THE EFFECTIVENESS OF CONTINUOUS ASSESSMENT IN TEACHING AND LEARNING OF MATHEMATICS IN THE FRANCES BAARD DISTRICT

by

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DECLARATION

My dissertation, entitled The Effectiveness of Continuous Assessment in Teaching and Learning of Mathematics in the Frances Baard District, is my original work. All sources used or quoted in the research were indicated and acknowledged by complete references.

The originality of the research work submitted to the university was tested using software acceptable to the university.

Furthermore, I declare that this academic presentation, in total, was not previously submitted for examination at UNISA for another qualification at any higher education institution.

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ACRONYMS

AaL	Assessment as Learning
AfL	Assessment for Learning
AoL	Assessment of Learning
ATP	Annual Teaching Plan
CAPS	Curriculum and Assessment Policy
CASS	Continuous Assessment
CUP	Cambridge University Press
DBE	Department of Basic Education
DoE	Department of Education
GET	General Education and Training
IMU	International Mathematics Union
LoLT	Language of Learning and Teaching
MEC	Member of Executive Committee
NERC	National Education Research Council
NCS	National Curriculum Statement
NDP	National Development Plan
NSC	National Senior Certificate
PIRLS	Progress in International Reading Literacy Study
SACMEQ	Southern and Eastern Consortium for Monitoring Education Quality
TEAL	Teaching Excellence in Adult Literacy
TIMSS	Trends in International Mathematics and Science Studies
UK	United Kingdom
UNISA	University of South Africa
USA	United States of America
ZDP	Zone of Proximal Development

ABSTRACT

Assessment is an essential component of teaching and learning at any level of education, as the information obtained informs stakeholders about the learner's progress and the teaching and learning process. To ensure the success of its education system, South Africa chose to use continuous assessment as an assessment model in 2001. This study explored the perceptions of teachers on the effectiveness of continuous assessment in teaching and learning mathematics at the Grade 5 level in the Frances Baard district. Ten participants were purposively sampled from ten schools as they had experience implementing continuous assessment and could offer valuable information. The study is underpinned by an interpretivist paradigm which offered a lens to view the findings. The qualitative study guided by a case study design was employed to collect data through semi-structured face-to-face interviews, non-participatory observation and document analysis. The study findings indicate that although the participants know about continuous assessment, they are not well acquainted with it, so they do not implement it fully. The lack of parental support was discovered to inhibit the possible impact that continuous assessment could have. The lack of resources to support continuous assessment was also a hindrance to its successful implementation. Conclusion/implications.

Keywords: Assessment, continuous assessment, feedback, teaching and learning, implementation and mathematics.

ABSTRAK

Assessering is ’n noodsaaklike komponent van onderrig en leer op enige onderwysvlak aangesien die inligting wat verkry word belanghebbers inlig oor die leerder se vordering in die onderrig- en leerproses. Om die sukses van die onderwysstelsel te verseker, het Suid-Afrika in 2001 deurlopende assessering as ’n assesseringsmodel gekies. Hierdie studie ondersoek die effektiwiteit van deurlopende assessering in die onderrig en leer van wiskunde op Graad 5-vlak in die Frances Baard-distrik. ’n Steekproef van tien deelnemers is doelbewus uit tien skole geneem aangesien hulle ervaring gehad het met die implementering van deurlopende assessering en waardevolle inligting kon bied. Die kwalitatiewe studie, gerig deur ’n gevallestudie-ontwerp, het data deur semi-gestruktureerde aangesig-tot-aangesig onderhoude, nie-deelnemende waarneming en dokumentanalise ingesamel. Die studie is onderlê deur ’n interpretivistiese paradigma wat ’n lens gebied het om die bevindinge te beskou. Die studiebevindinge het aangedui dat alhoewel die deelnemers bewus is van deurlopende assessering, hulle nie vertroud is daarmee nie en dit dus nie behoorlik implementeer nie. Daar is bevind dat die gebrek aan ondersteuning deur ouers die moontlike impak wat deurlopende assessering kan hê, inhibeer. Die gebrek aan hulpbronne om deurlopende assessering te ondersteun, is ook ’n struikelblok vir die suksesvolle implementering daarvan.

Leutelbegrippe: Beoordeling, deurlopende assessering, terugvoer, onderrig en leer, implementering, en wiskunde.

TSHOBOKANYO

Tshekatsheko e ke nngwe ya dikarolwana tse di botlhokwa tsa go ruta le go ithuta mo boemong bongwe le bongwe jwa thuto ka ntlha ya gore tshedimosetso e e fitlhelwang e sedimosetsa bannaleseabe ka tswelopele ya moithuti gammogo le ka tsamaiso ya go ruta le go ithuta. Go netefatsa gore go nna le katlego mo thulaganyong ya thuto ya yone, Aforika Borwa e tlhophile go dirisa tshekatsheko e e tswelelang jaaka sekaedi sa tshekatsheko ka 2001. Patlisiso e e tlhatlhoba bomolemo jwa tshekatsheko e e tswelelang jwa go ruta le go ithuta dipalo (mathematiki) mo boemong jwa Gerata 5 kwa kgaolong ya Frances Baard. Go ne ga tsewa sekao ka maikaelelo sa batsayakarolo ba le lesome go tswa dikolong di le lesome. Maikaelelo a se e ne e le go sekaseka maitemogelo a batsayakarolo mo go tsenngwetirisong tshekatsheko e e tswelelang mme gape le gore ba ka thusa ka go neelana ka tshedimosetso e e botlhokwa malebana le se. Patlisiso e ya tlhaloso (khwaletheitifi) e kokoantse tshedimosetso (datha) ka tiriso ya ditherisano tsa tebano-matlhong, ditemogo kwa ntle le go tsaya karolo gammogo le tshekatsheko ya ditokumente. Patlisiso e e tshegeditswe ke mokgwa wa botlhalosi oo o neetseng ka molebo wa go leba diphitlhelelo. Diphitlhelelo tsa patlisiso e di supa gore le fa batsayakarolo ba na le kitso e e rileng ka ga tshekatsheko e e tswelelang, ga ba na kitso e e tseneletseng ka ga yone, mme ke ka moo e sa tsenngwetirisong ka botlalo. Tlhaelo ya tshegetso ya batsadi e fitlhetswe fa e thibela tshusumetso eo tshekatsheko e e tswelelang e ka e dirang. Tlhaelo ya dithuso tsa go tshegetsa tshekatsheko e e tswelelang e fitlhetswe fa e le nngwe ya dikgoreletsi tsa tsenyotirisong e e atlegileng ya yone.

Mafoko a a botlhokwa: Tshekatsheko, tshekatsheko e e tswelelang, pegelo, go ruta le go ithuta, tsenyotirisong, le dipalo (mathematiki).

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CHAPTER 1
OVERVIEW OF THE STUDY

1.1 INTRODUCTION

The dynamism of the curriculum is meant to fine-tune the system to produce quality products that can function well in the real, competitive world. The time needed for teaching and learning in the South African education system is vital; however, completing assessment tasks, suggested by continuous assessment guidelines (DBE, 2011a:293-297), tends to whittle away that time, which results in teachers and learners coming under undue pressure to ensure curriculum coverage and the completion of assessment tasks, according to the Annual Teaching Plan (ATP).

A study by Jayathilake (1997) identified the strengths and weaknesses of the continuous assessment system. It recommended redefining the objectives of using continuous assessment by restructuring the format of assignments to evaluate learner achievement. Identifying, obtaining, and analysing data on learners' performance through various assessment methods is the ongoing, planned activity known as assessment. It entails four steps: creating and gathering accomplishment proof, assessing that evidence, documenting the results, and applying the information to comprehend and subsequently support the learner's progress in order to enhance the teaching and learning process (DBE, 2011a:293). There should be both official and informal assessments. Learners should receive continuous feedback to improve their learning experience in any scenario. This might help them reach the minimum performance level of 40% to 49% in mathematics that is necessary for advancement. If the method achieves its stated objectives, such as improving the quality of learner performance, assessment should be continuous.

The aim of continuous assessment is to transform South African education system as it constantly check the performance of learners, and this will give the teachers and learners an awareness of their performance and fine-tune where needed timeously. Timeous feedback is an essential feature of continuous assessment. Formative is a learner evaluation instrument used by teachers to collect, interpret and analyse learner data on how much they grasped or what they know and what the teacher can do next for learner improvement and advancement (DBE, 2011a:293). Formative assessments are primarily informal; they shouldn't be utilised for consideration of whether learners stay at a particular Grade or move to the next Grade (DBE, 2011a:293).

However, teachers tend to use this tool for grading and progression purposes instead of direction for improvement and, therefore, teach for assessing instead of assessing for teaching.
Because of the pressure associated with producing good results, teachers tend to focus on formative assessment at the expense of content delivery which may lead to forfeiture of objectivity of teaching and learning for understand as it is almost like rote learning.

This study argues that the pressure of continuous assessment on teachers and learners results in them developing a myopic view of curriculum objectives. The teachers and learners grapple with completing assessment tasks instead of ensuring that the curriculum is covered. Considering the above statement, teachers and learners become more concerned with grading rather than progress and development of knowledge and skills; the results become the focus for stakeholders. Classroom assessment assists the teacher in developing a true reflection of competence but in many cases, this tends to be testing rather than assessment. Continuous assessment activities, which include homework, assignments and projects, are predominantly done at home, where there is access to resources but much room for plagiarism and work being done by other people instead of assisting learners in completing the work independently.

Abera, Kedir, and Beyabeyin (2017) postulate that most challenges of continuous assessment include plagiarism, lack of feedback, and lack of proper facilities, amongst a host of others. This makes the approach exceedingly tricky for both the teacher and the learner to realise the truth about either's performance. Additionally, continuous assessment presents a challenge in testing the learner's knowledge of the content and gaining a true reflection of the teacher's work.

The review of learner competence in Mathematics is evident in the results from large-scale assessments. According to the Trends in International Mathematics and Science Studies (TIMMS, 2019), GRADE 5, 63% of South African learners have not acquired basic mathematical knowledge, 21% show some basic mathematics knowledge and in contrast, 11% can show and apply basic mathematical knowledge to solve problems while 4% are able to apply their knowledge and understanding to solve problems and a mere 1% possess the ability to utilize their expertise and comprehension in numerous intricate circumstances and elucidating reasoning (Reddy, 2022). The comparative study revealed a gloomy picture of essential mathematics competencies in South African learners which could indicate that not enough time is being spent on teaching the basic content as prescribed by the curriculum, the Curriculum and Assessment Policy Statement Mathematics (DBE, 2011a).

Validity, reliability, and fairness are essential in maintaining the quality of an assessment, such as continuous assessment, to ensure that it creates a motivating setting for learners. As a result, much emphasis should be placed on implementing a balanced and reliable assessment programme that will reveal accurate levels of competency in learners and inform future learning. This is needed so that learners fit into the global industry, which requires competence, knowledge, competitiveness, and creativity (Malcolm, Long & Chamberlain, 1999).

1.2 BACKGROUND TO THE RESEARCH

Mathematics is derived from Ancient Greek mathēmatikós or fond of learning and máthēma, knowledge, study, learning (Burton, 2011). The Advanced Learner Dictionary (CUP, 2017) views mathematics as a science and a study of quality, structure, space, and change. The Department of Basic Education (DBE 2011a:8) defines mathematics as "a language that makes use of symbols and notation to describe numerical, geometric and graphical relationships". The aim of the curriculum, as indicated in the Curriculum and Assessment Policy (CAPS) (DBE, 2011a:8), is to develop the mental processes of learners that enhance logical and critical thinking and problem-solving, which would contribute to decision-making.

Mathematics the world over is characterised by the par performance of learners (Sinyosi 2015). South Africa is not spared from this challenge, as revealed by several research bodies, namely Trends in Mathematics and Science Study(TIMSS) and Southern and Eastern Consortium for Monitoring Education Quality (SACMEQ) (Mabena, Mokgosi and Ramapela 2021). Several factors are linked to poor performance in Mathematics; these are tied to the learner, teacher or curriculum challenges (Suleiman and Hammed, 2019). Curriculum challenges include, among other things, the way learners are assessed. South Africa uses continuous assessment (CASS) to evaluate learner performance in its school system (Van der Berg & Shepherd 2015). The South Africa Department of Education adopted the use of continuous assessment in 1996, as part of education reform, to improve the quality of mathematics results. Teaching and learning must be responsive to the ever-changing demands of the socio-economic environment; hence, the continuous assessment model should provide learners with the knowledge, skills, and values required for self-fulfilment and meaningful engagement in society as citizens of a free democracy, regardless of their socioeconomic background, colour, gender, physical ability, or intellectual prowess, as indicated in the National Curriculum Statement NCS Grades R-12 policy (DoE, 2002). Within the Curriculum and Assessment Policy Statement (CAPS), assessment is defined as "a continuous

planned process of identify, gathering and interpreting information about the performance of learners and referred to as continuous assessment" (DBE, 2011a:293) and includes both informal assessments like quizzes and formal assessments like exams.

According to Dhakal (2019) the Nepalese authorities and notable education commissions singled out the importance of having a broad-based assessment system which assess learners on a regular basis to enhance the quality of education. Nepal introduced mathematics in schools in 1911 and since then, it has been taught as a compulsory subject in schools. the high-level national education commission of 1998 recommended the implementation of the continuous assessment method of learning from as early as grades 1 to 3, making it mandatory in Nepali schools, as per the tenth plan (2002-2007) and confirming its effectiveness as feedback confirmed the improvement in mathematics (Achatya 2013).

Tall (2008) reported that the teaching and testing of mathematics is now a global phenomenon and has resulted in one being able to see that some countries are more successful than others with the use of specific approaches, techniques and methods. Japan and other Asian countries consistently score higher marks in international tests, as indicated in TIMSS (2019). Japan uses a standardised test-based education system which includes four tests per year. Teachers use an existing system called "lesson study," which is the thorough preparation of lesson plans and emphasises group lesson planning, whereby all mathematics teachers in the phase or grade work together to plan their lessons. Learners do not take any form of examination until age 10 when they will be tested using a summative assessment (Tall, 2008).

According to McDermott and Rakgokong (2013), shared action when teaching mathematics is viewed as a better strategy, as problem-solving through effective questioning can identify and cover gaps in the learning process and find ways to resolve the challenges. Walsh and Sattes (2011) explain that understanding, analysing, applying, evaluating, and creating the highest level and from lowest to highest progression makes the learning process smooth and purposeful in the learning of mathematics. Learners have the opportunity to improve through continuous assessment, that is assessment for learning, which ensures the progression of learners in mathematics.

The use of continuous assessment in the teaching and learning process is growing as several countries have adopted the method, such as Ghana, Ethiopia and Botswana, to name but a few.

Research by Hayford (2007), conducted in Ghana on continuous assessment and lower-achieving learners, found that most teachers and students felt strongly that it helped slow learners in lower grades. However, the research did not assess the quality of learning and learners' progress nor take into account issues such as copying from others and the use of parents and guardians in helping with the completion of assessment tasks. Research in Nepal by Pyakurel, Kushiyait and Adhikari (2013) on the impact of continuous assessment in mathematics at the Grade 4 level found that learners' achievement levels through continuous assessment were higher.

Continuous assessment as an integral approach to the teaching and learning process, has been known for its rigidity and failure to reveal the reality on the ground and improve the quality of knowledge the learners will have when completing their primary education level (McDermott & Rakgokong, 2013). Haylock and Cockburn (2008) argued that continuous assessment has many shortfalls in the teaching and learning of mathematics; they suggest clarifying the gains and the goal of asking the learners questions to examine their intrinsic knowledge. Hassan and Sotonade (2021) argued that continuous assessment does not develop critical thinking. It opens loopholes for learners to use others' work or get their work done by paid experts at the expense of imparting knowledge through questions and answers that identify weaknesses in the learners and recommend remedial strategies to improve the knowledge.

As continuous assessment uses different forms of assessment, namely, tests, assignments, investigations and projects, to mention a few, some of these forms of assessments are done at home, away from teacher supervision. Parental supervision of continuous assessment tasks opens up the process of manipulation. In addition to parental supervision, learners can ask other people to complete their work for them with little or no input; some even go to the extent where the learner's handwriting does not appear on the assignment.

With technology projects, learners can buy the project from the street where the object is already made, which takes away the aim of continuous assessment. Learners should demonstrate what they have understood through application in completing the continuous assessment activity. However, the focus seems to be on the marks rather than on the demonstration of understanding and learning. This removes the purpose of continuous assessment. Nicol and McFarlen-Dick (2006) explain that the critical importance of continuous assessment is that it provides learners with feedback about how well they have mastered the material and developed the skill. The main disadvantage is discouraging learning by inducing the belief that this is what an individual is

capable of and that their future is predicted by assignment marks. This demotivates the learner especially when guardians pressure them to gain high marks. Marks do not indicate talent or intelligence but dedication, sincerity and hard work (Berihu, 2016).

The South Africa Department of Education adopted the use of continuous assessment in 1996 as part of education reform to improve the quality of mathematics results. Teaching and learning must be responsive to the ever-changing demands of the socio-economic environment; hence, the continuous assessment model should provide learners with the knowledge, skills, and values required for self-fulfilment and meaningful engagement in society as citizens of a free democracy, regardless of their socioeconomic background, colour, gender, physical ability, or intellectual prowess, as indicated in the National Curriculum Statement NCS Grades R-12 policy (DoE, 2002). Within the Curriculum and Assessment Policy Statement (CAPS), assessment is defined as "a continuous planned process of identifying, gathering, and interpreting information about the performance of learners and referred to as continuous assessment" (DBE, 2011a:293) and includes both informal assessments like quizzes and formal assessments like tests.

A challenge of the use of continuous assessment in the classroom has been noted by the researcher, who is an educator at the Grade 5 level. It was observed that learners are not doing their assignments themselves, choosing to delegate their work to those who are good in the subject area, or they copy from friends, or they ask their guardians and parents to complete the assignments for them. Learners excel at school (which the marks reveal) but struggle to pass the mathematics tests when compared to other learners at the same level on the international bench-mark as their content knowledge of the subject and skill proficiency is lacking.

There is a challenge facing teachers, including the researcher, in implementing continuous assessment. Both teachers and learners focus on completing the assignments restricting the time needed for thorough teaching and learning. This means that the focus seems to be on compliance of the ATP in completing the assessment procedures (Ojo & Mathabathe 2021).

Ghana experienced challenges in the implementation of continuous assessment. Hayford (2008) reported that the method has its challenges such as anxiety and frustration, and poor class participation, which are of grave concern. These challenges are similar to those experienced in the South African education system, at starting at FET learners repeat grade 10 because the progression process is different from that of GET. Learners face challenges in grade 10 where

knowledge acquisition is a basic requirement as they have to be able to apply, analyse and interpret what they learn (Nkosi & Adebayo 2021). The gap that was created at GET makes it difficult for them to do this and they get frustrated and they end up dropping out of school. The gap is also noticeable at the university level. Learners drop out due to academic difficulties; some repeat and spend more years than expected at university, while others are excluded (Umalusi 2009).

1.3 PROBLEM STATEMENT

Education systems are usually defined by their teaching and learning policies, while the quality of learners is determined by their learning process and achievement (Mkumbo, 2013). The education system is a sum total of the outlook of the curriculum, which includes but is not limited to how learners' skills and knowledge are evaluated. The information generated in an assessment is important so as to be in a position to make numerous teaching and learning decisions. In the South African context, as alluded to above, continuous assessment is the one in use. Preciado-Babb, Sabbaghan & Davis (2018) postulate that continuous assessment, when properly combined with other strategies, can narrow the knowledge gap and consequently improve the results.

The definitions of continuous assessment above point to a need for mathematics teachers to continuously document learner performance through various assessment strategies, as per policy (see CAPS, DBE, 2011a, 293-297). The outcome of the assessment task assists the teacher in developing feedback and strategies to attend to the learner's needs (De Lisle, 2016) to ensure that learners cultivate the pertinent grade-appropriate understanding and expertise in mathematics. However, despite the policy improvement by the South African Department of Education, learner performance in mathematics is not where it should be. This is evident in international and regional large-scale assessments such as the Trends in International Mathematics and Science Study (TIMMS) and the Southern and Eastern Consortium for Monitoring Education Quality (SACMEQ) IV (DBE, 2020; TIMMS, 2019; DBE, 2017) which indicate a greater need to focus on mathematics and reading in primary schools.

Taking the above issue of poor mathematics achievement by South African learners as a starting point, this research explores teachers' perceptions of the use of continuous assessment as a method of assessment and its actual implementation in the teaching and learning of mathematics in Grade 5 class in the Frances Baard schools in the Northern Cape, South Africa.

1.4 RESEARCH QUESTIONS

Based on the problem explained above, the main research question was: How effective is continuous assessment method in teaching and learning mathematics?

The main research question necessitated the formulation of the following sub-question:

1. What are the teachers' understanding of continuous assessment?
2. What are the benefits of using continuous assessment in teaching and learning of mathematics in grade 5?
3. What challenges do teachers face in implementing continuous assessment in the teaching and learning of mathematics?

1.5 AIM AND OBJECTIVES

This research aimed to explore the effectiveness of continuous assessment in the teaching and learning of mathematics.

To achieve the aim this study sought to achieve the following objectives:

1. To determine how Grade 5 mathematics teachers, understand continuous assessment.
2. To identity the benefits of using continuous assessment in the teaching and learning of mathematics in Grade 5.
3. To describe teacher challenges in implementing continuous assessment in teaching and learning of mathematics.

1.6 PRELIMINARY REVIEW OF THE LITERATURE

This section gives a brief review of the literature related to the topic under study and includes a discussion on assessment and continuous assessment, policy compatibility, evaluation, and the background of mathematics literacy, which has made it a focus area for many researchers to understand the best ways of teaching the subject.

Continuous assessment (CASS) was introduced in Nigeria as early as 1969 in a curriculum development paper presented by the National Education Research Council (NERC) (Emoefe,

2023). During the primary stage of schooling, continuous assessment and the examination made up the final mark for progression. Following this seminal work, continuous assessment has been implemented at universities as coursework and introduced as a part of the student's final mark, making it imperative to develop a research mentality.

There has been a significant movement towards the use of continuous assessment with innovative assessment methods such as portfolios, activity-based assignments and others in both practicality and complications of tasks in contrast to traditional summative termly examinations (Gronlund, 2006), replacing paper and pencil tests and examinations (Schwartz & Webb, 2002). This indicates a paradigm shift from the old ways with more emphasis on assessing learner knowledge and skills. Shepard (2005) declared that as opposed to conventional evaluation techniques, alternative assessments had higher inherent motivation. Makamane (2011) purports that continuous assessment, implemented in schools as an innovative approach to assessment, enhances the learning experience, motivates learners by moving toward formative assessment ethics, and allows them to assume ownership and accountability for their education and learning. Continuous assessment actively contributes to creating conditions that improve the standard of instruction and learning as an inherent component of the daily round of classroom life (Hargreaves, 2001).

Kellaghan and Greany (2003) recognised several roles of continuous assessment, such as developing the learners' knowledge, skills or understanding. This helps to diagnose problems they may be encountering, determine what needs to be taught next and assess the material covered in a class. McMillan (2000) pointed out that the outcome of the evaluation considerably influences the motivation of learners and regulates their motivation towards their learning, making them driven by results to do better than previously.

Alastair (2022) argues that teachers and learners view continuous assessment as a quality control technique that alters the learning setting in the education system, offers constructive learning chances, and encourages quick feedback. Continuous assessment is viewed as a quality improvement tool that pays close attention to learners and their learning as they engage in learning activities (Guilikers, Bastiaens, Kirschner & Kester, 2006). (Cauley and McMillan 2010) state that formative assessment as the supplementary method has an influence on learners' drive and accomplishment. In support of continuous assessment to ensure quality results in the education system, (Muskin 2017) explains it as a tool that assists educators in gathering critical data regarding student comprehension and promptly responds to inquiries from learners and enables

them to establish and meet purposeful learning objectives in addition to remediation and/or enrichment.

Recent approaches to assessment have attempted to increase the correspondence between what learners acquire and what is anticipated of them once they have finished their studies. According to (Derrick and Ecclestone 2006), continuous assessment as a commendable method for raising the calibre of academic output in schools because it lets learners to learn without the guidance of teachers, in groups, for their own sake, without formal training or credentials, outside of institutions, and at any time of day or year. The theoretical and philosophical underpinnings of formative evaluation and feedback are dismantled by this concept. In doing so, it takes into account the practicality of utilizing formative assessment.

As indicated previous, research by (Jayathilake 1997) in pursuit of assessing the strong point and flaws of continuous assessment, revealed and recommended the need to redefine the objectives of using continuous assessment in evaluating learners' achievement and restructuring the format of assignments if it is to achieve improved quality results. This is particularly important as challenges of continuous assessment which include plagiarism, non-existence of feedback, large class size, shortfall of time and absence of amenities, makes it very difficult for the assessor and the assessed to dictate the truth about their performance (Abera et al., 2017).

The South African Department of Education introduced continuous assessment is an assessment model that incorporates continuous feedback to integrate evaluation into instruction and learners' development (DBE, 2011a, 293-297). The model is used to determine the learner achievement during a grade or level, provide information to support the development of the learner, and allow enhancements to be made in the learning and teaching process. (Tshabalala and Ncube 2013) posit that implementing continuous assessment in the teaching and learning process of mathematics at the primary level is critical. However, the learning environment must be supported by the required resources. The availability of resources is the primary determinant of the effectiveness of continuous assessment, a notion confirmed by (Quimbo 2010), who stated that continuous assessment is possible if adequate resources are allocated to meet the demands of the learning setup; this includes qualified teachers and relevant learning material. In addition, (Navaratna and De Silva 2013) recommend educating learners on how effectively to use the strategy as a learning tool, especially at the commencement of their programme. The Pixley Ka Seme District of the Northern Cape, South Africa, recorded a 72.3% pass with an increase of

2.1% in the 2019 matric examinations, a sign of improvement, but the results seem to fluctuate. According to the MEC, Mac Jack, in 2019, of the 9,138 full-time candidates who wrote the National Senior Certificate (NSC) Examination, 1 633 (17,9%) candidates obtained distinctions, an increase of 2.1% compared to 2018. The figure reflects the improvement in results due to the continuous assessment approach being used.

However, (Mabula 2012) argues that continually assessing the learners is time-consuming and drains the energy of both the learners and the teachers. Too much time is spent doing work independently and not imparting knowledge; hence, learners end up putting their learning burden on those who have already excelled at the expense of their knowledge accumulation. The argument gained the support of authors such as Kafyulilo, Rugambuka and Moses (2012), who postulate that learning mathematics cannot be delegated to the learners. It is usually challenging to tell if one has complied and done the work personally (Mkumbo, 2013). Seifu (2016) examined the successes and failures of implementation of continuous assessment albeit at an institution of higher learning. The researcher recommended short-term procedures to address problems and issues, proving that the approach has flaws even in South Africa.

Despite all the contributions above, some questions arise as to whether the continuous assessment method of learning is applicable in the South African setting, or whether the country has to introduce a learning policy that applies the best learning practices and methods for developing knowledge and skills. The literature supports the notion that governments of developing countries must engage the method in building knowledge in their learners through continuous engagement.

Maganga (2013) has argued that mathematics needs to be studied using the best methods, as current methods seem to fall short, judged by the low amount of learners who excel in the subject area in South Africa. Those who excel usually use different models of learning methods; hence, it cannot be assumed that continuous assessment is the most effective at the primary level, such as Grade 5. Thus, the researcher sought to understand why Quimbo (2010) posits that continuous assessment is a panacea for improving knowledge in learners in mathematics subjects.

1.7 THEORETICAL FRAMEWORK

Theory is used in research to provide explanation, understanding and meaningfulness. Various theories can be attributed to understanding the usage of continuous assessment in the teaching

and learning of mathematics (Acharya, 2013). This study took into consideration the teaching of mathematics and as such, focused on the constructivist and behaviourist theories of learning.

1.7.1 Constructivist Learning Theory

Constructivist learning theory incorporates the theory of cognitive development and social constructivist theory and covers learning theory, teaching methods and education reform. Piaget (1936), in the theory of constructivism, argues that people produce knowledge and form meaning based on experience. He discusses the two critical components of constructing new knowledge: accommodation and assimilation. This theory underpins the investigation for its ability to trace the various psychological aspects that regulate the accomplishment or let-down of the assessment method from a South African perspective.

Vygotsky (1978) claimed that social interaction comes before development; awareness and perception are the products of socialisation and social conduct. Vygotsky, in his theory, claimed that cognitive development occurs in a zone of proximal development (ZDP); that is, the space between what learners can do without assistance as they are cognitively prepared, and what a learner can do with help and social interaction to have full development (Briner,1999). This is how social interaction with a knowledgeable person, such as a teacher or a peer can provide the learner with 'scaffolding' to support the learner's ever-changing comprehension of intricate skills. Concerted learning, discourse, modelling and scaffolding are techniques that encourage deliberate learning and promote learners' intellectual 0abilities and knowledge. The community plays an essential role in child development, hence an interplay between the learner and the environment (Bandura,1977).

According to social-constructivist theory, the ZPD is the knowledge realm of a learner with the ability to extend because of further social exposure, thereby gaining knowledge from the immediate social environment. Role models hold a crucial position in the instruction and acquisition of mathematical knowledge.

Suppose someone in a learner's social environment exhibits a love for mathematics. In that case, this can easily encourage the learner to develop the same attitude, and if someone loves something, they put effort into doing it well. As charity begins at home, learners learn their values, attitudes and social skills from their immediate environment, which supports them and their education to achieve academic.

According to Vygotsky (1978), the learner will eventually assimilate and internalise the knowledge through contact and interaction with people, adding value to its intrapsychological level.

1.7.2 Behaviourist Theory

Behaviourist theory is based on the work of a psychologist known as Thorndike (1949), which is referred to as the law of effect. The principles were advanced by Skinner 1904-1990, believing that practically every behaviour may be reinforced with a reward or kind gesture, and advocating the concepts of operant conditioning. According to Skinner (1953), positive and negative reinforcement strategies are used to condition behaviour. Positive reinforcements are good consequences as a response to positive behaviour or actions; for example, good comments or awarding of a star after a learner gets a good mark in a mathematics written activity. Negative reinforcement increases the response rate by eliminating possible unpleasant consequences; for example, if a child obtains good results at the end of a term and the parent exempts the child from doing manual work like watering the garden for a given period.

According to Smith's (2010) learning is perceived as a modification of behaviour, without the aim of bringing about a shift in behaviour towards the predetermined or anticipated path. In that context, the role of teachers is to create an environment to provoke desirable responses and to tell if the learners and teachers have attained the set desired objectives and responses to the stimuli. James (2006) argued that the environment is the best determinant and that learning, as conditioned stimuli, is supported by the work of Birkenstock and Gardyne (2010). Birkenstock and Gardyne (2010) further argue that the behaviourist learning theory encourages teachers to make decisions on the subject they are teaching, issue instructions, create a tempo for the lesson, and then create a platform to correct and reinforce the correct responses, ensuring that the learners have a substantial role in their learning process.

Stonewater (2005) postulates that in a mathematics class, using behaviourist theory, the teacher reviews previous material and homework and then demonstrates low- level problem solving, followed by seatwork, imitating the teacher’s demonstration. As a result, behaviourist theory can be acknowledged as an integral component of mathematics education.

In accordance with continuous assessment, learners are continuously assessed throughout the teaching and learning process, and their behaviour and attitude towards learning can positively

impact their learning development. In the case of mathematics teaching, the teacher should build an atmosphere whereby learners believe that mathematics is not a complex subject but rather an enjoyable subject that makes you see the world with a different eye in the sense that all problems have solutions. Learning is said to have occurred only when there is a change in the outward behaviour of the learner (Cherry, 2014). Note: according to behaviourism theory, behaviours are measured. The theory also uses experiments for data generation.

1.8 RESEARCH METHODOLOGY

This section briefly overviews the methodology used in the research process. The research objectives have been established, and this section describes how the research was executed with justification for the research design according to Creswell and Thomas (2013).

1.8.1 Research Paradigm

A research paradigm espouses as a system that directs action (Kivunja & Kuyini, 2017). According to Bakkabulindi (2017), a paradigm in research provides a lens through which the researcher forms his/her philosophical assumptions and presents their worldview. Positivism, interpretivism, critical inquiry, feminism and postmodernism are considered the most used paradigms in research (Cohen, Manion, & Morrison, 2018). The positivist paradigm scientifically explains the phenomenon, helping the research reach general conclusions using observation and measurement (Bakkabulindi, 2017). The critical paradigm situates its undertaking to understand social practices (Kivunja & Kuyini, 2017) to influence societal discourse and behaviour (Mack, 2010). Researchers using the feminist paradigm seek to explore how gender shapes the dominance (Creswell, 2013). The postmodernist paradigm seeks to deconstruct social practices that form social value systems (Gray, 2018). The postmodernist paradigm highlights perspectives related to society through class, gender, race and diverse groups (Creswell, 2013).

For this study, the researcher adopted the interpretivist paradigm. This paradigm assisted the researcher in studying the phenomenon in detail, especially how mathematics teachers understand and apply continuous assessment in their classrooms (Cohen, Manion & Morrisson, 2012). According to Cohen et al. (2012), the interpretivist paradigm assists the researcher in understanding the meaning behind actions. In this case, the aim was to ascertain the effectiveness of continuous assessment through the perceptions of Grade 5 teachers using face-to-face semi-

structured interviews, and non-participatory observations (Rubin & Babbie, 2011). The researcher also used document analysis, which helps contextualise the research in the field (Bowen, 2009). The paradigm is discussed fully in Chapter 3.

1.8.2 Research Approach

The researcher adopted a qualitative research approach due to the nature of the data sought. Shank (2002) defines qualitative research as an empirical inquiry into meaning. The qualitative research approach is a deliberate, planned inquiry into the experiences of a community or a group of people. In support of this, Denzin & Lincoln (2000) assert that qualitative research is the study of events in their natural environments with the goal of explaining or interpreting them in terms of the meanings that individuals assign to them.

Qualitative research methods include interviews, observations and document analysis as the most commonly used for collecting data (Cohen, Manion & Morrison, 2011). The benefit of using a qualitative approach is the ability to interact with the participants face-to-face, enabling the researcher to gauge their feelings, reactions and perceptions. Qualitative research has a flexible structure, as it can be constructed and reconstructed to a greater extent (Maxwell, 2012). The flexibility of the qualitative approach allows for fine-tuning, which promotes greater data reliability.

The researcher benefited from the insights gained through interviews and observations to get the details of the situation on the ground, as supported by Creswell (2013) and Creswell and Thomas (2013). The researcher guided the interviews to be objective by asking follow up questions to get clarity and to direct the interview into a desirable direction while the observation schedule was closed using a Likert Scale to confirm the degree of effectiveness or ineffectiveness of the variables under study. Triangulation was used to improve the reliability of the collected data and to substantiate research findings.

1.8.3 Research Design

A research design strategy recognises the research methodologies and is conducted to solve an inquiry problem (Wedawatta, Ingirige & Amaratunga, 2011). It involves the development of a research plan or structure to articulate the investigation into the problem and the execution of the research study to try to reduce bias and distortion of reality, according to Cohen et al. (2012). The

researcher used a case study, which is very helpful when understanding a problem, an event, or a phenomenon in-depth inside its actual, natural setting (Crowe, Creswell, Robertson, Huby, Avery & Sheikh 2011).

The case study resonates well with the qualitative approach, allowing the researcher to immerse him/herself in the context of the problem under review. The researcher also used phenomenology as a research strategy, which describes the findings of the research and provides a platform for the recommendations for improvement through the provision of data for possible recommendations to policymakers on the results of the effectiveness of continuous assessment in the South African Education System The researcher used phenomenology because it is varied, so the information is diverse and comprehensive. It ensures high quality and honesty in the data collected as it is done in a natural environment. The researcher had an opportunity of experiencing first hand through non-participatory observation, face-to-face semi-structured interviews and document analysis.

1.8.4 Research Methods

This section describes the research methods used to answer the research questions. In the following section, the selection of participants, data collection instruments and data analysis procedures that were followed are discussed. According to Sitko (2013), research instruments or tools are the apparatus used in data collection by the researcher. This research used interviews, observations, and document analysis to get a balanced assessment of the situation on the ground concerning the problem being investigated, as supported by (Hennink, Hutter & Bailey 2020).

1.8.4.1 Selection of Participants

Schools that participated in the study were purposively chosen from the Francis Baard district of the Northern Cape of South Africa, which has 32 schools. The research aimed to explore the perceptions of Grade 5 teachers regarding the effectiveness of continuous assessment in the teaching and learning of mathematics in different school settings. Ten (10) educators from 10 schools with an average of 32 learners in a classroom were purposively sampled to be part of this study. According to Taherdoost (2016), researchers use purposive sampling as it enables the researcher to target the relevant population to collect specific information and it is flexible, you can collect data using numerous ways. The participants were identified as they teach mathematics in

Grade 5, in the selected schools. The researcher believed the selected participants would be able to offer their perceptions regarding continuous assessment practices and application.

1.8.4.2 Data collection

Data collection is a significant phase of research, as the data collected sought to answer the research questions formulated in this chapter. Kabir (2016), postulates that data collection answers research questions, tests hypotheses and assesses results; data collection is thus the act of obtaining and measuring information on variables of interest in a predetermined, methodical manner. Face-to-face semi- structured interviews, non-participatory observation and document analysis were used as data collection instruments. These are briefly discussed in the next section, starting with interviews.

A. Face-to-face semi-structured interviews

Interviews are conversations of gathering information (Easwaramoorthy & Zarinpoush, 2006). An interview includes an interviewer and an interviewee; there are many platforms for conducting an interview, such as telephone, Internet, or face-to-face. The researcher used face-to-face semi-structured interviews for this research.

Interviews helped the researcher to get an in-depth analysis of the teacher's opinions on how effective continuous assessment is in teaching and learning mathematics. The researcher sought to hear how teachers were implementing the approach and to determine what challenges they faced when administering continuous assessment in mathematics. Also, how can they overcome these challenges to close the gaps created by these challenges to improve the quality of results of mathematics?

B. Non-participatory observation

According to Williams (2008), non-participatory observation is when someone watches a group of people without being involved in any of the group activities and does it passively from a distance. This ensures that the observation is reliable, as there is no influence of action or information from the researcher. This gives answers which are objective and neutral, as the researcher is not emotionally involved. It also allows for careful analysis of the situation and mostly freedom as the

participant is not being led to do or say anything, allowing the researcher to carry out the observation more smoothly without disturbance. The researcher observed the engagement of learners, how the lesson was delivered, communication skills by the teacher, whether the lesson was more learner-centred or not, as well as how the teacher managed their time and accommodated the diverse learners in the classroom. disturbance. The researcher observed the teaching and learning process using a prepared observation instrument.

C. Document analysis

D.

Bowen (2009) describes document analysis as a form of qualitative research in which documents are studied and interpreted to give voice. In this study, the researcher analysed the following documents:

- National Curriculum Statement (NCS), a CAPS document in which all teaching and learning are hitched upon in South African Education Schools.
- Learner Portfolio: Collection or evidence of formal assessments of the learner.
- Learner's books, including the DBE Workbook, including notes and daily or informal assessments.
- Teacher's Lesson Plan: Where the teacher plans what to teach daily, weekly, or monthly.

1.8.4.3 Data analysis

Saunders, Lewis and Thornhill (2003) explain data analysis as the systematic application and logic technique to describe, illustrate and evaluate data to become meaningful. A thematic analysis that examines the trends and patterns inherent in the collected data was used. Namey, Guest, Thairu and Johnson (2008) postulate that the theme moves beyond counting explicit words or phrases and focuses on identifying and describing simple and explicit ideas. In this research, a deductive approach was used, which involves analysing the data with predetermined themes that you expect to find in the data based on theory or existing knowledge. Braun and Clark (2013) outlined the six phases in thematic analysis:

- Familiarisation involves an in-depth reading of textual land audio recording data, recording data, and making notes. The aim is to fully self-orient with the data.
- Generating initial codes at this phase, begins by assigning codes that mirror the language and concepts of the participants and also take advantage of the researcher's theoretical framework.

- Highlighting key themes involves sorting codes into potential themes and collating all relevant coded data extracts within the identified themes.
- Re-evaluating the themes involves the refinement of candidate themes. The data within the themes should be homogeneous, yet there are clear distinctions between themes.
- Defining and naming the themes after establishing a satisfactory thematic data map. This stage defines and refines the data to identify each theme's main features.
- Writing the report to include an in-depth thematic analysis that will convince the reader of the merits and validity of the analysis.

1.9 MEASURES FOR TRUSTWORTHINESS

Gunawan (2015) argues that trustworthiness, which entails credibility, dependability, transferability, and confirmability, is paramount in qualitative research. Middleton (2021) states that in research, the phrase reliability refers to the consistency of a research study or a measuring test.

1.9.1 Credibility

Credibility refers to the confidence in the truthfulness of the data collected. Shenton (2004) argued that credibility corresponds to internal validity in the data collected and is a criterion for ensuring that the study examines what it is intended to. Oman (2013) state that prolonged engagement assumes that a longer relationship between a researcher and respondents can reduce the impact of reactivity and

Participants' bias consequently affected the researcher's credibility. The researcher used data triangulation to improve credibility.

1.9.2 Transferability

Transferability refers to how the findings can be replicated in different contexts. Houghton, Casey, Shaw, and Murphy (2013) state that transferability refers to findings that can be applied to other settings or groups. To achieve this, the researcher drew a sizeable qualitative population sample of 10 mathematics teachers and educators from 10 different primary schools. The researcher described not just the teacher's behaviour or experiences but also focused on their context to bring meaningful understanding to the reader.

1.9.3 Confirmability

The absence of bias in responder involvement is referred to as confirmability. According to Polit and Beck (2012), confirmability is the researcher's capacity to show that the data accurately reflects the replies of the participants rather than the researcher's prejudices or opinions. Confirmability can be achieved by explaining how the conclusions were reached and the interpretation of the data. Confirmability is achieved through checking and re-checking data analyses iteration promotes confirmability.

1.9.4 Dependability

The research findings should be consistent and should not be difficult to replicate. In support, Tobin and Begley (2004) put forward that dependability refers to the constancy of data under similar conditions. In support, Koch (2006) suggests that if a study's results were repeated with comparable subjects under comparable circumstances, then the researcher's methodology and descriptions would make the study credible. Catoto and Sanjose (2016) posit that dependability is obtained when researchers provide thorough literature relevant to the topic and investigation. Triangulation, or using several data sources to evaluate findings, was the method used to attain dependability.

1.10 ETHICAL CONSIDERATIONS

Omari (2011) argues that the research will be viewed appropriately through the researcher's actions in the field. Therefore, how the researcher carries him/herself in the field has to be ethical. An application for ethical clearance was sought from the University of South Africa's Ethics Committee. The researcher also requested permission from the Department of Basic Education to collect data through interviews, observation and document analysis. The researcher did not compel participants to take part in the research but sought their voluntary participation. The researcher asked school leadership to carry out the research and assure them that their input is strictly for academic reasons. The researcher explained to the participants that they were not compelled to participate in the research; participation was voluntary, and the participants signed consent forms. Using the instruments from the University's Ethical committee, the researcher spelt out and informed the participants of the confidentiality clause. Pseudonyms were used to protect the identity of the participants.

1.11 LIMITATIONS OF THE STUDY

The following are the limitations that the researcher was aware of:
The research was carried out when the Frances Baard District was also conducting TIMSS research targeting Grade 5 learners and educators. This resulted in overloading the same teachers, and some schools earmarked for data collection could not take part.
The time required to complete this investigation was limited; therefore, the researcher was compelled to investigate in the prescribed time, which made access to valuable respondents challenging given the geographical expanse of the target area. However, the researcher came up with a timeline for the completion of the research project.

Financial challenges in travelling in the cluster to access participating schools compromised research time. To mitigate this, the researcher clustered schools according to their locations to minimise travelling time from one school to the next so that several schools were covered on a given day. Teachers were uncomfortable critiquing education systems, but the researcher assured them that it was strictly for academic purposes (Pouline 2010).

1.12 DELIMITATION OF THE STUDY

- The study focused on the effectiveness of continuous assessment in learning mathematics in Grade 5.
- The study was confined to Francis Baard in the Northern Cape.
- The researcher endeavoured to use as much of the latest secondary data and literature as possible.

1.13 KEY CONCEPTS

It's critical to provide definitions and context for some of the terms used in this study to contextualize them. The following essential terms are utilised in the dissertation.

1.13.1 Assessment

The National Protocol on Assessment for Schools in the General and Further Education and Training Band Grade R-12 (DBE, 2011b) defines assessment as the process of gathering,

combining, and analysing data to help parents, educators, and other stakeholders decide how well their learners are progressing (DBE, 2011).

1.13.2 Continuous Assessment

The National Protocol on Assessment for Schools the General and Further Education and Training Band Grade R-12 (DBE, 2011b) put forward that continuous assessment is the consistent and constant valuation and evaluation of the subject (learners) in trying to see if the set targets are achieved using continuous engagement of learners and teachers. Continuous assessment is ongoing through a given teaching and learning period; in the case of South Africa, the period is termly (DBE, 2011a).

1.13.3 Effectiveness

Effectiveness is reached when clearly defined goals are achieved. Effectiveness can only be achieved by a serious investment of effort and dedication (Zidane & Olsson (2017). In support, Fraser (1994) put forward that effectiveness is gauged by a severe investment of effort and dedication (McCormick, 1981). In agreement, Burusic, Babarovic and Velic (2016) argue that effectiveness tests how well-stated objectives and their accomplishment align. Putting in place a credible educational policy supported by a vibrant assessment system marks a successful education system. Effectiveness in terms of assessment can be ascertained by the quality of the learner's end product. If a learner in South Africa can perform comparatively the same as their counterparts elsewhere, then effectiveness has been achieved.

1.13.4 Curriculum and Assessment Policy Statement

In 2014, the Department of Basic Education (2014) announced that for all subjects listed in the National Curriculum Statement Grades R–12, the Subject and Learning Area Statements, Learning Programme Guidelines and Subject Assessment Guidelines had been replaced by a single, comprehensive and succinct policy document called the National Curriculum and Assessment Policy Statement (CAPS) (DBE, 2011a). An improvement was deemed necessary on the National Curriculum Statement (NCS) Grades R-12, adopted at the onset of independence in 1994. CAPS spells out what should be taught in the classroom and prescribes the assessment methods to be employed in evaluating learner performance (DBE, 2011a).

1.13.5 Feedback

Obilor (2019) posits that feedback enables learners to reach their full potential in various training phases, increase their understanding of their strengths and areas for development, and pinpoint the steps that need to be taken to perform better. Feedback is an essential component of the teaching and learning process. It provides crucial information for the learner to see their strong and weak areas. In support, Brown (2007) postulates that feedback is the grease that keeps the wheels of understanding turning.

Nic ol (2007) asserts that feedback focuses on teaching learners to monitor, oversee and manage their own learning. Error correction is but one aspect of feedback. For feedback to be meaningful, it must be informative and make sense for the recipient. Shutes (2008) states that feedback helps learners understand the difference between where they are now and where they want to be in learning. Feedback develops responsive learners who are receptive to feedback and learning (Chappuis, Stiggins, Chappuis, & Arter 2012). This accelerates learning and increases learners' ability to reflect on their work. Learning is improved when learners are responsive to the teacher's feedback and material.

1.13.6 Teaching and Learning

Learning is an alteration of behaviour when a learner is exposed to new material (De Houwer, Barnes-Holmes & Moors 2013). Rajagopalan (2019) proposed that teaching can be described as the act of transferring or passing knowledge and skills. Teaching and learning can be regarded as two sides of the same coin. Teaching and learning involve the active participation of two parties: the one who imparts knowledge and the one who partakes in the information.

1.13.7 Implementation

Damschroder & Hagedorn (2011) states that the process of carrying out deliberate, planned actions with the goal of transforming concepts and facts into acceptable procedures that benefit people in the real world is known as implementation. It is about carrying out a plan. Implementation is a delicate stage of all the steps taken to put something into effect, it can make or break whatever to be put in motion.

1.13.8 Learning outcomes

A learning outcome is a precise description of what a learner should know, be able to accomplish, and/or value at the end of a unit of study, as well as how well they should be anticipated to meet those expectations. It outlines the content of education as well as the standards for proving mastery of it (Proits 2010).

1.13.9 Curriculum

Mulenga (2018) Curriculum refers to all of the thoughtfully selected, structured, creative, integrative, and evaluative experiences in education that are purposefully or inadvertently provided to students under the supervision of the school in order to assist them in achieving the desired results. These results, which are the product of the students' growth and maturation, are intended to be most useful in the context of a society that is evolving.

1.14 CHAPTER DIVISION

Chapter one focused on the general introduction of the topic, the concept of continuous assessment, and the motivation to carry out the study. The phrase continuous assessment was explained in depth and related to the teacher's knowledge of the concept and their interpretation and application of the problem that ignited the research study.

Chapter two focuses on the literature evaluation of teachers' statements about continuous assessment, their interpretations, and the application of the policy concerning the principles that guide the concept. Continuous assessment is defined and explained in context, as is the converging and divergent literature for and against the concept from experiences with it.

Chapter three focuses on the research methodology, the research design, the paradigm, the mixed approach, and the justification for using interviews, questionnaires, and observation in data collection. The data administration and collection processes are addressed in the same chapter, with ethical considerations central to achieving a generalisable and ethical research study.

Chapter four analyses the data generated using various strategies, namely document analysis, semi-structured interviews, and non-participatory observation. The findings are presented through themes and categories.

Chapter five summarises the research findings, derives conclusions from each research question and objective, and then offers recommendations for each objective or research question.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

This study aimed to explore the effectiveness of continuous assessment in the teaching and learning of mathematics. Therefore, this chapter reviews the relevant literature on teaching practice, preparation, and assessment by mathematics teachers in the intermediate phase in South Africa. Arshed and Danson (2015) state that the literature review evaluates the research on what other literary presentations are made to mould this research presentation and it allows a researcher to document the past and the current information relating to the phenomenon (Creswell, 2009).

The review begins with understanding the teaching of mathematics as a subject and the challenges that occur during the teaching process. The review considers teachers' knowledge of the curriculum, subject content knowledge, beliefs, confidence and pedagogical content knowledge as variables that affect the outcome of the product (learners) and the persistence of effort (Adetula, 2015). In relation to the effectiveness of pedagogical activities, teacher preparation and learner evaluation as part of teaching and learning activities in the classroom and high-level assessment, supporting and divergent literature was found as the researcher sought to identify and cover the literature gap with this research study.

The literature review functioned as a determinant of what mathematics teachers understand of continuous assessment and to identify gaps in the implementation of continuous assessment as a method of assessment. The literature on continuous assessment was reviewed to create a comprehensive understanding of continuous assessment and mathematics performance (Abbott, 2014).

2.2 THE TEACHING AND LEARNING OF MATHEMATICS

Mathematics is the science of numbers and how they relate to each other. It helps learners to think logically and critically and to analyse the world phenomenon and equipping learners with the ability to solve problems abstractly (DBE, 2011a). Mathematics assists learners in observing, presenting and researching quantitative links both among mathematical objects and in social and physical

phenomena, which are all human activities involved in this process. Ziegler and Loos (2017) explain mathematics as a field that focuses on quantitative computation and logical reasoning. Mathematics has evolved and has turned out to be more abstract and idealistic. Mathematics in the 19th century became handy in the areas of physical sciences and technology and, in recent times, has complemented the quantitative aspect of life sciences (Maass, Greiger, Ariza & Goos 2019).

In the South African education context, the Curriculum and Assessment Policy Statements (CAPS) document (DBE, 2011a) stipulates each subject's aim, scope, content, and assessment. In the teaching of Mathematics in the Intermediate Phase, CAPS gives the specification of content, which demonstrates the ideas and skills that are taught in each grade as they advance (DBE, 2011a, 12-33). The curriculum is specific in that it outlines the content area, the topics, the concepts and skills to be taught each week, supported by teaching guidelines. The instructional time is also specified with Intermediate-Phase mathematics being allocated six hours per week (DBE, 2011a:6). The Annual Teaching Plan (ATP) aligns with the CAPS document, outlining the full year's work as per each term, providing time frames when a concept should be taught (DBE, 2012). Looking at the Annual Teaching Plan, time is allocated to assess learners formally.

The Mathematics curriculum aims at building learners who can think critically and objectively and are able to solve problems (CAPS 2011). It is, therefore, crucial for developing countries to have young people who can think critically to solve economic problems and create a viable economic environment for the future. Africa is in critical need to create learners who are equipped with the relevant mathematical knowledge, and creative, and innovative skills applicable in the workplace to enable them to invent, produce, manufacture, and sell their own products (Roohi, 2012)., Thus, improving their living standards and contributing to the economy.

However, Sinyosi (2015) reports that poor learner performance in mathematics has become a global concern as most learners perform below expectations and prevent developing countries from achieving their developmental goals. Furthermore, Mokgosi and Ramapela (2021), in their findings, add that the level of mathematics competence among primary school learners is weak in most African countries. This problem is noticeable from primary to secondary level; hence, it prevents learners from choosing mathematics as a major at the university where they should further develop their mathematics skills (IMU, 2020). As indicated in Chapter 1, TIMSS (2019)

SACMEQ (2017) have also revealed poor learner performance in mathematics over several cycles in South Africa. The TIMSS (2011) assessment report showed that 68% to 90% of South African boys and girls in Grade 8 did not meet the minimum international standard in mathematics. Research further states that () South Africa was placed 38 of 39 participating countries (TIMSS, 2019; Mullis, Martin, Foy & Arora, 2012). Regional assessments like the Southern and Eastern Consortium for Monitoring Education Quality SACMEQ (2017) have shown low levels of achievement in mathematics by learners in South Africa.

Su, Ricci & Mnatsakanian (2016) put forward that expanding math reasoning abilities related to advanced mathematics, which calls for a higher degree of thinking, critical thinking, or thinking about thinking, can help teachers support learners while providing them options for solving issues or during calculations. Having a vibrant learner evaluation system alone will not ensure successful teaching and learning of mathematics. While classroom teachers have long employed various forms of assessment to track their students' mathematical learning and guide future instruction, policymakers worldwide are increasingly using external assessments to measure learners' mathematical proficiency and occasionally to compare that proficiency to that of students in other nations (Suurtamm, Thompson & Diaz 2016).

2.2.3 Challenges of the Teaching and Learning of Mathematics

In the South African context, the South African Curriculum Assessment Policy (CAPS) Mathematics (DBE, 2011a) states that it aims to create learners who are inquisitive, have a love for mathematics, are critically aware of the ability to solve problems in the real world. Learners should develop an ability to pay attention to and transfer what is learnt to other situations and appreciate the role mathematics plays in solving problems in these situations and develop knowledge of the interlink between mathematics and socio-cultural and socio-economic environments.

Mathematics teaching and learning are hampered the world over by the myth surrounding the subject; that is, the subject is difficult, hence the high failure rate. Maboya, Jita, and Cimbi (2020) put forward that mathematics education and found a view that mathematics is a complex subject for both the teacher and the learner. An objective of mathematics instruction is for learners to be ab le to explain the steps they took to arrive at the right answer and that learners are encouraged to practise the steps to achieve this objective (Edwards 2015). The steps are automatically grasped and repeated in the learners' thoughts (Alenezi, 2008). The problem is that learners are not

encouraged to understand the procedures; teachers should attach important on learners showing working by awarding marks on the working rather than the answer only. The emphasis is placed on memorisation techniques, whereas mathematics requires abstract thought which sometimes cannot be concretized. As a result, the memorisation technique has been found to create much stress on learners' limited working memory capacity (Everatt & Reid, 2009).

Teacher preparation is crucial in mathematics because it is directly related to learner achievement (Mullis et al., 2012). Makgato (2007) further revealed that teachers could significantly impact learner performance because there is a link between instructor expertise, including content knowledge, and pedagogical content knowledge, and learner performance (Carnoy & Arends, 2012). If teachers lack subject content knowledge, that is, a solid understanding of the subject; they could convey accurate information or omit crucial information. Educators should be capable of using appropriate teaching and learning approaches and strategies suitable for specific content knowledge (Makgato, 2007). There is compelling evidence, context of the study is needed here that a teacher's diligence, commitment and attention to fundamental instructional procedures and policies can result in effective teaching and learning (Chen, Wei & Jiang, 2017). Ferreira and Schulze (2014) further add that in South Africa, learners' ability to acquire mathematical knowledge and skills is influenced by the calibre of their teachers. Although teaching and learning is a two-way process, teachers are well placed to influence positively the way learners grasp mathematics concepts through proper planning of lessons, use of good teaching media, record keeping and effective assessment strategies.

According to the TIMSS (2019) study, teachers cannot apply all the variables that contribute to learning achievement in mathematics. As previously stated, teacher preparation is essential in mathematics and directly related to learner achievement (Mullis et al., 2012). However, there are other variables that affect the efficiency of mathematics teaching and learning and learner success. These variables include (1) how well teachers adapt their teaching and learning techniques, (2) The confidence of the teacher in outlining their expectations to learners, whether or not they use classroom discussion as a learning tool, and (3) the effectiveness of formative assessment and feedback strategies in enhancing the learning environment. These are the factors that affect learner engagement as stipulated when using continuous assessment (Ferreira & Schulze, 2014). Teachers in the mathematics classroom should be able to fine-tune their teaching strategies to suit learner and situational differences. Teacher confidence has a significant bearing on the

success of teaching and learning of mathematics. A teacher's confidence can rub on the learners and can also instil the love of the subject.

The language for instruction also has an effect on learner performance (Seethaler, Fuchs, Star & Bryant 2011). The transition of language from home language to using another language, such as English as the language of learning and teaching (LoLT), is a challenge as learners may need time to develop language proficiency (Mackay 2014). Bostock (2018) postulates that English is to be used as LoLT from grade 4 while vernacular is used from grade R-3; in some schools, Afrikaans are used from grade R-12. Dhlamini (2020) explains that learners also need to understand mathematical language written in English which would then affect their mathematic abilities. According to the PIRLS 2016, South African learners achieved the lowest score of all participating countries, especially those in schools in socio-economically challenged contexts, which points to the lack of reading literacy competence, which could also have an effect on mathematics performance (Howie Combrinck, Roux, Tshele, Mokoena, & Palane 2017). It could therefore be argued that learners struggle to read and comprehend mathematical terminology used in formal assessments, to provide accurate answers to questions asked (Asikhia 2010). The language barrier has a detrimental impact on reading comprehension and thus negatively affects performance in mathematics (Howie et al., 2017). English language proficiency is a factor, as revealed in research by Dempster and Reddy (2007), who posit that lack of English proficiency proved to adversely affect Grade 12 learners' performance in Mathematics. Lack of English proficiency. Lack of English proficiency in learners' hampers comprehension of mathematical problems and understanding of the demands of questions in both formal and informal mathematics activities. This negatively affects the overall performance of the learners. TIMSS (2019) contend that in most South African public schools, learners lack a sense of belonging, indicating an unhealthy school climate. Deficiencies in mathematics resources and a lack of use of technology in schools have been listed as some of the prevalent challenges in public schools (Thurm & Barzel, 2022; DBE, 2020). Makgato (2007) indicates that a lack of sufficient practical work and relevant resources, both visual and concrete, such as charts and manipulatives, could hamper learner development in mathematics. Furthermore, learner motivation and curiosity to perform well in mathematics could be thwarted. The researcher is of the belief that public schools adequately equipped with teaching and learning technologies, could assist learners in developing mathematical concepts (Bozkurt & Akalin 2010).

As indicated previously, there is time allocation for mathematics. Per policy, six hours (12 periods) are allocated for mathematics instruction per week in the Intermediate Phase CAPS (2011). Makgato (2007) reports that poor time management harms the teaching and learning of mathematics and curriculum coverage.
Teacher development must be associated with relevant knowledge of the changing world. The teacher must be prepared with current technological knowledge, including the ability to use robotics in teaching and learning (Silva, Martins, Cravino, Martins, Costa & Lopes 2023).

The assistance of homework, projects and assignments in mathematics is also a contributing factor, as many learners may not get help at home. For the learners to perform better in mathematics, there is a great need for the home and school to work in unison; the home should also supervise the learners to ensure the homework is done. The problem could be that the learner has little support, as family members may not be well-versed in mathematics. Lack of role models, with relevant mathematical support, could affect the learners' understanding. Related to this is parental involvement and attitude (Makgato, 2007). Sa'ad, Adamu and Sadiq (2021) blame parents' attitudes and interrupted instruction for their children's low mathematics performance. Some parents do not show interest in their children's work, for example, not checking their books or asking about their school work, to mention a few; this will discourage the learners from working hard and attaining better results. Karue and Amukowa (2013) put forward that in Kenya, poor arithmetic performance was mainly caused by factors related to the home environment, family history, and parents' inability to participate keenly in their children's learning. Cascio (2013) also reported that family-related issues are equally important in determining how well learners succeed. Learners lose academic attention when their parents are too preoccupied to worry about their development (Attwood (2014) in Sa'ad, Adamu & Sadiq, 2014). This includes learners who come from socially depressed circumstances where they are forced to abandon their schoolwork when they get home and take on the role of an adult doing household chores and taking care of siblings (Bhengu, 2021). Due to socio-economic factors, a lot of families are child-headed, which means the learners will have little time for their school work as they have to take care of their siblings in all aspects of life.

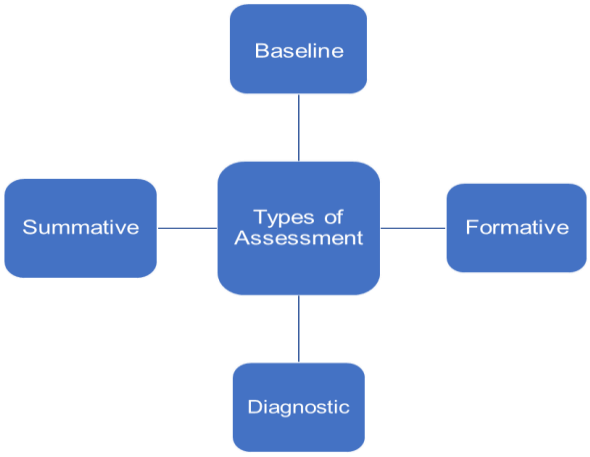
2.3 CONTINUOUS ASSESSMENT IN MATHEMATICS

The teaching and learning process has transitioned from a traditional teacher-centred approach to a learner-centred one to ensure effective classroom teaching and learning (Du Plessis, 2020).

To meet the demands of improved teaching and learning in mathematics, teachers should continuously engage their learners to gauge how learning is taking place. Through appropriate assessment approaches, which are integral to the teaching and learning process, teachers can structure their teaching according to the needs of the learners (Tosuncuoglu, 2018). Assessment should be accompanied by quick feedback which mathematics teachers may utilise to tailor their lessons and improve learning. Feedback is one of the key features of continuous assessment. Adarkwah (2021), in support, states that assessment feedback is a vital component of meaningful teaching and learning.

The Department of Basic Education defines assessment as a "continuous planned process that mathematics teachers use to identify, gather, interpret, and diagnose information about learners to improve classroom instruction" (DBE, 2011a:293). Therefore, it assists the teacher in developing feedback that can be used in many different ways to ensure academic development. Irrespective of the type of assessment, it is of utmost importance for teachers to know why they are conducting assessment (Ciofalo & Wylie, 2006).

Continuous assessment is an ongoing process undertaken by the teacher to continuously update how the learner is performing towards meeting the learning outcomes (Dreyer & Mawela, 2020). Continuous assessment has been designed by adopting baseline, formative, diagnostic, and summative assessment types to be used in South African classrooms (DBE, 2011a). Figure 2.1 below illustrates the types of assessment used in a mathematics classroom.



(Source: Adapted from DBE, 2011s)

Figure 2.1: Types of assessments

2.3.3 Baseline Assessment

Baseline Assessment establishes if learners have the necessary basic abilities and knowledge to master a given mathematics topic (Spaull & Kotze, 2015). A baseline assessment is administered before a concept is taught to gauge the pre-knowledge of the learners to ascertain where to begin and choose the appropriate approaches to prepare the given topic. According to Tomlinson (2020), a baseline assessment provides teachers with information on learners' capacities and knowledge gaps. Teachers use a baseline assessment to know what the learners know or do not know or can or cannot do. Tomlinson and Moon (2013) assert that since baseline assessment creates a standard for evaluating future progress, it is intended to be at the core of curriculum change. The importance of the baseline as an assessment module cannot be over-emphasised as it precedes all learning and sets the tone to ensure successful and meaningful teaching and learning. Kim (2019) posits that baseline assessment tasks give learners the opportunity to show their uniqueness during learning. The advantage in using a baseline assessment is that teachers will be in a strategic position to tailor how teaching and learning should ensue.

2.3.4 Diagnostic Assessment

Diagnostic assessments give learners the chance to consider their own ideas as well as their strengths and flaws (Jang, Stille, Wagner, Lui, & Cummins, 2010) and provide insightful data on learner learning. However, teachers must exercise some professional judgment when interpreting the information because there are various reasons why learners choose to respond in a certain way to a question. Diagnostic assessment measures the growth of learners and provides precise areas where improvement is required. Ciofalo and Wylie (2006) state that diagnostic assessment, when used effectively, can designate areas for progress with individual learners or all learners and inform the teacher about the learners' mathematics problem areas that might hinder performance; for example,
mathematics anxiety and psychosocial functions such as negative attitude. Diagnostic assessment should not be confused with baseline assessment; unlike baseline assessment, diagnostic assessment is done after teaching, particularly in preparation for formal assessment.

2.3.5 Summative Assessment

Summative assessment, also called Assessment of Learning (AoL), concentrates on the knowledge learners have acquired after a unit of study or grade level (Johnson & Jenkins, 2009). Woolfolk, Hughes and Walkup (2008) assert that summative assessment gives teachers and learners an indication of how much ground they have covered and is carried out after the completion of several topics (DBE, 2011a). It's a learning assessment that considers the performance of every learner and concentrates on the learning outcome.

2.3.5.1 Assessment of Learning (AoL)

AoL helps mathematics teachers use results-based and benchmarking-based approaches. In this assessment model, teacher direction is paramount, and learners are less engaged. Sometimes referred to as a grade in the middle of a teaching assignment or as a conclusion of a lesson or term, it can be used to rank learners (Achor, Imoko, & Kuse, 2012). The effectiveness of assessment for scoring and grading largely relies on legitimacy, consistency and weight assigned to a given task (Brookhart, Guskey, Bowers, McMillan, Smith, Stevens and Welsh, 2016). Therefore, some assessment activities are designed to gauge what has been learnt and what has not been achieved after a teaching episode.

2.3.6 Formative Assessment

Formative assessment, regarded as Assessment for Learning (AfL) and Assessment as Learning (AaL), is a methodical procedure used to collect learning evidence continuously. Formative assessment is an integral part of enhancing learner performance. Black and Wiliam (1998) explain that formative assessment provides the groundwork for effective teaching and learning strategies. Formative assessment is an assessment during teaching and learning to constantly keep tabs on whether learners understand what is being taught or whether the teacher's strategies are achieving the set goals. Formative assessment enables the educator to find out what the learners have grasped, how learning is progressing, and what will be learnt in the future (Masters, 2015).

2.3.6.1 Assessment of Learning (AfL)

Assessment for learning as a part of formative assessment, takes place throughout the learning process and is the procedure for finding and evaluating data. This data is used by educators and learners to determine where learners are in their learning, where they need to go, and the most effective way to get there. AfL is implemented through formative assessment in a classroom. Kanjee and Bhana (2020) explain that formative assessment is when feedback is given timeously, and these active feedback loops assist learning. TEAL (2010) defined AfL as a planned process in which teachers and learners use evidence to adjust their work. It helps the teacher identify the gap between what the learners know and what they need to know. With appropriate feedback, it is arguably the most powerful moderator in enriching achievement. Research indicates that teachers who use AfL effectively, see considerable results among all learners, irrespective of their socio-economic backgrounds (Flòrez & Sammons (2013)

Christodoulou (2017) indicates that AfL has advantages as it involves both learners and teachers, is carried out during the lesson, is based on informal work used to plan suitable activities, needs the teacher to provide feedback but it leads to specific actions that address learners' learning needs. The strategies the teacher can use with Afl are group task cards with work to be done during the lesson, hand signals, misconception check, teacher observation, quizzes to mention but a few.

2.3.6.2 Assessment as Learning (AaL)

AaL occurs when the learner acts as their own reviewer, monitoring and questioning what they have learnt in class and, with the help of the teacher, improving their learning (Paulo & Tilya, 2014). Therefore, AaL helps the learner self-direct the learning process by reflecting on how they learn and using the outcome to create a platform for growth. The strategies which can be used are peer tutoring, learners setting their own goals, learners developing own criteria of achievement, creating an environment where learners are free to air their views o mention but a few.

2.4 CONTINUOUS ASSESSMENT IN THE TEACHING OF MATHEMATICS

As indicated earlier, assessment is a continuous planned process to assist in the learner's development to improve the process of teaching and learning (DBE, 2011a:293). Continuous assessment refers to investigating learners' skills, knowledge, attitudes, and skills using various evaluation techniques to enhance learning and is thus an essential component of the learning

process (Ajayi, Ajayi & Akorende 2015). Makamure & Jojo (2023) assert that the existing summative assessments fall short in evaluating the entire spectrum of abilities and information that should be included in mathematics literacy and, as a result, fail to assess abilities that are difficult to assess. The continuous assessment presents itself as a feasible alternative to smoothen the shortcomings of other evaluation systems.

2.4.3 Essential Prerequisite for Continuous Assessment

Before designing an assessment, a mathematics teacher must ascertain that their planning will meet the requirements (Mpapalika, 2014). This involves looking hard at what information, content and skill is needed to complete the assignment. According to Hodgson and Watts (2016), some prerequisites must be met to conduct a credible and proper assessment. The assessment should be a calculated activity, which means that it should be planned, including how and when it will be done, and it should be based on concrete conditions, school hours, location and social factors, learner understanding, and the nature of instruction (Howard & Donaghue 2015).

A significant prerequisite for implementing continuous assessment is the teacher's proficient skills. These skills include planning and using assessment tools to measure learners' knowledge and skills of mathematical calculations and statistics. They could involve the use of tables, graphics, data, and calculating measurements (Maravanyika, 2018). For this reason, educators must understand the relevant assessment techniques and access to the necessary information and resources. Teachers with adequate knowledge of assessment can choose and use a variety of assessment techniques, tools, and methods (McTighe, 2015). The assessment must be designed using unambiguous, understandable and accurate language, and its results should be documented and conveyed to the learners.

2.4.4 Basic Strategies for Continuous Assessment in Mathematics

The teacher will determine the best way to evaluate learners in mathematics based purely on what he/she wants to learn from their performance. According to Watson and Ohtani (2015), the teacher will need to outline the assessment criteria clearly, and the learner will need to show those requirements for the assessment to identify whether or not the learner has met the learning objectives. The following assessment techniques could be utilised throughout teaching:

A. Performance-based assessment: requires the learner to master newly acquired content and skill.

   The requirements for high quality can be demonstrated through written assignments, role-playing, presentations, seminars, projects and portfolios (Wyatt-Smith Klenowski & Colbert, 2014).

B. Self- and peer assessment: involves learners reflecting on and evaluating the processes and outcomes of their learning. They consider their own and learners' work and reflect on the procedures, actions, and activities that contributed to its creation (Andrade & Valtcheva, 2009).

C. Performance-based assessment demands that the learner demonstrate mastery of the learnt skills. It makes the criteria for a quality performance clear. It can be shown through written assignments, role-playing, presentations, seminars, projects and portfolios (Wyatt-Smith et al., 2014). This section belongs to A.

D. Observational assessment refers to learners' activities in the classroom setting being assessed and noticeable behaviour being used as criteria. Teachers use a checklist or cooperative learning skills (Singh & Samad, 2013).

2.4.5 Strengths of Continuous Assessment

Continuous assessment uses a range of assessment techniques, emphasises meaningful learning, encourages regular and methodical learning, discourages last-minute cramming, and provides early warnings of learners struggling with the subject (Komba & Mwandanji, 2015). Continuous assessment similarly provides a continuous picture of how an individual learner is doing, developing and maturing as they progress in a subject. Additionally, it reduces the tension that many students experience as they prepare for their final exams. Most importantly, it creates a more natural assessment atmosphere that is more relevant to learners' circumstances (Komba & Mwandanji, 2015).

A teacher's responsibility is to ensure that continuous assessment occurs in their mathematics classroom as it serves a valuable purpose for teachers (Young-Loveridge & Bicknell, 2015). The teacher employs a variety of teaching techniques in order to remain informed about the learning process, discovering what learners understand and what mathematical operations they can perform (Ayodele, 2012). Being confident in what learners know and can do, allows all learners to

showcase their understanding, promotes learning to understand, and enhances teaching. In addition, Continuous assessment helps to identify learners who need help,
particularly the topics and skills that learners are having trouble with, the aspects of the subject that these learners find challenging and thus, determine the type of remedial work needed and with learners who are doing well, determine enrichment activities to extend them. Continuous assessment thus assists learners in knowing how far they are progressing, leading to an overall assessment (Toh, Quek, Leong, Dindyal & Tay 2011). Continuous assessment can inform teachers whether the teaching has been successful in assisting learners in learning in general. This means that teachers rely on assessment data to inform their practice (Aysel, 2012).

Assessment primarily also benefits learners in several ways (Yamamoto, 2012) as it involves a comprehensive series of evaluation techniques to direct and enhance learner performance (Tilya & Mafumiko, 2010). Continuous assessment encourages learners to use their full potential, particularly as feedback is immediately obtained and remedial action is put in place at the appropriate time (Walcott, Hudson, Mohr & Essex, 2015). In other words, feedback motivates learners to look back on the quality of their work and teaches them how to improve their performance (Ali & Ajibola, 2015).

2.4.6 Weaknesses of Continuous Assessment

Research points to various problems with continuous assessment. The process may require teachers to have assessment experience to use continuous assessment instead of end-of-term assessments. There are concerns about quality and expertise when implementing continuous assessment because many teachers require additional training in evaluation (Makuvire, Mufanechiya & Dube 2023). Teachers' understanding of continuous assessment's operational strategies determines how much time and effort they are willing to devote to conducting continuous evaluations (Meyers, 2018), mainly as this process entails time, effort, and commitment (Olkaba, 2020). To assist them in efficiently managing the computations and tasks related to the record-keeping element of continuous assessment, teachers need practical exposure to fundamental statistical principles.

One of the issues with evaluating the efficacy of teaching in schools in most public institutions is the issue of large class sizes. Ajayi et al. (2013) acknowledge that the desired outcomes of the effectiveness of continuous assessment in the mathematics classroom are hindered by

overcrowded classrooms, behaviour, apathy, learner absenteeism and lack of commitment. In addition, challenges include unclear continuous assessment regulations, heavy content material, busy schedules, the workload of teachers, teacher attitudes toward ongoing assessment, a lack of best practices, and variations in academic standards.

Of concern is a lack of trained personnel with a lack of subject understanding amongst teachers, lack of human resources such as a shortage of qualified and experienced mathematics teachers, insufficient and insufficient materials, particularly in teaching and learning in mathematics and hinder continuous assessment in mathematics (Vurayai & Muchuweni 2024). Finally, a high teaching load, inadequate check-in and check-out time, and a lack of motivation and teaching materials are a challenge (Sithole, Dairai & Matsvange (2021).

According to Sears, Karadeniz, Butler and Pettey (2015), continuous assessment might give learners the impression that any mistakes they make during the learning process can be held against them, which can result in a distinct type of stress in the learner's experience following the final assessment. The possibility of learners being overestimated in continuous assessment is high, especially during specific periods of the year when numerous teachers are concurrently requesting exercise (Sears et al., 2015).

Continuous assessment can affect the interaction between a learner and a teacher by giving the impression that the course is just a series of tests or mini-exams. Furthermore, since learners do most of their work at home or on distant computers these days, everyone must have equal access to resources (Schukajlow, Kolter & Blum, 2015a; Schukajlow, Krug & Rakoczy, 2015b).

Considering the above review on continuous assessment, the following section introduces the theoretical framework and discusses the theories that framed this study.

2.5 ASSESSMENT PROTOCOL

The role of the National Protocol of Assessment (NPA) in South African primary education is to regulate how learner performance is recorded and reported by Mathematics teachers (DBE, 2011b). The regulation includes promotion to the next grade based on the summative assessment. The learner should at least attain the following to qualify for promotion:

- The home language (HL) should be (Level 4) (50%-59%).
- First Additional Language (FAL) (Level 3) (40%-49%).
- Mathematics (Level 3) (40%-49%).

- Any other subject (Level 2) (30%-39%).
- Immigrant learners should achieve in one official language and be accepted in (HL), provided they obtain Moderate Achievement (Level 3) (40%-49%) in all three (3) of the remaining.

A learner may only be kept once in a phase and may not stay in the same phase for more than four years. According to Hernández (2012), the shortcoming of the protocol is the progression of a learner because of the age cohort, which entails that a learner in Grade 5 should be 11 years and younger, which means that a learner who has been retained at the Foundation Phase is now 12 years old. Age will dictate that the learner progresses to the next grade, even though the learner lacks the capability to cope with the standard of the next grade. This means that in the case of mathematics, the teacher may have a learner without a proper Grade 4 mathematics foundation. The progression by age has the potential to intensify the struggle to cope with mathematical concepts and operations in Grade 5; for example, if the learner cannot do multiplication, they will struggle to tackle multiplication as the learner lacks a base.

The other drawback of the progression policy is that a learner cannot be retained twice in a phase (DBE, 2011b), meaning that the learner is entitled to progress even if he/she lacks the competence to go to the next grade. However, if the teacher has a complete profile of the learner and can put an intervention in place to remediate issues, it could benefit the learner and ensure he/she meets the required standard (DBE, 2011b).

2.6 THEORETICAL FRAMEWORK

The theoretical framework supports the research and binds the findings together in a coherent presentation that reflects the researcher's methodological, epistemological, philosophical and analytical viewpoint (Kivunja, 2018). The theoretical framework, which employs carefully sifted theories that underpin the researcher’s line of thinking in the sense that he knows the subject at hand and intends to learn more about it, is handy for researchers who want to analyse data and respond to research questions (Varpio, Paradis, Uijtdehaage & Young, 2021). This research was underpinned by constructivist and behaviourist theories of learning as they are intimately related to the applicability of continuous assessment in the mathematics classroom.

Continuous assessment is the assessment of learners over time, meant to evaluate understanding, abilities, and disposition more comparatively than conventional testing (Bennett, 2011). Therefore, continuous assessment presents itself as a powerful and valuable tool that improves the reliability of learner assessment in comparison to end-of-term examinations.

Kidane (2013) believes that continuous assessment is better positioned to reveal fundamental changes in learner performance. It is an all-encompassing and effective way to measure learner progress and improve teaching. In other words, continuous assessment can gauge whether learners have fully grasped the mathematical content. If teaching and learning do not ensue as planned, the teacher and the learners collectively take corrective action (Tillema, 2014). Figure 2.1 below shows an overview of the theories underpinning this study that support continuous mathematics assessment.

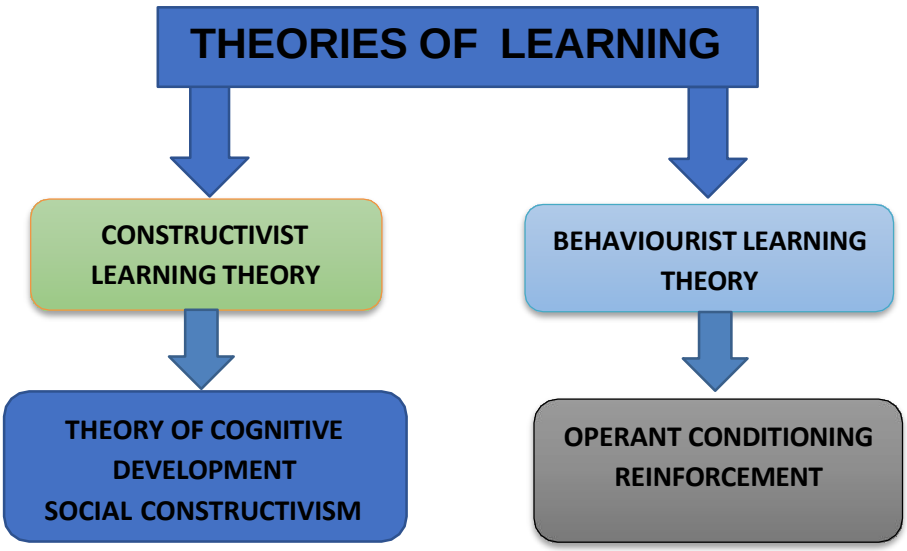


Figure 2.1: A synopsis of theories that validate continuous assessment

2.6.1 Constructivist Learning Theory

Jean Piaget (1896-1980) and Lev Vygotsky (1896-1934) advocated for the use of constructivist approaches in classroom practice. Piaget named his theory cognitive development while Vygotsky named his theory social constructivism. Swiss psychologist Jean Piaget is renowned for his research on children's intellectual development and his ground-breaking theory of cognitive development (Pakpahan & Saragih, 2022). Piaget's theory has a strong affinity for biology, and

his findings were based on experiments he carried out with his children, which gave rise to doubt of its credibility from some psychological points of view.

The basic feature of constructivism is the synthesis of human learning, in which learners build new knowledge, layer after layer. Therefore, prior knowledge impacts the new layer of knowledge amassed from novel experiences (Taber, 2018). As a result, learners make sense of unfamiliar situations using their prior knowledge. Shah (2019) considers constructivism to be a framework that promotes learners to actively participate in classroom instruction, shaping them to develop their own understanding of the content.

Vygotsky's social constructivist theory has support from sociology. Vygotsky keenly followed the sociological teachings and findings of Charles Darwin, John Dewey and others (Mkimbili, 2018) and was hugely influenced by sociological proponents, namely Karl Marx and Fredrick Engels, Charles Darwin's evolution, and Spinoza's dynamic perception of universal development (Alves, 2014). The theory is of vital importance to this research of continuous assessment in a mathematics classroom as it highlights the importance of understanding preconceived ideas as the learners move towards gaining new knowledge and understanding. Alemu (2013) states that constructivist learning theory in mathematics learning gives a teacher and a learner a background of knowledge and builds on the antecedent knowledge to get a better understanding and knowledge base.

2.6.1.1 Theory of Cognitive Development

Klahr (2012) states that constructivism theory entails that a learner builds knowledge using existing knowledge; in other words, prior knowledge and experiences are prerequisites. Piaget termed this system of knowledge schemata (Klahr 2012). Piaget (1983) emphasises that learners create schematic maps drawn from their experiences as they go through various developmental stages. Klahr (2012) added that Piaget gave the theoretical approach of cognitive development the name genetic epistemology since its main focus is on how an organism adapts to its environment.

The theory of cognitive development emphasizes the assimilation of new knowledge and its accommodation in harmony with already existing information. Gupta and Frake (2009) supported this by saying that organisation, adaptability (assimilation and accommodation), and equilibration are three interconnected processes that work together to promote cognitive development.

Learning encountered by a learner is cognitively organised, and adaptation creates harmony to allow for flawless modification (Piaget, 1983).

What underpins the process of organisation and adaptation are three notions, namely schemata, assimilation and accommodation. Schemata are mental representations that a learner uses to customise and organise his surroundings (Aguilar, & Pérez, 2015). Assimilation is a term coined by Piaget to explain how learners draw from their experience to solve problems presented before them (Zhiqing, 2015). During accommodation, learners restructure what they know to fit in new information about a problem presented to them (Zhiqing, 2015). Mathematics relies on learners creating associations; by nature, mathematics concepts rely on scaffolding; for example, the learners' knowledge of 2- dimensional shapes is very handy and linked to the learners grasping the concepts of properties of three-dimensional objects.

According to the theory of cognitive development, learners have their own base knowledge when they encounter new situations that they will be called upon to make sense of the new situation. For example, if an individual only knows donkeys, when they see cattle, they will refer to them as donkeys with horns drawn from their knowledge of donkeys (Sharma & Poonam, 2016). Gupta and Frake (2009) suggest that when learners do not undergo any change in behaviour or perfection in skills, they are assimilating more than they can accommodate. Continuous assessment will not yield positive outcomes if the children are exposed to over-teaching or excessive assessment episodes. This phenomenon is known as 'disequilibration' or cognitive discomfort. If schemata are adapted, learners will move back to assimilation.
However, depending on the learner's intelligence, these stages can be reached at an earlier or later age.

This theory forms the foundation of this study because, in a mathematics classroom, continuous assessment supports the learner in the assimilation and accommodation of mathematics concepts and procedures.

2.6.1.2 Implication of cognitive development theory on continuous assessment

The theory of cognitive development has far-reaching implications in assessment activities in the classroom since it also forms part of the teaching and learning process, as mathematics teachers should focus on the thought process of learners and not just the final product (Berk, 2001). In most

cases, continuous assessment is instituted during instruction; its function is to help the teacher fine-tune teaching and learning (Abejehu, 2016). It should be noted that if continuous assessment is appropriately planned, it can promote understanding across different types of learners with different learning styles.

As continuous assessment aims to promote fruitful teaching and learning of mathematics in the classroom, it should link the learner's actual capacity and his optimum capabilities (Mkimbili & Kitta, 2019). Continuous assessment is an integral part of effective mathematics teaching and learning developing a deep understanding of mathematics processes (Shepard, 2005). Most mathematics concepts are process-based; hence, there is a need for learners to be reflective in their learning rather than indulge in rote learning by memorising facts.

In mathematics assessment, much emphasis should be on the steps a learner takes to arrive at an answer, not only the answer itself, thus assisting with cognitive development. Mathematics teachers should continuously document learner performance through various assessment strategies. In a sense, they are developing feedback that should assist learners address their problems (De Lisle, 2016). Therefore, teachers must recognise the importance of learners initiating and actively participating in learning activities (Wandela, 2014) to develop their understanding and mathematical skills.

Assessment assists in the learner's cognitive development as it gives the teacher the opportunity for continuous and timely feedback during and after an assessment to identify issues, offer recommendations and remedy the situation (Black & Wiliam, 2009), thus promoting mathematical competencies. The feedback helps both the teacher and the learners to fine-tune and direct their energies to areas which need improvement (Black & Wiliam, 2009).

Piaget's theory of cognitive development appears to group learners into certain stages, ignoring the reality that learners achieve multiple stages of cognitive development at different ages (Suurtamm & Koch, 2014). This means that learners in the same classroom have different capabilities; hence, pushing learners through the stages can be detrimental in analysing the theory and its applicability (Smit & Birri, 2014). Therefore, if the assessment is rushed, it can produce fewer desirable results (Smit & Birri, 2014); however, a well-timed assessment can be used to improve learner confidence and spur them to achieve improved results (Stiggins, 2005).

2.6.2 Social Constructivist Theory

Social constructivism attaches importance to how the sociocultural environment shapes the cognitive development of learners (Mohamad & Romli, 2021). Vygotsky's social constructivist theory argues that learners' cognitive development is strongly related to society and can blossom in a positive social environment (Smit & Birri, 2014). Bigge and Shermis (2004) concur, that learning is the foundation of human growth, and social constructivist theory explains how learners use their social experiences to improve their cognitive skills. Thus, social constructivism offers an alternative to Piaget's theory of cognitive development in that it believes that cognitive development can occur as a result of external influence rather than being triggered within the individual. Piaget concentrated on cognitive development as an individual process in isolation from others while Vygotsky believed that society is at the centre of learners' cognitive development (Martinez, 2010).

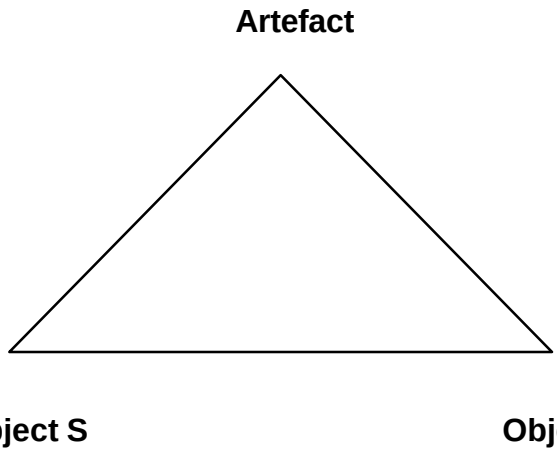
Social constructivist theory explains the relationship between three social elements in a child's cognitive development: culture, language, and the zone of proximal development (ZPD) (Shabani, Khatib & Ebadi, 2010). The ZPD is the gap between learners' ability to solve problems independently or through collaborative assistance by teachers and peers (Margolis, 2020). These three factors are crucial in general human knowledge development and understanding of human and natural sciences (Suurtamm & Neubrand, 2015).

2.6.2.1 Implications of social constructivist theory on continuous assessment

There are two aspects to how learners develop: inter-psychological development and intra-psychological development. It all starts with the individual learner interacting with other people (inter-psychological) and later within the learner (intra-psychological) (Vygotsky,1978). The immediate surroundings and the community have a crucial role to play in the student's understanding of the world. During the early days of development, the immediate social environment of the learner is the family, and it extends to the community outside the family and, finally, the classroom, which is an extension of society. Therefore, society is vital in the development of learners as social interaction has an influence and leads to cognitive development. Therefore, teaching and learning should be established upon close cooperation between the teacher and parents.

Because knowledge can emerge through social interaction rather than an individual process, Saleem, Kausar and Deeba (2021) assert that social constructivism is a practical theory in the classroom, primarily as it supports group projects, guided exploration, brainstorming and problem-based learning. These teaching strategies allow for interaction and the exchange of ideas and knowledge, which is a significant requirement in the teaching and learning of mathematics. In support, Topçiv and Myftiu (2015) posit that children develop knowledge as they speak and listen to each other. Using high-order questioning in continuous assessment challenges learners to think deeply, hence widening their horizons, and this is in consideration of the concept of ZDP (Paulo & Tilya, 2014).

A learner's level of proficiency measures the optimum capability that a learner can attain with the external assistance of a teacher or peers (Hein, 1991). Simply put, through the intervention or scaffolding of a teacher, the learner will be able to comprehend and perform a task that could be perceived to be too challenging (Taber, 2018). This is represented in a triangular presentation below.



(Source: Adapted from Ivan, 1989)

Figure 2.2: The zone of proximal development

The above triangular representation denotes that the Subject S represents the learner, the Artefact represents the teacher who should assist the learner, and the Object O represents the task which the learner is to complete in the teacher's presence (Daniel, 2001). The ZDP has one prominent feature: scaffolding (van der Veer 2020). Scaffolding closes the gap between what the learners can do and their potential. This means that scaffolding enables the learner to improve and reach

their optimum (Sawyer, 2006), further encouraging learners to take responsibility for their learning and reflect on their achievements.

One aspect to consider within the South African education context is language. According to Nziramasanga (2018), based on a socio-cultural view, the teacher should take into account the learners' competency in using the language of instruction, which in most cases is not their home language. Social constructivism, as supported by Nkala (2017), places emphasis on the process rather than the product.

2.6.2.2 The difference between Piaget's Cognitive development and Vygotsky's Social Constructivist Theory

Drew (2024) states that Piaget believed that children develop in stages, namely sensorimotor, preoperational, concrete operational and formal operational stages. On the other hand, Vygotsky, in his social constructivist theory, put forward that the development of children has no noticeable stages, and it is an ongoing process that is influenced by the social environment. Vygotsky, through the concept of ZPD, put emphasis on social modelling and that children's development can go beyond what they are capable of with proper direction and backing by someone knowledgeable. Semmar & Al–Thani (2015) postulate that Vygotsky acknowledges the importance language plays in the child's development, which will lead to beneficial social interaction between the child and knowledgeable somebody. Language is not prominent in the theory of cognitive development.

2.6.3 Behaviourist Learning Theory

Although several theorists have made a valuable contribution to the theory of behaviourism, this study focuses on two behaviourist theorists, namely Skinner (1904- 1990) and Thorndike (1874-1949). Skinner's behaviourist theory was called 'operant conditioning' and was influenced by Thorndike's findings. The laws of readiness, exercise and effect that Thorndike proposed form the foundation of this theory of learning. Behaviourist learning theory emphasises the change of observable behaviour in learners. In support of this, Jason, Stephen and Russell (2005) posit that learning has everything to do with the alteration of behaviour rather than the modification of the mind. Behaviour is the central concept of behaviourism; in agreement, Henry (2005) postulates that most of the challenges in the world can be easily dealt with if we take into

consideration human behaviour. In support, Kunwar (2020) posits that learning sciences such as mathematics are behavioural, and some learners can develop a mathematics phobia if the mode of learning is not behaviourally compatible. Behaviourist learning theory puts its basis on findings from experiments made with animals, and they put forward that the alteration of behaviour in animals occurs the same way it occurs in humans. Success in something will lead to a repeat of the behaviour, producing permanence in the occurrence of the behaviour. Mathematics is one subject which aims at producing repetition of behaviour, to notice this change in behaviour assessment formally or informally should be instituted (Hilgard 1975 in Onwuekwe 2014).

2.6.3.1 Thorndike's Learning Theory

Thorndike's operant or instrumental conditioning postulates that learning consequences bring about a behaviour change, and central to this theory is the law of effect. According to Morris and Maisto (2001), when success accompanies an action, it is most likely to be repeated (reinforcement); however, if an action results in no satisfaction (punishment), it is most likely not to be repeated. Thorndike did his experiments with animals in what he termed a puzzle box, where, through trial and error, the animals could associate certain effects with the behaviour that caused them (Gray 2011). Thorndike discovered that learning occurs through trial and error and by creating associations between stimuli and response (S-R) (Cataria 1999). This means learners can be induced to repeat good behaviour or perfect observable behaviour by receiving an incentive or punishment. For example, if a teacher asks a learner who has done well to stand up and ask learners to clap their hands for him, then it will spur learners to achieve more. The use of one of the types of assessment, formative assessment can be used during teaching and learning of mathematics to gauge probable change in behaviour for possible reinforcement or alter what is not working.

Morison and Macleod (2023) postulate that behaviourist learning theory consists of the influence of external factors such as incentives that a teacher gives to the learners to perform and penalties which affect learners' future behaviour. Good comments or things like sweets, gold stars, or smiley faces can motivate learners to continue to get good grades. Although Skinner used animals in his experiments, he felt the theory and its findings applied to humans (Morison & Macleod, 2023). Many factors come to play in the successful teaching and learning of mathematics, the environment has a considerable impact. Behavioural change in some instances, is impacted by the environment, home environment and school environment. The classroom, in particular, should

promote the teaching and learning of mathematics (Kazdin 2001). Motivation is very important in teaching and learning mathematics; for example, giving learners academic achievement pins for doing well in mathematics assessments will bring about competition, which will lead to improved performance.

2.6.3.2 Implications of Thorndike's Theory with regard to continuous assessment

Based on McTighe's (2015) narratives, the theory implies that an assessment task should progress from low-level taxonomy questions to high taxonomy, which will help to motivate the learners to apply themselves to the more challenging questions, as the success realised with more straightforward questions will spur them on. Furthermore, rewards and punishment can be used to motivate learners to get good marks in assessments, while repetition brings about perfection; good habits formed as a result of the modification of bad habits can improve the performance of learners. Finally, during the preparation for assessment, learners can practise the concepts covered, which should help to reduce errors and hence improve performance (McTighe, 2015).

2.6.3.3 Skinner's theory of reinforcement

Skinner's reinforcement theory is centrally based on shaping behaviour as a result of possible consequences, that is, rewards and punishments. The manifestation of certain behaviours is the result of possible consequences associated with them (Krishnan, 2014). Skinner did his experiments in the Skinner box with rats and pigeons; the rats in the box pressed the lever by mistake, and a food pellet was released. The repetition of the action was a result of a reward for getting food, and this repetition brought about a permanent behaviour change.

Sheeran (2002) states that the behaviour of individuals has no correlation with the person's goals and intentions in trying to understand their pattern of behaviour. Skinner asserts that reinforcement causes a change in behaviour as a result of learning. The theory can easily be married to how teacher and learner activities ensue in the mathematics classroom using continuous assessment (Ferreira & Schulze, 2014).

2.6.3.4 Implications of Skinner's theory of reinforcement on continuous assessment

Rewards and punishment are very useful in classroom instruction, as per Skinner's theory; however, they should be used carefully, otherwise they might have undesirable impacts (Ferreira &

Schulze, 2014). Rewards should be proportionate to the age of the learners. However, Lejeune, Richelle and Wearden (2006) posit that regardless of the mismatch in the notion of behaviourism, its value in the classroom cannot be overstated, particularly the principles of rewards and punishment.

The teacher needs to give learners timeous feedback on administered assessments and rewards such as good comments which should be used uniformly throughout (Ebhomien, Christie, & Smart 2012) The theory has a relationship with the assessment of mathematics in Grade 5 where reward and punishment is the most reinforcing methods for the teaching of mathematics using continuous assessment.

2.7 CHAPTER CONCLUSION

Unlike teacher assessment, continuous assessment consists of a range of activities: such as classroom activities, formal and informal assessment, projects and assignments. These activities are specifically designed to evaluate performance and achievement. The review of the literature revealed the nature of continuous assessment in South Africa and other countries such as Ghana, Tanzania, Zimbabwe and Nepal. Each country reports similar benefits; however, challenges and perceived struggles in stages were noted which resulted in the withdrawal of certain aspects of continuous assessment as it increases the burden on both teachers and learners (Chaurura 2017).

However, literature in the United Kingdom (UK) and the United States of America (USA) reveals that classroom assessments are an integral part of the teaching and learning process which supports lower-achieving learners (Abejehu, 2016). These countries have relevant policies in place, support and resources to improve teacher practice (Kidane, 2013). There are advantages of continuous assessment being implemented in mathematics teaching, even though they may be challenges, as it does enhance the calibre of mathematics teaching and learning (Mapendere & Masvimbo)

CHAPTER 3
RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the methodology used in exploring the perceptions of Grade 5 teachers on the effectiveness of continuous assessment in the teaching and learning of mathematics. The chapter examines the research methodology, which incorporates the research paradigm, research approach and design. In addition, the chapter outlines and describes the methods, which consist of sampling data collection and data analysis. Measures for trustworthiness and ethical consideration are also described in this chapter. The chapter begins by outlining the rationale for the empirical inquiry.

3.2 RATIONALE FOR EMPIRICAL INQUIRY

Mathematics is one of the important science subjects which, on the contrary, is having below par performance in most countries. South Africa as a country is not spared hence the need to examine its assessment procedures being Continuous Assessment. Wälde's (2016) research, which focused on the examination of the status of the application of continuous assessment in Mettu University, revealed that teachers considered continuous assessment as continuous testing, and students perceived it as a technique of evaluation used to increase their academic performance. The disparity in understanding and application motivated this study to explore local perspectives. Ogundokun and Ogundele (2012) indicated that there was a major connection between continuous assessment and good results in mathematics and English.

The research question: How effective is the continuous assessment method in teaching and learning mathematics? Gave focus to the study. According to the researcher's experience in the classroom, learners are not improving their mathematics competence as their summative marks do not tally with their knowledge of mathematics evident in continuous assessment activities. This was supported by the analysis done by Ndlovu & Mji (2012), on the TIMMS report of 2003. They claimed that 37% of grade 5 learners are performing below the international minimum benchmark, which is a minimum level of mathematics proficiency in mathematics while only 1% reached the advanced benchmark level. Moreover, these learners were compared with grade 4 from other countries which means they are under-performing at a higher grade (Graham & Mtsweni 2024).

This seems to indicate a knowledge gap which motivated this research to focus on the South African perspective. In addition, the completion of assessment tasks is time-consuming, which exposes teachers and learners to undue pressure in the bid to ensure curriculum coverage in compliance with the Annual Teaching Plan (ATP).

3.3 RESEARCH PARADIGM

A research paradigm underpins research and it comprises philosophies, opinions, or conceptions that permit the setup of theories and ideas (Creswell, 2016). Research cannot be carried out without a defined direction or line of perception as it helps narrow the path the researcher is going to take. Mukherji and Albon (2015) state that a paradigm is how one views and understands the world, which aligns with Hughes (2010). A paradigm is a way one perceives the world, which then moulds the way the research ensues.

There are three pillars to a research paradigm, namely ontology, epistemology, and methodology (Kivunja & Kuyini, 2017). These three pillars give rise to individual examples of research paradigms: the positivist paradigm, the interpretivist/constructivist paradigm, and the pragmatic paradigm (Rehman & Alharthi, 2016). A particular paradigm is chosen according to the suitability of the study and defines the point of departure of research and how it progresses (Chilisa, 2011).

Positivist researchers use large sample sizes to generate data that is a true representation of the population (Wahyum, 2012). Positivists believe that using similar tools and processes in research brings concrete, authentic and more realistic results as the same process is repeated with many different participants. Pragmatism came into being as a result of conflicting views between positivism and interpretivism (Kivunja & Kuyini, 2017). Pragmatism advocates a diverse and realistic approach to understanding the matter under investigation. Most research is situated in positivism or interpretivism; however, this research study is underpinned by the interpretivist research paradigm.

Interpretivism is founded upon the idea that realism is fluid, complicated and socially created (Hammersley, 2013). We can only receive other people's opinions when we get their vision of reality, which may differ from another individual due to their background and views (Smith, 2016). According to the interpretivist school of social science, it is necessary to comprehend people's ideas, reasoning and tactics to determine the evidence that may be collected about an incident

(Cohen, Manion & Morrison, 2017). The interpretivist paradigm underpinning this research, sought varied and diverse viewpoints through the voices of the participants, resulting in diverse perceptions of the use of continuous assessment in the classroom (Lincoln & Guba, 2013).

The interpretivism paradigm served as the foundation for this investigation
because it is based on an understanding of human sciences knowledge and how people see the world, the paradigm was selected for this investigation.
An ontology that allows for several interpretations of a single phenomenon is adapted by interpre tive.
The interpretivist paradigm does not generalise; rather, it allows the researcher to better grasp th e phenomenon in its complexity and particular context (Tuli, 2010).
The researcher selected this paradigm because it provides participants' perspectives on the effic acy of continuous assessment in mathematics teaching and learning.

Through their context and personal interpretations, the researcher would get insight into the. The interpretivist paradigm was also selected because it offers a variety of perspectives on phenomena. Using case studies, which offer more genuine information about the topic, the study is conducted in a natural context. Through the use of this paradigm in interviews, the researcher can examine participants' beliefs, values, prejudices, perceptions, feelings, and perspectives, as well as body language and responses to questions (Pervin & Mokhtar, 2022). This paradigm was chosen by the researcher in order to gain a better grasp of the experiences of the teachers. Through the subjective meanings that people ascribe to their social setting, the researcher hopes to gain a deeper knowledge of the participants' experiences.

3.4 RESEARCH APPROACH

The selection of research approach hinges on the paradigm and type of research problem and guides the methods of data collection, analysis and interpretation (Creswell, 2016; Datt & Chetty 2016). There are different ways to evaluate and clarify research and its results, depending on whether you wish to use expressive language, numerals, or both. Researchers often use quantitative, qualitative or mixed approaches in various projects. Equally, qualitative and descriptive quantitative research methods are synonymous with interpretivism (Pervin & Mokhtar 2022). However, interpretivists do not believe in the idea that there is a one-way approach, which means that they think there is no single way or correct path to knowledge (Nickerson, 2023).

Kothari (2019) defined the research approach as discovering solutions to a problem by employing observation, comparisons, and experiments to search for knowledge through independent and logical methods. Creswell (2014) went on to say that it is a collection of theoretical assumptions, strategies, and particular methods.

MacDonald (2016) explains that the qualitative approach brings out open, important and all-encompassing information that soothes the rough edges of novel and multifaceted situations. Denzin and Lincoln (2000) define qualitative research as research where the researchers observe objects in their natural settings and try to comprehend or deduce occurrences with regard to the values of people brought to them. Patton (2014) states that qualitative research methods offer thorough and in-depth information about the phenomenon under review.

The research adopted a qualitative approach, which took into account the participants' experiences, behaviours, and perceptions. It intends to address the study's how and why questions (Tenny, Brannan, & Brannan, 2023). Qualitative research also aims to analyse non-numerical data, obtain a person's real-life experience and social reality, and incorporate this to understand their attitude, beliefs, and motivation.

This research employed a qualitative approach, with interviews, observations, and open-ended questionnaires as the primary tools for gathering the study's data. The researcher chose this approach because it allows for triangulation.

Triangulation was utilised in this study because it allows the researcher to find reliable results. According to Noble & Heale 2019, triangulation validates the study's outcome. Using this method, the researcher aims to obtain actual, detailed and profound information that enlightens on action and denotations from the viewpoint of the research participants, which is a crucial part of qualitative research (Tsushima, 2015). This idea revealed the importance of hearing the voices of the participants and getting actual information about their personal experiences associated with the topic under study. The research objective was to get raw, authentic data from teachers who use continuous assessment in teaching and learning mathematics.

Using a qualitative research approach has advantages and disadvantages. As Rahman (2017) presented, the researcher was aware of these when choosing the approach. These are presented in Table 3.1.

Table 3.1: Advantages and disadvantages of the qualitative research approach

ADVANTAGES	DISADVANTAGES
i) It gives a detailed account of the feelings and perspectives of the participants. ii) It aims to comprehend human experiences in a certain context. iii) It enables the researcher to communicate people's perspectives, meanings and happenings. iv) It enables the researcher to identify the participants' experiences that shape how they do things. v) It assists the researcher in conducting direct interviews with the subjects.	i) The researcher may disregard sensitive facts and focus on values and experiences. ii) A researcher may offer little integrity to the results since this technique may ignore the socio-economic and ethnic patterns of the variables involved in the occurrence. iii) The researcher's results cannot be generalised beyond the defined population. iv) The analysis of results is time-consuming.

(Source: Adapted from Rahman, 2017:104-105).

When collecting data, the researcher was privileged to have collected data from individuals using face-to-face interviews as they allowed her to read the participants' body language and gather raw and objective data. This approach also is an added advantage as the researcher collected her data from different participants who have different experiences in the field as this gives a clear picture of what is happening at their school as they experience it as well as giving their own opinion of how they see things. The researcher also got an advantage of non-participating in the observation as she did not influence outcome of their natural environment. There are some discomforts that came with the the interview as some of the participants were not so comfortable in giving their full opinion when it comes to the policy, the researcher had to make sure that the participants are comfortable and a sure them that this was that research and their names would never be known as she used pseudonyms. The data collected was a lot as a result took time to analyse though the use of instruments came to the rescue

3.4 RESEARCH DESIGN

The research design is a blueprint to address the research problem () or the entire plan for putting together the research (Thakur, 2021; Guest & Fleming, 2015). Mattick, Johnson and de la Croix (2018) purported that it is the plan for the researcher to put together all elements of the study so that there is a logical process to address the research questions effectively. The aim of this study was to explore the effectiveness of Continuous Assessment in teaching and learning of mathematics. A case study emphasises understanding the dynamics within a single background and aims to intensively study the phenomenon under study (Bloomberg & Volpe, 2022; Coombs, 2022). A case study answers the 'How or Why' question through rich descriptions gathered from different sources of information (Merriam & Tisdell, 2016).

Case study assisted the researcher to how is continuous assessment method helping teachers to achieve their teaching goals when it comes to producing quality learners in mathematics. What exactly are their daily experiences with continuous assessment as well as how effective is this method of assessment according to them. The case study is also particularly useful when proposing new approaches and is applicable in a practice grounded in situations where participants' experiences are imperative. A case study can be used at micro, meso, and macro levels as well as involving many participants (Swanborn, 2010). The researcher used 10 participants from 10 different schools. Even if there is always room for improvement in every system, the researcher wanted to know why there is poor performance in mathematics in South Africa, which gaps are opening spaces for poor performance and how can these gaps be addressed.

The objectives of a case study are to objectively collect, present and analyse data (Yin, 2015). It is disputed that one case study is enough to generate a population and give analytical rise to theoretical generalisation (Eisenhardt & Graebner, 2007). Creswell and Plano Clark. (2011) purport that the researcher should take the information as raw as possible as a case study has the ability to comprehend the relationship between events, situations and people. The data collected in this research was from the horses' mouth and how they see and experience things regarding the effectiveness of continuous assessment in teaching and learning of mathematics. which ways are they coming up with to address the problem at hand. Harrison, Birks, Franklin and Mills (2017) suggest that a case study simplifies data collection for the researcher in different

ways as it captures the real situation of participants as it occurs, and it is easy to explain the results to non-specialised people.

The research design is a framework on which all study processes hang to create a cohesive unit to answer the research question (Yin, 2015). On the other hand, George (2019) states that the research design seeks to open the relationship which exists between variables. Creswell and Creswell (2017) propose that the research design ensures that research questions are fully answered and valuable information is generated.

Phenomenological research uses the accounts of the participants to investigate human experiences. These encounters are referred to as lived experiences. Phenomenological research aims to determine the significance of experiences for each individual. According to Donalek (2004), this kind of research is employed to investigate fields where little is known. Respondents are invited to explain their experiences as they see them in phenomenological research. Although they might write about their experiences, interviews are typically used to gather information. The researcher must consider his or her views and feelings to comprehend the lived experience from the subject's point of view. Ethnographic design entails gathering and analyzing cultural group data. The methodical observation, description, documentation, and analysis of the manner or patterns of life of individuals in a familiar setting is the definition of ethnology, according to (Sharma & Sharkar (2019). In ethnology, the researcher becomes a part of the culture by living with the people. Interviewing those who are more knowledgeable about that particular culture is the main goal of ethnographic design. One kind of qualitative research is action research, which looks for ways to enhance practice and examine the results of the action that was performed (Ellis & Clark (2015). In a specific hospital or healthcare environment, solutions are explored for practice issues. Unlike quantitative research studies, there is no attempt to generalise the study's findings. Implementing solutions is a real aspect of the research process in action research. The solutions are being implemented without any delays.

A unique form of community-based action research is called participatory action research (PAR), in which the researcher and study participants work together at every stage of the study, including problem identification, data analysis, the use of research methods, and the intended application of study findings. Throughout the whole research study, the researcher and the participants work together as co-researchers. Kelly (2005) claims that PAR offers a chance to include a community "in the development and assessment of a health program”.

A case study research design was carefully chosen for this research because it permits the gathering of detailed information in its original environment setting (Robson, 2002). and real insight into the participant's experience as it happens in their world (Crowe, Cresswell, Robertson, Huby, Avery & Sheikh, 2011). This study, which explored how effective the continuous assessment method is in teaching and learning mathematics, was conducted in the Northern Cape Province in the Frances Baard District. The choice of Frances Baard district was intentional because, when compared to other districts in the Province, it has diverse schools whose learners are drawn from different socio-economic backgrounds. This means that teachers and learners in these different schools are experiencing one thing in different ways. Moreover, their different experiences are essential to the study, it helps the researcher in getting data that is trustworthy. In this district, there are urban, peri-urban and farm schools. In support of this, McKusker and Gunaydin (2015) posit that qualitative research takes into cognisance the level of exposure of the group of people to the subject being researched in their usual environment.

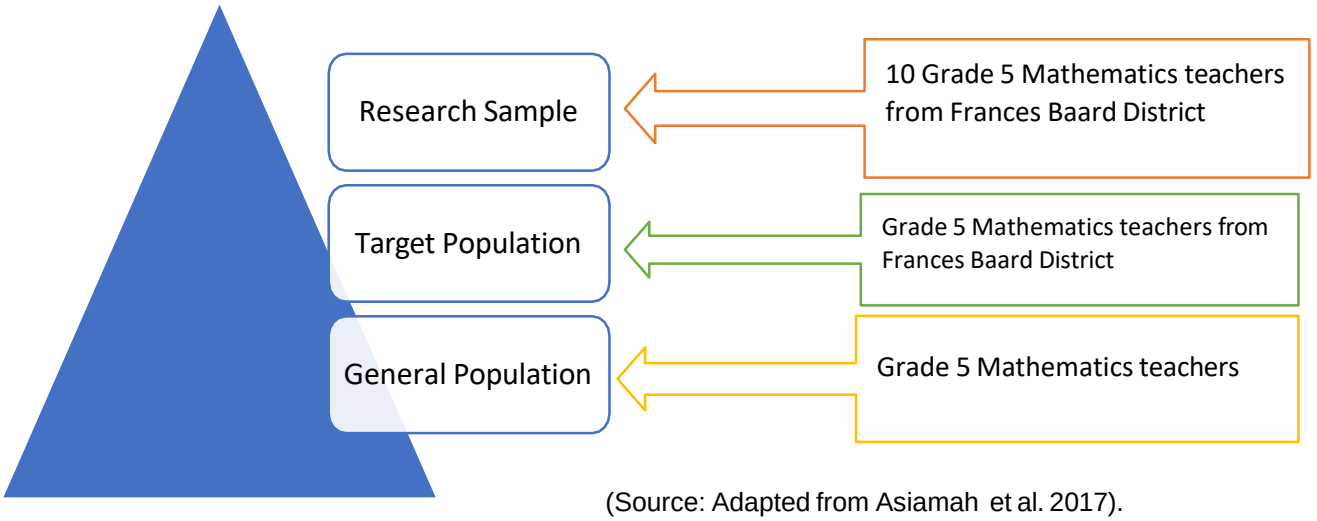
3.6 RESEARCH METHODS

This section provides a summary of the research techniques used. This section of the chapter describes the methods used to conduct the research (Creswell & Thomas, 2013). Using a qualitative research approach, and a carefully thought-out investigation, this section focuses on the sampling of teachers, the data collection, and the data analysis. The researcher benefitted from the insights through interviews and observations to get the details of the situation on the ground, as supported by Creswell (2003) and Creswell and Thomas (2013).

3.6.1 Target Population

The population is the total number of people who can volunteer information, which is fundamental to the topic under research (Agha, Alrubaiee & Jamhour, 2012). Magid (2018) extends the explanation by stating that the population consists of all possible members that possess the desired traits, which forms the background of the research. Saunders, Lewis and Thornhill (2019) refer to the population as all persons with homogeneous characteristics, which are of vital importance in research. It is thus a set of individuals with identical features (Abutabenjeh & Jaradat, 2018).

The population is further grouped into subgroups: the overall population, the accessible population and the population of interest. The overall population is the entire group in its totality (Banerjee & Chaudhury, 2010). The accessible population consist of certain members of the target population who can be included in the study (Michael 2024). The target population is the group of individuals that the researcher is interested in conducting research (Asiamah, Mensah & Oteng-Abayie, (2017).



(Source: Adapted from Asiamah et al. 2017).

Figure 3.1: Selecting participants from a population

The target population for this study includes Grade 5 Mathematics teachers in primary schools in the Frances District in the Northern Cape across the five (5) quintiles. To address the issues of equality in education, the South African government categorised schools into quintiles. Quintiles are categorised according to the needs of learners. The considerations are based on unemployment level, average income, and level of education. Quintile 1-3 schools are those whose learners come from economically disadvantaged families and are non-paying school fee schools, their government allocation is also very high. Quintile 4 and 5 schools are those whose learners come from socio-economically advantaged families. They pay school fees and help with the daily running of the school. Quintile 1-3 schools include farm schools, township, schools and Quintile 4-5 schools include former Model C schools (Obgbonna & Awuah 2019).

3.6.2 Sample

A sample is a number of people chosen to participate in a study (Singh & Masuku 2014) and from whom data are to be gathered (Creswell, 2009). Bhardwaj (2019) outlined the following reasons sampling in research.

- Sampling reduces cost and is less time-consuming.
- Sampling increases the degree of precision of the results obtained.
- Sampling gives the researcher a clue of the magnitude of possible error.
- Sampling saves on the number of resources to be employed in research.

This research used purposeful, non-probability sampling to gather information from the target population with the same phenomenon to obtain relevant data (Palys, 2008). Purposive sampling assisted in identifying 10 teachers from 10 different schools who met the set criteria of being qualified and experienced teachers, they were mathematics teachers at the Grade 5 level who had experience using continuous assessment in their classrooms and would thus provide relevant information to respond to the study inquiry. The researcher chose the sample of participants because it's a minimum sample as it saves money, and most answers could be the same because they are using the same method Hossan, Mansor & Jaharuddin (2023) was to get their perception of the effectiveness of the continuous assessment method. The Krejcie and Morgen (1970) sample size determination table was used to achieve the sample size for this study. Teachers were identified and sampled from the district population as indicated in Figure Table 3.2: Sample size

PARTICIPANTS	**TARGET POPULATION**	**SAMPLE SIZE**
Grade 5 Mathematics Teachers	130	10

3.6.3 Data Collection Tools

Data collection is a procedure to collect and evaluate data on themes the researcher wants to determine. It allows the person gathering data to respond to the research question, examine assumptions and produce findings (Kabir, 2016; Taherdoost, 2021). Data collection is regarded as a highly important step in conducting the study (Kabir, 2016). The purpose of collecting data is to gather detailed information that turns into data examination to give credit to answers to the question at hand. Sapsford and Jupp (2006) describe data collection as a deliberate process of

gathering relevant information with high accuracy to provide logical answers to a given inquiry. On the other hand, Qadri (2021) defines data collection as a strategy of collecting, approximating and finding out by employing methodologies that are laid down. Kabir (2016) further asserted that data collection is a procedure for putting together and evaluating the facts about the things the researcher wants to determine. Qualitative data is a complete and concrete outcome that is put together using well-planned interviews, observations, and document analysis. Scrutinising qualitative data allows for discovering knowledge and clarifying qualitative outcomes (Taherdoost 2021).

3.6.4.1 Face-to-face semi-structured interviews

Face-to-face semi-structured interviews were used as a source of data collection. These interviews used a variety of closed and open-ended questions Taktak, Bellibaş & Özgenel, (2024). Interviews allow the interviewer to get perception, understanding and experience in-depth (Ruslin, Mashuri, Rasak, Alhubsyi & Syam 2022). The interview aims to find the interviewees' point of view about familiarity with the question at hand (Kakilla, 2021). Furthermore, interviews allowed the interviewer to draw genuine deductions, as they could read the body language and understand the real feelings of the participants (Magaldi & Berler, 2020). Kvale (1996) insists on the different perspectives to qualitative research interviews, explaining that in the metaphor of a miner, some miners search for unbiased details to be measured, while others look for pieces of important implications.

In semi-structured interviews, the interviewer has a structure of subjects to explore. The vast amount of qualitative research is derived from the perspective that knowledge is positioned appropriately; the researcher's job is to ensure that a significant context is brought into focus to produce the required knowledge. Magaldi and Berler (2020) use semi-structured interviews in exploratory research as they generate new ideas as the interview proceeds. The use of semi-structured interviews helps the researcher provide a richer context, they are easier to process, and they are highly valued in their supremacy to employ deep conversations as they are flexible and generative (Paz-Soldan et al., 2014).

Semi-structured interviews were used in this research because they allowed the researcher to elicit detailed information about participants' perceptions of continuous assessment. The interviewer had the opportunity to scrutinise critically and arrive at a multi-sided supposition

(Ritchie & Lewis, 2003) by using different techniques to motivate the conversation and elicit responses from the interviewee.

The interviews were designed to be less complex and more straightforward to ensure that the collected data would serve the purpose of the study. The questions were open-ended to ensure that there was no ultimate answer, such as YES or NO, but rather to understand the degree to which the participants perceived the effectiveness of continuous assessment and give a conclusive view of the situation on the ground (Deterding 2018). With the aid of an interview schedule, the researcher collected data from the face-to-face semi-structured interviews (cf. Appendix D). Using the time and date convenient to the participants, the researcher mostly interviewed the participants in the Head of Department offices to ensure adequate privacy. The privacy guaranteed that the participant relaxed and freely volunteered responses. The interviews lasted half an hour. Each participant was interviewed once; the interviews lasted 30 minutes, hence 10 interviews were conducted, one interview per teacher.

3.6.4.2 Non-participatory observation

Non-participatory observation is when an observer watches a group passively from a distance, and he/she does not participate in anything the group is doing (Williams, 2008, cited in Saunders, Lewis & Thornhill, 2019). This is a reliable data collection technique because the researcher has no influence on the actions or knowledge of the participant. Non-participatory observation allows the researcher to analyse the situation carefully and, in most cases, gives participants more freedom because they are not being coerced into doing or saying anything; finally, it enables the researcher to conduct their observation more quietly and uninhibitedly because they are not participants.

Lesson progressions were observed by the researcher during lesson observations. The researcher was observing how the lessons were delivered in accordance to some requirements of Continuous Assessment method specifically looking for strengths and weaknesses. Some of the requirements of Continuous Assessment are namely communication skills, engagement of learners, learner centeredness, use of formative assessment, classroom management and empathetic to diversity. These strengths and weaknesses were regarded from a Constructivist and Behaviourist perspective.

During non-participatory observation, the researcher is present and not part of what is happening or trying to influence teacher practice in the classroom (Busetto, Wick & Gumbinger, 2020). Observation permits the researcher to document behaviour and practices that participants are unaware of (Morgan, Macdonald, Mckinlay, & Gray 2017). During non-participant observation, the researcher takes notes to document happenings around them (Morgan et al., 2017) because they are closer to the participants (Ciesielska, Boström & Öhlander, 2017).

In this research, the researcher followed the ethics process and made prior arrangements with the participant before the observation day. She went to the selected schools, met with the participants, discussed the process of the interview, and gave assurance of the participants' privacy. She assured the participants that Pseudonyms were to be used so they can be free to express themselves. On the same day the participants did give a date to the researcher on when she could come and do her class observation which suited the participant. The researcher also explained the important of their participation to the research. The researcher after the discussion gave then participant the form which the participant would go through on their own free time and sign when they are certain they would like to continue with the observation. She also assured the participants that during the set time they could feel free to contact her if they feel that they want to pull out or they could do it on the observation day as well. Participants had complete knowledge of the observation process and, as a result, were granted permission to be observed (Jibril, 2018). To carry out non-participant observation, the researcher developed an observation schedule (cf. Appendix E). The observation schedule helped the researcher document what was happening in the classroom to gain deeper insight into the participants' real world.

During observation, the researcher focused specifically on the lessons of the day, how they were conducted, were learners engaged, whether they were learner-centred, as well as the use of formative assessment recommended by CAPS. When observing the lesson, the researcher was also looking for strengths and weaknesses of the lesson from the teachers' side. These are some of the strengths she was looking for: the teachers' ability to create a positive and inclusive classroom setting, the ability to distinguish instructions, and their communication skills. The weaknesses observed were; flexibility, miscommunication, limited resources and time constraints (Vietnam Teaching Jobs, 2024). These were observed using a learning and cognitive theoretical lens. Each of the ten teachers was observed once, and the process lasted about an hour per lesson. Observation and semi-structured interviews were conducted during the same visit to the school to minimise possible disruptions to teaching and learning. The researcher was allocated a

desk at the back of each classroom where she could observe the lessons without being directly involved.

3.6.4.3 Document analysis

Document analysis is a systematic evaluation procedure for all sorts of documents, printed or electronically collectively (Fereday & Muir-Cochrane, 2006). Document analysis requires data to undergo a review to make sense, give details and build realistic insight like other analytic procedures in qualitative research (Corbin & Strauss, 2008). According to Asdal and Reinertsen (2022), documents are presented as social facts as they are shaped, circulated and consumed in socially coordinated methods. Bowen (2009) states that in qualitative research, documents are analysed whereby the researcher gives the assessment topic voice and significance.
Document analysis helps the researcher to triangulate the findings since it allows them to refer to various sources and put together a document criticism with, for example, interviews. The researcher tries to present “well-coordinated data that promotes reliability” by mirroring the connection between data (Eisner, 1991:110).

Triangulating data means that the researcher can reduce the impact of potential prejudices that may arise in a certain study by drawing a parallel between results through data sets by comparing evidence collected employing different methodologies. Patton (2014) posits that triangulation helps the researcher safeguard against the notion that findings are merely a result of a single approach, a single authority, or the researcher's preconceived notion.

- Documents might offer information about the context in which research is conducted. The text provides a context. Collected information is used as historical evidence as well as to give basic knowledge and historical viewpoints (Bowen, 2009).
- The evidence revealed in the documents can suggest that certain inquiries should be made and circumstances should be scrutinised as part of the research.
- Documents offer more research information. Information gathered from a collection of documentation can be a source of ideas (Ngulube, 2015).
- Documentation presents itself as a way to track growth and transformation. The availability of particular documents can enable the researcher to draw parallels with his/her findings to see if there is variation (Nidhish, Kamra, Dhillon & Rawat 2020).
- Document analysis can be used to confirm findings or support data from other sources (Rapley, 2007).

The following documents were examined in this instance:

i. The National Curriculum Statement (NCS), which provided detailed information on what to teach, the level of progression of concepts and cognitive level skills expected from learners in the grade
ii. Annual teaching plans that detail what to teach and the requirements of continuous assessment.
iii. The teacher's lesson plans
iv. Formal and informal assessments
v. Learning portfolio which contains information about informal evaluation (what the teacher has done to bridge the learning gaps) and marked formal assessments for reporting purposes.
vi. Learners' books which contain what the learners are doing and how the teacher provides feedback to each learner.

The documents were analysed by skimming, reading, reviewing and interpreting data using thematic analysis (Fereday & Muir-Cochrane, 2006). The documents were analysed by skimming, reading, reviewing and interpreting data using thematic analysis (Fereday & Muir-Cochrane, 2006). Using highlighting key subjects in thematic analysis, learners, and books were analysed using a contend tracker tool that checks how many activities were supposed to be covered per topic, how many were completed and shows percentage of the curriculum coverage. Learners' books were also used to check alignment with the CAPS document, ATP and the teachers' lesson plans. The learners' formal assessments (portfolio) were analysed according to the ATP. The researcher used thematic analysis method of generating initial codes. Familiarization was used during semi-structured interviews. Interviews were recorded in line with ethical clearance process. The researcher found the documents significant particularly as they have reference to the issues being explored. They defined the applicability of the collected data to answer the research problem and the reason for it.

Using a request letter approved by the UNISA ethics committee addressed to the teacher, the researcher requested the CAPS documents, the Annual Teaching Plan (ATP), lesson plans, the teaching portfolio and learners' books. The documents were collected at the end of the non-participatory observation. Since the research is all about ascertaining the effectiveness of continuous assessment in teaching and learning of mathematics in Grade 5 classrooms, the

documents collected formed a vital component in assessing the implementation of continuous assessment which should form the character of daily mathematics classroom teaching and learning.

The sources assisted the researcher in investigating and unpacking relevant issues that influence the implementation of continuous assessment as follows:

- To understand how mathematics teachers, plan their assessments to create feedback to enhance learning.
- To check that teachers, mark the learner's work and provide feedback to help the learners close the identified learning gaps.
- To check the alignment of teachers' assessment of learners based on the teaching plan and content presented in the classroom.

3.6.5 Data Analysis

For the researcher to make sense of the data, it should be systematically analysed. Bailey (2008) and Harding and Whitehead (2013) explain that data needs to be thoroughly analysed so that it can draw some conclusions.

Data analysis is an activity whereby information is collected in its raw state and then reduced so that it makes sense (Merriam, 2009). On the other hand, Nieuwenhuys (2007) states that data analysis is when a researcher creates a profound knowledge of everything about the data collected according to the topic.

The primary data from this primary study was thematically analysed to ensure that the research questions could be answered (Creswell, 2016). Thematic analysis is a qualitative method of comprehending and applying in comparison to others. Thematic analysis can be used by people who do not have expertise in research as it does not need the application of philosophies to conclude. Moreover, you can find established clarification as well as examples of how to use analytical approaches (Nowell, Norris, White & Moules, 2017). Furthermore, it is a rich way of analysing data, which allows the researchers to put together or give light to and weigh different data sets or data groups. In addition, different types of qualitative analysis have been constructed using its methods.

Braun and Clarke (2013) suggest that thematic analysis should be the first qualitative analysis technique for researchers to learn because of its ability to have a deeper examination of the data collected. Lastly, of utmost importance, the thematic analysis provides researchers with excessive flexibility when it comes to: (a) the kinds of research questions it can answer, ranging from intimate versions of the overview of participants and considerations and ideas in different social settings; (b) types of facts plus documents analysed; (c) the amount of data measured; (d) the selection of applied theoretical and/or epistemological framework; and (e) the ability to analyse data using an in-depth style (Braun & Clarke, 2013).

Braun and Clark (2006) outlined six phases in the thematic analysis process, namely:

- Familiarisation involves an in-depth reading of textual land audio, recording data, and making notes. The aim is to fully self-orient with the data.
- Generating initial codes begins by assigning codes that mirror the semantics and concepts of the people interviewed and also take advantage of the researcher's theoretical framework.
- Highlighting key subjects involves thematic coding, sorting, and collating all important coded information from the identified themes.
- Re-evaluating the themes involves modifying candidate themes. The data within the themes should be homogeneous, yet there are clear distinctions between themes.
- Defining and naming the themes occurs after establishing an acceptable thematic data map. This stage defines and refines the data to identify the main features of each theme.
- Writing the report involves writing an in-depth thematic analysis to persuade the person of the analysis's merits and soundness.

The researcher kept the data collected during this study safe according to university requirements. The data collected and recorded on the available instruments, namely face-to-face semi-structured interviews, non-participatory observations, and document analysis instruments, were thematically analysed using themes and sub-themes, resulting in themes and sub-themes. These themes are presented in Chapter 4.

3.7 TRUSTWORTHINESS MEASURES

According to Cohen et al (2012), the measure of trustworthiness allows external judgements about the consistency of procedures and the neutrality of findings or decisions. The researcher attended to the concept of trustworthiness in qualitative research, which comprises various essential elements, such as credibility, transferability, dependability, and confirmability.

3.7.1 Credibility

Credibility, according to Creswell (2014), describes the qualitative researcher's level of assurance regarding the accuracy of the study's findings or the extent to which this assurance can be proven. Adler (2022) purported that it offers a way to confirm the validity and precision of the researcher's findings. If the research findings are credible, they are based on evidence that is believable and represents the participants' original opinions accurately. Additionally, Moser and Korstjens (+ 2018) asserted that qualitative researchers can use triangulation to demonstrate the veracity of their study's findings. Triangulation is a way to avoid biases caused by using a single methodology.

Credibility was promoted throughout the study by using triangulation, in-depth analysis of data and thorough observation. The researcher also made serious observations of negative outcomes instead of treating them as noise and took a close look at the participants used to collect data (Stahl & King, 2020). The study used triangulation to ensure the credibility of the findings, the researcher triangulated the findings from the three data generation strategies: face-to-face semi-structured interview, non-participatory observation, and document analysis.

3.7.2 Transferability

According to Streubert and Carpenter (2014), transferability is the capacity of one’s research findings to be duplicated in a different study of the same mode. Researchers may be able to deduce that the research findings would apply to their own situations if there were enough parallels between the two scenarios. To put it another way, they ‘transfer ‘the findings of a study to a different situation. Readers must have as much information about the original study circumstance as possible in order to assess whether it is comparable to their own and to do this effectively.

This research ensured transferability by ensuring diversity in the sample so that it mirrored the population as much as possible. More information about the participants and their environment is available to achieve this.

3.7.3 Dependability

The most important requirements for any research technique is consistency, dependability and reliability of the results of a careful study (Saunders et al., 2019). However, employing qualitative research techniques to achieve the same conclusions is fairly demanding and difficult. The result comes from the fact that the facts are narrative in character and subjective. For this purpose, Cohen (2014) pointed out that considering the reliability and consistency of the data, it is preferable to focus on getting the same results. Instead of trying to reach the same conclusion, the objective in this case is to agree that the findings and outcomes are trustworthy and consistent, given the data collection methods. Training and practice may make the human instrument more trustworthy (Merriam 2016). In general, the application of three techniques, the position of the researcher, triangulation and the audit trail ensured the credibility of the findings (Cohen et al., 2012).

According to Polit and Beck (2012), dependability is a phrase used to characterise or quantify the consistency and reliability of a study's findings. It is crucial to document the precise methods employed for data collection, processing and interpretation to theoretically replicate the study by other researchers and provide comparable results (Kabir, 2016). An inquiry audit, completed by an outsider, is one technique for evaluating the dependability of a qualitative investigation (Stahl & King, 2020). Alternatives include using screening criteria to ensure the validity of the research.

In this study, the researcher ensured that she had a firm grip on the processes and methods used to collect data. The researcher always sought the outside opinion on every piece of information that was realised. To ensure dependability, the researcher picked the three data collection strategies because of their characteristic of being free from bias. Non-participatory observation divorces the researcher from the activities happening in the classroom. During the face-to-face semi-structured interviews, the participants were not given the questions prior to the interview, and the interviews were semi-structured, which removes any possible inclination of the participant to outside opinion (Haukås and Tishakov, 2020).

The researcher's random approach meant that whatever documentation the participant volunteered was a true reflection of the situation on the ground. Given the information collected above, the data were elicited in a natural atmospheric setting.

3.7.4 Confirmability

Liets and Zayas (2010) say that confirmability is the degree to which other researchers endorse discoveries. To prove that the qualitative study is reliable and unaffected by the biases or assumptions of the researchers, the researcher must establish its confirmability. Reliable research should lead to findings that fairly reflect the information received from participants (Suleiman & Hammed 2019). In other words, the data should be able to speak for itself. A common way to prove confirmability is to provide an audit trail that explains every stage of the data analysis and demonstrates that your conclusions are unbiased and fairly represent the participants' responses (Stahl and King. (2020). Therefore, offering an audit trail that details each step of the data analysis process and indicates that your results are not biased by conscious or unconscious bias but rather accurately reflect the participants' responses. Peer assessment by participants is also needed to confirm the interpretation of findings.

This study used a qualitative research approach with a case study design. Accordingly, the researcher must substantiate the methodological approach and provide in-depth examples of the fundamental processes and frameworks that have contributed to the development, shaping and integration of the implications associated with those phenomena. The researcher provided an audit of the procedures employed in data analysis to ensure that there is no bias or internal or external influence on the findings. A summary of the face-to-face interviews is part of the research in order to increase confirmability (Robson & McCartan, 2016).

3.8 ETHICAL CONSIDERATIONS

According to Creswell and Creswell (2018), it is the responsibility of the researcher to request approval from various stakeholders who are involved in the research undertaking. The researcher applied and obtained ethical clearance from the UNISA Ethics Committee (cf. Appendix A 2023/06/07/47970960/20/AM). The researcher then requested permission from the Northern Cape Department of Education to be allowed to collect data from schools under its management (cf. Appendix B).

There was a need to inform participants about the study with a consent which they needed to sign (cf. Appendix C). The informed consent request was sent to participants prior to the beginning of the investigation (Leavy, 2017). Leedy and Ormrod (2015) suggest that participants should be informed and given time to decide if they want to be part of the research project. Once the participants agreed to participate in the research, the research explained what the research was aimed at. The researcher informed the participants that their participation was completely voluntary, did not come with cash compensation, and could leave the study at any time without incurring any penalties. Participants were assured of confidentiality and anonymity when the results were presented and discussed. According to Cohen et al. (2011), confidentiality and anonymity maintain that responses presented cannot be linked to a particular participant.

The researcher made sure the sites were respected, and the participants were given the confidence that they were a large part of the research undertaking. As alluded to by Leedy and Ormrod (2015), the privacy of the participants was preserved. The researcher arranged appropriate times to visit research sites and discussed these with participants. The interviews were carried out at the most suitable time for each participant at the convenience of the participant. It was important for the researcher to establish good and respectful relationships with the participants and to avoid disrespectful and harmful words.

3.9 CHAPTER CONCLUSION

This chapter discussed the research methodology. It began by presenting the rationale of empirical inquiry followed by the research paradigm, research approach, and research design. The methods followed involved the selection of participants from the target population to constitute a sample. Furthermore, how data were collected, and the instruments used were also discussed in detail. Finally, the chapter explained how the generated data were analysed, considering measures of trustworthiness and ethical connotations. The next chapter, Chapter 4, presents the data and data analysis.

CHAPTER 4
FINDINGS AND DISCUSSION OF EMPIRICAL DATA

4.2 INTRODUCTION

In Chapter 3, the research design and methodology were examined in-depth, laying a foundation for meaningful empirical inquiry, considering the qualitative nature of the study. Chapter 4 presents what was unearthed in the data collection phase. Data were gathered using instruments such as semi-structured interviews, non-participatory observation, and document analysis. Ten participants were selected from ten different schools within the Frances Baard district of the Northern Cape Province, and they all had different contexts.

4.2 GENERAL PARTICIPANT INFORMATION

The study focused on the effectiveness of continuous assessment in teaching and learning mathematics. Ten participants were purposively selected to participate in the study because they had first-hand experience daily as they taught mathematics in Grade 5 using continuous assessment as the evaluation system.

In line with what was envisaged in Chapters 1 and 3, ten participants took part in this study. The ten selected schools in the Frances Baard district use English and Afrikaans as the language of instruction in teaching mathematics. Participants were selected based on their first-hand experience using continuous assessment in mathematics teaching. Schools were also selected due to their difference in background to allow for the reliability of information and the true representation of the population. The participants were interviewed and then observed in their classrooms, and finally, documents such as informal and formal assessments of the learners and teacher's lesson plans were analysed. Paz-Soldan et al. (2014) postulate that face-to- face semi-structured interviews give a deeper background and with classroom observations and analysis of documents, the study's findings on the effectiveness of continuous assessment in the teaching and learning of mathematics are presented, providing an overview of the true opinions of the participating teachers.

4.2.1 Participant Profiles

An overview of the participants' information is provided in Table 4.1 below.

Table 4.1: Participant profiles

PARTICIPANT AND LANGUAGE OF INSTRUCTION	GENDER	YEARS OF TEACHING MATHEMATICS GRADE 5	HIGHEST QUALIFICATION
Participant 1 English	F	1	Bachelor of Education (Intermediate and Senior Phases)
Participant 2 English	M	27	Advanced Certificate in Education
Participant 3 English	F	2	Bachelor of Education
Participant 4 English and Afrikaans	M	26	Advanced Certificate in Education
Participant 5 English	M	27	Advanced Certificate in Education
Participant 6 English and Afrikaans	M	27	Advanced Certificate in Education
Participant 7 English and Afrikaans	F	30	Diploma in Educational Law
Participant 8 Afrikaans and English	F	14	Bachelor of Education (Intermediate and Senior Phases)
Participant 9 English	F	30	Honours Bachelor of Education in Management
Participant 10 English	M	3	Bachelor of Education

As stated above, the participants were purposively sampled to offer first-hand experience in using continuous assessment in the teaching of mathematics in their Grade 5 classrooms. This selection of participants ensured in-depth perceptions of the reality of what is taking place in different schools and their contextual factors were elicited.

4.3 CATEGORIES AND SUB-CATEGORIES

The semi-structured interviews were recorded in audio format, and the transcription of interviews allowed for thematic analysis. Categories and sub-categories emerged from collected data during generation of initial codes and are presented in Table 4.2.

Table 4.2: CATEGORIES AND SUB-CATEGORIES

	CATEGORIES	**SUB-CATEGORIES**
1	Teachers' understanding of continuous assessment (research Q1)	1. Teachers' conceptualisation of continuous assessment. 2. Teacher knowledge of continuous assessment approaches.
2	Benefits of continuous assessment in teaching and learning of mathematics (Research Q2)	1. Teachers' perception of the relevance of policy 2. Teachers' understanding of the benefits of continuous assessment for the learner
3	Challenges faced by teachers when implementing continuous assessment in the teaching of mathematics (Research Q3)	1. Teachers' challenges when implementing continuous assessment in mathematics in Grade 5. 2. Teachers' skills in implementing continuous assessment in Grade 5 mathematics 3. Resources to support continuous assessment

4.3.1 Category 1: Teachers' Understanding of Continuous Assessment

Theme 1 presents the teachers' understanding of the continuous, evaluation system proposed by the Curriculum and Assessment Policy Statement (CAPS) for Mathematics (DBE, 2011a: 293-297). The researcher wanted to determine if teachers understand the assessment system, particularly continuous assessment, which would assist in answering the sub-questions What is teachers' understanding of continuous assessment?

Assessment is the process of obtaining and discussing information from diverse sources and activities to establish a thorough understanding of what learners know, understand, and can do with their knowledge as a result of their educational experiences (DBE, 2011a). To understand whether teachers understood what continuous assessment means and how it is implemented, two categories were developed: teacher conceptualisation of continuous assessment and teacher knowledge of continuous assessment approaches.

Sub-Category 1: Teacher's conceptualisation of continuous assessment

Continuous assessment is defined as the practice of continuously testing learners for the majority of their educational careers (Abonyi, Okereke & Omebe, 2005). After collecting learner information, teachers can utilize this data to better understand their students, organize and assess their lessons, and foster a supportive learning environment in the classroom. According to Obi and Obineli (2019), continuous assessment should include a formal evaluation of learners' affective traits and motivation in which they will need to demonstrate their commitment to work overtime and preparedness for the workforce and proficiency in team or group performance contexts.

As alluded to above, teachers should have an unadulterated and clear understanding of assessment in general so that they can successfully implement continuous assessment to full advantage, which sets to achieve spelt-out objectives. When asked about their understanding of continuous assessment, its meaning and what it entails, participants offered various responses:

Participant 1 said that continuous assessment functions as an indicator of where learners are and where they need to improve as well as guides the teacher on the way forward. The learners need to understand what they are writing and determine what The learner understands of their work. The assessment gives a sense of what to improve as well as the learner‘s understanding of the work. Assessments also lead the teacher on the way forward. In the CAPS curriculum, learners are tested every day on the knowledge of what they have been taught through tests and everyday activities.
When the same teacher was asked about the approaches of continuous assessment that are aligned in the CAPS Intermediate Phase, she had this to say: I think it’s the formal and informal assessment that you have to record in the SASAMS. She went on to explain baseline saying that the DBE makes it a requirement now at the beginning of every year for teachers to do it. Baseline can be her guide to build her work. Participant 2 about continuous assessment, its meaning and how effective it is in teaching and learning of mathematics in grade 5, responded that it is used as a means of seeing how the learner has progressed and how the learner's data are collected on an ongoing basis.
Participant 2 had this to say about continuous assessment approaches; I think these are our formal and informal assessments that we use every day we build our formal tasks from the informal ones, informal are our daily class activities while our formal tasks are the projects assignments learners complete at home over a certain prescribed time they need to go and get help if they can’t complete them in class. Participant 4 says continuous assessment is a process of checking whether teaching is taking place formally/informally and is a tool used to measure whether teaching is reaching the learners.

Participants 3 and 5 view continuous assessment as a tool that is used concerning what the learners have learnt and that it can be formal and informal. Participant 3’s understanding tends to indicate that continuous assessment is meant for the evaluation of learners only, without focusing on the teacher's side. To accentuate his belief that continuous assessment is learner-orientated, he explained that it is a tool that you use to assess/check/monitor whether a specific topic has been understood and curriculum has been grasped. The CAPS ATP is clear on continuous assessment … it also stipulates the work that should be done.

Participant 5 additionally mentioned that continuous assessment should be built around the character of learners you have in your mathematics class. Concerning Participant 5, Participant 9 shared the sentiment that continuous assessment has its thrust on the learner saying that continuous assessment checks how much learners have understood from a learning episode, albeit by using informal and formal assessment. On the other hand, Participant 6 considered continuous assessment as playing a two-pronged function checking whether the learners understood what the teacher wanted to communicate. It is also meant to check whether the teacher's objectives are met.
Participant 6 says that the assessment measures the teacher's exposition and the acceptance of concepts by learners.

Participant 7 has a similar understanding to Participant 6 in that continuous assessment they say it can be used as a system that assists teachers in critiquing their teaching for future improvement and also in measuring the success of teaching and learning mathematics. They said that continuous assessment is used continuously using approaches such as classwork. Moreover, Continuous assessment does not consume a lot of time but I have to sacrifice a little time to prepare assessment tasks. The teacher states that continuous assessment calls for discipline on the part of the teacher to avoid teaching to assess which is not beneficial to learners.

Participants 8 and 10, did not have a clear understanding of continuous assessment. Although the participants have different views on what continuous assessment is, most participants agree that continuous assessment is done on an ongoing basis and is not a specific event. Participant 8 explained that continuous assessment is done throughout the term and can be informal like mental maths or formal tests. Continuous assessment is drawn from the work done by the learners during a given period. The teacher feels that social learning theory fits well with continuous assessment because children benefit from group activities. Participants stated that they prefer setting their own assessment tasks as opposed to collaborating in setting the tasks or common papers. This allows the teachers to prepare their own formal tasks and thus allow them to grow.

Sub-category 2: Teacher's knowledge of continuous assessment approach

Continuous assessment as a method of evaluating teaching and learning employs various approaches. Knowledge of these approaches is a basic requirement for educational practitioners to implement the assessment effectively. Participant 5 effectively used formative assessment throughout the observed lesson to ensure that the lesson objectives were met. Although the participant utilised some of the approaches of continuous assessment during the class observation, when triangulation was applied with responses of the semi-structured interview it painted a different picture. The participant showed little knowledge of the continuous assessment approaches outlined in the CAPS document. When asked during the interview about the approach they feel is best for learners, the participant singled out projects such as an assessment approach as important in that it is very interesting for learners with different learning styles as it develops various skills in learners in one task.

Participants 6 and 9 indicated that they use formative assessment to check the understanding of the learners, unlike Participant 1, who stated that he prefers tests as a form of assessment because he thinks that it gives the true qualities of the learners. Ekanem, Inyang and Umo (2019) state that formative evaluation, which is also referred to as formative assessment, periodic assessment, or assessment for learning, involves assessing learners' progress at regular intervals to determine their degree of learning attainment and offers the necessary remediation. Participant 6 has a high preference for using a baseline approach, and Participant 7 concedes that, continuous assessment can be implemented optimally when the use of technology is incorporated into the teaching and learning of mathematics. However, it is worth noting that Participants 1, 7, and 8 displayed minimal knowledge of the types of assessments outlined and discussed in detail in the Intermediate Phase CAPS document. Participant 3, in his responses, confuses diagnostic assessment and baseline assessment. However, the participant outlines that examination as a form of assessment should be improved to take the form of a test to allow the teacher to help learners explain the demands of the questions more.

Feedback to learners after assigning an informal and formal assessment is a prerequisite because it allows learners to see where and what they did wrong to take corrective action which motivates them to achieve more. Gibbs and Simpson (2004) assert that the greatest impact on learner achievement comes from the feedback offered to learners. Participants 6 and 8 generally did not provide feedback on the informal activities assigned to the learners. On some occasions, especially in formal activities, the activities were not appropriately designed according to cognitive levels which may the teacher and learners a false picture of what the learner is capable of doing. Table 4.1 in the CAPS document for mathematics outlines the cognitive levels and the percentages delineating how much each level should be assigned. These cognitive levels are knowledge (25%), routine procedures (45%), complex procedures (20%) and problem solving (20%). The cognitive levels need to be taken into account when designing any form of continuous assessment (DBE, 2011a:296). Overall, participants exhibited little knowledge of the types and forms of assessment prescribed in the CAPS document.

4.3.2 Category 2: Benefits of using Continuous Assessment in the Teaching and Learning of Mathematics

Teaching and learning mathematics in general and in Grade 5 in particular, aims at making a permanent observable change in behaviour in the learners. Mathematics teaching and learning aims to produce learners who can operate in any environment that deals with problem solving without any limitations. Theme 2 deals with the benefits of using continuous assessment in the teaching and learning of mathematics and is made up of two categories: teachers' perceptions of the relevance of policy on continuous assessment and understanding of the benefits of continuous assessment on the learner.

Sub-category 1: Teacher's perceptions of the relevancy of policy

The Curriculum and Assessment Policy Statement defines the direction the education system should take. In the Intermediate Phase CAPS policy documents, there is a foreword by the Minister of Basic Education, Mrs Angie Motshekga (DBE, 2011a), which spells out what the education system seeks to achieve. Policies, especially in

the education system, must be harmonious with other policies enacted to support the main policy. Teachers should be well versed with policy and in this particular case, CAPS Mathematics (DBE, 2011a) and The National Protocol on Assessment for Schools in the General and Further Education and Training Band (Grade R- 12) (DBE, 2011b) to implement them effectively.

The Annual Teaching Plan (ATP) which was streamlined in line with CAPS spells out what should be taught in each subject and grade at the given time which makes work easier when they plan their work. Participants 5 and 9 commented on the ATP and suggested that there are too many topics planned for each term, resulting in the teacher failing to complete the curriculum and teach all relevant mathematical concepts, which means that learners progress to the next grade with gaps in their learning. The participant also pointed out that the work planned in the ATPs puts pressure on teachers to ensure curriculum coverage; consequently, teachers rush through the concepts, negating the basic aims of continuous assessment, which is to ensure knowledge acquisition and skill development. Participants 3, 5, 6, 7,8 and 10, when looking at informal learning activities in the learners' books using the tracking tool, which is an instrument used to track the curriculum coverage, the researcher found that most concepts were sacrificed due to lack of time to cover all work.
However, Participant 7 had a different view on the ATPs because she felt that they have made it easier for teachers to track and fine-tune their teaching. Participant 3 defends the current policy formulations by stating that the policy is relevant to the proper implementation of CASS and that the policy should keep improving.

Participant 6 concede that the CAPS document makes a serious attempt to explain what continuous assessment entails and the CAPS document also spells out how the learners are assessed or evaluated. Participant 1 concurred by saying, that CAPS as a curriculum that uses continuous assessment as an evaluation system is very relevant because it has specific aims and objectives however the Annual Teaching Plan does not help to enlighten the teacher about Continuous Assessment processes. Participant 8 felt that policy put pressure on teachers by labelling schools as underperforming. Participant 2 in agreement stated that the policy of 60% is putting pressure on teachers although the contextual factors differ. Participant 2 gave an example of a tortoise and a zebra running the same race expecting them to perform the same.

Participant 1 stated that the policy of condonation of mathematics during promotions and progressions makes learners think that passing languages is more important. At the end of the year learners fail mathematics but learners are allowed to go to the next Grade through condonation. Participant 5 bemoans the lack of policy harmony by saying that learners are promoted due to age cohort, condonation of mathematics and number of years in the phase which disregards learner performance. This according to the participant, undermines the effectiveness of continuous assessment.

According to the National Development Plan (NDP) General Certificate of Education and Training level (GET), the target for mathematics is 60% of learners should achieve 50% across the provinces (RSA, 2013). Participant 9 suggested that the target set by the Department is unrealistic and contradicts what continuous assessment seeks to achieve. The pressure on teachers to produce 'good' results leads to teachers teaching to assess. Teaching to assess produces learners who lack skills and knowledge, that go against the primary outcome of continuous assessment. Most participants feel that in the South African education system, there are policy contradictions where the National Development Plan 2030 (RSA, 2013) targets 60% of learners to achieve 50% only to have mathematics condoned at the end of the year, allowing learners to be promoted to the next grade with low mathematics marks; this sentiment was put across by Participants 3 and 9 who feel the policy of condoning learners with mathematics marks below 50% lowers the importance of the subject.

Sub-category 2: Teacher's understanding of the benefits of continuous assessment for the learners.

This theme reveals teachers' understanding of the benefits of continuous assessment for the learner. According to Participant 5, one of the benefits is that it marries theory and practice, thereby revealing the link between what the learner learns in the classroom and how it is applied in practice. Continuous assessment is a tool that motivates and builds confidence in learners. This is because it encourages learners to learn from real-life experiences. They learn from things they experience every day; for example, a learner in Grade 6 can ascertain the cost-effectiveness of different products or services using rates and would confidently help their parents during shopping.

Continuous assessment benefits learners more in the fact that it is learner-centred which eventually improves productivity and gives a sense of motivation to learners as they are encouraged to take control of their own learning. Continuous assessment also improves the relationship between the teacher and the learner as they have to work together towards achieving the same goal. There is strong interaction through metacognitive talk during discussions and through question and answer between the teacher and learner as well as peers and also on feedback by numerous comments and interventions given by the teacher. When learners are motivated, they become disciplined and this will lead to improved classroom culture and the teaching and learning environment as well. There is improved attainment and achievement when the teacher and the learners work together throughout the process of informal assessment building towards their formal assessments. It means learners are going to achieve in their formal assessments as they work through numerous informal assessments which offers many opportunities to improve their performance and thus attain high marks in their grades.

Continuous assessment is beneficial because you are able as a teacher to check whether objectives are being met on an ongoing basis, quipped Participant 6 when asked about the benefits of continuous assessment on the learner. In support, Participant 4 said, that continuous assessment helps teachers to know how far they are and the kids can know if they are developing. Participant 6 agreed by saying, that continuous assessment is beneficial in that the teacher can check whether the objectives are met on an ongoing basis. Participant 5 concedes that continuous assessment benefits learners in that it marries theory and practice as mathematics is also found at home and community and this builds confidence in learners

Participant 1 agreed with Participant 5 but went further by saying that continuous assessment helps meet educational goals. Participant 2 responds by saying that feedback should be given immediately to both learners and parents; delayed feedback is denied feedback. Participant 9 suggested that continuous assessment has the advantage of striking a balance; it uses a variety of assessment types which cater for individual differences. However, Participant 2 reported that assessments should be set in line with Bloom's taxonomy; but teachers include mostly Level 1 and 2-type questions as the learners cannot read and write with comprehension.

4.3.3 Category 3: Challenges Faced by Teachers when Implementing Continuous Assessment in the Teaching of Mathematics in Grade 5

Like any other assessment system, continuous assessment has its pitfalls, which the teacher must negotiate to meet the system's objectives. This theme looked at the challenges faced by teachers in implementing continuous assessment in teaching mathematics in Grade 5. The theme consists of three categories: teachers' challenges when implementing continuous assessment in mathematics in Grade 5, teachers' skills in implementing continuous assessment in Grade 5 mathematics and adequacy of resources to support continuous assessment.

Sub-category 1: Teacher's challenges when implementing continuous assessment in mathematics in Grade 5

Participant 1 declared that the Annual Teaching Plans (ATP) that were put in place to support continuous assessment are too prescriptive and put the teacher under much pressure. The participant stated that continuous assessment puts much pressure on the teacher, as some of the teaching time is taken up by assessment, as learners sometimes do their assessment tasks in class during mathematics periods. As previously indicated, teachers are challenged with curriculum coverage as the ATP seems overloaded.

Participant 8 felt that the policy put pressure on teachers by labelling schools as underperforming. Participant 2, in agreement, stated that the 60% policy is putting pressure on teachers, although the contextual factors differ. Participant 2 gave an example of a tortoise and a zebra running the same race, expecting them to perform the same.

Participant 1 stated that the policy of condonation of mathematics during promotions and progressions makes learners think that passing languages is more important. At the end of the year, learners fail mathematics but are allowed to go to the next Grade through condonation. Participant 5 bemoans the lack of policy harmony by saying that learners are promoted due to age cohort, condonation of mathematics and number of

years in the phase, which disregards learner performance. This, according to the participant, undermines the effectiveness of continuous assessment.

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Although the transition from learning mathematics in the vernacular to English in Grade 4 was recorded as a policy challenge, Participant 6 reaffirms its negative impact on continuous assessment because the new mathematics terminology in English throws most learners off guard. During non-participatory observation, the teacher could be seen code-switching to Sesotho at regular intervals to scaffold the learners and ensure that they had grasped the concept and developed understanding.

Teachers were asked about the challenges they face in the implementation of continuous assessment in mathematics in Grade 5 and various responses were given. Participant 2 believes the CAPS curriculum is overloaded, so teachers don't meet with the parents often. Participant 9 concurred with Participant 2 by saying that overloading teachers results in getting tired and mitigating their performance. The participant added that the tiredness of teachers as a result of overloading meant that the teacher was unable to do intervention activities to help struggling learners. The ATP meant to make things easier in continuous assessment implementation had Participant 1 negatively saying that the ATP dictates a lot to the teacher to the extent of laying out the method the teacher should use even if they are not comfortable.

Participant 5 bemoaned the little part parents and guardians are playing in their children's learning by saying that parents are not so involved in their children's learning; hence, the teacher is left alone. Participant 7 had the same view, stating that I sometimes arranged extra lessons to help learners, but most of them did not attend. Participant 10 is unhappy and suggests that continuous assessment is not beneficial because the people who train you contradict each other regarding policy implementation. Participant 10 decried the prevalence of plagiarism, which is synonymous with some continuous assessment strategies as projects and assignments are done at home, whereby the parents do learners' work, and the child suffers in the exam.

Participant 8 put forward that learners struggle when they are exposed to unusual questioning from an unusual examiner as in common assessments. Participant 2 contradicts this view by saying that he believes the solution to this is when subject advisors set papers centrally to monitor quality of work. Participant 4 had a better view of continuous assessment that continuous assessment allows for assessing learners on continuous basis and this helps the learners to relax and cope better than when the assessment is just an examination at the end of a given period. The learners in the Frances Baard District come from different backgrounds and the participants feel that the parents or guardians are poor farm workers with no or little educational background. Such learners have no support at home or role models.

Sub-category 2: Teacher's skills in implementing continuous assessment in Grade 5 mathematics

For continuous assessment to thrive, teachers should be well-versed in the assessment system to implement it successfully. However, the study exposed a major issue as most teachers lacked the proper skills to implement continuous assessment satisfactorily. Participant 2 said he manages to cover the knowledge gap by attending workshops. Participant 10 in support said,

"most of the workshops that we attend teach us how to plan our assessments and give out exemplars which is a light on how to set your assessments." Participant 1 does her own research to improve her knowledge of continuous assessment implementation. This calls for teachers to be adequately trained to drive the system forward, and training must

be ongoing. Therefore, this category was analysed to ascertain teacher proficiency in implementing continuous assessment in the Frances Baard district.

Students at tertiary are not conversant with continuous assessment because of policy adjustments. Newly qualified teachers only learn about the policies at work, and as a result, it becomes difficult for them to be able to implement the curriculum effectively for successful teaching and learning and, in addition, understand how the policy should be implemented. Participant 6 is newly qualified and only received guidance from the mentor teacher and peers; she did not receive formal continuous assessment training or orientation when appointed. However, like all the participants, Participant 6 indicated that they received some training on continuous assessment during the road shows, which was inadequate; however, continuous assessment workshops are not regular. Participant 7 said she last received training in continuous assessment during her college years. This questions the regularity of the training and its effectiveness because some participants mentioned roadshows are done after school for at least 2 hours.

Sub-category 3: Resources to support continuous assessment

In his theory of cognitive development, Piaget emphasises the role and importance of using concrete objects to promote teaching and learning. Learners attain Piaget's stages of cognitive development in the same Grade at different ages. The availability of resources in teaching mathematics is very important because learners' learning styles must be considered when planning mathematics lessons. Continuous assessment can achieve its objective if resource availability is guaranteed.

Participant 6 acknowledged that resources are vital for mathematics for the subject to move with the new trends in the environment. Participant 8 has the good fortune to have many resources to use in her implementation of continuous assessment, namely television and the Internet. However, the participant still prefers traditional resources in teaching mathematics, as technology is taking away good things from teaching and relies on her ability to capture the learners' attention.

Some teachers do not consider that technology adds value to their lessons hence they say the use of technology is not always preferred. Other teachers say that the use of devices and the internet in the classroom disrupts the class as children will wander around other things, losing focus of the content as they are called “cyber wanders”. They also say it can affect lesson flow, and it is time-consuming to set up equipment. It is also supposed that most teachers need more professional development when it comes to using information and communication technology (ICT) in the classroom, so it is vital for them to keep up with the ever-changing technological advances. The other factor hindering technology use in classes for long-serving teachers is the fear of embracing new things and change.

Participants 4 and 9 stated that their school has inadequate resources to accommodate all teachers, which hampers the implementation of continuous assessment. Participant 4 attested that one of the challenges of acquiring resources is ensuring their security, considering where the school is located. Most resources are lost to theft and replacing them is not financially viable. It should be noted, though, that the researcher did not see any use of technology in mathematics teaching and learning in all the lessons observed.

However, Participant 7 stated that, in addition to resources to use directly in day-to-day teaching, it is fortunate that she has resources to ensure that they are in constant communication with parents regarding the work of the learners. The teacher uses WhatsApp to communicate with parents regularly.

4.4 NON-PARTICIPANT OBSERVATIONS

To support the interview data, non-participant observation was used in a classroom setup on how the participants make use of Continuous Assessment. The table below will answer the questions on class observation schedule (*cf.* Appendix E) on what was observed during learning and teaching time.

Table 4.3: Non-participant observation analysis

CRITERIA	OBSERVATIONS
1. Where the learners given formal or informal assessment activities?	- All the learners in the observed classes were assessed in one form or another.
-Types of assessment learners were engaged in.	In 8 classes, teachers employed formative assessment through oral questioning by teachers and learners for clarity and checking learners' understanding. However, in two instances, learners were engaged in diagnostic assessment.
-Forms of assessments the learners were engaged in.	No formal assessment was observed throughout the observation period. However, the learners received an informal assessment in the form of classwork or homework if the learners could not finish the work in class. All the informal activities were done by the learners individually.
2 How was feedback given to the learners?	-During non-participatory observations, the teachers were giving their learners feedback using verbal and written feedback. The teachers used words like good job, well done and excellent to encourage learners. In some instances, other learners clapped their hands for correct responses given by other learners.
3 Strengths observed	In 7 observed classes: - learners actively participated in the teaching and learning and were exposed to different methods to explain mathematics. - Feedback was given timely, and classwork and homework were marked and revised. Diversity was accommodated, and some educators allowed peer teaching to ensue.

CRITERIA	OBSERVATIONS
4. Weaknesses observed	- The researcher observed that discipline was not upheld in 3 classes, hindering progress in teaching and learning. - The use of teaching and learning media was neglected, which retards proper teaching and learning. - Although peer marking can be used in the classroom, the teacher should also check progress to ensure quality and positive feedback. - The inadequacy of teaching and learning resources, such as textbooks, is a barrier to assigning homework because learners lack resources to use at home. - 6 of the participants did not have evidence of lesson planning. - Some of the participants did not have learner portfolios which are vital for record keeping. The teachers' experience had nothing to do with the lack of learner portfolio.
5. What classroom factors influenced the completion of assessment activities?	- Peer tutoring - Knowledge of the content of the learners. - Maintenance of discipline in the classroom. - Variation of teaching methods by teachers. - Learners were allowed to use the chalkboard to demonstrate their mathematics skills. In 7 classes, teachers gave many examples to help learners understand the concept. - On the rarest of occasions, learners were allowed to work in groups, which allowed for the exchange of ideas.

CRITERIA	OBSERVATIONS
	- One of the participants assisted some learners with homework in class due to the lack of knowledgeable individuals at home.
6. Which areas of improvement is needed? The teacher regarding continuous assessment Implementation?	- 3 participants did not engage the learners in formative assessment to check progress in teaching and learning. - The use of media should be encouraged to appeal to - Different types of learners. -Time should be properly and appropriately managed to ensure that all teaching and learning activities are performed during the lessons. - Constructive feedback to the learners throughout the lessons should form part of teaching and learning.

4.5 DOCUMENT ANALYSIS

To augment the data from the interviews and classroom observation, document analysis was conducted. Table 4.4 below sheds light on the findings of document analysis.

Table 4.1: Document analysis

DOCUMENT ANALYSED	CRITERIA	FINDINGS
1. Lesson planning	Lesson planning	- Most participants had evidence of lesson planning, save for a few.
2. ATP	Availability of ATPs	- All participants had common ATPs from the department that guided the teaching and learning of mathematics in grade 5.

DOCUMENT ANALYSED	CRITERIA	FINDINGS
3. Learners' books	Are informal activities - In the learners' books - According to the ATPs/RTPs. - Are the activities marked. - Are learners given timely feedback? - -Is the feedback constructive? - Is there evidence of a review of the activities? - Are learners given mental mathematics? Is there an intervention administered by the teachers? - Are there revision activities assigned to	- 8 of the participants were in line with the ATP, the one who was not was behind because of taking Too long on some concepts. - All activities assigned to the learners were marked. - Learners were given timeous feedback which is a prerequisite of CASS. - 4 of the feedback from participants was not constructive, most of the studied learners' books had no comments to communicate with the learners fully. -All participants showed little or no evidence of revision and the formal activities had no corrections. - Although mental mathematics should be part of daily teaching and learning to sharpen learners' mathematics skills, no mental mathematics activities were seen. - Intervention is neglected; no amount of intervention was evident. - There are no revision activities in the form of informal class tests.

DOCUMENT ANALYSED	CRITERIA	FINDINGS
	the learners after a topic?	
4. Learner Portfolios	- Do learners have portfolios - Are the formal activities of the learners filed in the portfolios? - Are formal activities set according to Bloom's taxonomy? - Are the activities marked?	- Most learners have portfolios neatly prepared. - The formal activities are filed in the portfolios termly. - In most cases, the formal activities are commensurate with Bloom's taxonomy levels; however, in some cases, the level of questions lacks balance. - The formal activities are marked, and the feedback is timely and functional.

4.6 TO SUM UP

As revealed by the data, teaching time is inadequate, leaving no time to assist learners in developing grade-appropriate mathematics knowledge and skills. Teachers seem to focus on assessment, but the system is based on results, not processes, to inform further learning or identify problem areas. The teacher should ensure that teaching and learning are done to effect behavioural change in learners but not with assessment in mind. Formative assessments should allow the teacher to supervise and ensure that the learners acquire relevant knowledge and skills, with continuous assessment being the best learning assessment system; however, continuous assessment is assessment driven, making it ineffective, hence, poor performance in

mathematics in the country, according to large-scale assessments such as TIMMS (2019) and SACMEQ (2017).

Most teachers do not have lesson plans with self-set objectives for each lesson. They take lesson plans done by the D.B. E and rely mainly on the ATP and the CAPS documents. This shows a lack of lesson preparation and planning. The objectives will enable teachers to gauge the success of a lesson. No contextual factors are considered in the Department's provision of school resources. Because of their background and context, some schools are under severe resource constraints, vital for continuous assessment implementation. In addition, most teachers are not fully orientated towards or trained in continuous assessment implementation, as evidenced by their inability to state the continuous assessment approaches outlined in the CAPS document. However, during the interviews, they claimed to be well-oriented regarding the CAPS document. The researcher discovered a correlation during lesson observation, interviews and document analysis. New teachers who enter the system are not inducted adequately into continuous assessment, as no orientation or induction workshops are conducted.

Contextual factors such as large classes, learners living far from school and lack of parental support make it difficult for teachers to institute intervention. The 60% pegged by NDP goals are unrealistic as the learners have poor reading proficiency, which makes learners struggle with high-order questions; most teachers, as observed during document analysis, set their formal assessment tasks mostly in Levels 1 and 2, curtailing learners' potential. According to Bloom's taxonomy, the setting of low-level questions is a mechanism teachers use to ensure that they meet the 60% threshold, which, in a real sense, gives an unrealistic picture. Formative assessment highlights issues which need intervention. Interventions to address poor performance should be given importance because it is an opportunity for the learners to catch upwith their peers. All participants involved had no planned or administered intervention activities, evidence that interventions are not planned.

A promotion and progression policy with an array of considerations for mathematics for a learner to progress to the next grade dilutes the importance of the subject, and the learners are aware, making them not put in a lot of effort. Learners who are forced to repeat a grade seem to have no discipline, as they lack discipline.

There is a need to triangulate findings from the different tools in the discussion chapter.

4.6 CHAPTER CONCLUSION

This chapter presented the themes and sub-themes emerging from the analysis of data. As indicated in the themes and sub-themes and the summing up section, practical teaching and learning of mathematics in Grade 5 is hindered by many challenges. Low performance in mathematics results from continuous assessment not being implemented effectively, mainly because teachers are not well-orientated about continuous assessment, creating gaps in the system. Completing formal assessments is given precedence over skill development and knowledge acquisition. As a result, the system is result-orientated; hence, teachers teach to assess instead of assessing to teach. There should be a paradigm shift from all stakeholders to realise the full potential of the learner assessment system.

CHAPTER 5
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This study aimed to explore the perceptions of Grade 5 teachers regarding the effectiveness of continuous assessment in the teaching and learning of mathematics in Frances Baard District in answer to the research question: *How effective is the continuous assessment method in teaching and learning mathematics?* Chapter 5 outlines the teacher's views and experiences on the effectiveness of continuous assessment in the teaching and learning of mathematics in Grade 5. This chapter also discusses the resources suitable to achieve teachers' goals, parental involvement and strategies to improve mathematics results. This chapter also offers recommendations based on what emerged from the findings of the empirical study. The findings are presented through each sub-research question outlined in Chapter 1.

5.2 SUMMARY OF RESEARCH FINDINGS

This study's findings emerged from the interview data gathered from participants. The participants reported on their own opinions and honesty regarding their experiences in their different environments.

5.2.1 RQ1: What are the teacher's understanding of continuous assessment?

Teaching and learning should result in learners acquiring new knowledge or developing new skills, and these can only be ascertained by assessing learners formally or informally. This also means continuous assessment is about seeing how learners handle the materials they are exposed to.

However, teachers understand continuous assessment differently, and they give a variety of explanations of what they think continuous assessment is. The participants' responses revealed that a teacher uses continuous assessment to check whether teaching has occurred. Some teachers believe that it is an indicator of where learners need to improve and as a guide to the teacher on the way forward. Others regard it as a means of seeing how the learner has progressed and how to assist the learner on

an ongoing basis. Some participants asserted that continuous assessment is data collection on learner performance.

Other teachers view continuous assessment as a tool used to identify what learners have learnt and whether it can be formal or informal. On the other hand, some indicate that continuous assessment checks how much learners have understood from a learning episode by using informal or formal assessment. Meanwhile, other teachers understand it as a playing two-pronged function, checking whether learners understood what the teacher communicated and whether the teachers' objectives were met. Other teachers consider it as a system that assists teachers in critiquing their teaching for future improvement and as a measuring stick of success in the teaching and learning process, that is, to determine if the teacher has achieved his/her objectives. The participants also felt that continuous assessment can be used to see areas where the teachers and learners can improve.

All participants' teachers agree that continuous assessment is ongoing and not a specific event (cf. Chapter 4, Section 4.4.1). However, a lack of training, professional development, and experience affects the use of continuous assessment in the teaching and learning process.

Subject content knowledge (SCK) and pedagogical content knowledge (PCK) of mathematics is an issue as about 62% of mathematics teachers in South African primary schools cannot perform at Grade 4 mathematics. Yet, they are found to be teaching mathematics in Grade 6 due to a lack of proper profiling at the primary level (Tailor and Tailor, 2013). This is seen as of paramount importance in lesson preparation, planning and reflection. Teachers' lack of SCK and PCK limit them from delivering the subject to its full potential. This means that little understanding of how to implement continuous assessment as an integral part of the teaching and learning of mathematics compromises effective teaching and learning. Lack of quick and timely feedback, which is the backbone of continuous assessment, helps with the progress of the learner and allows remedial action to be taken on time but is not being well implemented in schools. Little or no interventions besides corrections tend to take place in mathematics classrooms to help learners struggling with the subject.

5.2.2 RQ2: What are the benefits of using continuous assessment in teaching and learning mathematics?

Continuous assessment works hand-in-hand with the CAPS curriculum system and is a perfect evaluation system if properly administered. With the help of the ATP, learners and teachers can track their progress from term to term throughout the year. The ATP, an offshoot of CAPS, is meant to support continuous assessment and can be used for planning purposes. According to most participants, continuous assessment is used as a measuring stick and gives space for everyone involved in teaching and learning to develop. Tilya and Mafumiko (2010) state that continuous assessment encourages learners to utilise their potential fully. Continuous assessment benefits learners as feedback is immediate, and remedial action can be done timeously (Ali & Ajibola, 2015). Continuous assessment reduces anxiety associated with final exams and creates an accessible assessment environment that is comfortable for exploration for learners (Komba & Mwaridanji, 2015)

According to some participants, continuous assessment benefits learners immensely as it combines theory and practice to allow learners to learn things they see daily and can relate to. Continuous assessment allows learners to have control of their learning through assessment types such as planned process-based assignments. Continuous assessment helps participants collect data to plan and define teaching and learning going forward. As an assessment model, continuous assessment has the advantage of striking a balance in its approaches catering to learner diversity.

5.2.3 RQ3: What challenges do teachers face in implementing continuous assessment in teaching and learning Grade 5 mathematics?

Just like any other system, continuous assessment is faced with many challenges by teachers when implementing and administering the system. Ensuring challenges are minimised or eliminated in implementing continuous assessment will significantly benefit the country’s basic education system. One of the challenges singled out by participants is policy-related annual teaching plans (ATPs), which were developed to alleviate the upheavals brought about by the coronavirus. They feel that ATPs dictate too much and leave little room for teachers' creativity during teacher exposition.

Another challenge of continuous assessment is also due to policy contradictions in the National Development Programme on Education, which expects 60% of learners to attain 50% in mathematics in the GET band. This high target puts much pressure on learners, and teachers will teach for assessment instead of assessing for teaching.

Effective teaching and learning are only considered to have taken place in continuous assessment if learners have acquired the skills and knowledge they are required to obtain. Teachers should formulate the objectives and goals they seek to achieve and be guided by them in teaching and learning mathematics instead of rushing to complete the curriculum. What stood out is that not all participants seem to be well versed in continuous assessment even if they subconsciously use it daily in teaching and learning mathematics in grade 5.

However, many participants did not receive training on continuous assessment, and the little effort put in during term workshops is inadequate. Effective teaching and learning cannot take place as teachers teach to assess as opposed to assess to teach. Most of the participants are aware that assessments are grouped into formal and informal assessments. However, they do not appreciate that there are many more continuous assessment approaches that they are using, although they profess ignorance of them.

One reason for continuous assessment implementation not being effective is that the language of learning and teaching shifts at Grade 4 from the vernacular to English, creating discord. Language proficiency was one of the challenges that Grade 5 teachers faced as learners in the Foundation Phase are taught in the mother tongue, and the transition is not smooth. They get to grade 5 while still struggling with the language. Participants believe that mathematics should be taught in English from the Foundation Phase to mitigate the dissonance that characterises the transition from the Foundation Phase to the Intermediate Phase.

Most participants have the impression that the time allocated for the work planned during a given term is too little, as it is abruptly cut short, and the deadline for submission of results is pegged at a date that is too early. This robs the learners of learning time as the teachers scramble to meet the deadline for result submissions.

The ATP prescribes what the teacher should do which leaves little room for the teacher to be creative and explore other strategies to support continuous assessment. Of concern to all participants is that 60% of learners are expected to achieve 50% or better, according to the policy on promotion and progression, which condones mathematics and demotivates both the teachers and the learners as they both know that mathematics does not affect promotion and progression.

Most participants are not developing lesson plans that aim to achieve goals set in the CAPS document, they teach learners for promotion and progression. A few participants prefer preparing their own formal assessments while most of them are in support of common formal assessments set centrally as this will lessen their workload. This will allow teachers more time to concentrate on their core function, which is teaching and learning. In addition, they have poor record-keeping skills, which is a requirement for continuous assessment. For example, learners keep their formal assessments in their school bags instead of filing them in an assessment folder, which the teacher must keep safely. In support, Hassan and Sotonade (2021) argue that recordkeeping is an important component of the continuous assessment programme. Some schools are understaffed because of the policy of a teacher-pupil ratio of 1 teacher to 35 learners. This ratio overloads teachers, resulting in them burning out or having no time to intervene with their learners. This situation is especially prevalent in farm schools, where enrolment is low.

Due to the differences in the backgrounds and contexts, some schools have adequate financial resources to acquire any resources they might need. However, most participants singled out the lack of resources to support continuous assessment as an impediment to continuous assessment, and for one reason or another, resources in most schools are inadequate.

Parental participation is not a challenge in some schools, especially former Model C schools, parents value their children’s education, and they are ready to assist in any way possible. Some parents, because of their educational background, can help their children with their class work and can also afford to have personal resources to use at home. This is quite the opposite of what is obtained in other schools where parental support is non-existent.

Plagiarism was singled out as a problem when learners do their assignments or projects at home; either they do not do it and then copy from the one learner who does the work, or parents do the work for the children. Absenteeism was one of the factors that affected the smooth running of teachers' work as learners stayed home for no valid reason and lost out on their learning. (*cf.* Chapter 4, Section 4.4.1).

5.2.5 Main Research Questions: How effective is continuous assessment method in teaching and learning mathematics?

Regarding the main research question, the study confirmed that teachers have little knowledge of continuous assessment and its approaches as aligned in the CAPS document. Most participants felt that policy adjustments negatively impact the implementation of continuous assessment as they demand 60% of learners to achieve 50% or better in mathematics while condoning mathematics, rendering it not important. Teachers believe that if properly implemented, continuous assessment has the ability to produce competent and quality learners. However, the evaluation system is littered with challenges that render it less effective (Abera, Kedir & Beyabeyin, 2017).

Curriculum coverage was singled out as a challenge as the teacher has to focus on covering the curriculum regardless of how much learners have grasped the content as the focus is on completing formal assessment for recoding (*cf.* Chapter 4. Section 4.5.3). In addition, the ATP is religiously followed by participants who feel that it prevents them from being creative. Participants reported that the curriculum is overloaded and administration work is time-consuming. They were also concerned about the lack of resources to properly implement continuous assessment in order for it to become effective.

A further challenge is the lack of parental involvement, as parents are not supporting their children with homework, assignments and projects which should be completed at home. Parents are not involved in their children’s education so much of the teaching and reinforcement is left in the hands of the teacher (*cf.* Chapter 4, Section 4.5.3) as well as absenteeism which parents do not control. Absenteeism, plagiarism, overloading of admin work, lack of adequate time to effect intervention, and general lack of skills to implement continuous assessment were some of the prominent

findings which came to light. Continuous professional development on continuous assessment was also lacking (*cf.* Chapter 4, Section 4.4.1)

5.4 RECOMMENDATIONS

After analysing the data collected from the ten participants, several findings are made that could be useful to the stakeholders in the education fraternity. These recommendations were made on how to ensure that continuous assessment becomes an effective tool in the mathematics teaching and learning process.

5.2.4 Recommendations to the Department of Basic Education

- It is recommended that realistic and feasible goals are set by the Department of Basic Education and should correct the policy contradictions; for example, set a target of 60% of learners to attain 50% or better only to condone mathematics at the end of the year, pushing learners to the next grade. With the thrust of promoting the teaching and learning of mathematics, contradictions like these will work against such essential policies. Reasonable goals must be established to motivate teachers and learners to work hard and achieve the target.
- It is recommended that time allocation for teaching and learning is revisited: attention must focus on teaching and learning instead of assessment because most of the time, teaching and learning are cut short so that schools can meet the deadline for the submission of results.
- It is recommended that there is continuous teacher development: Workshops should be held more regularly and should focus on imparting mathematics subject content as opposed to the current setup where the focus is on assessment. Newly appointed teachers fresh from universities should be orientated to be able to function in continuous assessment without any doubts.
- It is recommended that interventions are arranged: Schools need remedial
- teachers who focus on mathematics as this will ensure that the remedial teacher dedicates time and resources to addressing the weaknesses of the learners. The system will benefit from learners who have developed the right mathematics knowledge and skills.

- ❖ It is recommended that resources are made available: resources in many schools are inadequate and technology needs to be incorporated into teaching and learning. Some schools lack adequate resources to meet the latest trends, and even if financial resources are available, it is the Department's responsibility to ensure schools have the relevant and necessary resources. Mathematics needs all the resources to ensure the mathematics classroom is vibrant and meets the curriculum goals.
- ❖ It is recommended that the teacher/pupil ratio be reduced so teachers can give individualised attention to learners and have more time with learners.
- ❖ It is recommended that parents become more involved: The Department must educate parents on the importance of their presence or involvement in their children's education. The Department could have road shows now and again and speak to parents and the School Governing Bodies on the importance of their involvement in their children's education, parents must feel part of a school and its development There is little to no support from parents in their children education especially from schools who are in Quintile 1-3 schools.

5.5.2 Recommendations to Teachers of Grade 5 Mathematics

- ❖ It is recommended that Mathematics teachers develop their lesson plans that reflect the aim and objectives as well as lesson reflections. Lessons must be prepared in advance for a smooth flow of lessons. Teachers must remember that continuous assessment, which is integral to the teaching and learning process, is learner-centred to facilitate growth and motivation in learners.
- ❖ It is recommended that teachers ensure that content delivery is the most important tool that can develop learners' knowledge and skills and allow them time to acquire knowledge. Feedback must be timely and meaningful for remedial action to be taken to assist learners where necessary. Record keeping is important for the development of the learner and continuous evaluation by other teachers. Formative assessment is at the heart of continuous assessment which encourages teachers to assess learners before teaching which helps teachers to know where learners are what to improve and how to approach their lessons.

- ❖ It is recommended that from teacher suggestions as the curriculum changes, teachers must also evolve as they are the drivers of the curriculum. Teachers should incorporate technology to enhance teaching and learning in their classrooms.
- ❖ It is recommended that teachers to understand continuous assessment and how it functions so they can produce quality learners and address the issue of poor performance in mathematics. They must be aware of the mathematics approaches aligned in the CAPS document as this can help learners perform better and effectively.
- ❖ The research findings suggest that teachers need support when it comes to continuous assessment implementation and administration in mathematics teaching and learning. They must keep abreast of its functions and benefits to the teacher and learners so it becomes an effective evaluation system in the Grade 5 mathematics teaching and learning process.

5.5 LIMITATIONS OF THE STUDY

This study was conducted to create the most reliable and credible data possible; however, some limitations must be considered, especially when working with people. In case studies, there is a limit to the number of participants that participate. Only ten participants participated in this study, so the data findings were based on the perception of these ten participants. When the researcher started data collection, the Department of Basic Education had also started TIMSS research targeting Grade 5 learners in mathematics, which coincided with my data collection targeting the same grade. Some schools designated for TIMSS were reluctant to participate in data collection, citing work overload for their teachers. The researcher could sense air of reluctance from participants because they felt pressured between this study and TIMMS as the two very important activities ran during the same period. The participants drawn from the population were never before exposed to such an academic research activity so they were unsure what to expect. This resulted in participants being uncomfortable initially. The authorisation letter from the Northern Cape Department of Education intimidated them from opening up but the intervention and assurance by the researcher that their identities and privacy will be uphold throughout the research. The reason for carrying out this study was to find out if

continuous assessment is an effective evaluation method in the teaching and learning of mathematics in Grade 5 and if the findings should work as a source of further research opportunities.

5.6.1 Hawthorne Effect

Like most research, this was caught up in the furore of the Hawthorne effect. The Hawthorne effect occurs when a participant changes his/her behaviour because he/she is conscious that he/she is in the spotlight (McCambridge, Witton & Elbourne, 2014). Although insignificant, it is worth noting that some of the participants were found to be under the influence of the Hawthorne effect. However, the researcher tactically managed to sway this so that the participants relaxed and responded as naturally as possible.

5.6.2 Time Intensive

The researcher strove to ensure reliability by ensuring that the sample from teachers who have first-hand in-depth knowledge of continuous assessment in teaching mathematics. In achieving this, the researcher ensured that the sample's complexion mirrors the population's diversity, resulting in an expansive geographical area, which meant much travelling for the researcher, rendering the research time-consuming. Time-consuming was one of the limitations of the research, which was inherited from the case study design. Data analysis in this research was tiresome and time-consuming as the researcher had to deal with a lot of information resulting from a lot of data being collected (Hearn, Clarkson & Day (2020). The information had to be examined, and only relevant data to be retained, especially on the interviews. also, triangulating the data took a lot of time.

5.7 SUGGESTIONS FOR FURTHER RESEARCH

Having outlined the recommendations to the Department of Basic Education, the researcher found room for further research to improve the teaching and learning of mathematics.

- Mathematics is essential for the country's socioeconomic development; to address this challenge, an in-depth analysis of the causes of low mathematics performance should be instituted.
- There is a need to investigate the lack of parental involvement and how parents can participate in their children's learning because the school cannot do it alone.
- Research should be done to determine how teacher development can be improved for prospective mathematics teachers.
- Teacher development should be careful and particular to produce a teacher who can promote continuous assessment and ensure the successful implementation of the CAPS (2011) curriculum.
- Researchers should ensure that there is enough literature on continuous assessment so that teachers have access to information when needed.
- This study explored the effectiveness of continuous assessment in teaching and learning of mathematics in Grade 5 in the Frances Baard District. A similar study could be conducted in other districts or provinces and with different subjects to compare outcomes. Subject advisors and Departmental heads could get involved for more in-depth and wide variety of opinions.

5.8 A FINAL WORD

Mathematics is an essential subject in the curriculum but is also surrounded by myths, making many learners consider it complex. Adequate information is needed for teachers to be fully equipped to teach it successfully. This study on the effectiveness of continuous assessment in mathematics teaching and learning aimed to contribute to mathematics teaching, especially in Grade 5. Teachers displayed that they are receptive to new ideas and ways to improve the way mathematics is taught. Mathematics teachers across the experience divide were excited to share their experience in implementing continuous assessment. The road to unearthing valuable information was littered with hindrances but was very fulfilling.

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APPENDICES

Appendix A: Ethical Clearance Certificate

UNISA university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2023/06/07

Ref: **2023/06/07/47970960/20/AM**
Name: Ms F Musungwa
Student No.:47970960

Dear Ms F Musungwa

Decision: Ethics Approval from 2023/06/07 to 2026/06/07

Researcher(s): Name: Ms F Musungwa
E-mail address: 47970960@mylife.unisa.ac.za
Telephone: 083 348 8406

Supervisor(s): Name: Dr S.B. Mahlambi
E-mail address: Emahlasb@unisa.ac.za
Telephone: 012 429 2629

Title of research:

The effectiveness of continuous assessment in teaching and learning of mathematics in Francis Baard District.

Qualification: MEd Curriculum and Studies

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2023/06/07 to 2026/06/07.

*The **medium risk** application was reviewed by the Ethics Review Committee on 2023/06/07 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher will ensure that the research project adheres to the relevant guidelines set out in the Unisa Covid-19 position statement on research ethics attached.
2. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

University of South Africa
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3. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
4. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
5. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
6. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
7. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
8. No field work activities may continue after the expiry date **2026/06/07**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number **2023/06/07/47970960/20/AM** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Kind regards,

Prof AT Motlhabane
CHAIRPERSON: CEDU RERC
motlhat@unisa.ac.za

Prof Mpine Makoe
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Appendix B: Ethical Clearance Certificate – NCDE

IK Nkoane Education House

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Private Bag X5029
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Republic of South Africa

Tel: 053 839 6500
Fax: 053 839 6580/1
Web:ncdoe.ncpg.gov.za

DEPARTMENT OF EDUCATION

Enquiries: J N Horne
Contact No.: (053) 839 6757
Reference: L2.10.2.4.3
Date: 27 June 2023

P.O. Box 64
Magogong
8575

Dear Ms. F. Musungwa

APPROVAL TO CONDUCT RESEARCH

The aforesaid matter with, Ref: L2.10.2.4.3, bears reference.

This letter serves to indicate that approval is granted to conduct research for the dissertation titled: **"The Effectiveness of Continuous Assessment in Teaching and Learning of Mathematics in South Africa, Frances Baard District".**

The onus rests with you as the researcher to arrange appropriate and relevant time schedules with the sampled teachers in order to conduct the research. A copy of this approval letter must be presented to the school (Principal and SGB) and the District Director as proof that permission for the research has been granted.

The following conditions must be strictly applied during the conduct of your research in the Northern Cape Department of Education (NCDoE). Approval may be withdrawn should any of the conditions listed below be flouted.

Criteria for approval	Comment
Value of the proposed research	The research topic covers a policy position of the Basic Education Sector and thus has value. This study aims to explore how Mathematics teachers understand and apply Continuous Assessment in their classrooms.
Policy and Strategic Alignment	The research is aligned to policy and to the Medium Term Strategic Framework (MTSF). The outcome of the research serves to assist in teacher development which falls within the ambit of the priorities of the Basic Education Sector.
Potential benefits to the NCDoE	The NCDoE would benefit from the research as empirical evidence would be available that is derived

	from the Northern Cape experiences.
Contribution to the knowledge base and literature in the Basic Education Sector	The Research Report findings will contribute to the knowledge base and literature of the Basic Education Sector as it seeks to extend the existing literature on Continuous Assessment strategies that can be adopted to improve the quality of Mathematics teaching and learning.
Appropriateness of the methodology adopted	The researcher will adopt an Interpretivist paradigm which is anchored within a qualitative research approach.
Ethical Considerations	Ethical clearance was granted by the Ethics Review Committee of the College of Education of the University of South Africa (UNISA). The research study will adhere to ethical principles namely voluntary participation, informed consent, anonymity, confidentiality, no harm to participants, confirmation that the study is free of plagiarism and that results are accurately represented.
Accountability	The accountability is as per NCDoE Research Guidelines.
Conditions to be agreed by the applicant	The conditions to be adhered to are as per NCDoE Research Guidelines.
Types of Research	Qualitative Research has been identified by the researcher which includes face-to-face semi-structured interviews, non-participatory observations and questionnaires. Grade 5 Mathematics teachers from ten schools in the Frances Baard District, have been sampled for the study.
Datasets	No dataset was requested by the researcher.

This approval is subject to the submission of a copy of the final research report as well as a presentation on the purpose, findings and recommendations of the research to relevant NCDoE officials and the schools concerned.

The Northern Cape Education Department wishes you well in this important undertaking and is looking forward to examine the findings of your research study.

Kind regards

MS M MARAIS
HEAD OF DEPARTMENT

12.07.2023
DATE

Appendix C: Participant Information Sheet

PARTICIPANT INFORMATION SHEET

Date: _____

Title: The Effectiveness of continuous assessment in Teaching and Learning of mathematics in Frances Baard District.

DEAR PROSPECTIVE PARTICIPANT:

I Furasiya Musungwa am doing research under the supervision of Dr Mahlambi S.B Senior lecturer in the Department of Curriculum and Instructional Studies at the University of South Africa (UNISA), studying towards a Master of Education (Med). We have no funding to sponsor this study. We are inviting you to participate in a study entitled: The Effectiveness of continuous assessment in Teaching and learning of Mathematics in South Africa.

WHAT IS THE PURPOSE OF THE STUDY?

The study is expected to explore the challenges being faced by teachers in implementing continuous assessment in teaching and learning of mathematics in order to produce quality learners.

WHY AM I BEING INVITED TO PARTICIPATE?

You are invited because you are currently teaching mathematics, you have relevant knowledge in the use of continuous assessment in the teaching and learning of mathematics in grade 5. I obtained your details from your school Principal. The total number of participants is 20 (n=20)

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

You are expected to respond to face-to-face semi-structured interview questions. To achieve this end, an audio recorder will be used, which will later be transcribed. During the interview, you will be expected to respond to questions about how you are

implementing continuous assessment in grade 5 mathematics teaching and learning in line with signing the consent form—teacher's demographic information. Methods and approaches for continuous assessment, challenges and benefits of continuous assessment approaches and strategies to improve teachers' proficiency in using continuous assessment in mathematics. A study report may be submitted for publication, but individual participants will not be identifiable in such a report.

HOW WILL THE RESEARCHER PROTECT THE SECURITY OF DATA?

The researcher will store hard copies of your responses under lock and key for not less than five years in the supervisor's office and or the researcher's home for future research or academic purposes. Electronic copies of the research will be stored in a password-protected computer. Future access to the stored data will be subjected to approval from the Research Ethics Review. Hard copies will be shredded if deemed necessary, and electronic copies will be permanently deleted from the hard drive using the relevant software.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

You will not receive any payment for taking part in this research.

HAS THE STUDY RECEIVED ETHICS APPROVAL?

The research has received Ethical approval from the Ethics Review Committee of the UNISA CEDU research ethics. A copy of the approval letter can be accessible as and when it is needed by the researcher.

HOW WILL I BE INFORMED OF THE FINDINGS/ RESULTS OF THE STUDY?

If you want to be informed of the final research findings, kindly contact Furasiya Musungwa at 0833488406 or e-mail 47970960@mylife.unisa.ac.za. The findings can be accessed for three years.

Should you have concerns about how the research has been conducted, contact Dr Mahlambi S.B. at 012 4292 629 or e-mail Emahlasb@unisa.ac.za.

Thank you for taking part in this study and reading the information sheet.

_____

(insert signature)

_____

(type your name)

Appendix D: Interview Questions

SEMI-STRUCTURED INTERVIEWS QUESTIONNAIRE

The effectiveness of continuous assessment in teaching and learning mathematics in Frances Baard District.

DEAR PROSPECTIVE PARTICIPANT:

I, Furasiya Musungwa, am doing research under the supervision of Dr Mahlambi S.B., a Senior lecturer in the Department of Curriculum and Instructional Studies at the University of South Africa (UNISA), studying towards a Master of Education (Med). I would like to know if you have read and signed the consent form as a study participant. Please indicate by saying Yes or No before we proceed with the interview. You are requested to respond to four main questions.

Question 1: Teacher demographic information.

1.1 State your name, gender and school name.

1.2 How long have you been working as a teacher?

1.3 May you please indicate your highest qualification.

1.4 How long have you been teaching mathematics?

1.5 Indicate the Grades you have taught mathematics.

1.6 Have you been trained on how to implement assessment in mathematics?

1.7 Was the training beneficiary?

1.8 If yes, Yes/No, how?

QUESTION 2: Methods or approaches used for continuous assessment.

2.1 What is your understanding of the term assessment regarding classroom teaching and learning?

2.2 What are the types of assessments prescribed in the CAPS document?

2.3 What is the importance of each type in the teaching and learning of mathematics in Grade 5?

2.4 What is your understanding of Continuous Assessment?

2.5 Do you think Continuous Assessment assists you in meeting the educational goals in the Mathematics CAPS document?

2.7 If Yes/No, how?

2.8 Are there any specific Continuous Assessment approaches you think are assisting you in improving mathematics teaching in Grade 5?

2.9 Can you elaborate on one?

2.8 How do you develop mathematics assessments for your learners?

Question 3: Benefits and challenges of continuous assessment approaches.

3.1 Do you have the relevant CAPS document for mathematics?

3.2 Is the CAPS document or any other assessment-related document clear on what Continuous Assessment is?

3.3 How does the CAPS document suggest CASS should be implemented in mathematics?

3.4 What do you think are the benefits of continuous assessment to the:

a. Learner

b. Teacher

3.5 Do you experience challenges when implementing continuous challenges in your mathematics classroom? Mention them.

3.6 How do these challenges impact the teaching and learning of mathematics in Grade 5?

3.7 How do the challenges you mentioned impact the learners' performance in your class?

3.4 Do you have adequate resources to administer continuous assessment?

3.5 Have you been equipped to administer Continuous Assessment in your classroom?

Question 4: Strategies to enhance teachers' proficiency in using continuous assessment in mathematics.

4.1 Have you received any training on the use of Continuous Assessment in mathematics?

From whom did you receive the training?

4.2 Did the training equip you with the skills necessary to use continuous assessment in your class?

4.3 What was missing from the training you received?

4.4 Do you have internal assessment workshops/developments run by the school or the government?

4.5 If yes, are they effectively reskilling you on continuous assessment-related matters?

4.6 If no, why do you think the school is not helping you with this issue?

4.7 Which other stakeholders can assist you with continuous assessment implementation in mathematics?

Appendix E: Observation Sheet

NON-PARTICIPANT OBSERVATION SCHEDULE

The effectiveness of continuous assessment in teaching and learning of mathematics in Frances Baard District.

DEAR PROSPECTIVE PARTICIPANT:
I, Furasiya Musungwa, am doing research under the supervision of Dr Mahlambi S.B, Senior lecturer in the Department of Curriculum and Instructional Studies at the University of South Africa (UNISA), studying towards a Master of Education (Med). I would like to know if you have read and signed the consent form as a participant in this study. Please indicate by saying Yes or No before we proceed with non-participatory observation. There are nine (n=9) main items to be observed: Lesson plan, ATP/RTP, and CAPS document. Learners' books, portfolios, teaching methods/approach, and challenges encountered by the teacher when conducting a lesson using continuous assessment. To record, a pseudonym will be assigned to the names of schools and teachers.

Name of school	
Name of Teacher	
Grade	

Criteria	**Possible Answers**
1. Were the learners assessed during the lesson?	Yes☐ ☐
- State the strengths observed - State the weaknesses observed	
2. What type(s) of assessment(s) were learners engaged with?	☐ Baseline ☐ Diagnostic ☐ Formative ☐ Summative
3. What are the forms of assessment learners were engaged in?	**Formal Assessments** ☐ Test ☐ Assignment ☐ Investigation

	☐ Project Informal Assessment ☐ Classwork ☐ Homework ☐ Oral activities
4. How did learners complete the assessment?	☐ Individual ☐ Group
5. How was feedback given to learners?	☐ Verbal ☐ Written ☐ Class ☐ Individual
6. Which classroom factors influenced the completion of assessment activities?	
7. Which area of improvement is needed for the teacher regarding CASS implementation?	

Appendix F: Interview Transcript

THE EFFECTIVENESS OF CONTINUOUS ASSESSMENT IN TEACHING AND LEARNING OF MATHEMATICS IN FRANCES BAARD DISTRICT.

1. State your name, gender, and school name.

My name is (name withheld). I am a male person; the school's name is (name withheld)

2. How long have you been working as a teacher?

27 years now.

3. Could you please indicate your highest qualification?

I have an A.C.E, Advanced Certificate in Education in Mathematics, from the University of Western Cape.

4 How long have you been teaching mathematics?

27 years

5. Indicate the grades you have taught mathematics.

4, 5, 6, 7, 8 thus far.

6. Have you been trained on how to implement assessment in mathematics?

Yes. The D.B.E organises the trainings, and I also learned about assessment at Western Cape University.

7. What is your understanding of the term assessment as it relates to classroom teaching and learning?

The term assessment is a process of checking whether teaching and learning is taking place. It is a tool that is used to measure if what you are doing is reaching the learners. What you are doing on a daily basis can be done informally or formally. I develop my assessments from what I have taught in class; I cannot just develop assessments from the ATP based on those requirements.

8. Do you think CASS is helping you meet the educational goals contained in the mathematics CAPS document?

Yes, it does; it is a measuring stick; we have time frames allocated in the A.T.P and CAPS document. You can see if you are leaving the kids behind or if they are moving with them. CASS assist big time because you can assist learners during the term and wait until the end of the term, which will make learners fail.

If it is done continuously, you will pre-empty whether the learners will fail or not and be on time so you can assist the learner on time. CASS is good as it works as a measuring stick. The AT P and CAPS document does not put pressure on teachers. According to me, I must expose learners to the ATP and be able to cover the topics prescribed in the ATP. The teacher must cover the curriculum as well as accommodate slower and faster kids. Though you find some pressure, it should not be as it goes with the job. Planning is very important in teaching; do a baseline, and you will know learners and plan properly, and on time, you will be able to spread around.

9. Do you experience challenges when implementing CASS in your mathematics classroom?

In our environment, learners come from low backgrounds where the school is not valued or their level of education is low, so parental support is a problem for us. When we give formal assessments, even homework, most learners do not do it because of the above-mentioned factors. They will copy from one learner who did their work. As a result, you will mark one learner's work in 10 learners, which is not a true reflection of whether the learner knows what you taught. The D.B.E. is trying to do formal assessments at school to prevent plagiarism. Some courses can be adequate, but there is always room for improvement. Our kids struggle to do investigations at home as they do not have the resources to do so.

10. What are the benefits of CASS approaches?

CASS as a system shows you as a teacher whether you are going or coming. Shows you as a teacher if you are reaching learners. As an institution, if teaching and learning are taking place by monitoring, Department Heads monitor and chequebooks, and if there are no activities, there are no teaching and learning taking place, and they also monitor files. Through CASS, the department can see if the school is functioning and if teaching and learning are taking place because you cannot assess what you did not teach. CASS works better because you must have a number of tasks to perform, and if you do it properly and continuously, it is the best system.

Appendix G: Proof of Editing

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THE EFFECTIVENESS OF CONTINUOUS ASSESSMENT IN TEACHING AND LEARNING OF MATHEMATICS IN THE FRANCES BAARD DISTRICT

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