field of inclusive education, filling the gap in literature applicable to the inclusion of oral HI learners in the South African context.

6.3.4 Summary of answers to the research questions

In Table 6.4, I provide a summary of the research questions, the data collection techniques used, the objectives of the questions and research findings.

Table 6.4

Summary of Answers to the Research Questions

Research questions	Data collection techniques	Objectives of the questions	Research findings
1. What is the nature of inclusive schools' mathematics teachers' beliefs?	▪ Interviews ▪ Observations	To explore the teachers' beliefs about the nature of mathematics and inclusion.	Both teachers had a Platonist and problem-solving view during ERT. Francis also had an instrumentalist view. During ERT and the communication method, the teachers did not have a problem-solving view. Both teachers had positive beliefs about inclusive education, provided that the HI learners could cope on their own – they confused *inclusion* with *integration*. Both believed they had the necessary skills to teach HI learners. Continuous training is required to enhance the teachers' understanding of inclusion especially the barriers to learning HI learners face.
2. What practices are used during face-to-face teaching and ERT to include HI learners in the general mathematics classroom?	▪ Interviews ▪ Observations ▪ Documentation	To explore the inclusive practices of the mathematics teachers during face-to-face teaching and ERT.	During face-to-face teaching and ERT neither of the two teachers taught the classes containing HI learners differently from the classes without HI learners. It is suggested that the school should have a clear policy on inclusive practices and ensure the teachers know the policy. Teachers' inclusive practices should be monitored.

Research questions	Data collection techniques	Objectives of the questions	Research findings
			In both teachers cases, *curriculum differentiation*, *differentiating assessment*, *critical learning goals*, and *pedagogy and the learner social role* were somewhat evident during face-to-face teaching. During ERT, the communication method was asynchronous and *curriculum differentiation*, *critical learning goals*, *social role of the teacher*, and *feedback* were somewhat evident. Overall, less inclusive practices were evident during ERT than during face-to-face teaching.
3. How are these practices influenced by the teachers' beliefs about the nature of mathematics and inclusivity?	▪ Interviews ▪ Observations ▪ Documentation	To explore the influence teachers' beliefs have on their inclusive practices.	The stated beliefs about the nature of mathematics did not influence the teachers' inclusive practices. On the other hand, the teachers' beliefs about inclusion influenced their inclusive practices as they mainly believed inclusion was not a specific way of teaching HI learners and the HI learners should cope on their own.

6.4 What would I have done differently?

Due to the COVID-19 pandemic I already had to change my research as I could not observe mathematics teachers in other public inclusive schools. It would have been valuable to investigate whether the beliefs of other teachers within a different setting and with different training influenced their inclusive practices.

With the insight of hindsight, I would have provided the participants with the questionnaire relating to the first interview a day or two before the scheduled interview for possible richer data. I would have also employed a research assistant to videotape all my sessions for careful perusal and analysis.

6.5 Providing for errors in my conclusion

Because of the subjective nature of the study, my own beliefs and experiences may have influenced the process of making sense of the unique situation. I have made some conclusions on the participants' beliefs and their inclusive practices, however, I have to accept that some of the conclusions may have been incorrect, albeit unknowingly and unintentionally. To enhance the trustworthiness of my study, I made use of multiple data collection strategies such as multiple observations, interviews, documentation and audio-visual digital materials. In reducing the Hawthorne effect, I emphasised the fact that I was interested in the uniqueness of each teacher and how each teacher handles the inclusion of HI learners. I was there to learn from them and not to criticise their beliefs and practices. I avoided the tendency to seek answers that would have supported my pre-conceived ideas in order to enhance the trustworthiness of the data analysis.

6.6 Conclusions

Here I list concise, summative conclusions regarding the influence of mathematics teachers' beliefs about the nature of mathematics and inclusion on their inclusive practices.

- The participants' beliefs about the nature of mathematics and the manifestation of their inclusive practices were not congruent.
- The participants' beliefs about inclusion and the manifestation of their inclusive practices were congruent. Both teachers had positive beliefs about inclusive education, provided that the HI learners could cope on their own.

- There is a need for continuous training to enhance the teachers' understanding of inclusion especially the barriers to learning HI learners face.
- A dedicated person should be responsible for monitoring the teachers' inclusive practices.
- During face-to-face teaching and ERT neither of the two teachers taught the classes containing HI learners differently from the classes without HI learners with limited inclusive practices.
- The school should have a clear policy on inclusive practices and ensure the teachers know the policy. Teachers' inclusive practices should be monitored.
- Less inclusive practices were evident during ERT than during face-to-face teaching. An inclusive school cannot forget about the learners experiencing barriers to learning in a time of ERT.

6.7 Recommendations for policies, practice and research

It became clear that training is imperative for successful inclusive practices, and not just once-off training, but continuous training. However, the training should not only focus on the technology and the barriers to learning the HI learners might face, but also on the different teaching strategies – the inclusive practices – that should be followed when teaching oral HI learners in the classroom. The school should have a clear policy on inclusive practices and ensure the teachers know and apply that policy. Part of the policy can include processes to monitor the teachers' inclusive practices. The school can have an experienced inclusive teacher, or possibly a HoD, dedicated to monitoring the inclusive practices of the other teachers.

Several aspects of teaching in an inclusive school require further research in order to make inclusion work. These include investigation into:

- The implementation of inclusion policy at inclusive schools.
- The training and preparation of teachers teaching in inclusive schools.
- The monitoring of teachers teaching in inclusive schools.
- The influence of inclusive practices on the teachers' beliefs about inclusion.
- The training required for teachers teaching in inclusive schools.

6.8 Limitations of the study

I am aware that the data was gathered from a very small number of mathematics teachers teaching in one inclusive school and that the results cannot be generalised. However, generalisation was not the aim of this in-depth qualitative study. I acknowledge that different researchers may interpret the data differently, as my perspective is bound by space, time, and personal experience. The possibility that subjectivity may have influenced the findings cannot be ruled out.

6.9 Final Word

The past five years have been a time of different challenges due to the COVID-19 pandemic, accelerated growth and learning for me, both professionally and personally. I gained extra respect for the teachers applying ERT and continuing with educating the learners during such an unforeseen, chaotic time in our lives. I hope that my findings will contribute to school policy, teacher training and theory and that this study will contribute to the realisation of inclusive practices. Not only due to learners with barriers to learning, but also to incorporate the overall diversity of learners in our classrooms so that we can get to a point where “it seems to be unclear what exactly distinguishes inclusive teaching practice from general good teaching practice” (Lindner & Schwab, 2020, p. 18).

References

Abelson, R. P. (1979). Differences between belief and knowledge systems. *Cognitive science*, *3*(4), 355-366. https://doi.org/https://doi.org/10.1207/s15516709cog0304_4

Ackah-Jnr, F. R. (2020). Inclusive education, a best practice, policy and provision in education systems and schools: The rationale and critique. *European Journal of Education Studies*, *6*(10), 171-183. https://doi.org/https://doi.org/10.5281/zenodo.3605128

Acquah, E. O., Tandon, M., & Lempinen, S. (2016). Teacher diversity awareness in the context of changing demographics. *European Educational Research Journal*, *15*(2), 218-235. https://doi.org/https://doi.org/10.1177/1474904115611676

ACT Deafness Resource Centre. (n.d.). *A general guide to noise levels - in decibels*. Retrieved 7 November 2021 from https://www.actdrc.org.au/noise-levels/

Adoyo, P. O. (2007). Educating deaf children in an inclusive setting in Kenya: Challenges and considerations. *Electronic Journal for Inclusive Education*, *2*(2).

Agbenyega, J. A., & Deku, P. K. (2011). Building new identities in teacher preparation for inclusive education in Ghana. *Current issues in Education*, *14*(1).

Ainscow, M. (2005). Developing inclusive education systems: What are the levers for change? *Journal of educational change*, *6*(2), 109-124. https://doi.org/https://doi.org/10.1007/s10833-005-1298-4

Ainscow, M., Booth, T., & Dyson, A. (2004). Understanding and developing inclusive practices in schools: A collaborative action research network. *International Journal of Inclusive Education*, *8*(2), 125-139. https://doi.org/https://doi.org/10.1080/1360311032000158015

Alasim, K. N. (2018). Participation and interaction of deaf and hard-of-hearing students in inclusion classroom. *International Journal of Special Education*, *33*(2), 493-506.

Almanthari, A., Maulina, S., & Bruce, S. (2020). Secondary school mathematics teachers' views on e-learning implementation barriers during the COVID-19 pandemic: The case of Indonesia. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(7). https://doi.org/https://doi.org/10.29333/ejmste/8240

Alothman, A. (2014). *Inclusive education for deaf students in Saudi Arabia: Perceptions of schools principals, teachers and parents* [Doctoral Dissertation, University of Lincoln].

Anderson, L. (2020). *'Smiles are infectious': What a school principal in China learned from going remote*. Retrieved 10 November 2021 from https://www.edsurge.com/news/2020-03-20-smiles-are-infectious-what-a-school-principal-in-china-learned-from-going-remote

Antia, S. D., Jones, P. B., Reed, S., & Kreimeyer, K. H. (2009). Academic status and progress of deaf and hard-of-hearing students in general education classrooms. *The Journal of Deaf Studies and Deaf Education*, *14*(3), 293-311. https://doi.org/10.1093/deafed/enn006

Antia, S. D., & Stinson, M. S. (1999). Some conclusions on the education of deaf and hard-of-hearing students in inclusive settings. *Journal of deaf studies and deaf education*, *4*(3), 246-248. https://doi.org/10.1093/deafed/4.3.246

Artiles, A. J., Kozleski, E. B., Dorn, S., & Christensen, C. (2006). Chapter 3: Learning in inclusive education research: Re-mediating theory and methods with a transformative agenda. *Review of research in education*, *30*(1), 65-108. https://www.jstor.org/stable/4129770

ASHA (American Speech-Language-Hearing Association). (n.d.). *Degree of hearing loss*. https://www.asha.org/public/hearing/degree-of-hearing-loss/

Avramidis, E., & Norwich, B. (2002). Teachers' attitudes towards integration/inclusion: A review of the literature. *European Journal of Special Needs Education*, *17*(2), 129-147. https://doi.org/10.1080/08856250210129056

Ayantoye, C. A., & Luckner, J. L. (2016). Successful students who are deaf or hard of hearing and culturally and/or linguistically diverse in inclusive settings. *American Annals of the Deaf*, *160*(5), 453-466. https://doi.org/10.1353/aad.2016.0008

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). New York, NY: Academic Press.

Basilaia, G., & Kvavadze, D. (2020). Transition to online education in schools during a SARS-CoV-2 coronavirus (COVID-19) pandemic in Georgia. *Pedagogical Research*, *5*(4), 1-9.

Berndsen, M., & Luckner, J. (2012). Supporting students who are deaf or hard of hearing in general education classrooms: A Washington state case study. *Communication Disorders Quarterly*, *33*(2), 111-118.

Bešić, E., Paleczek, L., Krammer, M., & Gasteiger-Klicpera, B. (2017). Inclusive practices at the teacher and class level: The experts' view. *European Journal of Special Needs Education*, *32*(3), 329-345. https://doi.org/https://doi.org/10.1080/08856257.2016.1240339

Bhagwatwar, P. A. (2017). Validity of research methodology in psychology: Ideographic vs nomothetic approach. *Researchgate.net*. https://www.researchgate.net/publication/321748985_VALIDITY_OF_RESEARCH_METHODOLOGY_IN_PSYCHOLOGY_IDEOGRAPHIC_vs_NOMOTHETIC_APPROACH

Blatchford, P., & Webster, R. (2018). Classroom contexts for learning at primary and secondary school: Class size, groupings, interactions and special educational needs. *British Educational Research Journal*, *44*(4), 681-703. https://doi.org/10.1002/berj.3454

Blömeke, S., Kaiser, G., König, J., & Jentsch, A. (2020). Profiles of mathematics teachers' competence and their relation to instructional quality. *ZDM : Mathematics Education*, *52*(2), 329-342. https://doi.org/10.1007/s11858-020-01128-y

Buli-Holmberg, J., & Jeyaprathaban, S. (2016). Effective practice in inclusive and special needs education. *International Journal of Special Education*, *31*(1), 119-134.

Bulmer, M., & Rolka, K. (2005). The "A4-Project"-Statistical world views expressed through pictures. *International Group for the Psychology of Mathematics Education*, 193-200.

Burns, J. P. (2005). *An analysis of the implementation of differentiated instruction in a middle school and high school and the effects of implementation on curriculum content and student achievement* [Doctoral Dissertation, Seton Hall University].

Carolan, J., & Guinn, A. (2007). Differentiation: Lessons. *Educational Leadership*, *64*(5), 44-47.

Carrillo, C., & Flores, M. A. (2020). COVID-19 and teacher education: A literature review of online teaching and learning practices. *European Journal of Teacher Education*, *43*(4), 466-487.

CAST. (n.d.). *About Universal Design for Learning*. Retrieved 10 November 2021 from https://www.cast.org/impact/universal-design-for-learning-udl

Clark, M. (2007). *A practical guide to quality interaction with children who have a hearing loss*. San Diego, CA: Plural Publishing.

Clason, D. (2020). *Understanding the degrees of hearing loss*. Healthy Hearing. Retrieved 7 November 2021 from https://www.healthyhearing.com/report/41775-Degrees-of-hearing-loss

Cologon, K. (2014). Better together: Inclusive education in the early years. *Inclusive education in the early years: Right from the start*, 3-26.

Conner, T. S., Tennen, H., Fleeson, W., & Barrett, L. F. (2009). Experience sampling methods: A modern idiographic approach to personality research. *Social and personality psychology compass*, *3*(3), 292-313. https://doi.org/10.1111/j.1751-9004.2009.00170.x

Coubergs, C., Struyven, K., Vanthournout, G., & Engels, N. (2017). Measuring teachers' perceptions about differentiated instruction: The DI-Quest instrument and model. *Studies in Educational Evaluation*, *53*, 41-54.

Coviello, J., & DeMatthews, D. E. (2021). Failure is not final: Principals' perspectives on creating inclusive schools for students with disabilities. *Journal of Educational Administration*, *59*(4), 514-531. https://doi.org/10.1108/JEA-08-2020-0170

Crandell, C. C., & Smaldino, J. J. (2000). Classroom acoustics for children with normal hearing and with hearing impairment. *Language, speech, and hearing services in schools*, *31*(4), 362-370.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Los Angeles: SAGE.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Los Angeles: SAGE.

Croll, P., & Moses, D. (2000). Ideologies and utopias: Education professionals' views of inclusion. *European Journal of Special Needs Education*, *15*(1), 1-12.

Dalton, E. M., Mckenzie, J. A., & Kahonde, C. (2012). The implementation of inclusive education in South Africa: Reflections arising from a workshop for teachers and therapists to introduce Universal Design for Learning. *African Journal of Disability*, *1*(1).

DBE. (2010). *Guidelines for full-service/inclusive schools*. Pretoria: Government Printers.

DBE. (2011). *Guidelines for responding to learner diversity in the classroom through curriculum and assessment policy statements*. Department of Basic Education. https://www.education.gov.za/Portals/0/Documents/Publications/GUIDELINES%20FOR%20RESPONDING%20TO%20LEARNER%20DIVERSITY%20%20THROUGH%20CAPS%20(FINAL).pdf?ver=2016-02-24-110910-340

DBE. (2014). *National policy pertaining to the conduct, administration and management of the National Senior Certificate examination*. Department of Basic Education. https://www.education.gov.za/Portals/0/Documents/Policies/PolCondAdminManageNSC.pdf?ver=2015-02-03-154737-197

de Souza, B. (2020). Assessing pedagogical practices Malawian mainstream secondary teachers interpret from national policies and strategies on inclusive education. *Journal of Educational Studies*, *19*(2), 133-148. https://doi.org/10.10520/ejc-jeds-v19-n2-a4

Deafness Foundation & Deaf Children Australia. (2005). *Are you being heard?: Information and teaching tips for teachers of students with a hearing loss*. Author.

Dela Fuente, J. A. (2021). Implementing inclusive education in the Philippines: College teacher experiences with deaf students. *Issues in Educational Research*, *31*(1), 94-110.

Department for Education and Skills (DfES). (2004). *Removing Barriers to Achievement: The Government's Strategy for SEN*. Department for Education and Skills.

Di Fabia, A., & Maree, J. G. (2012). Ensuring quality in scholarly writing. In J. G. Maree (Ed.), *First steps in research* (pp. 136-144). Pretoria: Van Schaik.

DoE. (2001). *Education white paper 6: Special needs education: Building an inclusive education and training system*. Pretoria: Department of Education. https://www.vvob.org/files/publicaties/rsa_education_white_paper_6.pdf

Donitsa-Schmidt, S., & Ramot, R. (2020). Opportunities and challenges: Teacher education in Israel in the COVID-19 pandemic. *Journal of education for teaching*, *46*(4), 586-595.

Dreyer, L. M. (2017). Constraints to quality education and support for all: A Western Cape case. *South African Journal of Education*, *37*(1), 1-11. https://doi.org/10.15700/saje.v37n1a1226

Dyson, A., & Forlin, D. (1999). An international perspective on inclusion. In P. Engelbrecht, L. Green, & S. Naicker (Eds.), *Inclusive education in action in South Africa* (pp. 24-42). Pretoria: Van Schaik.

Easterbrooks, S. R., & Stephenson, B. (2006). An examination of twenty literacy, science, and mathematics practices used to educate students who are deaf or hard of hearing. *American Annals of the Deaf*, *151*(4), 385-397.

Engelbrecht, P., & Muthukrishna, N. (2019). Inclusive education as a localised project in complex contexts: A South African case study. *Southern African Review of Education with Production*, *25*(1), 107-124.

Engelbrecht, P., Nel, M., Smit, S., & van Deventer, M. (2016). The idealism of education policies and the realities in schools: The implementation of inclusive education in South Africa. *International Journal of Inclusive Education*, *20*(5), 520-535. https://doi.org/10.1080/13603116.2015.1095250

Engelbrecht, P., Nel, N., Nel, M., & Tlale, D. (2015). Enacting understanding of inclusion in complex contexts: Classroom practices of South African teachers. *South African Journal of Education*, *35*(3), 1-10.

Erbas, E. (2017). *Strategies that teachers use to support the inclusion of students who are deaf and hard of hearing* [Master of Science in Education, Indiana University].

Erickson, F. (2012). Qualitative research methods for science education. In *Second international handbook of science education* (pp. 1451-1469). Los Angeles: Springer.

Eriks-Brophy, A., & Whittingham, J. (2013). Teachers' perceptions of the inclusion of children with hearing loss in general education settings. *American Annals of the Deaf*, *158*(1), 63-97.

Ernest, P. (1989a). The impact of beliefs on the teaching of mathematics. *Mathematics teaching: The state of the art*, *249*, 254.

Ernest, P. (1989b). The knowledge, beliefs and attitudes of the mathematics teacher: A model. *Journal of education for teaching*, *15*(1), 13-33.

Estabrooks, W. (1998). *Cochlear implants for kids*. Alex Graham Bell Assn for Deaf.

Fenstermacher, G. D. (1978). A philosophical consideration of recent research on teacher effectiveness. *Review of research in education*, *6*, 157-185. https://doi.org/10.2307/1167245

Fernandez, C. J., Ramesh, R., & Manivannan, A. S. R. (2022). Synchronous learning and asynchronous learning during COVID-19 pandemic: A case study in India. *Asian Association of Open Universities Journal*, *17*(1), 1-14. https://doi.org/10.1108/AAOUJ-02-2021-0027

Ferri, F., Grifoni, P., & Guzzo, T. (2020). Online learning and emergency remote teaching: Opportunities and challenges in emergency situations. *Societies*, *10*(4), 86.

Finkelstein, S., Sharma, U., & Furlonger, B. (2019). The inclusive practices of classroom teachers: a scoping review and thematic analysis. *International Journal of Inclusive Education*, 1-28.

Furlonger, B. E., Sharma, U., Moore, D. W., & Smyth King, B. (2010). A new approach to training teachers to meet the diverse learning needs of deaf and hard-of-hearing children within inclusive Australian schools. *International Journal of Inclusive Education*, *14*(3), 289-308.

Gardner, H., & Hatch, T. (1989). Multiple intelligences go to school: Educational implications of the theory of multiple intelligences. *Educational Researcher*, *18*(8), 4-10.

Garofalo, J. (1989). Beliefs and their influence on mathematical performance. *The Mathematics Teacher*, *82*(7), 502-505.

Gavrilean, B. T. (2022). 6. Challenges of Covid-19 Pandemics, on-line Teaching within Vocational Higher Education for Hearing-Impaired Students. *Review of Artistic Education*, *24*(1), 286-293. https://doi.org/10.2478/rae-2022-0034

Geldenhuys, J. L., & Wevers, N. E. J. (2013). Ecological aspects influencing the implementation of inclusive education in mainstream primary schools in the Eastern Cape, South Africa. *South African Journal of Education*, *33*(3), 1-18.

Gibbs, G. R. (2018). *Analyzing qualitative data* (2nd ed.). London: SAGE. https://doi.org/10.4135/9781526441867

Graves, M. F., & Braaten, S. (1996). Scaffolded reading experiences: Bridges to success. *Preventing School Failure: Alternative Education for Children and Youth*, *40*(4), 169-173.

Green, T. F. (1971). *The activities of teaching*. New York: McGraw-Hill.

Gremp, M. A., & Easterbrooks, S. R. (2018). A descriptive analysis of noise in classrooms across the US and Canada for children who are deaf and hard of hearing. *The Volta Review*, *117*(1-2), 5-31.

Griful-Freixenet, J., Struyven, K., Vantieghem, W., & Gheyssens, E. (2020). Exploring the interrelationship between Universal Design for Learning (UDL) and Differentiated Instruction (DI): A Systematic Review. *Educational Research Review*, *29*(2020), 100306. https://doi.org/https://doi.org/10.1016/j.edurev.2019.100306

Hammeken, P. A. (1995). *Inclusion: 450 strategies for success - A practical guide for all educators who teach students with disabilities*. ERIC.

Hannula, M. S., Di Martino, P., Pantziara, M., Zhang, Q., Morselli, F., Heyd-Metzuyanim, E., Lutovac, S., Kaasila, R., Middleton, J. A., Jansen, A., & Goldin, G. A. (2016). Attitudes, beliefs, motivation, and identity in mathematics education : An overview of the field and future directions. In *Attitudes, beliefs, motivation, and identity in mathematics education : An overview of the field and future directions* (pp. 1-35). Cham: Springer International Publishing : Springer. https://doi.org/10.1007/978-3-319-32811-9_1

Haug, P. (2017). Understanding inclusive education: Ideals and reality. *Scandinavian Journal of Disability Research*, *19*(3), 206-217. https://doi.org/http://doi.org/10.1080/15017419.2016.1224778

Hearingloop.com.au. (n.d.). *Roger Wall Pilot*. Retrieved 25 July 2022 from https://www.hearingloop.com.au/shop/phonak-equipment/roger-wall-pilot/#

Hebebci, M. T., Bertiz, Y., & Alan, S. (2020). Investigation of views of students and teachers on distance education practices during the Coronavirus (COVID-19) pandemic. *International Journal of Technology in Education and Science (IJTES)*, *4*(4), 267-282.

Herman, C., Meltz, A., & Pillay, V. (2014). Inclusive education: A case of beliefs competing for implementation. *South African Journal of Education*, *34*(3), 1-8.

Hill, D. J., & Rahaman, M. M. (2013). Inclusive education in Bangladesh: Accounting for the friction between policy and practice. *Journal of Bangladesh Studies*, *15*(2), 40-48.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*, *27*.

Holley, J. K. (2015). *Teacher Attitudes: An analysis of middle school teachers' attitudes towards inclusion* [Master's research paper, Marshall University].

Jacob, R. T. d. S., Bevilacqua, M. C., Molina, S. V., Queiroz, M., Hoshii, L. A., Lauris, J. R. P., & Moret, A. L. M. (2012). Frequency modulation systems in hearing impaired children: Outcome evaluation. *Revista da Sociedade Brasileira de Fonoaudiologia*, *17*, 417-421.

Jenkins, J. R., Pious, C. G., & Jewell, M. (1990). Special education and the regular education initiative: Basic assumptions. *Exceptional children*, *56*(6), 479-491.

Kaden, U. (2020). COVID-19 school closure-related changes to the professional life of a K–12 teacher. *Education Sciences*, *10*(6), 165.

Karakaya, K. (2020). Design considerations in emergency remote teaching during the COVID-19 pandemic: A human-centered approach. *Educational Technology Research and Development*, 1-5.

Karisa, A., Samuels, C., Watermeyer, B., McKenzie, J., & Vergunst, R. (2022). Priorities for access to early childhood development services for children with disabilities in South Africa. *South African Journal of Childhood Education*, *12*(1). https://doi.org/10.4102/sajce.v12i1.1119

Khamis, G. (2011). Teachers' beliefs and practices observed in inclusive classes. *Electronic Journal for Inclusive Education*, *2*(8), 3.

Khan, N. B., & Joseph, L. (2020). Healthcare practitioners' views about early hearing detection and intervention practices in KwaZulu-Natal, South Africa. *South African Journal of Child Health*, *14*(4), 200-207. https://doi.org/10.7196/SAJCH.2020.v14i4.1708

Khirwadkar, A., Khan, S. I., Mgombelo, J., Obradovic-Ratkovic, S., & Forbes, W. A. (2020). Reimagining mathematics education during the COVID-19 pandemic. *Brock Education: A Journal of Educational Research and Practice*, *29*(2), 42-46.

Kilpatrick, J. (2001). Understanding mathematical literacy: The contribution of research. *Educational studies in Mathematics*, *47*(1), 101-116.

Kite, B. J. (2020). How the medical professionals impact ASL and English families' language planning policy. *Psychology in the Schools*, *57*(3), 402-417.

König, J., Jäger-Biela, D. J., & Glutsch, N. (2020). Adapting to online teaching during COVID-19 school closure: Teacher education and teacher competence effects among early career teachers in Germany. *European Journal of Teacher Education*, *43*(4), 608-622.

Krishna, A. R. (2013). *From OBE to CAPS: educators' experiences of the new life skills curriculum in the foundation phase* [Master's dissertation, University of KwaZulu-Natal].

Krishnan, I. A., De Mello, G., Kok, S. A., Sabapathy, S. K., Munian, S., Ching, H. S., Kandasamy, P., Ramalingam, S., Baskaran, S., & Kanan, V. N. (2020). Challenges faced by hearing impairment students during COVID-19. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, *5*(8), 106-116.

Lang, H., & Pagliaro, C. (2007). Factors predicting recall of mathematics terms by deaf students: Implications for teaching. *Journal of deaf studies and deaf education*, *12*(4), 449-460.

Le Hanie, L. (2017). *Teaching mathematics to oral hearing impaired learners in an inclusive environment* [Master's dissertation, University of Pretoria].

Leatham, K. R. (2006). Viewing mathematics teachers' beliefs as sensible systems. *Journal of Mathematics Teacher Education*, *9*(1), 91-102.

Leigh, G., & Crowe, K. (2020). Evidence-based practices for teaching learners who are deaf or hard of hearing in regular classrooms. In *Oxford Research Encyclopedias*: Oxford University Press.

Letzel, V., Pozas, M., & Schneider, C. (2020). Energetic students, stressed parents, and nervous teachers: A comprehensive exploration of inclusive homeschooling during the COVID-19 crisis. *Open Education Studies*, *2*(1), 159-170.

Liljedahl, P. (2008a). Teachers' beliefs as teachers' knowledge. *Symposium on the occasion of the 100th anniversary of ICMI, Rome.*, *17*, 2008.

Liljedahl, P. (2008b). Teachers' insights into the relationship between beliefs and practice. *Beliefs and attitudes in mathematics education: New research results*, 33-44.

Liljedahl, P., Rolka, K., & Rösken, B. (2007). Belief change as conceptual change. *European research in mathematics education V. Proceedings of CERME5*, 278-287.

Lindner, K.-T., Alnahdi, G. H., Wahl, S., & Schwab, S. (2019). Perceived differentiation and personalization teaching approaches in inclusive classrooms: Perspectives of students and teachers. *Frontiers in Education*, *4*, 58.

Lindner, K.-T., & Schwab, S. (2020). Differentiation and individualisation in inclusive education: A systematic review and narrative synthesis. *International Journal of Inclusive Education*, 1-21.

Lissi, M. R., Iturriaga, C., Sebastián, C., Vergara, M., Henríquez, C., & Hofmann, S. (2017). Deaf and hard of hearing students' opportunities for learning in a regular secondary school in Chile: Teacher practices and beliefs. *Journal of Developmental and Physical Disabilities*, *29*(1), 55-75.

Luckner, J. L., Slike, S. B., & Johnson, H. (2012). Helping students who are deaf or hard of hearing succeed. *Teaching Exceptional Children*, *44*(4), 58-67.

Luitel, L. (2020). Exploring teachers' experiences on the nature of mathematics based on their curricular and pedagogical practices: A phenomenological inquiry. *International Electronic Journal of Mathematics Education*, *15*(3).

Macharia, W. (2022). Realising the Right to Education for Learners with Disabilities during the Covid-19 Pandemic in Kenya. *ESR Review : Economic and Social Rights in South Africa*, *23*(2), 10-15. https://doi.org/10.10520/ejc-esrrev-v23-n2-a3

Magano, M. D., & Mapepa, P. (2018). Support to address barriers to learning for learners who are deaf. *African Journal of Disability*, *7*(1), 1-8. https://doi.org/10.4102/ajod.v7i0.381

Makwela, M. M., & Smit, E. I. (2022). Psychosocial challenges of children with disabilities in Sekhukhune District, Limpopo province of South Africa: Towards a responsive integrated disability strategy. *African Journal of Disability*, *11*(1). https://doi.org/10.4102/ajod.v11i0.799

Mavuso, M. F. (2022). Exploring Senior Phase teachers' competencies in supporting learners with specific learning difficulties: Implications for inclusive education. *African Journal of Disability*, *11*(1). https://doi.org/10.4102/ajod.v11i0.901

Mays, B. J., & Brevetti, M. A. (2020). Lessons on ways to develop self-empowerment. *Journal for Multicultural Education*, *14*(1), 61-84. https://doi.org/10.1108/JME-06-2019-0047

Mazuruse, G., Nyagadza, B., & Makoni, T. (2021). Inclusive education implementation challenges facing selected primary and secondary schools in Mashonaland East Province in Zimbabwe. *International Journal of Educational Development*, *6*(1), 1-21. https://doi.org/10.25159/2312-3540/9690

McKee, M., Moran, C., & Zazove, P. (2020). Overcoming additional barriers to care for deaf and hard of hearing patients during COVID-19. *JAMA Otolaryngology–Head & Neck Surgery*, *146*(9), 781-782.

McKenzie, J. A., & Dalton, E. M. (2020). Universal design for learning in inclusive education policy in South Africa. *African Journal of Disability*, *9*, 776. https://doi.org/10.4102/ajod.v9i0.776

Means, B., Bakia, M., & Murphy, R. (2014). *Learning online: What research tells us about whether, when and how*. Routledge.

Meltz, A., Herman, C., & Pillay, V. (2014). Inclusive education: A case of beliefs competing for implementation. *South African Journal of Education*, *34*(3).

Merriam, S. B. (1998). *Qualitative research and case study applications in education* (2nd ed.). San Francisco: Jossey-Bass Publishers. http://catdir.loc.gov/catdir/toc/onix06/97007167.html

Mitchell, D. (2015). Inclusive education is a multi-faceted concept. *Center for Educational Policy Studies Journal*, *5*(1), 9-30.

Mohmmed, A. O., Khidhir, B. A., Nazeer, A., & Vijayan, V. J. (2020). Emergency remote teaching during Coronavirus pandemic: The current trend and future directive at Middle East College Oman. *Innovative Infrastructure Solutions*, *5*(3), 1-11.

Morgan, B., & Sklar, R. H. (2012). Sampling and research paradigms. In J. G. Maree (Ed.), *Complete your thesis or dissertation successfully: Practical guidelines* (pp. 69-80). Claremont: Juta & Company Ltd.

Morgan, H. (2020). Best practices for implementing remote learning during a pandemic. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *93*(3), 135-141.

Morin, A. (2018). *What is Universal Design for Learning (UDL)?* Retrieved 11 November 2021 from https://www.understood.org/articles/en/universal-design-for-learning-what-it-is-and-how-it-works

Mousley, K., & Kelly, R. R. (1998). Problem-solving strategies for teaching mathematics to deaf students. *American Annals of the Deaf*, *143*(4), 325-336.

Navarro, S., Zervas, P., Gesa, R., & Sampson, D. (2016). Developing teachers' competences for designing inclusive learning experiences. *Educational Technology and Society*, *19*(1), 17-27.

Nieuwenhuis, J. (2007). Introducing qualitative research. In J. G. Maree (Ed.), *First steps in research* (1st ed., pp. 48-68). Pretoria: Van Schaik.

Nieuwenhuis, J. (2016a). Analysing qualitative data. In J. G. Maree (Ed.), *First steps in research* (2nd ed., pp. 103-131). Pretoria: Van Schaik.

Nieuwenhuis, J. (2016b). Introducing qualitative research. In J. G. Maree (Ed.), *First steps in research* (2nd ed., pp. 49-70). Pretoria: Van Schaik.

Nieuwenhuis, J. (2016c). Qualitative research designs and data-gathering techniques. In J. G. maree (Ed.), *First steps in research* (2nd ed., pp. 71-102). Pretoria: Van Schaik.

Nisbett, R. E., & Wilson, T. D. (1977). The halo effect: Evidence for unconscious alteration of judgments. *Journal of personality and social psychology*, *35*(4), 250.

Nthibeli, M., Griffiths, D., & Bekker, T. (2022). Teaching learners with autism in the South African inclusive classroom: Pedagogic strategies and possibilities. *African Journal of Disability*, *11*(1). https://doi.org/10.4102/ajod.v11i0.979

Olawale, B., Mncube, V., & Harber, C. (2021). Critical Social Pedagogy in Mathematics Teacher Education. *International Journal of Higher Education*, *10*(6).

Opertti, R., Walker, Z., & Zhang, Y. (2013). Inclusive education: From targeting groups and schools to achieving quality education as the core of EFA. *The SAGE Handbook of Special Education: Two Volume Set*, *1*, 149.

Ormston, R., Spencer, L., Barnard, M., & Shape, D. (2013). The foundations of qualitative research. In J. Ritchie, J. Lewis, C. M. Nicholls, & R. Ormston (Eds.), *Qualitative research practice: A guide for social science students and researchers* (pp. 1-25). Los Angeles: Sage.

Pagiling, S. L., Palobo, M., & Mayasari, D. (2021). Preservice teacher belief on nature of mathematics and mathematics teaching and tearning: a quantitative study. *Journal of Physics: Conference Series*, *1806*(1). https://doi.org/10.1088/1742-6596/1806/1/012111

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of educational research*, *62*(3), 307-332.

Pakulski, L. A. (2021). Is another paradigm shift needed to close the academic achievement gap for students with hearing loss? *The Hearing Journal*, *74*(11), 22-24. https://doi.org/10.1097/01.Hj.0000800724.72774.33

Paliokosta, P., & Blandford, S. (2010). Inclusion in school: A policy, ideology or lived experience? Similar findings in diverse school cultures. *Support for Learning*, *25*(4), 179-186.

Patton, M. Q. (2002). Qualitative research and evaluation methods. Thousand Oaks. *CA: Sage Publications*, *4*.

Phonak for Professionals. (n.d.). *Roger wireless technology*. phonakpro.com. Retrieved 19 April 2022 from https://www.phonakpro.com/us/en/about-phonak/technologies/roger-wireless.html#:~:text=Roger%20microphones%20have%20been%20developed,or%20cochlear%20implant%20sound%20processors.

Powers, S. (2001). Investigating good practice in supporting deaf pupils in mainstream schools. *Educational Review*, *53*(2), 181-189. https://doi.org/10.1080/00131910120055606

Rappolt-Schlichtmann, G. (2020). *Distance learning:6 UDL best practices for online learning*. Retrieved 11 November 2021 from https://www.understood.org/articles/en/video-distance-learning-udl-best-practices?_sp=c19c53a3-7087-46a4-a8e2-aad694029f84.1636642754763

Rasmitadile, R., Aliyyah, R. R., Rachmadtullah, R., Samsudin, A., Syaodih, E., Nurtanto, M., & Tambunan, A. R. S. (2020). The perceptions of primary school teachers of online learning during the COVID-19 pandemic period: A case study in Indonesia. *Journal of Ethnic and Cultural Studies*, *7*(2), 90-109. https://doi.org/https://doi.org/10.29333/ejecs/388

Reed, C. M. (2020). Lessons learned: A retired principal returning to university teaching offers advice for new teachers. *Odyssey: New Directions in Deaf Education*, *21*, 62-65.

Reich, J., Buttimer, C. J., Fang, A., Hillaire, G., Hirsch, K., Larke, L. R., Littenberg-Tobias, J., Moussapour, R. M., Napier, A., & Thompson, M. (2020). *Remote learning guidance from state education agencies during the COVID-19 pandemic: A first look* https://doi.org/osf.io/k6zxy/

Reimers, F. M., & Schleicher, A. (2020). A framework to guide an education response to the COVID-19 Pandemic of 2020. *OECD. Retrieved April*, *14*, 2020.

Rokeach, M. (1968). *Beliefs, attitudes and values: A theory of organization and change*. San Francisco: Jossey-Bass Inc.

Roos, H. (2019). Inclusion in mathematics education: An ideology, a way of teaching, or both? *Educational Studies in Mathematics : An International Journal*, *100*(1), 25-41. https://doi.org/10.1007/s10649-018-9854-z

Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. ERIC. https://eric.ed.gov/?id=ED466086

Rose, D. H., & Strangman, N. (2007). Universal design for learning: Meeting the challenge of individual learning differences through a neurocognitive perspective. *Universal access in the information society*, *5*(4), 381-391.

Rouse, M. (2008). Developing inclusive practice: A role for teachers and teacher education. *Education in the North*, *16*(1), 6-13.

Sabrina, N. (2017). *Teachers beliefs in practicing inclusive education: Case study of elementary schools in Banda Aceh* [Master's dissertation, University of Tampere].

Safrudiannur, Belke, L., & Rott, B. (2021). A pseudo-longitudinal approach for investigating pre-service teachers' beliefs during their university education. *International Journal of Science and Mathematics Education*, *20*(6), 1099-1122. https://doi.org/10.1007/s10763-021-10194-x

Safrudiannur, & Rott, B. (2020). Offering an approach to measure beliefs quantitatively: Capturing the influence of students' abilities on teachers' beliefs. *International Journal of Science and Mathematics Education*, *19*(2), 419-441. https://doi.org/10.1007/s10763-020-10063-z

Salend, S. J. (2011). *Creating inclusive classrooms: Effective and reflective practices* (7th ed.). New York: Pearson.

Samuels, A., Stemela, U., & Booi, M. (2020). The intersection between health and education: Meeting the intervention needs of children and youth with disabilities. *South African Health Review*, *2020*(1), 171-181. https://doi.org/10.10520/ejc-healthr-v2020-n1-a21

SAnews.gov.za. (2020). President Ramaphosa announces a nationwide lockdown. https://www.sanews.gov.za/south-africa/president-ramaphosa-announces-nationwide-lockdown

SAnews.gov.za. (2021, 22 November). Basic education sector makes progress in implementing inclusive education. *South African Government News Agency*. https://www.sanews.gov.za/south-africa/basic-education-sector-makes-progress-implementing-inclusive-education

Santoli, S. P., Sachs, J., Romey, E. A., & McClurg, S. (2008). A successful formula for middle school inclusion: Collaboration, time, and administrative support. *Rmle Online*, *32*(2), 1-13.

Schwab, S., & Alnahdi, G. (2020). Do they practise what they preach? Factors associated with teachers' use of inclusive teaching practices among in-service teachers. *Journal of Research in Special Educational Needs*, *20*(4), 321-330. https://doi.org/10.1111/1471-3802.12492

Seabi, J. (2012). Research designs and data collection techniques. In J. G. Maree (Ed.), *Complete your thesis or dissertation successfully: Practical guidelines* (pp. 81-95). Pretoria: JUTA.

Simkiss, D. (2013). Education of children with hearing impairment. *Paediatrics and Child Health*, *23*(10), 434-437.

Smith, C. (2020). Challenges and oppportunities for teaching students with disabilities during the COVID-19 pandemic. *International Journal of Multidisciplinary Perspectives in Higher Education*, *5*(1), 167-173.

Snelling, J., & Fingal, D. (2020). *10 Strategies for Online Learning During a Coronavirus Outbreak*. Retrieved 14 January 2021 from https://www.iste.org/explore/learning-during-covid-19/10-strategies-online-learning-during-coronavirus-outbreak

Song, Y. (2016). To what extent is Universal Design for Learning “universal”? A case study in township special needs schools in South Africa. *Disability and the Global South*, *3*(1), 910-929.

Stipek, D. J., Givvin, K. B., Salmon, J. M., & MacGyvers, V. L. (2001). Teachers’ beliefs and practices related to mathematics instruction. *Teaching and teacher education*, *17*(2), 213-226.

Suprayogi, M. N., & Valcke, M. (2016). Differentiated instruction in primary schools: Implementation and challenges in Indonesia. *PONTE*, *72*(6), 2-18.

Takala, M., & Sume, H. (2018). Hearing-impaired pupils in mainstream education in Finland: Teachers’ experiences of inclusion and support. *European Journal of Special Needs Education*, *33*(1), 134-147. https://doi.org/10.1080/08856257.2017.1306965

Ternes, T. (2017). *Is that a banana in your ear? Understanding hearing loss.* North Dakota Assistive Technology. Retrieved 7 November 2021 from https://ndassistive.org/blog/is-that-a-banana-in-your-ear-understanding-hearing-loss/

Thompson, A. G. (1992). Teachers' beliefs and conceptions: A synthesis of the research. In *Handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics.* (pp. 127-146). New York: Macmillan Publishing Co, Inc.

Thomson, C., Brown, D., Jones, L., Walker, J., Moore, D. W., Anderson, A., Davies, T., Medcalf, J., Glynn, T. L., & Koegel, R. L. (2003). Resource teachers learning and behavior: Collaborative problem solving to support inclusion. *Journal of Positive Behavior Interventions*, *5*(2), 101-111.

Timmons, V., & Clairns, E. (2010). *Case study research in education* (A. J. Mills, G. Durepos, & E. Wiebe, Eds.). CA: SAGE Plubications, Inc. https://doi.org/10.4135/9781412957397

Tomlinson, C. A. (2000). Differentiation of instruction in the elementary Grades. .

Tomlinson, C. A. (2005). Grading and differentiation: Paradox or good practice? *Theory into practice*, *44*(3), 262-269.

Tomlinson, C. A. (2017). *How to differentiate instruction in academically diverse classrooms*. ASCD.

https://books.google.co.za/books?hl=en&lr=&id=zoh2DgAAQBAJ&oi=fnd&pg=PP4&ots=59yWsUnO0c&sig=MwzD1MA6gXTWc1ER-MybRf8zwYk&redir_esc=y#v=onepage&q&f=false

Tomlinson, C. A., & Imbeau, M. B. (2010). *Leading and managing a differentiated classroom*. Virginia: ASCD.

Tomlinson, C. A., & Strickland, C. A. (2005). *Differentiation in practice: A resource guide for differentiating curriculum, grades 9-12*. Virginia: ASCD. https://books.google.co.za/books?hl=en&lr=&id=OiKfhxJ-np8C&oi=fnd&pg=PR7&ots=74GW58nCjS&sig=8m-siNCwliMayuV3Pb_P6aWLUkc&redir_esc=y#v=onepage&q&f=false

Toquero, C. M. D. (2020). Inclusion of people with disabilities amid COVID-19: Laws, interventions, recommendations. *Multidisciplinary Journal of Educational Research*, *10*(2), 158-177.

Törner, G., & Grigutsch, S. (1994). „Mathematische Weltbilder" bei Studienanfängern—eine Erhebung. *Journal für Mathematik-Didaktik*, *15*(3-4), 211-251.

touchboards.com. (n.d.). *Mimio Teach - Wireless interactive whiteboard system*. Retrieved 18 July 2022 from https://www.touchboards.com/mimio-teach-portable/mobile-devices/

UNESCO. (1994). *The Salamanca statement and framework for action on special needs education* (Vol. 1). Paris: UNESCO.

UNESCO. (2005). *Guidelines for Inclusion: Ensuring access to education for all*. Paris: UNESCO. http://www.ibe.unesco.org/sites/default/files/Guidelines_for_Inclusion_UNESCO_2006.pdf

Uys, M., & Selesho, E. (Eds.). (2017). *Inclusive education for children with a hearing loss: a practical guide for parents and teachers*. Pretoria: BK.

VanWynsberghe, R., & Khan, S. (2007). Redefining case study. *International journal of qualitative methods*, *6*(2), 80-94.

Vermeulen, J. A., Denessen, E., & Knoors, H. (2012). Mainstream teachers about including deaf or hard of hearing students. *Teaching and teacher education*, *28*(2), 174-181. https://doi.org/10.1016/j.tate.2011.09.007

Vesga-Bravo, G.-J., Angel-Cuervo, Z.-M., & Chacón-Guerrero, G.-A. (2021). Beliefs about mathematics, its teaching, and learning: Contrast between pre-service and in-service teachers. *International Journal of Science and Mathematics Education*, *20*(4), 769-791. https://doi.org/10.1007/s10763-021-10164-3

Villa, R. A., Thousand, J. S., Nevin, A., & Liston, A. (2005). Successful inclusive practices in middle and secondary schools. *American Secondary Education*, 33-50.

Walsh, M. (2018). *The inclusion of students with special needs in the general education classroom* [Senior theses, Dominican University of California].

Walton, E., & Lloyd, G. (2012). From clinic to classroom: A model of teacher education for inclusion. *Perspectives in Education*, *30*(2), 62-70.

Whittle, C., Tiwari, S., Yan, S., & Williams, J. (2020). Emergency remote teaching environment: A conceptual framework for responsive online teaching in crises. *Information and Learning Sciences*.

Yada, A., & Savolainen, H. (2017). Japanese in-service teachers' attitudes toward inclusive education and self-efficacy for inclusive practices. *Teaching and teacher education*, *64*, 222-229.

Yang, X., Kaiser, G., König, J., & Blömeke, S. (2020). Relationship between pre-service mathematics teachers' knowledge, beliefs and instructional practices in China. *ZDM : Mathematics Education*, *52*(2), 281-294. https://doi.org/10.1007/s11858-020-01145-x

Yoro, A. J., Fourie, J. V., & van der Merwe, M. (2020). Learning support strategies for learners with neurodevelopmental disorders: Perspectives of recently qualified teachers. *African Journal of Disability (Online)*, *9*, 1-10. https://doi.org/10.4102/ajod.v9i0.561

Zheng, H. (2009). A review of research on EFL pre-service teachers' beliefs and practices. *Journal of Cambridge Studies*, *4*(1), 73-81. https://aspace.repository.cam.ac.uk/bitstream/handle/1810/255675/200901-article9.pdf?sequence=1&isAllowed=y

Zhu, N., Gao, L., Wang, J., Wang, Y., Huang, Z., Guo, N., & Feng, Y. (2021). Professional qualities of special education itinerant teachers: A qualitative study from China. *International Journal of Disability, Development and Education*, *68*(6), 742-757. https://doi.org/10.1080/1034912X.2021.1958199

Appendices

Appendix A: Letter of consent to the Director/Principal of the school

Mrs. L. le Hanie
545 Stephan Road
Magalieskruin
0182
linda@zikedish.com
Cell: 072 2909 478

February 2020

Dear Sir/Madam

Request to conduct research

I am currently enrolled for a Doctoral degree in Mathematics Education at the University of Pretoria. My research is aimed at investigating the relationship between mathematics teachers' beliefs and their inclusive practices when teaching oral hearing impaired learners in an inclusive school. I hereby request permission to use your school as one of the six inclusive schools for my research.

The data collection process will be as follows:

- One (if possible two) mathematics teachers per school will be requested to participate. The teachers who participate should teach mathematics to learners between Grades 4 and 12 and will have oral hearing impaired learners in one or more of their classes. They also need to teach more than one mathematics class per grade.
- One semi-structured interview per teacher is requested. The interview needs to take place before any observation and will take approximately 50 minutes. The interview will be conducted outside school hours at a time and place convenient for the teacher. Audio recordings of the interview will be made.
- Four lessons per teacher will be observed. The first two lessons will be the same lesson taught to two different classes of the same grade. In one of the classes, there will be oral hearing impaired learners while in the other one there will be no oral hearing impaired learners. The same will happen for the third and fourth lessons to be observed. The lessons will be videotaped in such a way that only the teachers' faces will be seen. I will not be in direct contact with the learners. The learners will be present

in the class during the observations together with the researcher. No learner will be identified or visible in the video. The learners as well as the parents/guardians will receive a letter of informed consent for the video recording of the lessons.

The teachers will be asked to hand out the consent letters (provided by the researcher) for the parents of the learners in the classes as well as the assent letters to the learners. I kindly request that the teachers take responsibility for collecting the letters' reply slips as I am not on the premises.

- I would like to have access to documentation in the form of the teachers' preparation files, tests, exams, PowerPoint presentations and other applicable documentation as I would like to take photographs of the documentation.
- Lastly, the teacher(s) will have access to transcriptions within 14 days of the interview before the data is analysed in order for them to change their answers it they are not satisfied.

Only my supervisor and I will have access to the video and audio recordings and photographs which will be password protected. The data collected will only be used for academic purposes. All data collected with public funding may be made available in an open repository for public and scientific use.

Please take note regarding the research, no tuition time will be lost; no incentives will be given; and there will be no implications for academic assessments. All participation is voluntary. Confidentiality and anonymity will be guaranteed at all times. After the successful completion of my Doctoral degree, I will give feedback to the school in the form of a written report or a copy of the thesis. For any questions before or during the research, please feel free to contact me.

If you are willing to allow me to conduct research at your school, please sign this letter as a declaration of your consent.

Yours sincerely

LLHanie

Researcher: Mrs. L. le Hanie

6 February 2020

Date

6 February 2020

Supervisor: Dr. L.S. van Putten Date

I hereby grant consent to Mrs. L. le Hanie to conduct her research at this school for her Doctoral research. I also give consent to Mrs. L. le Hanie to video record the lessons, audio record the interview(s) and photograph the necessary documentation.

School director/principal's name: _____

School director/principal's signature: _____

Date: _____

Email address: _____

Contact number: _____

Appendix B: Letter of consent to the mathematics teachers

Mrs. L. le Hanie
545 Stephan road
Magalieskruin
0182
linda@zikedish.com
Cell: 072 2909 478

February 2020

Dear Sir/Madam

Letter of consent to the mathematics teacher

You are invited to participate in research aimed at investigating the relationship between mathematics teachers' beliefs and their inclusive practices when teaching oral hearing impaired learners in an inclusive school. The research will be reported in my Doctoral thesis at the University of Pretoria.

I would like to invite you to participate in this study's data collection phase by being observed teaching the same mathematics lesson to two classes. One class will have oral hearing impaired learners and the other class will have no oral hearing impaired learners. You will be interviewed before the observations and will also be asked to allow me access to your preparation files, tests, exams, PowerPoint presentations and other applicable documentation.

The data collection process will be as follows:

- Grades 4-12 mathematics teachers in Gauteng teaching mathematics to oral hearing impaired learners in an inclusive school are invited to take part in the research.
- Four mathematics lessons per teacher will be observed at a time convenient to you as it should not disrupt your timetable and programme. The first two lessons will be the same lesson being taught to two different classes of the same grade. In one of the classes, there will be oral hearing impaired learners while in the other one there will be no oral hearing impaired learners. The same will happen with the third and fourth lessons to be observed. Note that you are not required to do anything beyond what you normally do during the teaching of a mathematics lesson; no extra preparation is

needed. The observation will be video recorded. This will allow for a clear and accurate record of your classroom practice.

- One semi-structured interview with you is also requested and needs to take place before any observation. The interview will be conducted outside school hours at a time and place convenient to you and will take approximately 50 minutes. Audio recordings of the interviews will be made.
- I would also like to have access to documentation in the form of your preparation files, tests, exams, PowerPoint presentations and other applicable documentation. I would like to take photographs of the documentation in order for you to have it back as soon as possible.
- Lastly I would like to request that you hand out the consent letters, which I will provide, to the parents of the learners in the classes as well as the assent letters to the learners. I kindly request that you take responsibility for collecting the letters' reply slips as I am not on the premises. The reply slips need to be collected before the observation of the lessons.

Should you declare yourself willing to participate in this research, you will be one of six teachers that form part of my research project. Please take note that no tuition time will be lost; no incentives will be given; and there will be no implications for academic assessments. Your participation is voluntary and confidentiality and anonymity will be guaranteed at all times. You may decide to withdraw at any time without giving any reasons for doing so. You and your school will not be identifiable in the findings of my research and only my supervisors and I will have access to the video/audio recordings and photographs which will be password protected. You will have access to the interview transcriptions within 14 days of the interview before the data is analysed in order to make any changes to your answers. The data collected will only be used for academic purposes. All data collected with public funding may be made available in an open repository for public and scientific use. After the successful completion of my Doctoral degree, I will give feedback of my findings to the school in the form of a written report or a copy of the thesis.

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

If you are willing to participate in this research study, please sign this letter as a declaration of your consent, i.e. that you participate willingly and that you understand that you may withdraw at any time.

Yours sincerely

Researcher: Mrs. L. le Hanie — Date: 6 February 2020

Supervisor: Dr. L.S. van Putten — Date: 6 February 2020

I hereby grant consent to Mrs. L. le Hanie to observe four of my mathematics lessons, conduct an interview with me as well as have access to my preparation documents for her Doctoral degree research. I also grant consent to Mrs. L. le Hanie to video record the lessons, audio-tape the interviews and analyse the photographs taken of my preparation documents.

Teacher's name: _____ Date: _____

Teacher's signature: _____ Cell: _____

Email address: _____

Appendix C: Letter of consent to the parents

Mrs. L. le Hanie
545 Stephan road
Magalieskruin
0182
linda@zikedish.com
Cell: 072 2909 478

February 2020

Dear Sir/Madam

Consent to conduct research in your child's classroom

I am currently enrolled for a Doctoral degree in Mathematics Education at the University of Pretoria. My research is aimed at investigating the relationship between mathematics teachers' beliefs and their inclusive practices when teaching oral hearing impaired learners in an inclusive school.

In order to do the research, I will observe your child's mathematics teacher during two lessons while he/she is teaching mathematics to a class with a hearing impaired learner and a class without a hearing impaired learner. Your child may be in either of these classes. I would like to video record these lessons as it will help me to have an accurate record of the teacher's classroom practice. When video-recording the lesson, I will focus on the teacher and not on the learners in the class. The video recordings will be taken from the back of the class and I will only film the teacher. All video recordings will be password protected and will only be used for my Doctoral degree.

Please take note that no tuition time will be lost; no incentives will be given; and there will be no implications for academic assessments. Both the children and the teacher are ensured of being treated with confidentiality and anonymity at all times and only my supervisors and I will have access to the recordings. The data collected will only be used for academic purposes. All data collected with public funding may be made available in an open repository for public and scientific use.

If you have any questions or concerns, please do not hesitate to contact me. If you are willing for your child to be present during the video recorded lessons please sign this letter as a declaration of your consent and return it to your child's mathematics teacher.

Yours sincerely

Researcher: Mrs. L. le Hanie — Date: 4 February 2020

Supervisor: Dr. L.S. van Putten — Date: 4 February 2020

I, the undersigned, hereby grant consent to Mrs. L. le Hanie to video record the lessons where my child will be present. I am aware that my child will remain anonymous and that the findings of this research will be used to promote teaching and learning in the mathematics classroom.

Parent's/Guardian's name: _____

Parent's/Guardian's signature: _____

Date: _____

Child's name: _____

Grade of child: _____

Appendix D: Letter of assent to the learners

Mrs. L. le Hanie
545 Stephan road
Magalieskruin
0182
linda@zikedish.com
Cell: 072 2909 478

February 2020

Dear learner

Presence during classroom research

I am enrolled for a Doctoral degree at the University of Pretoria and want to determine how mathematics teachers teach mathematics to hearing impaired learners in an inclusive school. This implies that I will not be teaching you. I want to film your teacher with a video camera while he/she is teaching mathematics to a class with a hearing impaired learner and a class without a hearing impaired learner. You can be in either of these classes. This will happen during two of your mathematics lessons. I will be standing at the back of the classroom and the video camera will be focused on your teacher and not you. The video will be used for my studies and no one will see the video recording but my supervisors and me.

That is the only way you will be involved in the research and you do not have to do anything except what your teacher expects you to do. Please take note that no tuition time will be lost; no incentives will be given; and there will be no implications for academic assessments. If you have any questions you may contact me at any time.

Yours sincerely

LL Hanie

Researcher: Mrs. L. le Hanie — Date: 4 February 2020

Supervisor: Dr. L.S. van Putten — Date: 4 February 2020

I hereby grant assent to be present in the mathematics class when my teacher will be video recorded by Mrs. L. le Hanie.

Learner's name: _____ Date: _____

Learner's signature: _____ Grade: _____

Appendix E: Teacher interview protocol 1

TEACHER INTERVIEW PROTOCOL 1

(Alothman, 2014; Botha, 2011; Erbas, 2017; Pacha, 2015; Salend, 2011)

(Semi-structured interview prior to any lessons)

Name of school	
Name of researcher	Mrs. L. le Hanie
Name of teacher	
Pseudonym	
Date of interview	

A: Background of the teacher

1. Tell me more about yourself:
   - Where did you study?
   - What qualifications do you have, apart from matric (final year of school)?
   - Where have you been teaching?
   - How many years of experience do you have as a mathematics teacher?
2. Why did you decide to become a mathematics teacher? What were the influences?

B: The nature and value of mathematics

1. Did you enjoy mathematics at school level when you were a child? Please elaborate.
2. How would you describe a good mathematics teacher?
3. How do you view mathematics as subject?
4. Complete the sentence: Mathematics is ….
5. What according to you is the purpose of mathematics?
6. What do you believe is the value of mathematics?
7. Please describe yourself as mathematics teacher.
8. There are three types of mathematics teachers with specific attended outcome according to Ernest (1989):
   - Teacher as instructor – mastering skills with correct performance
   - Teacher as explainer – learner understanding knowledge
   - Teacher as facilitator – learner constructing understanding

   What type of teacher would you say you are? Please elaborate.

C: The nature of inclusion

1. What according to you is inclusion / inclusive education?
2. Have you received any training regarding inclusive education?
3. Do you believe inclusion is a desirable educational practice?
4. Do you believe most learners with disabilities can be educated in regular classrooms?
5. Do you believe inclusion works well in your class?
6. What do you believe is the effect of inclusive education on you as a teacher?
7. What do you believe is the effect of inclusive education on non-disability learners?
8. How is inclusion affected by the demands of the curriculum?
9. If another teacher asked you for advice about inclusion, what advice would you give?

D: The nature of including hearing impaired (HI) learners

1. Have you received any training regarding inclusive education for HI learners?
2. Have you ever had an HI learner in your classroom before?
3. How long have you been working with HI learners?
4. Does the inclusion of HI learners in your school make your work difficult? Why / why not?
5. Did you have to adapt your way of teaching due to the HI learners? Please elaborate.
6. Would you say you have the necessary skills to teach HI learners in the inclusive classroom?
7. Have you ever read documentation from the South African department of education regarding inclusive education and/or guidelines for inclusive education?
8. What various inclusive practices are you applying?
9. Please elaborate on your teaching methods.
10. Are you able to make the needed instructional modifications for HI learners?
11. Who are the role players when having HI learners included?
12. Who is primarily responsible for the HI learner(s) you are teaching?
13. What kind of support do you get for having to teach the HI learner? Please elaborate.
14. How does inclusion affect the assessment of the HI learner?
15. How are HI learners assessed?
16. How does the assessment of HI learners influence your inclusive practice?

Appendix F: Teacher interview protocol 2

TEACHER INTERVIEW PROTOCOL 2

(Semi-structured Zoom-interview after ERT period)

Name of school	
Name of researcher	Mrs. L. le Hanie
Name of teacher	
Pseudonym	
Date of interview	

A: LOCKDOWN

1. When the total lockdown was announced on 23 March 2020 to be started at midnight of 26 March 2020, what was the school's approach towards it and what was your reaction to the school's approach on how to deal with the lockdown?
2. What were the school's expectations of you as a mathematics teacher during total lockdown? What did it entail?
3. When did you have to start the online teaching?
4. How did you prepare for online learning / teaching?
5. What was needed for you to be able to start the online teaching from home? (Such as physical conditions etc.)
6. What does online teaching entail? Explain the procedures you would follow to prepare an online lesson.
7. What are the challenges regarding online teaching?
8. How can the challenges be addressed?
9. If you and a teacher shared a grade, did you share lessons? Please elaborate on the sharing of a grade.
10. What support did you receive for becoming an online teacher? Please name all the support.
11. Did all the learners have access to the internet? If not, how did you deal with that?
12. How did you accommodate the HI learner(s) during the lockdown period? Please discuss everything you did.
13. What did you do differently for the hearing impaired learners than the rest of your class during lockdown?
14. Briefly explain your adaptation process from being a face-to-face teacher and becoming an online teacher.

15. Please elaborate on the assessment of the learners during lockdown.

B: POST LOCKDOWN

1. ~~When total lockdown was over, how did the school manage the return of the learners? Please elaborate.~~
2. ~~What did you have to do differently once back in the classroom? (Physical classroom etc.)~~
3. ~~Were all the learners back at school? If not, how did you go about to accommodate learners not returning to school?~~
4. ~~How did wearing a mask affect your teaching in class. Please elaborate.~~
5. ~~According to you, how does the wearing of a mask (you as teacher and the hearing impaired learner) influence the hearing impaired learner?~~
6. ~~How do you accommodate the hearing impaired learner now in the post lockdown situation in school?~~
7. How did lockdown influence the assessment of learners post-lockdown? Elaborate on the assessment of HI learners as well.
8. How do you view mathematics as a subject since the COVID-19 pandemic?
9. Please describe yourself as a mathematics teacher during total lockdown ~~and once the learners returned to school~~.
10. How did the pandemic influence (change) your way of teaching?
11. There are three types of mathematics teachers with a specific expected outcome according to Ernest (1989):
    - Teacher as instructor – mastering skills with correct performance
    - Teacher as explainer – learner understanding knowledge
    - Teacher as facilitator – learner constructing understanding

    11.1 What type of **ONLINE**-teacher would you say you are? Please elaborate.

    ~~11.2 What type of post lockdown **Face-to-face** teacher would you say you are? Please elaborate.~~
12. In a utopia, how do you see a perfect online mathematics lesson?
13. Will you make more use of online learning in the future, if everything is back to "normal"?
14. What are the expectations of the school towards you as a mathematics teacher in a post-lockdown period (and the future)?

C: GENERAL

1. What are you most proud of in your online teaching journey so far?

2. What is your biggest online teaching challenge so far?
3. What tech tools are you currently using in your teaching?
4. What support do you still need? With tech and with online teaching?
5. If you need support with technology, please explain if this is an existing but hard to work with tool, or a new tool you would like to learn how to use. Please make sure you specify any Moodle features and/or other tools you have in mind.
6. Is there anything else you would like to share with me regarding your experience of being a teacher during COVID-19? Please feel free to elaborate.

Appendix G: Possible observation sheet

POSSIBLE OBSERVATION SHEET

(To be used for all the observations per teacher during face-to-face teaching and ERT.)

Name of school		
Name of researcher	Mrs. L. le Hanie	
Subject observed	Mathematics	
Grade observed		
Topic of the lesson		
Duration of the lesson		
Number of learners present in class		
Number of HI learners present in class		
Name of teacher		
Pseudonym		
Date of observation		
Observation number		
Lesson with / without HI learners (tick)	**With** HI learners	**Without** HI learners

ASSESSING TEACHERS' INCLUSIVE PRACTICES THROUGH OBSERVATIONS (CAST, n.d.; Dalton et al., 2012; Deafness Foundation & Deaf Children Australia, 2005; DBE, 2011; Erbas, 2017; Whittle et al., 2020) (Videotaped lesson and field notes during all the observations as well as ERT videos.)		
INCLUSIVE PRACTICES	Evident: ✓ Somewhat evident: ● Not evident/sufficient: ✘	**COMMENTS (support with examples)**
Multiple means of engagement		
Different classroom strategies that empower the learners; provide choices for the learners; reduce learner anxiety; and reward learners' efforts.		
Multiple means of representation		

Present educational resources through a variety of modalities (visual, auditory or tactile) and methods such as videos, websites, pictures etc.		
Multiple means of action and expression		
Provide learners with a variety of options to practice tasks, communicate and demonstrate what they have learned, which allow learners to capitalise on their special abilities or talents		
Curriculum differentiation:		
Differentiating of content		
Abstractness *Some learners might need to access content first at a concrete level*		
Complexity *4 levels: **K**nowledge, **R**outine, **C**omplex, **P**roblem solving*		
Variety *Expansion of curriculum – prevent learners from getting bored*		
Differentiating the (physical) learning environment		
Adaptation of classroom *e.g. carpets and curtains to absorb sound and reduce reverberation*		
Noise levels *Inside and outside noise levels;*		
shut windows and doors if possible;		
add rubber tips to chairs and tables		
Seating arrangements *HI learners not next to equipment which makes a noise, e.g. overhead projectors and air conditioners;*		
HI learners facing board and overhead projector;		
Teacher always facing the HI learners		
Class size		
Classroom displays		

Subject matter information boards and pictures;		
Classroom rules;		
Daily tasks/homework;		
Announcements on board		
Resources *Visual aids;*		
Assistive listening devices in classroom such as FM system;		
technological support;		
providing vocabulary in written format		
Differentiating teaching methods		
Learning materials *Wide range of materials included e-learning;*		
materials might need to be adapted		
Methods of presentation *Brief directions and verbal instructions;*		
Repetition of information;		
Repetition of questions and answers from other learners;		
Written notes on board;		
Flexible grouping		
Learning activities *Tiered assignments; modification of format of task e.g. amount of information reduced*		
Lesson organisations *The use of multiple intelligences*		
Differentiating assessment	(If not observed in class, then documentation will be analysed)	
Four levels of mathematics assessment visible *(K; R; C; P)*		
Alternate assessment based on modified attainment of knowledge *(Due to disability the learner might need more time to master the content. Assess learner's mastery of*		

grade-level content with reduced load / more at functional level.)		
Alternate assessment based on grade-level attainment of knowledge *(additional time; readers; amanuensis)*		
Critical learning goals		
Having critical learning goals		
Ratio of teacher to learners		
Ratio of the teacher to learners		
Communication method		
Synchronous or asynchronous		
Building agency		
The opportunity to engage learners on topics and approaches of particular interest, instead of general lessons and formats.		
Assessments	(If not observed in class, then documentation will be analysed)	
Individualised assessments with the use of technology.		
Social role of the teacher		
Relationship between teacher and parents to gain insight into the learners' needs and environmental constraints.		
Pedagogy and the learner social role		
A social-driven pedagogical approach to enhance learner engagement and participation by employing a problem-posing pedagogical approach.		
Feedback		
Feedback relating to progress and assessments, for example alternative feedback strategies, such as non-graded formative feedback, self-feedback and peer feedback.		
ANY ADDITIONAL COMMENTS		

Appendix H: Additional research studies for Literature Control: Theme 1

Articles published since 2020 related to Teachers' Beliefs about the Nature of Mathematics				
AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	RELATING TO MY RESEARCH FINDINGS	*JOURNAL*
Blömeke, S., Kaiser, G., König, J., & Jentsch, A. (2020).	Profiles of mathematics teachers' competence and their relation to instructional quality	Exploratory study with 77 secondary mathematics teachers from Germany.	N/A	*ZDM : Mathematics Education*
Luitel, L. (2020).	Exploring teachers' experiences on the nature of mathematics based on their curricular and pedagogical practices: A phenomenological inquiry	Four male mathematics teachers from different ages and ethnicities with more than five years teaching experience and currently studying their master's degrees in Nepal.	Teachers being textbook-oriented promotes the Platonist view of mathematics and that a content-oriented curriculum enables teachers to select the teacher-centred pedagogy. An approach of practice until a learner has memorised the work or knows the process or steps of solving specific problems, has an intention to control the mathematical activity and problem-solving through instrumental actions	*International Electronic Journal of Mathematics Education*

Articles published since 2020 related to Teachers' Beliefs about the Nature of Mathematics				
AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	RELATING TO MY RESEARCH FINDINGS	*JOURNAL*
			and is more likely to promote the instrumentalist view of mathematics. It is necessary to motivate and encourage learners in mathematics.	
Pagiling, S. L., Palobo, M., & Mayasari, D. (2021).	Preservice teacher belief on nature of mathematics and mathematics teaching and tearning [sic]: A quantitative study	103 preservice mathematics teachers studying at the Musamus University of Merauke, Indonesia, completing a questionnaire.	N/A	*Journal of Physics: Conference Series*
Safrudiannur., Belke, L., & Rott, B. (2021).	A pseudo-longitudinal approach for investigating pre-service teachers' beliefs during their university education	142 pre-service teachers – some in the beginning of their studies, some in the middle and some at the end of their studies. Interviews with five students at the end of their studies.	N/A	*International Journal of Science and Mathematics Education*
Safrudiannur., & Rott, B. (2020).	Offering an approach to measure beliefs quantitatively: Capturing the influence of students' abilities on teachers' beliefs	43 Indonesian teachers answering a questionnaire to	N/A	*International Journal of Science and Mathematics Education*

Articles published since 2020 related to Teachers' Beliefs about the Nature of Mathematics				
AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	RELATING TO MY RESEARCH FINDINGS	*JOURNAL*
Vesga-Bravo, G.-J., Angel-Cuervo Z.-M., & Chacón-Guerrero, G.-A. (2021).	Beliefs about mathematics, its teaching, and learning: Contrast between pre-service and in-service teachers	Five pre-service teachers studying a Bachelor's in Mathematics, and three in-service teachers who were Ph.D. candidates in Mathematics Education participated in the study.	N/A	*International Journal of Science and Mathematics Education*
Yang, X., Kaiser, G., König, J., & Blömeke S. (2020).	Relationship between pre-service mathematics teachers' knowledge, beliefs and instructional practices in China	495 Chinese pre-service mathematics teachers.	N/A	*ZDM : Mathematics Education*

Appendix I: Additional research studies for Literature Control: Theme 2

Articles published since 2020 related to Teachers' Beliefs about Inclusion				
AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	RELATING TO MY RESEARCH FINDINGS	*JOURNAL*
Coviello, J. & DeMatthews, D. E. (2021).	Failure is not final: Principals' perspectives on creating inclusive schools for students with disabilities	Three elementary principals – purposeful sampling.	A cultural shift is necessary to coordinate teamwork and a dedicated focus on the needs of the learners with disability, however, it will not take hold immediately.	*Journal of Educational Administration*
De Souza, B. (2020).	Assessing pedagogical practices Malawian mainstream secondary teachers interpret from national policies and strategies on inclusive education	33 mainstream secondary teachers in four schools in the Lower Shire districts of Chikwawa and Nsanje in Malawi.	Having appropriate teaching methodologies.	*Journal of Educational Studies*
Karisa, A., Samuels, C., Watermeyer, B., McKenzie, J., & Vergunst, R. (2022).	Priorities for access to early childhood development services for children with disabilities in South Africa	Literature based.	Services between audiologists and caregivers should be strengthened. A UDL approach can guide planning and practice of ECD teachers.	*South African Journal of Childhood Education*
Khan, N. B., & Joseph, L. (2020).	Healthcare practitioners' views about early hearing detection and intervention practices in KwaZulu-Natal, South Africa	38 healthcare practitioners, including audiologists and speech therapists completed a survey.	The healthcare practitioners feel that identification of hearing loss and subsequent intervention should occur before the age of six months and that hearing screening should be mandatory at birth.	*South African Journal of Child Health*

Articles published since 2020 related to Teachers' Beliefs about Inclusion				
AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	RELATING TO MY RESEARCH FINDINGS	*JOURNAL*
Kite, B. J. (2020).	How the medical professionals impact ASL and English families' language planning policy	Eight hearing families of bimodal-bilingual deaf children.	N/A	*Psychology in the Schools*
Makwela, M. M., & Smit, E. I. (2022).	Psychosocial challenges of children with disabilities in Sekhukhune District, Limpopo province of South Africa: Towards a responsive integrated disability strategy	36 participants participating in individual and key informant interviews and focus group discussions.	N/A	*African Journal of Disability*
Mays, B. J., & Brevetti, M. A. (2020).	Lessons on ways to develop self-empowerment	The process of discovery being analysed and interpreted through participants' narratives as a rigorous act of coding, imagination and logic to aggregate findings	HI student feeling isolated when her hearing aid stopped working for two days.	*Journal for Multicultural Education*
Mazuruse, G., Nyagadza, B., & Makoni, T. (2021).	Inclusive education implementation challenges facing selected primary and secondary schools in Mashonaland East Province in Zimbabwe	30 learners and 15 teachers participated in questionnaires, focus group discussions and observations.	A lack of support from the society, negative attitudes from the teachers, incapacitation of schools and inadequate physical resources that would assist in the implementation of inclusive education were the major challenges.	*International Journal of Educational Development*

Articles published since 2020 related to Teachers' Beliefs about Inclusion				
AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	RELATING TO MY RESEARCH FINDINGS	*JOURNAL*
Reed, C. M. (2020).	Lessons learned: A retired principal returning to university teaching offers advice for new teachers	The retired principal.	Teachers find and implement effective and meaningful accommodations and modifications. Literacy is crucial for HI learners. Teachers work collaboratively with other education professionals and learn all they can about instructional approaches. Culture of support exists for HI learners.	*Odyssey: New Directions in Deaf Education*
Samuels, A., Stemela, U., & Booi, M. (2020).	The intersection between health and education: Meeting the intervention needs of children and youth with disabilities	Literature based.	N/A	*South African Health Review*
Zhu, N., Gao, L., Wang, J., Wang, Y., Huang, Z., Guo, N., & Feng, Y. (2021).	Professional qualities of special education itinerant teachers: A qualitative study from China	Seven special education itinerant teachers were interviewed.	N/A	*International Journal of Disability, Development and Education*

Appendix J: Additional research studies for Literature Control: Theme 3

Additional articles published since earlier search in 2022 related to South African Teachers' Face-to-Face Inclusive Practices				
AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	RELATING TO MY RESEARCH FINDINGS	*JOURNAL*
Mavuso, M. F. (2022).	Exploring Senior Phase teachers' competencies in supporting learners with specific learning difficulties: Implications for inclusive education	18 teachers selected through purposive sampling. Individual and focus group interviews.	Teachers have different competencies in providing learning support and their competencies can enhance or hinder learning support.	*African Journal of Disability*
Nthibeli, M., Griffiths, D., & Bekker, T. (2022).	Teaching learners with autism in the South African inclusive classroom: Pedagogic strategies and possibilities	Teachers (mainstream school teachers; full-service school teachers; and special school teachers) working with learners with autism spectrum disorder were interviewed.	Pedagogic strategies such as differentiation, scaffolding, use of visual cues, group work and collaboration. "Inclusive education is a whole school approach, and it is only by the collective effort of all members that it can be achieved" (p. 10).	*African Journal of Disability*
Articles related to the Remote Teaching (ERT) of HI Learners during the COVID-19 Pandemic				
AUTHOR AND YEAR	TITLE OF ARTICLE	PARTICIPANTS / METHODOLOGY	RELATING TO MY RESEARCH FINDINGS	*JOURNAL*
Fernandez, C. J., Ramesh R., & Manivannan, A. S. R. (2022).	Synchronous learning and asynchronous learning during COVID-19 pandemic: A case study in India	655 students (between 17 and 21 years of age) undergoing synchronous and asynchronous learning during	Synchronous learning is sometimes stressful (increased screen time). Asynchronous learning allows self-exploration (MOOCs), however, more	*Asian Association of Open*

		COVID-19 completed a survey.	written assignments had to be submitted. Teachers helping students to learn through digital platforms. Combination of synchronous and asynchronous learning led to balanced education.	*Universities Journal*
Gavrilean, B. T. (2022).	Six Challenges of COVID-19 pandemic, on-line teaching within Vocational Higher Education for hearing-impaired students	Article written from the perspective of an HI student at the Faculty of Visual Arts and Design who attended a special high school where teaching was done through sign language.	HI learner close to teacher in order to lip-read. During COVID-19 a form of support technology converts speech into text. The teachers are taken out of their comfort zone as their faces are showing	*Review of Artistic Education*
Macharia, W. (2022).	Realising the right to education for learners with disabilities during the COVID-19 pandemic in Kenya	Exploring the measures that the Kenyan Government has put in place to support learning for learners with disabilities during COVID-19 pandemic.	Proposes using captions and providing audio descriptions during online and televised sessions. "Providing appropriate psychosocial support to learners, teachers and education officials, as well as caregivers, to manage the impact of COVID-19 on learners."	*ESR Review : Economic and Social Rights in South Africa*