



UNIVERSITY OF
MPUMALANGA

Creating Opportunities

**PARENT-TEACHER COLLABORATION IN TEACHING
GRADE 3 MATHEMATICS USING CELL PHONES AT A
SELECTED SCHOOL IN MPUMALANGA**

by

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UNIVERSITY OF MPUMALANGA

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DECLARATION

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DEDICATION

I dedicate this study to my late parents, Vhamiya Mathebula and Lucas Mathebula, who, although they were not educated, valued education and ensured that I got educated.

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ABSTRACT

This study aimed at designing a strategy to improve the teaching and learning of mathematics among Grade 3 learners using cell phones with the collaboration of parents and teachers. The challenge of improving the teaching and learning of mathematics is prevalent in primary schools, especially in Grade 3 classes, which are exit classes from the Foundation phase to the Intermediate phase. Conducting this study was necessary because mathematics is one of the critical subjects in primary schools through which, when a learner fails, they fail the grade. This study was conducted to find a strategy that can be used to enhance the teaching and learning of mathematics.

The theoretical framework that informed the study is posthumanism because it is concerned with hybridization between humans and non-humans and opening discourses that examine what it is to be human and critically question the concept of the human on the improvement of human capabilities using advanced technologies. The focus is on using technologies (the cell phone) in teaching and learning mathematics among Grade 3 learners. The study conceptualization is based on the theory of connectivism. Connectivism accepts that technology plays a significant role in the teaching and learning process, suggesting that our constant connectedness allows learners to choose their learning. Furthermore, the connectivist lens contributes to the study by bringing a fresh and new understanding of teaching and learning using technology devices brought about by the study.

This study adopted a participatory action research methodology because it can alter established research paradigms and redefine the role of research participants, referred to as co-researchers in this study. According to participatory action research, this transforms kids into active researchers and change agents. To alter societal conditions, the marginalized and oppressed must find answers to the problems that impact them, which is the core focus of participatory action research. In this study, engaging in participatory action research using posthumanism theory and connectivism as a conceptual framework provided the language and opportunities to articulate the direction for ongoing research and to establish the available possibilities present that can be solutions to other challenges experienced within society.

Data were analysed in the study using critical discourse analysis. The information included pictures, audio and video recordings, student workbooks, documents, and reflections from other researchers. Data were analysed at three levels: textual, discursive practice, and social structure. Because CDA facilitates the analysis of issues directly experienced by co-researchers, it was employed to analyze data in this study.

The study investigated possible solutions to the problems and conducive conditions for the strategy. Furthermore, the study analysed and presented possible ways to circumvent the threats and risks that could hinder the successful implementation of the strategy. The findings were presented, the indicators of success were identified, and recommendations were made.

LIST OF ABBREVIATIONS/ACRONYMS

CAPS	Curriculum and Assessment Policy Statement
CDA	Critical Discourse Analysis
ICT	Information and Communications Technology
IWB	Interactive Whiteboard
PAR	Participatory Action Research
QMS	Quality Management System
SMT	School Management Team

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CHAPTER 1 :

OVERVIEW OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND TO THE STUDY

This study formulates a strategy to improve mathematics teaching and learning among Grade 3 learners using cell phones with the collaborative support of parents and teachers. In Norway, Aouad and Bento (2020:3) argue that parent-teacher collaboration is part of an emergent network structure guided by the complexity theory. In Kenya, parent-teacher collaboration is driven by the Competency-Based Curriculum (CBC), which follows Vygotsky's social constructivism theory (Mwarari, Githui & Mwenje, 2020:202). The *South African Schools Act (SASSA)* (RSA,1996) provides for parental involvement guided by Epstein's model of parental involvement (Samuel-Okoyel, 2021:17; Munje & Mncube, 2018:81). The mathematics curriculum focus on Norway, Kenya, and South Africa, is on oral, writing or writing, reading, numeracy, digital skills, numbers, measurement, geometry, number operations and relationships, patterns, functions and algebra, space and shape, and data handling (Republic of Kenya, 2017:10; Mullis, Martin, Goh & Cutter, 2015:2; DBE, 2011:10-11). The cell phone is an integrated computer that allows web browsing and running software applications (Bala, 2020:1635). The use of cell phones in education still needs to be studied extensively (Bjørngen, Fritze & Haugsbakk, 2021:2). Therefore, based on the above, this study looks at how cell phones can assist the teaching and learning of mathematics Grade 3 with collaboration between teachers and parents.

Several challenges may deter the effective integration of cell phones in teaching mathematics to Grade 3 learners. At times, the ministry of education has a negative attitude towards both parents and teachers, regarding them as a disruptive and unwanted tools (Ngesi, Landa, Madikiza, Cekiso, Tshotsho & Walters, 2018:2). This attitude remains a challenge in many countries, including Norway (Bjørngen et al., 2021:2) and South Africa (Mwapwele, Marais, Dlamini & Van Biljon, 2019:7). In Kenya, older teachers face challenges when using ICT for teaching and learning due to their age (Ogabo, Omulando & Barasa, 2019:169). Lack of ICT infrastructure, policy development, and teachers' inability to use cell phones for teaching are also challenges (Wambiri & Ndani, 2016:12). Literacy levels of parents in rural areas make

for limited supervision. They are unable to assist or reinforce their children's learning (Munje & Ncube, 2018:82). Exposure to harmful or unwanted content that might affect children psychologically and prolonged use of digital devices causing physiological challenges are serious challenges (Bala, 2020:1636; Vrcelj, Hoic-Bozic & Dlab, 2020:4). Hence this study aims at identifying the challenges faced by teachers and parents when using cell phones in teaching and learning mathematics in Grade 3.

There are various ways in which the challenges have been mitigated. Attitudinal challenges can be overcome by changing the mindset of both teachers and parents (Ibrahim & Kadiri, 2018:9). According to Bala (2020:1637) and Wambiri and Ndani (2016:3), self-efficacy, deliberate quest, and curiosity to learn computer basics should be the driving force towards using cell phones and other technologies because the search engine in the cell phones enables learning (Wambiri & Ndani, 2016:3). They further suggest that teachers need to review their approach to pedagogy to minimize evolving learner behaviour that may come when using cell phones for teaching and learning. The following strategies are suggested by Ibrahim and Kadiri (2018:9): consent from a parent to use cell phones at school, mandatory keen observation by the teacher to avoid diverting attention to other things, and careful planning that ensures that cell phones are only used for learning. Aumentado (2021:78) suggests re-aligning the education system and the school to cater to all learners' needs. Zahra and Alanzi (2019:152) believe that further research must be conducted to determine the best health education techniques and parental awareness. Education departments and schools should advocate for and promote the integration of cell phones in education by ensuring policy development, funding, teacher training and programming content in cell phone applications (Samuel-Okoyel, 2021:17).

To use cell phones efficiently and effectively, parents and teachers need to work together (Domina, Renzuli, Murray, Garza & Perez, 2021:2). Research indicates that school policies and practices set a platform for families to build relationships using a broad array of digital devices (Viberg, Grönlund & Andersson, 2021:23). This helps parents to have access to relevant information and, as a result, develops social capital between home and school (Domina et al., 2021:3). Teachers get assistance with developmental opportunities to maximize the effects of mobile devices to use in the teaching and learning process of the mathematics curriculum when parents and teachers collaborate (Aumentado, 2021:63). The concept of learning anywhere

anytime using a cell phone can be made effective by mobile applications like WhatsApp, Facebook, and Twitter, where learners can interact with both parents and teachers from a distance (Shumba, Chaamwe & Chimanga, 2020:1). To create a conducive environment for using cell phones when teaching and learning mathematics in Grade 3, parents need to provide social support that will foster average screen time to avoid physiological and psychological challenges that come with the excessive use of cell phones (Lissak, 2018:154). The study aims to bring conducive conditions that allow for the use of cell phones in teaching and learning mathematics.

Some threats come with using cell phones in teaching mathematics for Grade 3 with the collaborative support of parents and teachers. These include lack of cooperation, lack of communication between parents and teachers, both teachers' and parents' poor planning, lack of self-efficacy on the side of both teachers and learners and appropriate use of cell phones and technological factors (Wambiri & Ndani, 2016:2). Parent-teacher collaboration is of great importance to connect meaningful contexts for strengthening children's learning. According to Hoyles (2018:1), mathematics teachers must be part of the transformative processes that transform mathematics teaching using digital technologies. This study is vital to identify the possible threats that may pose challenges to the usefulness of this strategy. Global threats that affect using cell phones when teaching mathematics in classrooms include Prejudice and resistance. However, the United Nations Education, Scientific and Cultural Organization (UNESCO) promotes the use of cell phones in education (Kőrösi & Esztelecki, 2015:99). A need for sound mathematical pedagogical approaches are vital to help teachers design effective learning experiences to produce transformation in the teaching and learning of mathematics with the successful use of digital technologies (Wambiri & Ndani, 2016:3). Using cell phones to teach mathematics results in teachers and learners sharing collaborative learning activities in varying contexts; the use of cell phones and related technologies allow learners to access and download learning material that can be used offline (Ndume, Songoro & Kisanga, 2020:224). In Norway, they use math trails with the assistance of other digital technologies like cell phones with applications like Google Maps; to improve the teaching and learning of some mathematics concepts and to emphasise the extracurricular playful learning using concepts of mathematizing and mathematical modelling (Fessakis, Karta & Kozas, 2018:50). In Kenya, the collaboration between parents and teachers is of vital

importance as it enhances the practical, healthy academic and psychosocial and social development of the learners (Mwarari et al., 2020:201). It also allows for a properly managed school environment, shared responsibility between parents and teachers and effective exchange or communication between parents and teachers (Javier & Jubay, 2019:201). This study focuses on the conditions that bring about the strategy's effectiveness.

Investigating the benefits of using cell phones in the classroom to teach Grade 3 mathematics is necessary to explain how parents' and teachers' collaboration can improve teaching and learning. Even though it may be seen as an essential avenue that has the capability of weakening the divide between the poor and the rich in society and thus providing equal education for all, research indicates that the use of cell phones for learning in South Africa and other countries has its challenges (Shumba et al., 2020:1; Ngesi et al., 2019:2). It remains a fact that cell phones are potential educational tools that can facilitate education productively when used responsibly (Mwapwele et al., 2019:7). This study seeks to identify challenges associated with using cell phones in teaching and learning mathematics in Grade 3, find solutions to the challenges, and identify possible threats. It seeks to find evidence that answers to the problems does work.

1.2 PROBLEM STATEMENT

According to Jojo (2019:1), teaching mathematics is crucial as it provides essential insights into fundamental principles of life that are applied globally and locally; however, teaching mathematics remains a challenge in South Africa. Jojo (2019:1) further indicates that mathematics teaching in most South African schools has been classified to be among the worst performing in the world. As a result, this study proposes using cell phones to improve the learning and teaching process of mathematics Grade 3 with the collaborative support of parents and teachers. Studies have shown that parent-teacher collaboration significantly enhances teaching and learning (Wambiri & Ndani, 2016:3). Furthermore, studies indicate that using cell phones dramatically improves performance, enhancing cognition and independent learning (Ngesi et al., 2019:2; Hoyles, 2018:210). Further research still needs to be undertaken on this subject; upon this background, this study aims to formulate a

strategy to improve the teaching and learning of mathematics in Grade 3 with the collaborative support of parents and teachers.

Based on the above discussion, the research question that the study is attempting to answer is:

How to improve the teaching of Grade 3 mathematics using cell phones with the support of parents and teachers?

In response to the research question, this study aims to formulate a strategy to improve the teaching and learning of Grade 3 mathematics using cell phones with the collaborative support of parents and teachers. This aim can be made operational and achievable by dividing it into the following objectives:

1. To investigate the challenges of teaching and learning Grade 3 mathematics using cell phones with the support of parents and teachers;
2. To explore solutions to challenges of teaching and learning Grade 3 mathematics using cell phones with the support of parents and teachers;
3. To analyze conducive factors for teaching and learning Grade 3 mathematics using cell phones with the support of parents and teachers.
4. To identify possible threats when using cell phones to teach Grade 3 mathematics with the support of parents and teachers and find ways of overcoming them; and
5. To investigate whether the solutions to the challenges identified are effective.

1.3 THEORETICAL FRAMEWORK

The theoretical framework that guides this study is posthumanism. The posthumanist-human relationship is based on the assumption that it questions us about what confronts us and how we respond to those questions (Bayne, 2018:1). Furthermore, Posthumanism advances the rhetoric that “When we can no longer rely on the 'human' as an autonomous, rational being who provides an Archimedean point for knowing about the world” Wolfe (2009, in Pollock, 2011:235). Posthumanism challenges the exceptionalism of humans and the fundamental role of humanity constructed in modernity (Bayne, 2018:1).

Posthumanism is relevant for this study because of its focus on the complete contamination and hybridization of human beings with other living beings and machines (Valera, 2014:486). Valera (2014:486) further explains that posthumanism understands technology as one of the many practical ways to reach a not purely technology end by embracing the symbiotic relationship between technology and people. But, Posthumanism is embedded in cybernetics and information, wherein cybernetics is concerned with laying bare what biological and non-biological systems share with humans, animals, and machines (Mahon, 2017:31). This study focuses on using cell phones, which are technological devices to assist the teaching and learning of mathematics Grade 3 with the collaborative support of parents and teachers.

Posthumanism concerns itself with the notion of social justice in education in its social and environmental form relating to the following themes: our technological essence, our bodily relationship to ourselves and nature, our relationship with the world, and our relationship with intelligent systems the like 5G mobile systems (Peters, 2020:583). Posthumanist theorists propose a complete reconfiguration and new approaches and changes in what is being studied in educational fields (Bolter, 2016:7).

1.4 CONCEPTUAL FRAMEWORK

The conceptual framework that guides this study is connectivism. Connectivism is a framework that helps to understand that learning in a digital age is all about making connections and using available networks. Furthermore, in connectivist environments learning is viewed as the process of exploring the network and pattern recognition (Yu, 2021:2). George Siemens first introduced this theory, which viewed traditional learning theories as inadequate and named it a digital age theory (Corbett & Spinello, 2020:2). Connectivist theory aims to find the knowledge that is in a system or organization when it is needed. Furthermore, it determines whether the knowledge is still valid or acceptable and tries to recognize whether there are links in the meta-information characterized by its autonomy, openness, connectedness, and diversity (Boyras & Ocak, 2021:1226). Connectivism, when used in the classroom, follows the following five steps: determining the teaching activities, explaining the knowledge points, group discussion, extension exercise and practice (Yu, 2021:3). Learning in the connectivist environment involves three cyclic phases: planning, cognitive processing, and

evaluation (AIDahdouh, 2021). In connectivist settings, the teacher's role is to create a learning platform and context that can help learners to construct their personal learning environments through network connections (Yu, 2021:3).

Another reason connectivism theory is chosen as a conceptual framework for this study is that it advances the idea that learning is no longer confined to school facilities and infrastructure/ classrooms. However, technology-enhanced tools and media enable new modes of learning (Kotze, 2021:15). Connectivism is a learning theory that can bring out an in-depth understanding of the learning skills that involve various technologies and tasks needed for learners to flourish in a digital era, in the same way emphasizing that learning has changed and that technology influences how we learn and where we learn (Vitoulis, 2017:4). Learners are regarded as active users of knowledge driven by the dynamic flow of information in collaboration with the environment and interaction with others (AACTE & P21, 2010:3).

In connectivist theory, learning also occurs in non-human beings and is guided by the following principles discussed by Boyraz and Ocak (2021:1124):

- In a connectivist setting, learning and knowledge production come from diverse ideas. Much emphasis is put on the need to know more and the ability to gather more new knowledge than what is already known.
- Connectivism proposes that learning and knowledge production come from human factors and non-human factors; subsequently, learning is stimulated and influenced by establishing and maintaining connections. Old and unnecessary information needs to be abandoned; and
- Students should learn new and imported information, and that database information should be appropriately linked to the right people.

There are various challenges and criticism that affects connectivism as a theory. The biggest challenge is that it is recognized as a learning theory; many scholars view it as an influential phenomenon that inspires teachers and learners to change their practice rather than being a theory (AIDahdouh, 2021). Critically, it is difficult to regard connectivism as a learning theory because it cannot be seen as a theory without significant studies that informs its development and relevance within the context of other theories; however, it is worth exploring (AIDahdouh, 2021). According to Boyraz and Ocak (2021:1127), there are still gaps in the literature regarding connectivism. As

a result, it is only proper that reflections in practice must be limited and, to a great extent, remain open to criticism.

1.5 LITERATURE REVIEW

This study is about understanding how the collaboration of parents and teachers can improve the delivery of the mathematics curriculum in Grade 3 in Mpumalanga rural primary schools. Both theory and research confirm that effective parent-teacher collaboration is a critical factor that has a more significant impact on learners' academic and social development, as parents are essential partners in ensuring effective education for their children (Van Der Wal, 2020:5). For the success of the parent-teacher collaboration, Adams, Harris, and Jones (2016:60) believe that parent-teacher collaboration should be voluntary, the need to share resources should be facilitated, responsibility in decision making, aiming towards common goals should be an objective of the collaboration, parents and teachers need to acknowledge each other's roles, they should build a relationship of that is characterized by the ability to work together, trust and respect for one another.

Cell phones are a powerful educational tool that needs to be explored extensively. Makira and Owino (2021:501) indicate that in Kenya, during the pandemic, the radio has been regarded as a tool for learning; what is interesting is that cell phones have a radio application that uses no data. Some of the most beneficial applications in a cell phone that can be used as games, tasks, and question-and-answer activities include Microsoft Forms, Kahoot, Loomen, Matific and Nearpod (Vrcelj et al., 2020:2). In Norway and other Nordic countries, the focus is on using digital technologies to teach mathematics by developing mobile applications to improve their math trails strategy that focuses on teaching realistic mathematics using Google Maps and other applications, thus making teaching, and learning mathematics fun (Buchholtz, 2020:79). In South Africa, Msila (2015:1973) believes that, in a globalized world, the use of cell phones and other technologies as well as up to date digital tools in classrooms is unavoidable and needs teachers who are confident and have effective school management. Research in Norway indicates that mobile learning is consistent with realistic mathematics; however, only a few published papers combine mobile learning and realistic mathematics. Few mobile applications adopt the realistic

approach and take advantage of mobile devices, including freedom of movement and increased interactions when learning (Fessakis et al., 2018:50). According to Buchholtz (2020:80), mathematics learning in Norway is extrinsic and expected to bring interest and joy. As a result, incorporating mobile devices in their mobile math trail bring about systematic reward containing elements of participation and gamification. Buchholtz (2020:80) further explains that the success of the Norwegian math trail application is seen when learners use their mobile devices to get digital screenshots of their solutions and enter them into their action-bound application. This study suggests a strategy that will enhance the idea of using cell phones when teaching grade 3 mathematics with the collaboration of teachers and parents: ultimately making learning mathematics easy and fun. It further proposes that more studies need to be done to explore how the cell phone can enhance mathematics education in the foundation phase.

1.6 RESEARCH DESIGN AND METHODOLOGY

This study uses Participatory Action Research (PAR) to find a strategy to use in teaching and learning mathematics in a Grade 3 classroom with the collaborative support of parents and teachers. PAR is chosen and is relevant for this study because it is an epistemological framework that reconfigures ways of knowing in the search for valuable human purposes to foster action for social justice (Galletta & Torre, 2019:1). PAR has its roots in its purpose of encouraging the people affected by the problem under investigation, who are usually the poor and deprived communities to help them look into their situations analyze the structural reasons for their oppressive conditions and therefore try to find a way out of them through practical action using the reflective cycle of collecting and analyzing data (Tetui, Coe, Nurtig, Bennett, Kiwanuka, George & Kirachoe, 2017:41).

PAR is relevant to this study because it can create forums that empower people to define their agenda, thus allowing them to improve the quality of their lives and the self-esteem of the deprived, as is the case with this study (Balakrishna & Claiborne, 2017:186). This study uses PAR because it acknowledges the location of the work, its possibility of improving the lives of people involved in the study, especially the marginalized, and the fact that it enables the people involved in the study to recognize

their personal resources and create a drive towards self-reliance (Nelson, 2017:7). Furthermore, Participatory Action Research (PAR) was chosen for this study because it encourages and advocates for active participation by the affected people to construct their new identities and find mutual solutions. PAR investigates the actual practices rather than the abstract practices of learning that involve fundamental, material, and concrete practices of particular people in particular places (Dube, 2020:141). This study aimed to formulate a strategy that will improve the teaching and learning of mathematics using cell phones, a resource that is easily accessible even to the poorest; the strategy will be formulated together with the people affected, referred to as the co-researchers following the principles of PAR.

The origins of Participatory Action Research are comprehensive and typically evolving, with its early traces going back to the time of Kurt Lewin, a Prussian Psychologist who was a Jewish refugee who grew up in Nazi Germany, John Elliott, Clem Adelman from Britain, and Paolo Freire (Orlowski, 2019:33; Nelson, 2017:2). According to Balakrishna and Claiborne (2017:187), participants in PAR are seen as active contributors who possess knowledge of the study under investigation. Furthermore, it recognizes and values people, especially as social beings within a political, economic, and social context. PAR creates space that allows one to critically reflect on a philosophical understanding of knowledge as socially produced through history, power and epistemology that recognize the liberatory impulse of critique and potential for transformation (Galletta & Torre, 2019:1).

PAR is a research method that questions the exclusive academic notions of expertise, legitimizing and prioritizing perspectives from lived experiences and situated knowledge, particularly those historically marginalized (Galletta & Torre, 2019:2). According to Asuquo and Etowa (2016:15), PAR is characterized by the following distinctive characteristics: 1) It is participatory in nature, 2) It has a democratic impulse, and 3) Its primary aims are to produce knowledge that is useful and action-oriented (Asuquo & Etowa, 2016:13). The role of the researcher in PAR is that of a facilitator, and the research process follows the following stages: planning, observation, action reflection and sharing (Balakrishnan & Claiborne, 2017:191). The principles of PAR are comprehensive, and it opens room for reflective processes and aims to transform both theory and practice (Asuquo & Etowa, 2016:13). PAR has its challenges, which include, among others, the fact that it is dominated by Western epistemologies and

methods which can be overcome by creating new spaces for knowledge systems to work together in participatory action research processes by decentering western knowledge so that it becomes more equitable to indigenous knowledge epistemologies (Balakrishnan & Claiborne, 2017:197).

According to the provincial analysis of results, the pass rate in Mathematics Grade 3 in the past three years was 83%, 84% and 86%, respectively. These mathematics results did not meet the district target of 90%; however, in their recommendations for improvement, they suggest that schools be supported with online learning, including radio and television, as well as a teacher, connection on WhatsApp, creating study groups and motivational sessions for parents, learners and teachers (Mpumalanga DoE, 2022:39).

In this study, the mathematics team and the School Management Team (SMT), after analyzing the mathematics results in Grade 3, uncovered the causes thereof and together negotiated contextualized solutions to the problem by coming up with an idea to conduct a study that will create a strategy that will improve the learning and teaching of mathematics, together with the collaboration of parents using PAR as it is relevant in this study because it allows for the researcher to mutually identify a problem with the community, and find solutions.

The mathematics team and the SMT realized that the parents of the learners work far from home and, as a result, have little or no time to assist their children with schoolwork, especially mathematics. According to the Department's subject policy, they must do classwork and homework daily. This study aimed to design a strategy that will enable the parents of these learners to work collaboratively with the teachers to tackle the mathematics curriculum. For the strategy to work, it needs all the people involved to participate in this research; hence this study followed PAR.

1.6.1 The research site

The research site for this study was a primary school in the deep rural areas of Mpumalanga province. It is a quintile one school and predominantly poor. The community is mainly migrants from Mozambique, and the area can best be described as an excluded and marginalized community. The classes are dilapidated with an

addition of four container schools that are not beneficial for productive learning. Teaching and learning conditions are generally of an inferior standard. Most of the parents of the learners in this area work on farms more than 40 kilometres away from home, compelled to leave home too early in the morning and return home very late at night. The school has Grades R–7 and an enrolment of 350 learners. It has ten teachers and two support staff members. The school and its area are fertile grounds for conducting PAR.

1.6.2 Gaining entry

A letter to the principal of the school was written. Other letters to request permission to conduct research were written to the Department of Education in Mpumalanga province and the circuit to request permission to conduct research at the school. The researcher wrote letters to the identified team members asking them to join the study. Letters of consent were written to parents of the learners involved in the study to request them to permit their children to participate in the study. The problem under investigation was explained in the letter. Their rights were explained in the letter. The team identified a study coordinator to coordinate the activities of the study and a scribe to take minutes of meetings and invite members to meetings.

1.6.3 The research team

The research team identified and established a dedicated team through negotiations with the SMT, the HoD and the mathematics team, who assisted in identifying the team of different stakeholders involved in the study. The research team comprised the school principal, the school Foundation Phase HoD, and the Grade 3 class teacher, who was responsible for lesson presentation with the assistance of the other team members. The guardians and parents of all the Grade 3 learners could collaborate with the teacher and the team members in facilitating the teaching and learning process. The collaboration reaches its focal point when parents and teachers work together, especially regarding homework and other assessment forms. The district foundation phase education specialist, commonly known as curriculum implementer, would be responsible for conducting workshops to raise awareness of the importance

of using cell phones for learning and teaching. The librarian was responsible for motivating the learners in different ways and assisted in workshopping the learners and parents about the proper use of cell phones and how to avoid cyber bullying and other crimes related to cell phone use. The school and the community librarians advised parents and learners to use the Internet for learning and provided learners with free data. The focus was a collaboration between the teacher and parents in delivering the mathematics curriculum using cell phones. The team planned a series of topics and competencies to be taught, following the curriculum as displayed in the CAPS units and daily lesson plans were planned. The teacher was observed while teaching; photos and video recordings were taken. Observation notes were taken and transcribed, followed by meetings to discuss the content covered and skills observed. Discussions on the effectiveness of the interactions and processes took place. The research team was responsible for monitoring the proceedings of the whole data generation process.

1.7 DATA GENERATION

A SWOT analysis was used to generate data, reflecting on the collected data's strengths, weaknesses, opportunities, and threats (Teele, Nkoane & Mahlomaholo, 2020:109). The team members were referred to in this study as co-researchers who brought about the change this study aimed to bring. The research process was organized into phases, running from July 2022. The research team discussed the challenges teachers experienced when not using cell phones for teaching mathematics, how they can integrate cell phones into teaching mathematics in Grade 3, and how they would engage learners and parents.

More discussions followed, and team members were responsible for formulating the strategy. These meetings were voice and video recorded. During the meetings, notes were taken and were later transcribed and analyzed.

1.8 ACTION PLAN

The action plan outlined the identified five priorities. The role of the team members is outlined in the action plan, where all the activities, resources and time frames were

clearly outlined, including those responsible for monitoring each activity's vision and time frames. The template of the action plan is outlined below.

Table 1.1: Action Plan

Priorities	Activities	Responsibilities	Resources	Timeframes	Monitoring
Priority 1	Planning	Study coordinator	Classroom	Two weeks	Discussions
Empowering teachers					
Priority 2	Discussions on finding a strategy	Team members	Meeting room	Two weeks	Discussions
Empowering parents					Reflections
Priority 3	Discussions	Study coordinator and learners	Classroom	12 weeks	Lesson presentations and reflections
Empowering learners					
Priority 4	Discussions	Grade 3 class teacher, librarian	Classroom	12 weeks	Learners' workbooks
Enforcing collaboration					
Priority 5	Engaging learners with the cell phone	Grade 3 class teacher, learners and personnel	Classroom and home Cell phones	1 hour daily	Learners' workbooks
Engagement					

1.9 DATA ANALYSIS

Critical Discourse Analysis (CDA) was used to analyze data. It evaluated and analysed transcribed and verbal texts to disclose the discursive power bases, inequality, dominance, and bias (Teele et al., 2020:109). Leotti, Sugrue and Wings-Yanez (2021:6) discuss the following stages of CDA: Identifying a social problem, identifying obstacles towards addressing the social problem, considering whether the social problem serves a broader purpose, and identifying possibilities to solve the social problem. The data analyzed were from photos, videos, and recordings of meetings and discussions (Teele et al., 2020:109). Data analyses also came from pictures, recordings, videos, and transcribed notes.

1.10 VALUE OF THE RESEARCH

This study should help teachers use cell phones and their applications in teaching mathematics in Grade 3. It will help improve parent involvement in education and improve home-school communication. It will give the Department of Education an idea of how they can help and train teachers in future, including training them to integrate technologies into their daily teaching and learning activities especially using the cell phone. School principals and management teams can use the information gathered in this study to support and provide relevant ICT tools and training for their teachers and staff. SMTs and principals can build solid and productive relationships with parents and the community to provide better education for their children.

1.11 ETHICAL CONSIDERATIONS

The rules of the University of Mpumalanga were followed when seeking ethical clearance. The Department of Education in Mpumalanga was requested to grant permission to conduct research. Permission from all team members or co-researchers in this investigation was requested. Permission to conduct research with learners was sought from parents and learners through consent and assent forms. The aim and objectives of the study were explained to all participants. All co-researchers were made aware of their rights when participating in this study.

1.11.1 Confidentiality

Confidentiality is mainly concerned with what will happen to the generated data once it is in the researcher's possession and how the information will be disclosed to others in a way that does not reveal information that was to be treated with some degree of confidentiality (Sim & Waterfield, 2019:3004). In this study, confidentiality was negotiated and ensured. Co-researchers had to adhere to agreed standards and ensure no risks or benefits. Team members were treated respectfully; no harm was anticipated in this study. Reporting findings was done with discretion, and results were communicated to participants through their own preferred methods of communication. Information was stored in a computer locked with a pin.

1.11.2 Anonymity

According to Sim and Waterfield (2019:3004), anonymity is concerned explicitly with attributing information to individual co-researchers. It is challenging to ensure anonymity in PAR because of the researcher's multiple roles and the environment where co-researchers know one another (Godfrey-Faussett, 2022:5). Team members knew who participated in the research. People's identities were concealed where necessary, and pseudonyms were used.

The rights of co-researchers were explained and ensured. All documents, recordings and photos were stored safely and later; they would be discarded safely according to the rules of research expected by the university. Letters of permission and consent

were issued to all team members. All team members were treated with respect throughout the study, and no harm or exploitation was anticipated in this study. Issues related to social justice and democracy were adhered to.

1.12 LAYOUT OF THE CHAPTERS

Chapter 1 provided the introduction and background to the study, the problem statement, the research question, the aim and objectives. Chapter 2 will focus on the literature review, the theoretical framework guiding the study and the conceptual framework. Chapter 3 will present the research design and methodologies and discuss how data were generated.

Chapter 4 will focus on data analysis, presentation, and interpretation.

Chapter 5 presents the conclusion, summary of findings and recommendations of the study.

1.13 RESEARCH TIMELINE

Table 1.2: Research Timeline

RESEARCH ACTIVITY	TIME IN MONTHS
1. Submission of the Research Proposal	March 2022
2. Chapter 1: Introduction and Background	March 2022
3. Chapter 2: Literature review	April 2022
4. Chapter 3: Data generation	June to August 2022
5. Chapter 4: Data analysis	September to November 2022
6. Chapter 5: Recommendations and conclusion	November 2022
7. Finalization of the first draft	November 2022
8. Submission for examination	December 2022

1.14 CONCLUSION

The study aimed to design a strategy to enhance mathematics teaching in Grade 3 with the collaborative support of parents and teachers. The chapter presented the background of the study and the problem statement. It discussed the study objectives, a brief discussion based on the theoretical and conceptual frameworks, the research design and methodology, data analysis, and the chapters' layout.

CHAPTER 2 : THEORETICAL FRAMEWORK, CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 INTRODUCTION

This study sought to formulate a strategy to teach the Grade 3 mathematics curriculum using cell phones. This chapter presents posthumanism as a theoretical framework that guides the study. It discusses the conceptual framework, namely connectivism, that directs the study. It discusses the literature review on how cell phones can enhance mathematics teaching and learning in a Grade 3 classroom. The related literature was studied and organized following the study's aims and objectives. The theoretical framework, conceptual framework and literature review discussed in this chapter will focus on the in-depth relationality with the challenges of teaching mathematics in Grade 3 using cell phones with the collaborative support of teachers and parents. The solutions to the challenges, the threats and conducive factors will be explored, and an effective way of implementing the strategy will be identified.

2.2 THEORETICAL FRAMEWORK

In research, a theoretical framework is seen as a valuable tool that can be used to navigate, guide, and direct a study. It is a product of a particular existing theory or theories in the literature that have already been tested and validated, and accepted in the scholarly literature (Garvey & Jones, 2021:2). A theoretical framework serves as a researcher's lens that they can use to view the world (Grant & Osanloo, 2015:12). To ensure that a research study is coherent and focused, Mceleli (2019:12), supports the idea that a theoretical framework is a tool that the researcher can use. Furthermore, the theoretical framework helps guide the researcher to choose and apply relevant methodologies to reach the anticipated research aims. When there is a lot of data that need to be explored, a theoretical framework assists in redirecting the attention to that phenomenon of interest leading to modes of inquiry that may be missed (Garvey & Jones, 2021:2).

This study uses posthumanism as a guiding lens through which the teaching of the Grade 3 mathematics curriculum can be enhanced using cell phones o formulate a strategy.

2.2.1 Relevance of posthumanism for this study

Posthumanism is relevant for this study because it relates perfectly well with the aim of the study, with its focal point being the interdependence between humans and non-humans, better described as “total contamination and hybridization of human beings with other living beings and machines” (Valera, 2014:486). Valera (2014:486) further explains that posthumanism understands technology as one of the many means to reach a not purely technology by embracing the symbiotic relationship between technology and people. Posthumanism is embedded in cybernetics and information, wherein cybernetics is concerned with laying bare what biological systems and non-biological systems, that is, humans, animals and machines, share (Mahon, 2017:31). Posthumanism concerns itself with the notion of social justice in education in its social and environmental form about the following themes: our technological essence, our bodily relationship to ourselves and nature, our relationship with the world and our relationship with intelligent systems like the 5G mobile systems (Peters, 2020:583). Posthumanists theorists propose a complete reconfiguration and new approaches and changes to what is being studied in educational fields (Bolter, 2016:7)

2.2.2 Posthumanism as a theoretical framework

According to Ulmer (2017:20), posthumanism becomes a research methodology when it opens opportunities to analyze the diverse challenges of our present day, our current epoch, especially within the concept of the Anthropocene, which is a central concept in posthumanism. The shift towards posthumanism suggests that design should tackle questions that are concerned with the possibility of designing and creating intelligent systems that can safely redesign themselves in a manner that requires that the social, political, environmental, and ethical dimensions of intelligent systems be taken into cognizance (Forlano, 2017:14). Forlano (2014:14) further articulates that while we calibrate our fundamental understanding of the posthuman

situation involving human and the non-human and the ways of being in the world, it is essential to establish similar design methods, frameworks, and practices that are going to improve the challenges we face as a planet address. Posthumanism sets the stage for these emerging design practices. Theories related to transformative research stress the need to deconstruct and reconstruct knowledge frameworks that elevate and foster inequity and injustice, both methodologically and disciplinary (Ulmer, 2017:21). Ulmer emphasizes that posthumanism firmly rejects the belief that humans are the only species able to produce knowledge. Still, it creates room for other forms, things, beings, and phenomena to know and create knowledge. Hence this study uses posthumanism as a theoretical framework to demonstrate that non-humans, like cell phones, can be an effective source of knowledge. Furthermore, this study uses posthumanism as a theoretical framework to move away from the notion that humans can only construct knowledge and that humans do learning for humans; it moves away from the tradition that students can only learn when physically contained in spaces designated for learning (Ross, 2021:12).

2.2.3 The origin of posthumanism

According to Forlano (2017:7), post-humanism originated in science fiction in the 1970s. However, Koole (2020:1054), on reviewing Braidotti (2019), suggests that posthumanism emerged from progressive knowledge systems that are a result of a reaction to humanist thought for a period of over the past thirty years. They both support the idea that posthumanism is about humanity that can be changed, transcended, or put to an end using technological advances or the evolutionary process; an artistic, scientific, or philosophical practice reflecting this idea. Forlano (2017:1) articulates that posthumanism integrates both the human and the nonhuman, including technologies, organizations, and things.

Posthumanism was first coined by Ahab Hassan in 1977 with the view that it is recognized as a representation of the convergence of two contrasting aspects of our reality; that is, the conjunction of imagination and science as well as myth and technology (Jansen, Leeuwenkamp & Urricelqui Ramos, 2021:217). They further argue that posthumanism is an evolving concept that is based on ideas from radically different strands of thought, a general term for ideas that explain, promote, or deal

with the crisis of humanism; it has to do with how the conceptualization and understanding of humans as biological beings and moral beings in traditional ways shifted from humanism.

To understand posthumanism, a breakdown of the word is required; literally, posthumanism implies 'after humanism'. Humanism embraces both philosophical and ethical movements concerned with human beings' value, agency, and moral supremacy. A view is put forward that post-humanity is on the rise because humanism will transform itself into posthumanism, thus ending radical humanism (Nath & Manna, 2021:193). Nath and Manna (2021:193) further explain that the key theme in posthumanism is that human beings are the creation of nature which coexists with other natural creations like other organisms which do not deserve supremacy and that posthumanism includes the hybridization of biological humanity using technology and the incorporation of transhuman traits.

According to Ross (2021:6), posthumanism emerged from two research fields, i.e., anti-humanism and anti-anthropocentrism. Ross further argues that anti-humanism is against the idealist and separatist view regarding the human as a representative of the biological human species; while disputing these claims, Ross believes that thinking and knowing are not the prerogative of humans alone but take place in the world in its entirety. It rejects possessive individualism and proposes affirmative and collaborative ethics rather than profit and maximization, which is the goal of anthropocentrism. On the other hand, anti-anthropocentrism dethrones the human from a hierarchical understanding of our relationship to non-humans others and rejects possessive individualism and profit maximization; instead, it supports affirmative, collaborative, and egalitarian allyship (Braidotti, 2019:90).

2.2.4 What is posthumanism?

Posthumanism is described broadly in several phenomena, including academic discipline and artistic movements to political advocacy campaigns as well as the development of commercial technologies (Gladden, 2018:32). Gladden further indicates that it is challenging to define posthumanism. However, a given form of posthumanism can be classified in four ways, namely (i) either as analytic posthumanism that understands post-humanity as a socioecological reality that

already exists in the contemporary world, or (ii) as a synthetic posthumanism that understands posthumanism as a collection of hypothetical future entities whose development can be realized or prevented intentionally, or (iii) as a theoretical posthumanism that primarily seeks to develop new knowledge, or (iv) as practical posthumanism that seeks to bring about some social, political, economic and technological change. Furthermore, posthumanism can be categorized into five different types of posthumanism 1) posthumanism of critique, 2) posthumanism of imagination, 3) posthumanism of conversion, 4) posthumanism of control, and lastly, 5) posthumanism of production. This study focuses on posthumanism as a theoretical framework that seeks to develop new knowledge to bring about social, political, economic, and technological changes, especially in the teaching and learning environment.

2.2.5 The evolution of posthumanism

Posthumanism emerged from radical epistemologies and as a reaction to European humanist thought that placed the human at the Centre of concern with specific historical situatedness, sociocultural structures and inequalities (Koole, 2020:1054). It can be traced back to the following periods in history.

2.2.5.1 *The Dark Ages*

The Dark Ages is the period between the 5th and the 14th century (the Middle Ages), and it is referred to as the Dark Ages because it was seen as a time of intellectual darkness. It is the time between the fall of Rome and the Renaissance (Fröhlich, 2022:1; Öztürk, 2022:36). Furthermore, many scholars reject the notion of the Dark Ages due to its negative connotations and view it as misleading and inaccurate because during those times agricultural innovations boomed, for instance, the invention of the plough, the horse collar, and the use of the metal horseshoe. The term 'dark ages' was coined by Francesco Petrarca, a poet concerned about the lack of good literature during that period (Hughes, 2022:1).

Significant advances in mathematics and science were made during this period, despite the church suppressing natural scientists and prohibiting procedures such as autopsies and dissections.

This period laid a good foundation for future advances in mathematics and sciences, arts, literature, architecture, and other cultural realms (Fröhlich, 2022:1).

2.2.5.2 Humanism

The humanist approach centred on the idea that self-expression and creating the self are essential. The period of humanism came with an increase in nature's pollution due to man's unlimited use of technology, the rise in consumerism, and the progress of technological inventions (Brinkmann, 2017:123). All this happened because man forgot that human well-being depends upon the natural environment and the safety of other species. The machine became an object of human interest; the computer became the current articulation of machine automation that extends the human and replaces humans, making them more physically and cognitively machinelike (Wakefield, Chandler & Grove, 2022:390). Posthumanism is about how all this can be rethought, how it can be reimagined. The central theme in posthumanism is about how man's role is now selfishly elevated and distinguished.

2.2.5.3 Anti-humanism

This period came immediately after the Second World War, with the realization that man is viewed as the cleverest species in the world. Anti-humanism focuses on fighting for social justice and how humans can cultivate a closer relationship with nature (Ross, 2021:1). Furthermore, Ross (2021) views posthumanism as emerging from anti-humanism and anti-anthropocentrism, with anti-humanism as a critique of idealistic image of man and anti-anthropocentrism as a field of research that critiques human supremacy. Both anti-humanism and anti-anthropocentrism provoke the ontological relationality that emphasizes the interconnection between the self and others that the humanist and anthropocentric assumptions shelved.

2.2.5.4 Feminism

Feminism raises an awareness that posthumanists have a feminist mindset that is generally seen as anti-racist, post- and decolonial thinkers and practitioners

concerned with posthuman convergence while trying to avoid universal posture or generalizations. According to Braidotti (2019:32), research centres for posthuman studies emerged from countries like the United Kingdom (UK), Denmark, Canada, Sweden, and South Korea. Posthumanism aims to speed up the process of delivering social justice, tackle challenges related to climate change and the erosion of democracy and reduce the accelerated disparity between rich and poor (Koole, 2020:1054). Feminism is about claiming equal rights between differently gendered, racialized, or classed people. Furthermore, it is deeply concerned about women and other minorities' emancipation. The call sees feminism as fighting against servitude, violence, and brutality and sees nature as a naturalization of inequalities.

The relation between feminism and posthumanism is based on their concerns about political and ethical questions concerning diversity and vulnerability of the people involved in a particular investigation (Susen, 2022:80). To better describe the relationality between feminism and posthumanism we need to look at: "the anthropocentric biases of humanist thought and human exceptionalism, the optimistic belief in technological progress, the hierarchical categories of nature and culture, the other, the self, the human, the non-human, and the ethics of current human-non-human relations questions the feminist and posthuman approaches" (Kuby, Spector & Thiel, 2018:479). The relationship between feminism and posthumanism can be fully described as renegotiating, relooking at the human, the non-human and humanity in the sense of questioning the two-sided divisions and hierarchies between organism and machine (Susen, 2022:81). This relationship further applies not only to the mind and body, but also to nature, and culture, human and animal and male and female, taking into cognizance the fact that human beings are enmeshed in the process of becoming with or becoming all that is other than human (Koole, 2020:1054).

Feminism and posthumanism ascertain that our engagement with the world is constituted intersectionally and structurally embedded in the social, class, ethnic, gender, age and ability variables, which invite us to consider the emancipatory potential of humanity in a way that benefits many, including the countless non-human forms of existence through objectivity, normativity, and subjectivity (Susen, 2022:80).

The anticipated posthuman and feminist-related problems in this study might be comparing cell phone usage by boys and girls with children from rich and poor backgrounds, referred to as the digital gender divide in some research.

2.2.6 The objectives of posthumanism

Posthumanism is ultimately aimed at a progressive elimination and fluidization of the living being, which requires the human to think beyond his traditional humanist limitations and embrace more than human beings, including the materialistic (Valera, 2014:483). Posthumanism is embedded in cybernetics and information wherein cybernetics is concerned with laying bare what biological systems and non-biological systems, that is, the humans, animals, and machines share (Mahon, 2017:31). In essence, this relates to the study because of the way the cell phone does precisely what a human being (teacher) does. The cell phone, through its mobile applications, can teach and enhance the teaching of mathematics.

Posthumanism concerns itself with the notion of social justice in education in its social and environmental form pertaining to the following themes: our technological essence, our bodily relationship to ourselves and nature, our relationship with the world and our relationship with intelligent systems like the 5G mobile systems (Peters, 2020:583). Posthumanist theorists propose a complete reconfiguration and new approaches and changes in what is being studied in educational fields (Bolter, 2016: 7). Similarly, as a critical research theory, posthumanism emphasizes the importance of deconstructing and reconstructing knowledge frameworks that perpetuate inequality and injustice, taking into consideration the fact that justice involves more than what human relations can offer, and that justice involves material, ecological, geographical, geological, geopolitical and geophilosophical situations (Ulmer, 2017:2).

According to Susen (2022:79), posthumanism signals a period defined by the Fourth Industrial Revolution and the Sixth Extinction, highlighting human and non-human forces' interdependence and reminding us of the confluence of Zoe-geo and techno-based dimensions can significantly shape the way we relate to the world.

Posthumanism challenges teachers' way of thinking that, makes them limit themselves and their potential in many ways and could encourage them to think critically about

ways in which they can change systems that make it difficult for them to produce better results progressively and ultimately produce responsible, innovative citizens capable of changing systems that oppress them (Howlet, 2018:108). The Covid-19 pandemic created a situation that could have led to a massive failure in the education system; however, due to the posthuman ideas of using technology to expand on what man can do by non-humans, education continued using mobile technologies.

Posthumanism emanates from numerous viewpoints, including environmental, ethical, economical, health and wellbeing, equality, and education, aimed at changing the attitudes and values of people politically and conceptually (Konst, 2019:109). Konst further argues that posthumanism encourages and creates a growth mindset of empowerment where people act to influence their communities positively to find solutions to their daily problems, including educational problems (Konst, 2019:109).

Posthumanism aims to present humans as non-contained beings who can be distributed in many ways beyond their local space and time, caught in an unending chain of events without beginning or ending (Valera, 2014:486). Valera (2014) further articulates that posthumanism suggests understanding the human as embodied in an extended technological world.

According to Peters (2020:583), posthumanism is regarded as a means to understand the fundamental question of “what it is actually to be human in the twenty-first century?” by looking at the following four themes.



Figure 2.1: Four themes in posthumanism

The figure illustrates the four diverse posthumanism themes: technological essence, intelligent systems, the animal body, and the physical processes. All the themes focus on the posthuman view of being human in the twenty-first century.

2.2.7 Posthumanism and education

Posthumanism can shape the education system by embedding posthumanist thinking into the curriculum, submerging posthumanist values in educational institutions, and creating spaces conducive to collaborative interaction where participants are encouraged to think beyond humans and make space for non-human others (Koole, 2020:1055). According to Howlet (2018:108), posthumanism in education relates to founding pedagogical practices in ecological thinking that assume fundamental inseparability of ways of knowing and being that suggest a closer interrogation of the 'human'.

2.2.8 Different formats of posthumanism

According to Susen (2022:64), Braidotti views posthumanism as a goal-directed attempt to challenge humanist beliefs about the human and its dependent forms of existence in trying to answer the question of what it is that counts as human and focusing on the repositioning of the human, with particular reference to the human and non-human forces that explore multiple subjects extending to multiple axes that include the trans-sex, transgender, transspecies, trans corporeality and ultimately understood in a way as a product and a producer of the posthuman condition, not in contradiction of the post-anthropocentrism.

Gladden (2018:40) describes different formats of posthumanism, classified as synthetic and analytic as well as theoretical and practical. Analytic theoretical posthumanism manifests posthumanist methodology to distinguish hidden anthropocentric biases and posthumanist expectations within human activity. On the other hand, synthetic theoretical posthumanism could display a posthumanism of imagination. The formats are summarized as follows in Table 2.1 below.

Table 2.1: Formats of posthumanism

Form of posthumanism	Classification	Purpose
1. Posthumanism of imagination	Synthetic theoretical posthumanism	Creatively envisions the hypothetical future post humanities to explore their implications
2. Post-humanism of control	Synthetic practical posthumanism	Aimed at developing new technologies that give individuals an opportunity to manage their own post-humanization or put into effect measures which could be legal or economic controls to preside over the development of such technologies
3. Posthumanism of production	Hybrid post-humanism, all four included	Develops rigorous and robust theoretical framework that is then implemented to successfully generates concrete, tangible products or services within the contemporary world
4. Posthumanism of critique	Analytic theoretical posthumanism	It reveals the anthropocentric biases and post-humanist ambitions within different fields of human activity.
5. Posthumanism of conversion	Analytic practical post humanism	Seeks to change the thinking and influence how human beings view the world around them.

2.2.9 The researcher’s relationship with co-researchers in posthumanism

According to Koole (2020:1054), the current technological revolution that is happening intensifies populism, militarism, anxiety, and ecological disaster, which in many ways weighs much upon us psychologically and politically and spreads our fears to new dimensions globally and locally. However, Braidotti (2019: 32) believes that posthumanism provides us with ways to relook into our existence as humans and look for ways to advance our capacity to move forward in a positive manner. Koole (2020:1054) interrogates Braidotti, thinking about posthumanism and education and suggest that it can shape our education system positively if we submerge our

posthuman thinking and our posthuman values into our curriculum as well as into the structure of our educational institutions.

2.2.9.1 *The ontology of posthumanism*

According to Zapata, Kuby and Thiel (2018:479), posthumanist ontology is deeply rooted in the relationality known through our being with and in the world through relations between humans, non-humans, and more than humans (ethico-onto-epistemology). According to Radomska (2010:102), to understand the question of ontology, materialism, and agency in posthumanism, a posthumanist performative approach concerns itself with the understanding of technoscience and natural, cultural tendencies that expressly acknowledge and consider matters of dynamism. Furthermore, posthuman ontology forces one to understand, think, observe, and theorise as practices of engagement with and as part of humanity in which we have our being. Radomska (2010:102) further indicates that realist ontology can be described in four ways: 1.) reality that is composed of things in phenomena, 2.) reality that defines the world as an open, dynamic process of intra-activity and materialism, 3.) reality that equates dynamism and agency which refers to the reconfiguration of the world, and 4.) reality that defines the universe as the “agential intra-activity in its becoming”. This ontology forms the basis of an indeed posthumanist account.

According to Diaz de Liano and Fernandez-Gots (2021:543), posthumanism suggests new ontological frameworks that challenge conventional Western metaphysics to be used. However, some critics view this notion as potentially and theoretically intolerant. According to Kuby et al. (2018:480), posthumanism brings to the fore a way of recognizing that vastly diverse types of critical approaches like feminism, anticolonialism, antiracist thoughts, technologic studies, ecology, and other approaches do have a common ground in challenging the ways humanism has restricted politics and education by minimizing or minoritizing discourses that matter the most to people, especially to women and the formerly colonized and marginalized. Kuby et al. (2018:481) further acknowledge that posthumanism pushes to open the intersectionality to the point where all, irrespective of a field or interest, position of power or status, can no longer afford to ignore these critiques. Posthuman knowledge drives the agenda that makes us realize that we are responsible in all the relations we

are entangled with daily, irrespective of whether we participate or not (Anderson, 2022:396). Furthermore, it encourages us to reimagine and reconsider our understanding of our worldly relations in the ongoing process of becoming formed and potentially reformed. This is particularly useful in this study, because it seeks ways of teaching the mathematics curriculum in a Grade 3 class in a manner that is related to the current trend of life, where a cell phone is no longer a luxury tool for some, but a necessary tool for all, which can be used for educational purposes with the aim of enhancing learning conditions, closing the gap of presence and time, and making learning quite interesting and enjoyable to young learners.

2.2.9.2 Epistemology

Posthumanist epistemology places humans neither at the center stage, nor separate them from the nonhuman, the context, the world, or the researcher's epistemic apparatus. However, a posthumanist practice epistemology employs an approach that is mainly practice-based to study and focuses on everyday collaboration as relational practice, ensuring affective ethics that intensifies our capacity to affect and to be affected by others (Gherardi, 2021:19). Posthumanism is a radical voice in research that makes distinct the boundaries between theory and method (Ross, 2021:7). It fosters an evolution of language by using approaches in research that focuses on peer collaboration as relational practice formed through sharing and caring activities without compromising ethics by employing a practice-based approach to study (Gherardi, 2021:19).

2.3 CONCEPTUAL FRAMEWORK

This study is guided by connectivism as a conceptual framework. Connectivism is a framework that helps to understand learning in a digital era. Furthermore, connectivism regard knowledge as a network and learning as a process of exploring the network and pattern recognition (Yu, 2021:2) The concept 'connectivism', according to Yu (2021:1), adapts to the changes in the current social environment where learning can no longer be only confined in classrooms, but can happen anywhere and anytime through various networks online. Yu further argues that the Massive Open Online

Course (MOOC) comes from connectivist theory, and that leaning that follows connectivist approaches brought change in methods of learning, tools for learning, and resources people use for learning.

2.3.1 What is connectivism?

Boyras and Ocak (2021:1122) describe connectivism as an epistemological approach to learning that focusses on network interactions, both in the individual's mind and in the environment. Furthermore, connectivism differ from approaches like behaviorism, cognitivism, and constructivism because it does not only focus on what to do, but it also focusses on what to think or how to make sense like these other approaches, but it offers learning processes and principles that reflect the underlying conditions of the social environment of the current situation that are based on technology.

2.3.2 Origin of connectivism

This theory was first introduced by George Siemens, who viewed traditional learning theories as inadequate and named it a theory of the digital age (Spinello & Corbet, 2020:2). Finding knowledge in a system or organization when it is needed, determining whether the knowledge is still valid or acceptable, and identifying the links in the meta-information marked by autonomy, openness, connectivity, and diversity are the goals of connectivist theory (Boyras & Ocak, 2021:1226).

Learning in a connectivist environment involves three cyclic phases: planning, cognitive processing, and evaluation (AIDahdouh, 2021). In connectivist environments, the teacher's job is to establish a platform and context for learning that will enable students to build their own unique learning environments through network connections (Yu, 2021:3).

Relevance of connectivism for this study. The relevance of connectivism theory in this study is that it advances the idea that learning is no longer confined to school facilities and infrastructure, but technology-enhanced tools and media enable new modes of learning (Kotze, 2021:15). In connectivist learning settings, it is the teacher's responsibility to create a platform and context that will allow students to create their

own special learning environments through network connections. (Yu, 2021:3) Connectivism provides insights into learning skills and tasks needed for learners to flourish in a digital era and emphasizes the fact that learning has changed, and that technology influences the way we learn, how we learn and where we learn (Vitoulis, 2017:4). Learners are regarded as active users of knowledge driven by a dynamic flow of information in collaboration with the environment and interaction with others (Joao, 2018:205).

2.3.3 Learning in connectivist environments

In connectivist theory learning also occurs in non-human, and the ability to learn and gain knowledge comes from a range of perspectives which are more significant than what one currently knows emphasizing the fact that non-human forces can also contribute to learning (Boyraz & Ocak, 2021:1124). Learning is stimulated and influenced by establishing and maintaining connections, old and unnecessary information needs to be abandoned, students should learn new information, and information in data bases should be linked to the right people to the right extent (Kotze, 2021:15). Furthermore, in connectivist learning environments, students are guided and encouraged to explore for information on their own online and share what they discover through peer networks that take place in the classroom (Yu, 2021:1). Connectivism brings a new dimension to learning where learning information can be accessed through the selection of appropriate technical material, appropriate technology, design, and the use of laboratories and learning in real conditions (Pecina & Marinic, 2021:7980). Learners no longer simply consume information in connectivist learning environments; instead, they actively contribute to its creation (Shrivastava, 2018:3). Shrivastava (2018:3) explains further that learning in a connectivist environment includes using social media, which has grown to be the most well-liked and effective way for students to learn. and regarded as self-motivating and informal, making learning informal and fun; therefore, appreciated by most young learners. According to Boyraz and Ocak (2021:1123), the starting point of learning in a connectivist environment is activating knowledge by connecting and participating in a learning community that allows interaction, sharing, dialogue and thinking together, including members who are more knowledgeable using words, images, videos,

multimedia, and other advances in technology. Learning in connectivist settings relies heavily on technology and both learners and the educator benefit, because connectivism fosters and creates opportunities for collaboration; it empowers both learners and teachers; it embraces diversity (Shrivastava, 2018:4).

2.3.4 Challenges faced by connectivism as a framework.

There are some difficulties and objections to connectivism. The fact that it is not a fully developed theory and that it only exists as a powerful phenomenon that motivates teachers and students to change their practices is one of the criticisms, but it also points out that it cannot be developed into a theory without substantial research to guide its development in the context of other theories (AIDahdouh, 2021). Boyraz and Ocak (2021:1127) claim that there are still gaps in the connectivism literature, which will limit practice reflections and leave them highly susceptible to criticism.

2.3.5 The role of emotions in connectivism

Emotions play a major role in connectivist learning environments, in that the learning process triggers negative-activating emotion, which results in a positive effect on performance because there will be a need for alternative solutions to seek help and to employ a higher level of thinking when one is frustrated (the need to act) (AIDahdouh, 2021).

2.3.6 Steps in connectivism

Connectivism, when used in the classroom, follows the following five steps (Yu, 2021:3).

1. The first step in connectivism theory when used in the classroom is to determine the teaching activities. That can include, among others, the digital learning opportunities, online courses, webinars, social networks, and blogs.
2. The second step includes explaining the knowledge points. This refers to the provision of the content summary of knowledge acquired by the teacher to learners with the aim of breaking down complex knowledge.

3. The third step is breaking into groups for a group discussion, where learners are expected to perform tasks, do practical work, and investigate knowledge paths and interest to deepen their understanding of knowledge and to solve real problems.
4. The fourth step is an extension exercise. Learners are given more difficult exercises and tasks, expansive practical issues, and extension exercises.
5. The fifth step is practice, where the acquired skill is put to practice.

These conceptual framework steps are necessary for the study to follow in the classroom practice when implementing the strategy, because they are in line with the normal day-to-day delivery of lessons.

2.3.7 Principles of connectivism

Connectivist theory as a conceptual framework is closely related to posthumanism. Connectivism takes into consideration the fact that learning occurs in non-humans, which is a similar concern in posthumanism (Boyras & Ocak, 2021:205; Bolter, 2016:7). Connectivism is guided by the following principles:

- Learning and knowing resides in different ideas.
- Learning is the process of connecting certain circuits and knowledge.

As a learning theory, connectivism is based on the notion that learning can occur outside of the classroom through knowledge that is dispersed across a network of connections, the comprehension that decisions made at one point in time may change due to rapidly changing foundations, and the notion that information is continuously generated and acquired (Downes, 2022:59). According to Downes, connectivism is a learning theory that offers an empirical foundation for understanding teaching and learning by redefining how we view knowledge, how learning occurs, what we are trying to accomplish when we learn, and how learning is imparted and evaluated, rather than necessarily being treated as an alternative learning theory with which to interpret phenomena (Downes, 2022:59).

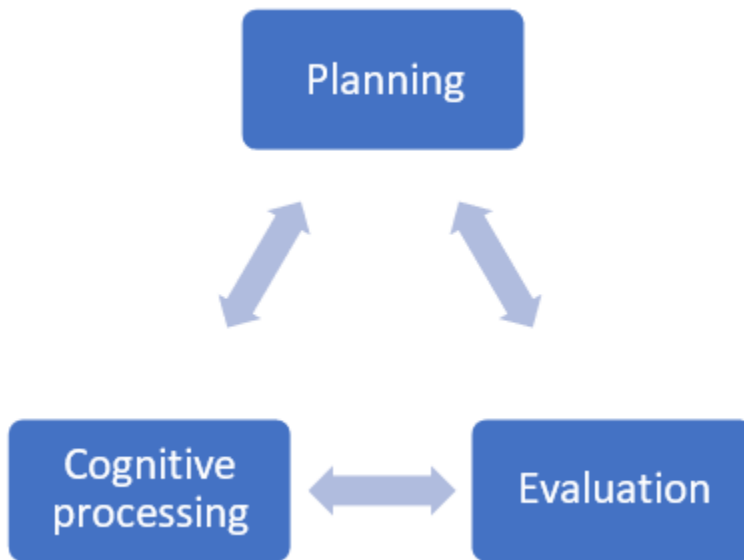


Figure 2.2: Phases of learning in a connectivist classroom

2.3.8 The role of the researcher in connectivism

The role of the researcher in a connectivist learning environment, is to create a learning platform and context that help learners to construct their personal learning environments through network connections (Yu, 2021:3). The researcher needs to look for appropriate applications and verify them empirically in the teaching process (Pecina & Marinic, 2021:7978). In connectivist learning environments, learners are active, enjoy playing and have.

self-discipline and control. It is therefore necessary for the researcher to understand the situation of the learners, make use of it after class time and to provide the targeted guidance (Yu, 2021:3).

2.3.9 Relevance to the study

This study used cell phones to find a strategy that will enhance the teaching and learning of mathematics Grade 3. Connectivism is relevant in this study because it supports the idea that learning is no longer confined to school facilities and infrastructure, but technological tools.

Media and the digital space enable new modes of learning that are not limited to time, space, and environment (Kotze, 2021:15). Connectivism ensures that learning occurs anywhere, anytime, with or without a teacher with the assistance of a network of various connections.

2.4 RELATED LITERATURE

2.4.1 The need for parent teacher collaboration

This study aims to better the teaching and learning of mathematics in Grade 3 in rural primary schools in Mpumalanga by examining the effects of parent-teacher collaboration. Since parents play a crucial role in their children's education and are important participants in it, theory and research suggest that successful parent-teacher collaboration is essential for students' academic and social growth (Van Der Wal, 2020:5). Adams et al. (2016:60) identify the following ideas as essential to the success of parent-teacher collaboration: that it should be voluntary; the need to share resources; responsibility in decision-making; aiming for shared goals; acknowledging one another's roles; the capacity to work together; and trust and respect for one another.

2.4.2 Challenges towards the use of cell phones for the teaching and learning of Mathematics

2.4.2.1 Failure to recognize the benefits of using the cell phone for teaching and learning

The cell phone is a powerful educational tool that needs to be explored extensively (Makira & Owino, 2021:501). The cell phone offers a transition from the occasional use of technologies for teaching and learning to a frequent and integral use of technology in education, because of its portable and computational nature (Ibrahim & Kadiri, 2018:2). However, the cell phone is viewed as a disruptive, unwanted tool at schools by most schools and governments, as well as parents and teachers (Ngesi et al., 2018:3). This attitude is not only a challenge in South Africa, but in many countries, including Kenya and Norway (Bjørngen et al., 2021:2; Mwapwele et al., 2019:169).

Research indicates that in Kenya, during the time of pandemic, the radio was one of the tools that were used for learning (Makira & Owino, 2021:498). What is interesting is that the cell phone has a radio application that uses no data. It only needs a connection to headsets to play the radio. Some of the most beneficial applications in a cell phone that can be used for teaching mathematics in an enjoyable and interesting manner includes games, YouTube videos, Google Maps, calculator, calendar, and clock. There are also programmes that assist in practicing concepts by using tasks and question-and-answer activities, including among others, Microsoft Forms, IXL, Kahoot, Loomen, Matific and Nearpod (Vrcelj et al., 2020:2). This discussion explains how beneficial a cell phone can be to learners, but a big challenge remains that it is regarded as a harmful, unwanted object in the classroom. Stakeholders in education need to recognize the benefits a cell phone brings into the classroom, especially in the teaching and learning of mathematics.

Children learn the most when they play. These cell phone applications and programmes can be effectively used to teach mathematics in an interesting manner by not focusing on the mathematics skills only, but also in enhancing the learners' skills in using technological tools, communication skills and the ability to explore on their own as the cell phone apps can enhance their curiosity to discover more. However, in most instances, parents and teachers are ignorant of these benefits.

Posthumanist theory suggests that for education to advance, there is a need for a change in pedagogical practices and ecological thinking in view of changing the understanding of the human as the sole creator of knowledge (Howlet, 2018:107) Hence this study suggests the use of cell phones as a tool that is capable of not only improving the teaching and learning of mathematics, but also offering more than just teaching.

2.4.2.2 Challenges that are caused by lack of parent teacher collaboration in the teaching and learning of Mathematics in Grade 3

Parent-teacher collaboration remains a challenge in supporting learners to use digital technologies in their teaching and learning of mathematics. Research indicates that parents and teachers need to collaborate to adjust more efficiently in their roles and responsibilities.

and to improve learners' outcomes (Adams et al., 2016:60). The following factors hinder the success of parent-teacher collaboration when it comes to supporting their children with schoolwork.

- Literacy levels of parents
- Unclear roles and responsibilities
- Preconceived ideas about parent teacher collaboration
- Communication strategies

According to Mwarari et al. (2020:201), parental involvement in education is of vital importance, it should be done with the aim of involving the children, guiding them, empowering, and inspiring them. Mwarari et al. (2020:21) emphasizes that parents and the school should work together in a partnership that is based on Epstein's six forms of partnerships, which are parenting, communicating, volunteering, learning at home, making decisions, and working with the community. The communicating partnership plays a major role in this study. It focuses on establishing efficient two-way communication between the home and the school. regarding school activities and learner progress, for this study the communicating tool being the cell phone, which is also a learning tool.

The cell phone provides for engaged learning by giving immediate feedback which in turn motivates the learners to excel, because that continuous assessment can let the learners and parents work together to practice and do math's activities in case a learner needs assistance (Buchholtz, 2020:79). The curriculum builds on the child's previous knowledge and learning that go outside the classroom; hence increasing collaboration with parents and peers.

2.4.2.3 Failure to promote active learning

In Norway and other Nordic countries, they foster active learning by focusing on using digital technologies to teach mathematics by developing mobile applications to improve their math trails strategy that focuses on teaching realistic mathematics using Google Maps and other applications, thus making teaching, and learning of mathematics fun (Buchholtz, 2020:79). Learners learn best when they are hands-on and involved. Operating the cell phone on their own encourages them to learn faster

and to discover new things on their own; hence increasing their curiosity to discover more and learn more, because research in Early Childhood Education (ECE) has shown that using technologies like the cell phone in mathematics education improves learner engagement, motivation, persistence, curiosity, and attention and reduces mathematics difficulty (Papadakis, Kalogiannakis & Zaranis, 2021:6). Furthermore, digital technologies like the cell phone could change for the better the way mathematics can be taught and learned. They strengthen the learner's ability to participate and cooperate with classmates and teachers and thus enhance their ability to express themselves while they learn at their own pace. Learners are said to be learning effectively in positive environments that are enjoyable and encouraging, and the cell phone could offer such an environment.

Mathematics is seen as a human activity, with human values, close to reality, close to children and have a relationship with society at large. The cell phone is a technological tool that makes it possible for learners to manage mathematical language, to recognize and solve mathematics problems that relate to the real world at a very young age (Viberg et al., 2021:22). The use of cell phones in the teaching and learning of mathematics promotes active learning because learners are engaged in doing activities that provoke thinking and problem-solving skills (Barrientos, 2021:634). Barrientos (2021:635) further indicates that active learning occurs when learners can start to independently build on their own knowledge and understanding of the world by actively building on previous knowledge. Active learning promotes participation, and the more learners participate, the more they grasp the learning content fast. The learners are the core components of the learning process, engaging in the mathematics concepts in ways that enable them to construct their own understanding of concepts and procedures while the teacher is just a manager of the learning process (Lister, MacDonald & Shumway, 2020:617).

Grade 3 learners struggle with enumeration, problem solving and other geometric knowledge which can be developed dramatically using the cell phone and relevant mathematical software (Papadakis et al., 2021:8). One such an example is the math trails strategy of teaching realistic mathematics. Math trails are a strategy used to make the teaching of mathematics more practical and easier for learners to understand a particular concept by encouraging them to be more open and engaged practically in lessons using mobile applications (Buchholtz, 2020:80).

2.4.2.4 Challenges caused by lack of teacher development.

de Sa Filho (2021:40) suggests that the problems that come with not using a cell phone as a teaching and learning tool arise because of a few challenges, including teacher development. Furthermore, age difference between the generations of mathematics teachers add to the problem of teacher development. Two such generations of teachers are described as the digital natives, born after computers and digital devices, and the digital immigrants, born before computers and using digital technologies in their lives. Digital immigrants include many teachers, while digital natives include many learners. This generational gap contributes to the clash in view of whether to use cell phones in schools for learning or not.

Teachers are key factors in integrating technology in classrooms. They should therefore be offered training and opportunities to be prepared and to acquire the skills they need to provide instruction to learners (Wambiri & Ndani, 2016:4). They further indicate that the self-efficacy of teachers plays a major role in their effective use of digital technologies in the classroom. Research indicates that the younger generation of teachers are more likely to integrate technology in their teaching than their older counterparts, who are more comfortable with the old teaching and learning techniques. In South Africa, Msila (2015:1973) is of the view that, in a globalized world, integrating digital technologies in classrooms is unavoidable and this needs teachers who are confident and an effective school management.

2.4.2.5 Lack of policy development

Policy development is one of the most important elements to be considered when using digital technologies in the teaching of mathematics. It is very important for governments, parents, policy developers and teachers to start realizing that a cell phone is an easy, handy tool that can bring the best results when used for teaching mathematics. For this to happen, schools need to develop detailed policies around the use of cell phones in schools.

Policy development is necessary when using cell phones in the teaching and learning of mathematics (Ngesi et al., 2018:3). Furthermore, policies play a major role in incorporating intervention strategies and programmes in schools. They allow for the

restructuring of the process of teaching and learning where necessary. Effective use of the cell phone as a teaching and learning tool requires much-needed policies that will guide the implementation and continuity of using the strategy.

The Department of Education has an ICT policy that guides schools to craft their own ICT policy; however, the Department of Basic Education in South Africa does not have a policy that governs the use of cell phones in the teaching and learning process.

There is a need for the Department of Education, policy makers, educators, managers, and parents to be engaged when designing and putting the policies into practice. The Department needs to ensure that mobile technologies (cell phones) are used in schools to improve the quality of teaching and learning (Hove & Grobbelaar, 2020:60). Hove and Grobbelaar (2020:60) further indicate that the policies developed need to aim at putting extra measures in place that ensure that schools get to use mobile technologies for teaching and learning by setting standards, procedures, and processes in place in the entire education system.

2.4.2.6 Protection against harm and unwanted content

Teaching and learning using mobile technologies like the cell phone have many advantages for learners, including the fact that it gives an opportunity of being mobile due to its structure and the participants involved (learners). It provides regular and consistent usage of portable computing equipment that fills the gap between formal and informal learning by increasing learners' freedom to learn wherever they are and whenever they choose (Ibrahim & Kadiri, 2018:2). However, the use of cell phones in teaching and learning comes with challenges like exposure to harmful, unwanted content that may lead to psychological as well as physiological challenges due to the prolonged and excessive use of cell phones by learners. Mustafaoğlu, Zirek, Yasacı, and Özdiñçler (2017:13) claim that children's incorrect use of digital technologies in terms of content, duration, and frequency as well as the stance they take when using them threaten their health, development, and risk musculoskeletal issues, obesity, and insufficient sleep. Mustafaoğlu et al. (2017:13) further indicates that for digital devices to have a positive influence on learners, the usage needs to be monitored and a nurturing social environment be created to support the learners.

2.4.3 Solutions to the challenges

2.4.3.1 *Failure to recognize the benefits of using cell phones for teaching and learning of Mathematics*

Different Countries take different approaches to using cell phones for math instruction and learning. Realistic Mathematics Education (RME), a cutting-edge instructional strategy that stresses mathematics as a human activity that must be related with real life and uses real- world situations as the starting point, is congruent with the integration of mobile devices for learning in Norway. However, there are only a few published papers that combine mobile learning and RME and only a few mobile applications adopt the realistic approach and take advantage of mobile devices, which include freedom of movement and increased interaction when learning (Fessakis et al., 2018:50).

According to Buchholtz (2020:80), mathematics learning in Norway is extrinsic and expected to bring interest and joy. As a result, they incorporate teaching with mobile devices and have their math mobile application, the Mobile math trail application, which brings about systematic reward containing elements of participation and gamification. Buchholz further explains that the success of the Norwegian math trail app is seen when learners use their mobile devices to get digital screen shots of their solutions and enter them in their Action-bound app. This example from Norway emphasizes and clearly shows the effectiveness of using a cell phone when teaching mathematics. This study suggests a strategy that will enhance the use of cell phones in the teaching and learning of mathematics Grade 3 with the collaboration of teachers and parents; hence making leaning mathematics easy and fun. It further proposes that more studies need to be done to explore how the cell phone can enhance mathematics education in the foundation phase.

In most schools in South Africa, as a school rule, most schools classify the cell phone as a problematic, prohibited item. This is because of the disturbances it may cause at school, like ringing during lessons, or the learner using it during lessons and not concentrating. However, the cell phone is a rich educational resource that can be used to benefit learners, especially in mathematics.

2.4.3.2 Lack of parental involvement

According to research, parent-teacher collaboration is an important element of education since it improves students' socio-emotional and academic progress and positively builds self-esteem, positive attitude, and behaviour in school (Javier & Jubay, 2019:195). This study aims at investigating the reasons why parents are not involved. When parents and teachers work together the learners are supported and motivated. They feel cared for and as result their morale and energy to work hard is invigorated, because the sense of acknowledgement inspires the spirit of handwork and improve their academic performance.

Parent-teacher collaboration improves parents' satisfaction with teachers and school as well as increasing recognition of the value of both teachers and parents (Javier & Jubay, 2019:196). Javier and Jubay (2019:196) further indicates that the challenge to parents not involved can be mitigated by making parents aware of their responsibilities and the benefits thereof, for effective parents' involvement in using the strategy of cell phones to teach mathematics, several factors need to be taken into consideration:

- Age of parents and guardians need to be considered; aged guardians will need extra support from both the teachers and other parents.
- Economic status of parents needs to be investigated; when parents do not have the cell phone other means need to be put in place to assist them.
- The general use of cell phones by learners needs to be supervised both at school and at home to avoid unwarranted setbacks.
- Time management is also factor that might need to be looked at, especially when learners use their cell phones.

2.4.3.3 Failure to promote active learning.

According to Buchholtz (2020:81), cell phone comes with pre-loaded mathematical applications that promote active learning and can make the teaching and learning of mathematics easier. Besides the preloaded applications, some other mobile applications can be downloaded freely or bought. Furthermore, the Google application and other types of search engines can also assist learners to search for mathematics websites, mathematics videos and other mathematics teaching and learning material.

Some of these applications include the following:

- The calculator

The traditional learning and teaching of mathematics required of learners to memorize times tables and other mathematics concepts, but with the cell phone, having a calculator that comes handy with the cell phone, it is easy for learners to do addition, subtraction multiplication and division with ease.

- The camera

The camera can help learners to save time by taking pictures of tasks, notes, and other learning materials for future use instead of taking a lot of time copying.

- Google Maps

Google Maps can help the learners to grasp the concepts of time and distance in a very practical way and thus help them understand the difference between kilometers and meters, an idea of a distance between cities and countries.

- The calendar

The calendar helps learners to learn many things about time in days, weeks months and years. It can help them to compare years and understand what a leap year is and when does it come with ease, because the calendar in a cell phone has all the years' calendars, making it easy to compare years.

- The clock

The clock can be used to teach time. Some cell phones have options for a clock that can help learners to check time differences in different cities and countries. It has an option for a digital or analogue clock. Some have a world clock option, an alarm, stopwatch, and timer options that can help learners to learn varying aspects related to time.

These are applications that can be used without the internet and are suitable for learners in lower grades like Grade 3. In past years, learners in Grade 3 were expected to memorize multiplication tables, but with the calculator in the cell phones the learners can use it for multiplication addition, subtraction, and division with ease.

Numerous other educational math programs offer opportunities for personalized practice that are tailored to children's needs and are even based on learning science theories that adhere to the universal design principles (Outhwaite, Faulder, Guilford & Pitchford, 2019:285). These programs also offer a blended learning strategy and embrace the concepts of socially involved, meaningful, and active learning with clear learning objectives. Mathematics applications have many features that can foster active learning. This is possible using methods that works with manipulation of virtual objects (which can assist learners when learning about 3D objects), verbal labels and numerical representations, visual and auditory inputs using, screenshots, voice and video recordings, or lessons, which also assist learners, they can revisit lessons they did not fully understand when presented and help to enhance children's understanding (Outhwaite et al., 2019:286).

2.4.3.4 *Teacher development*

Teacher development is an essential part of the teaching and learning system and it is an ongoing endless process. For teachers to be able to use cell phones and other mobile technologies in the classroom, they need to be developed. Most of our teachers in South African schools are not trained to integrate mobile technologies in their classrooms for teaching and learning (Gist, Bianco & Lynn, 2018:14). The responsibility of ongoing teacher development should not only rest with the Department of Education. Ongoing teacher development can happen at school level, initiated either by the teacher himself or herself, or the SMT. Teacher development should be aimed at the broader needs of the Department as well as the specific needs of the school.

Gist et al. (2018:14) further argues that when teachers are developed, they can perform their duties with confidence and pride. Research indicates that an informed teacher is inspiring and brings confidence to the learners Gist et al. (2018:14) further indicate that teachers can be developed by attending workshops, training courses, and enrolling at colleges and universities.

The Department of Education offers teachers an instrument to measure their performance which then gives room for development. The Quality Management System (QMS), if used correctly by schools and teachers, offers an important room

for teacher development.

2.4.4 Conducive conditions that ensure effective use of the cell phone for teaching and learning of Mathematics

Using online learning platforms is seen as one of the conditions that can ensure the effective use of cell phones for enhancing the teaching mathematics in a grade 3 classroom. Therefore, the use of available online programmes that ensure active learning using mobile devices. Programs like IXL are built on well-established learning progression theories and math education principles (Bashkov, Mattison & Hochstein, 2021:1). It is aligned with the CAPS curriculum and provides comprehensive coverage of math's concepts and applications. It gives learners an unlimited opportunity to experiment with the many mathematics activities it has, and it has an exciting feedback feature that is encouraging to the learners, especially young learners like Grade 3 learners. It gives ratings like "excellent, fantastic, or well done" (Smith, Mansfield & Wainright, 2021:2). Moreover, this exciting application reviews learners' performance indicates which mathematics skills a learners need to practice more. A child as young as Grade R can follow this program with little or no assistance at all. Learning using IXL in an app or on a desktop is fun, and at the same time meaningful.

The drawback of using the IXL mathematics program is that one needs to subscribe and pay either monthly or yearly and one needs data to operate the program. However, it is a very good mathematics programme that is available on cell phones, tablets, and desktops. As this study is using cell phones in the teaching of Mathematics Grade 3 with the collaboration of parents and teachers, this is one of the best programs parents and teachers can use. According to Smith et al. (2021:3), another beneficial feature with the IXL program or app is that a parent can track his or her child's progress by looking at the history and analytics of the child's engagement and therefore be able to assist the child. furthermore, the analytics also tell which areas need further development.

Assessment plays a major role in the teaching and learning process, as it ensures positive continuity of learning. For assessment to be productive, assessment strategies need to be collaborative and compassionate, meaning that learners need to be given prompt feedback so that they can be able to identify their gaps and make sense of their gradings. This will motivate them for their next challenge (Mahlomaholo

& Mahlomaholo, 2022:19). The IXL program is very good in giving prompt feedback.

2.4.5 Anticipated threats and how to circumvent them when using cell phones for teaching and learning of Mathematics

The most feared threats that may arise when using cell phones for teaching and learning is exposure to harmful and unwanted content. Digital or mobile technologies in the classroom bring about unwanted behaviour and actions if learners are not properly monitored and this might lead to several physical, psychological, and social threats (Viberg et al., 2021:22). Furthermore, the literacy levels of parents are also a threat because parents might be unable to support their children in the proper use of digital devices due to lack of knowledge and expertise.

Teacher development needs to be treated as a priority, especially because teacher training and development, especially for the older generation of teachers, they were not trained to integrate digital technologies for teaching and learning, to use. (Thomson, Gray, Walkowiak & Alnizami, 2022:339). Teachers who are digitally competent can deal with whatever challenges the use of mobile technologies can bring, because they know what is at stake.

2.5 SUCCESS INDICATORS OF THE STUDY

This study will be deemed successful when the parents and teachers of learners in Grade 3 continue to work together to improve the standard of learning and instruction in mathematics in Grade 3 by using the cell phone as a teaching and learning tool of choice. To ensure collaboration between the teachers and parents, it will be prudent for parents and teachers to continue using the cell phone to communicate schoolwork and challenges faced by individual learners as well as communicating and sending extra teaching resources to the learners and parents.

The success indicators of this study will be when parents who are old and illiterate start realizing that despite their being old and illiterate, they can play an important role in supporting the education of their children effectively, like those parents who are young and educated. When parents start realizing the importance of collaborating with the school when it comes to assisting their children with schoolwork, parents will realize that the cell phone that most of them have can be very beneficial in the teaching

and learning of mathematics as well as in communication between them and the school. When parents start realizing that, despite the cell phone being an excellent tool for teaching and learning, it can have harmful and unwanted consequences if used by children unmonitored. Viberg et al. (2021:22) indicate that policies and practices in schools can set a platform for families and schools to build relationships using digital devices, thus helping parents to access to vital information and hence develop capital between school and home.

It is of vital importance for government and all stakeholders in education to recognize and realize the powerful impact a cell phone can provide in improving the teaching and learning of mathematics in Grade 3 and other grades in general and start looking again at the legislation and policies governing the use of cell phones in schools.

2.6 CONCLUSION

According to the literature review in this chapter, collaboration between parents and teachers is crucial to enhancing the teaching and learning of mathematics. and that a cell phone can be used effectively to ensure collaboration as well as a teaching tool of choice to teach mathematics as a subject as it has many features that can be used to teach mathematics. The literature review indicated exactly how the cell phone can be used as a teaching tool. Examples of mathematics programs, applications and websites were given to prove that the cell phone has many benefits in a mathematics classroom. To illustrate the purpose of the study, the literature was discussed along with examples from South Africa, other nations in Africa, and worldwide settings.

The claim made in this study is that cell phones enhance math instruction and learning, which is made feasible by cooperation between teachers and parents.

When parents and teachers use the cell phone to communicate learners' work and progress, learners use the cell phone to advance their learning. The challenge advanced by the literature in the study is that although the cell phone is handy and available in nearly all households, it is still treated as an unwanted tool in the classroom. It is regarded as a disruptive tool; therefore, this study calls for review of policies to accommodate the use of cell phones in the classroom. The most pertinent theoretical framework for the study as it relates to the hybridization of education was

posthumanism. Posthumanism supports the notion that learners can learn anytime, anywhere with or without a teacher using all forms of technological means. The conceptual framework guiding this study is connectivism concerned with learning as a network of connections. Connectivism opens a platform for access, sharing and creation of knowledge.

CHAPTER 3 :
RESEARCH DESIGN AND METHODOLOGY ON THE USE OF CELL PHONES IN
TEACHING MATHEMATICS GRADE 3 WITH THE COLLABORATION OF
PARENTS AND TEACHERS

3.1 INTRODUCTION

The study design and technique utilized in developing a strategy to be employed in the teaching and learning of mathematics in Grade 3 with the cooperation of parents and teachers are presented in this chapter. There was audio and audio-visual content used to present the data. Data was gathered via analyzing documents. Data analysis was done using CDA. The research team was discussed as well as the criteria of recruiting team members were agreed upon. The roles and responsibilities of the team members shared among team members, the credentials and purpose of the inclusion of team members will be highlighted.

3.2 RELEVANCE OF PAR AS A RESEARCH METHODOLOGY

PAR is relevant research methodology for this study, because it is a research methodology that gives research participants (co-researchers) an opportunity and capacity to be part of the research process and to be heard (Balakrishna & Claiborne, 2017:187). This study focuses on finding a strategy to the teaching of mathematics Grade 3 using cell phones with the collaborative assistance of parents and teachers. Therefore, this study needs the collaboration of parents, teachers, and relevant stakeholders as co-researchers to work together. This can be possible when using PAR as a preferred research method. According to Rumsey, Stowers, Sam, Neil, Rodrigues, Brookes and Daly (2022:4), PAR is a research methodology that allows people to carry out their own research for themselves, on themselves with relevant stakeholders and partners with the aim of bringing about social change.

According to Schubotz (2019), PAR is an empowering strategy that fosters social transformation by seeking to address the fundamentally uneven power relationships between the researcher and the subjects being studied. Its objective outcome is to promote cooperation, respect for one another, trust, responsibility, fairness, and

societal reform (Smith et al., 2021:435) PAR is a research methodology that attempts to redistribute power relations by working as a team on the research process by finding a common goal as to what is to be researched, how is it going to be researched, how the research is beneficial. Since PAR focuses on taking local action to address local issues and social inequalities, the communities affected have a crucial part in decision-making (Tetui et al., 2017:104). In classroom situations, teachers often find it difficult to work together with parents and relevant stakeholders in education to solve curriculum and educational problems. Using PAR approach is beneficial for this study because it blends the strength of academic experts involved in the study with the strength and lived experiences of the people involved in the study. Furthermore, the truths are established through the participation of important stakeholders using multiple sources and methods for investigation. It is a transparent and systematic approach (Halliday, Margaret, David, Garrett, Deborah & Turnbull, 2019:177). Furthermore, Halliday et al. (2019:178) are of the opinion that the process of PAR rather than the results is important because all involved have an important role to play. It anticipates no bias from an outsider as it engages in collective investigation and the outcome of the process is expected to be empowering.

3.2.1 Historical origin of PAR

Historically, action research gave rise to PAR (Gaffney, 2008:11). Technical action research, practical action research, and emancipatory action research are the three basic types of action research. Practical action research and emancipatory action research both meet the requirements for PAR because they both involve participants who are affected by the problem being studied and use a facilitator who is a team member to guide the process (Gaffney, 2008:11). PAR played a significant role in history within the social sciences. By engaging in repeated stages of planning, action, and reflection, academics like Kurt Lewin sought to create a research technique to bridge the gap between study, theory, and application in 1946, while at the same time, Paulo Freire during the 1970s, pursued community-based social justice using PAR approaches. To this day, PAR projects are still influenced by these perspectives (Smith et al., 2021:129).

The history of PAR is evolving, and it can be traced back to action research; hence this study discusses the different forms of action research to understand PAR.

3.2.1.1 Action Research (AR)

Meriläinen, Kelman, Peters, and Shannon (2021:7) claim that Paulo Freire created the groundwork for participatory action research with a focus on social justice in the 1940s, which is where action research first emerged in the UK and North America. Further evidence from Meriläinen et al. (2021:3) suggests that PAR was developed as an experiential methodology, a motivating force behind community-driven research aiming for the equitable distribution of power and knowledge, and support for the oppressed and marginalized by challenging shared beliefs about research that have to do with the treatment of co-researchers as research subjects and objects, as well as theory and practice. A German psychologist Kurt Lewin, who was tired of research that is not productive, came up with an idea of action research. He believed that good research must bring about real social change and not just end in the production of books (Nehez, 2022:2). Nehez (2022:2) goes on to say that action research falls under one of the following categories:

1. Technical action research.
2. Practical (Useful) action research.
3. Emancipatory (Empowering) action research

According to Karampelas (2022:3), action research centres on the idea that a phenomenon or topic can be understood and investigated better through actions undertaken by the researchers, groups and organizations affected by the context they wish to investigate or improve. Karampelas (2022:3) further explains that action research is an intervention in activities that can lead to solving the problem or achieving the desired improvements. Banegas (2019:3) articulates that the idea behind action research came with the understanding that a teacher cannot learn without understanding that learners learn too. He further suggests that PAR prioritizes the action over the research, because its aim is to improve practice rather than produce knowledge.

3.2.1.2 *PAR is emancipatory by nature.*

According to Maibi (2020:88), PAR is emancipatory in nature because it has the potential to help co-researchers gain a fresh perspective that will enable them to free themselves from the limitations of illogical, counterproductive, and unfair social structures that impede their ability to grow and exercise self-determination. This study adheres to PAR because it is a method of working that enables educators, students, and communities to develop their practices, their comprehension of their practices, and the environments in which they live and work to modify the nature of work, the worker, and the workplace (Kemmis, 2022:1b). PAR acknowledges and recognizes the people involved in the study, how the study can improve their lives. It enables the marginalized. The team members in this study came from the community and have never participated in a research study before. They were empowered because their contribution and input in this study were observed practically by themselves, and they have seen their inputs being put into practice in fulfilling the objectives of the study.

3.2.2 Knowledge production

To encourage critical reflection and lived experiences, social transformation, and knowledge generation, the PAR research technique actively seeks to involve community members in research, teaching, and action on local social concerns (Smith et al., 2021:435). It engages people in their own fields. In this study, the engagement between co-researchers called for acceptance of new knowledge which enabled them to approach certain aspects of the device, the cell phone, under investigation which they did not know and helped them to analyze the challenges they may face as parents and to find collective ways of dealing with the challenges.

3.2.3 PAR is collaborative by nature

PAR ensures change by giving voice and agency to co-researchers; it presents to them an opportunity to participate in knowledge production that focuses and addresses their specific needs and is culturally sensitive, hence PAR is regarded as a research method that is decolonizing, respects cultural beliefs and making them appear in the research process if needs be (Asuquo & Etowa, 2016:15). In this study

the inclusion of parents, learners, teachers, and education experts like the curriculum implementer creates a true sense of collaboration and collaborative knowledge production.

3.2.4 PAR suits the theoretical framework of posthumanism in this study

The co-researchers in this study, who among others are teachers, can use PAR to collaboratively advance their understanding of their profession and the contexts in which it occurs. This makes PAR pertinent to the posthumanism theoretical framework used for this study. As a result, it enables the teachers to experiment with various teaching methods as they go through the cycles of self-reflection that include thinking, planning, acting, evaluating, and reflecting (Bjorke, Standal & Moen, 2022:5). Similarly, Ulmer (2017:4) describes posthumanism as a paradigm that raises new perspectives on research that straddles the fields of education, social justice, and the environment. This type of research transcends human limitations. Ulmer (2017:5) adds that posthumanism offers opportunities for new ways of thinking about the problems of the present. This is related to PAR, because it is a research method that strengthens capacity, focuses on community development, empowerment, access, social justice, and participation, while at the same time it is democratic, equitable, liberating and life changing (Nelson, 2017:7). Furthermore, this study uses technology in the form of a cell phone to teach mathematics in Grade 3. Parents, learners, and teachers collaborate in the learning and teaching process using a cell phone not only as a learning tool but also as a means of communication and enabler of collaboration. In addition, when used in conjunction with educational research, PAR can be used to improve curricula, foster professional growth, and solve problems in a range of work settings. Its goal is to bring about change in practice.

3.2.5 Objectives of PAR

The objectives of PAR can differ. The objectives that are most pertinent to this study will be highlighted in this section. By promoting capacity, community development, empowerment, access, and participation, PAR's primary objective is to promote social justice (Nelson, 2017:6). The objectives of PAR are twofold: firstly, it seeks to gain

insight into the dynamics of the development process and knowledge about the processes of these kind, and secondly it aims at developing practice and action-oriented results with and for the actors involved (Ukowitz, 2021:3). According to Meriläinen et al. (2021:7), the objectives of PAR include among others involving the marginalized communities in making themselves heard, transforming identified structures of oppression, connecting power and action where action is aimed at making a difference while power should be seen as power to rather than power for. A more radical approach to PAR, according to Meriläinen et al. (2021:8), would aim to redistribute power to:

- bring resources that are perceived as lacking from marginalized communities.
- activate existing capacities within the community for a purpose; and
- encourage or support the community to make a claim for a societal redistribution of power, resources, and rights.

These objectives of PAR are related to this study in that it seeks to help underprivileged learners use a cell phone in the teaching and learning of mathematics Grade 3.

3.2.6 Formats of PAR

Research indicates that PAR is not a single, monolithic research method, but ascertains that there are varying formats of PAR (Gustafson, Parsons & Gillingham, 2019).

3.2.6.1 *Feminist PAR*

A feminist pedagogy is a framework that has the potential to situate a problem, inform analysis and understand the findings. It gives co-researchers a central role in data collection and analysis. Co-researchers are treated as people who are knowledgeable and as such play an important role in knowledge production (Nelson, 2017:7). Furthermore, knowledge generated in feminist participatory action research sheds light on the topic under investigation and provides realistic and effective answers to the issues raised by the research and influences actions of other actors in the research

to solve the problem. Feminist PAR is undertaken by women and girls (Guishard, Heyward, Brown & Stoddard-Pennant, 2021:2).

3.2.6.2 Participatory digital methodologies

Participatory digital approaches are widely used in the human sciences, particularly in education, according to Smith et al. (2021:129). Blogging, digital storytelling, and photovoice are some of these digital approaches. Similarly, the use of digital approaches to PAR also could shed light on both individual and group identities, flattening the hierarchy of the interactions between researchers and participants and assisting coresearchers in improving as researchers. Participatory digital technologies attempt to provide special chances to develop information and experiences that may not be available or possible through the conventional research frameworks, according to Danford, Darnel, Larrazabal, Abdellatif and Smith (2020:131). By engaging in participatory planning, action, and reflection processes, it can bridge the gap between study, theory, and application. Challenges facing participatory digital technologies include access to, as well as experience with digital technologies that might be influenced by gender, race, class, or even sexual orientation. In other words, it concretizes a digital divide based on inequitable access.

3.3 THE ROLE OF THE RESEARCHER

According to Ukowitz (2021:15), the role played by the researcher in PAR is primarily that of a facilitator and an empowering one alluding to neutrality and a process of collective knowledge generation that might be helpful to the entire group. Ukowitz (2021:5) further argue that the most important role of the researcher is to unfold the whole research process to the co-researchers, break the ice, and build trust and rapport. The researcher acts as the research link with the responsibility of organizing a team of co-researchers involved in the study. The co-researchers comprise the Grade 3 teacher, the school HoD, the circuit manager, the Foundation Phase HoD, a librarian, parents, police, and a nurse. The establishment of the research team is facilitated by the researcher. The working team plays the role of mediating the co-researcher's engagement in terms of control, commitment, and collaboration. The

researcher has a role of ensuring a safe and conducive environment for co-researchers to voice their concerns, views, and challenges freely.

3.4 THE RELATIONSHIP BETWEEN THE RESEARCHER AND THE CO-RESEARCHERS

In PAR, the co-researcher-researcher relationship is built on mutual trust, mutual respect, and the position of being equal partners, this relationship ensures that the researcher and Co-researcher work together to determine the problem and create solutions in collaboration with one another so that the most sustainable solution can be implemented (Koole, 2020:1053). The aim of PAR as a research method is to shift the responsibility of the research process from one independent researcher to groups that are directly affected by the problems under investigation. PAR researchers set their goals on the directly affected groups for them to get expertise and lay knowledge from the people affected by the problem. Furthermore, PAR focuses on the co-researchers' skills and their experiences they have with the people involved in the study. The relationship between the researcher and co-researcher is based on combining the co-researchers' various areas of expertise with their unique social contexts to solve the problem cooperatively. They work together in identifying the social problems that affect the community, the resources and to find solutions that can be sustained through the active role played by the co-researchers. PAR aims to empower the people affected by the problem under investigation by involving them in the problem directly to find solutions that they can own and sustain.

The study follows a posthumanism lens for guidance to address the relationship between the problem under investigation and the people affected by the problem. Posthumanism shows that knowledge or schools as such relate to the non-human human world in so many obvious and unobvious ways (Ross, 2021:12). By resolving the relationship between the posthuman and the environment, posthumanists create solutions to the issues they face. This way of thinking recognizes and encourages the influence that the researcher and the co-researcher have, as well as the possibility of altering the dynamic. To reduce the complexity of the research process into a manageable endeavour, co-researchers, adopting a posthuman mindset, combine available resources, theories, philosophical understanding, and methods of inquiry in

novel ways. They do this by developing affirmative ethics, developing new ways of thinking, and improving their capacity to identify constructive, alternative, non-hierarchical, and respectful ways of interacting within such assemblages (Koole, 2020:1054).

The co-researchers, following a posthumanism theory, worked together as a team. Their activities are all focused and directed towards one goal based on posthuman objectives, based on PAR guided by the following nine principles:

- The Identification of the individual and group project;
- Altering and studying discourse, practice, and social organization: the distribution of power, Running Head: Participatory action research;
- Changing the culture of working groups, institutions, and society;
- Action and reflection;
- Unifying the intellectual and practical project;
- Knowledge production;
- Engaging the politics of research action;
- Methodological resources; and
- Developing a work-related theory.

3.5 ETHICAL CONSIDERATIONS

Ethical considerations are very important to be considered when undertaking a research project to take decisions that are ethically sound. The researcher in this study, requested ethical clearance from the University of Mpumalanga to comply with ethical considerations and moreover, a request for authorization to carry out research at a school was made to the Mpumalanga Department of Education.

The researcher made it clear to the school and co-researchers that participating in the study is voluntary, that information gathered will be treated with confidentiality, and will be made available to them on request. Co-researchers were advised that if they decide not to continue with the study, they can stop participating at any time. Permission was sought from all co-researchers through written letters. Informed consent was sought from the learners' parents and guardians for all research-related activities after the learners were informed of the issues of anonymity, confidentiality,

protection against harm, and informed consent. They were informed that they might stop participating in the study whenever they wanted. The research was reported using fictitious names.

3.6 RHETORIC IN PAR

Language usage in PAR is very important. The basic goal of PAR technique is to give the oppressed and marginalized people more power through language that builds ability and emphasizes participation, social justice, and access. (Nelson, 2017:4). This method advocates co-researchers to be treated with respect, not as necessarily as objects of research but as Co-researchers. The co-researchers are provided with space for growth by participation. They are given an opportunity to identify their own challenges and to find solutions that they can own and hence implement, thus making intervention effective (Nelson, 2017:7).

The research team in this study identified the prevalent language that is used in the area, considering that it is understood, spoken, and written by all. They identified Xitsonga as a unifying language for all of them. They decided to use Xitsonga because all co-researchers can speak, understands and are able to write using the language, including the learners. The Xitsonga language enabled all the co-researchers to freely express their cultural wealth and the value attached to it. The use of language enables communities to build power and maximize participation (Halliday et al., 2019:177).

3.7 CHALLENGES OF PAR AS A RESEARCH METHODOLOGY

PAR as research methodology has several challenges, which include, among others, the broader types and objectives of stakeholder involvement, power distribution and control among the research team members, establishing common, complementary learning processes through reflexive and reciprocal exchange, and the difficulty in ensuring and guaranteeing an action stage carried out with meaningful coproduction (Smith et al., 2021:130).

According to Nelson (2014:8), some of the challenges that come with using PAR as a research methodology can be categorized as those that come with the objectives of PAR, those that come with the co-researchers, and those that come with ethical issues. However, Smith et al. (2021:130) suggest that the use of digital methodologies can mitigate these challenges.

3.7.1 Challenges that come with the objectives of PAR

The general challenges that come with the objectives of PAR include fear of participants referred to in this research methodology as co-researchers to participate in the study, the everyday stress that comes with engaging in a research process, the tension between commitment in relation to the actual involvement, priorities of co-researchers and the workplace, travel distance between the co-researchers and the researcher, ability to draw lines of inclusion, and exclusion between co-researchers and the researcher, for instance when the librarian, or a parent is involved.

3.7.2 Challenges that come with co-researchers

The challenges co-researchers face includes sharing different values, perspective, and abilities with the researcher. If not dealt with, the balance of power between the researcher and the Co-researchers becomes a problem. Accessing the community is a challenge at times, due to the protocols of access some communities might have. PAR is seen as egalitarian (Nelson, 2017:8).

3.7.3 Challenges that come with ethical issues

Gustafson et al. (2019:4) discuss challenges that come with ethical issues, which include concerns about proving the legitimacy to colleagues who view PAR as a soft research method, the assumption that it is under-theorized, and the belief that research should be mutually beneficial. Negotiating power dynamics in institutionalized settings, such funding agencies and research ethics boards, is one of the difficulties (Nelson, 2017:6). Sharing knowledge utilizing unorthodox writing techniques that are more accurately a reflection of critical realists' epistemic perspective and consistent

with feminist PAR can help overcome the challenges of power and control in the construction of knowledge (Gustafson et al., 2019:4).

3.8 SUCCESS INDICATORS OF PAR

A PAR approach enables greater commitment and teamwork. It improves team cohesion and increases local ownership of the entire problem under study (Tetui et al., 2017:49). For PAR to be successful in this study, there should be a clear indication that there is empowerment of parents together with the learners and teachers in the community. When the parents and learners get involved, they will own up to the strategy aimed at improving the teaching and learning of mathematics; they can help with the resources the school needs to ensure the strategy continues to be used.

This empowerment process invites the collaboration of parents and teachers to work together as a team, to make collective decisions, and to share roles and responsibilities as far as using the strategy under investigation. Although the research was conducted at one school, the parents who participated showed keen interest and willingness to encourage other parents to support the use of cell phones to help their children learn.

3.9 STUDY CONCEPTUALISATION

The study is attempting to answer the following research question:

How to improve the teaching of Grade 3 mathematics using cell phones with the support of parents and teachers?

In response to the research question, the aim of this study was to formulate a strategy to improve teaching and learning of Grade 3 Mathematics using cell phones with the collaborative support of parents and teachers. This aim was made to be made operational and achievable by dividing it into the following objectives:

1. To investigate the challenges of teaching and learning of Grade 3 mathematics using cell phones with the support of parents and teachers;
2. To explore solutions to challenges of teaching and learning of Grade 3 mathematics using cell phones with the support of parents and teachers;

3. To analyze conducive factors for teaching and learning of Grade 3 mathematics using cell phones with the support of parents and teachers;
4. To identify possible threats when using cell phones to teach Grade 3 mathematics with the support of parents and teachers and find ways of overcoming them; and
5. To investigate whether the solutions to the challenges identified are effective.

3.9.1 Step 1

This study is based on a school in the Bohlabela district of Mpumalanga province. Co-researchers were invited through letters sent via Grade 3 learners to their parents, letters given to the educators, HoD and circuit manager. The others were invited telephonically, and a letter was sent using WhatsApp. The invitation indicated the topic under study. The letter outlined how they will be involved in the study and the conditions. Issues of ethical consideration such as trustworthiness, anonymity, confidentiality, and the right to withdrawal were also explained in the letter.

Finding a technique to enhance the teaching and learning of mathematics in Grade 3 using a cell phone with the cooperation of teachers and parents was the first thing that needed to be done in the first phase. The researcher identified the problem. To present the problem, the researcher scheduled a meeting with the principal, HoD, and teachers. The researcher needed to present the problem to the team that will be constituted.

3.9.2 Step 2

The research team was identified. The researcher identified the Grade 3 class teacher, the Foundation Phase HoD, the school admin clerk, the parents of Grade 3 learners, the community librarian, the district curriculum implementor and the Grade 3 learners. The community librarian was also invited to talk to parents and learners about concerns relating to smartphone use, such as cyberbullying. The Grade 3 class teacher was selected because she was teaching mathematics in that grade. To find the research team, she needed for the study, the researcher met informally with the HoD of the school.

Planning was necessary after the informal meeting, and it resulted in the formation of the research team. Each member of the team was made to understand their roles and responsibilities. Priorities were set and decision taken on which activities to undertake. The team was very much aware that they were all co-researchers and that their task was to create a plan for using cell phones to teach math in Grade 3 with the help of parents and teachers.

3.9.3 Step 3

The researcher identified the resources to use during the study. It included a laptop, a voice recorder, video recorder, tablets, cell phones, and connectivity resources. The distance from home to school was an advantage as all parents needed to walk to school. The presence of the community librarian made it easy for the team to get mobile devices and the community librarian managed to bring tablets to the school that were used together with the few cell phones the researcher had.

The team first identified the problems the teacher had in teaching mathematics in the Grade 3 classroom. Team members identified several solutions, the strategy to be used was agreed upon by all team members and they analyzed its strengths and its weaknesses. They all participated in implementing the strategy identified.

3.9.4 Step 4

The team requested a timetable for the Grade 3 class. They visited the class for observations during mathematics periods. Learners' workbooks and mark record sheets were analyzed and examined by the team. Meetings were organized to examine what could be done to improve math teaching and learning after the visits. Video and voice recordings were taken during the meetings. This encouraged the team to work together to find solutions to their problem.

3.9.5 Step 5

After generating data, it was examined, analyzed, and interpreted using a technique called Critical Discourse Analysis that was accepted by everyone on the team. Several

different sorts of technologies were used to create the descriptive account of the data collected.

Through their communication skills, the team members improved their comprehension of one another as they participated in the data analysis and interpretation process.

3.9.6 Step 6

The study's conclusions were subsequently formulated in light of the study's findings. The generated information was then used to develop the conclusions, which included the numerous discourse texts examined, the choice of words used by the teachers and other team members, the gestures observed on the video recordings, and the learners' responses recorded during lessons.

3.9.7 Step 7

The study's major goal was to devise a strategy for using cell phones to enhance the teaching and learning of mathematics in Grade 3 while enlisting the help of both parents and teachers. After having discussed the findings with the Grade 3 teacher and the parents involved the researcher reported the findings to the school HoD and the circuit manager. This was done to create an awareness that for the strategy to be implemented the school, the parents had to support the provision of the required mobile devices, the necessary support from parents and teachers and the ongoing support of the various stakeholders. The community librarian, already a stakeholder in the school by being a member of the school QLTC, can collaboratively work with the Grade 3 teacher to offer ICT skills to both the teacher and the learners.

3.10 DESCRIPTION OF THE RESEARCH SITE

The school under investigation is situated in the deep rural areas of Bohlabela district and in a predominantly poor community. Bohlabela district is the poorest area of Mpumalanga province. The school was selected because learners at this school perform below average. Grade 3 is the exit point of the foundation phase and as a result learners are expected to have mastered basic mathematics skills to start learning in

the intermediate phase where they will be expected to work independently at times. For the Grade 3 learners to be competent in mathematics, a strategy needs to be designed to enhance Grade 3 mathematics instruction and learning. This strategy needs to involve the collaboration of parents and teachers using cell phones. The location of this study makes it a rich and fertile ground for the expression of PAR. A study that uses PAR as a guiding lens is sensitive to the poor and the marginalized and focus on involving those who are affected by the problem to find solutions. To advance social justice, equity, and democracy, PAR seeks to transform both the researcher and the co-researchers at the research site.

3.11 HUMAN AND PHYSICAL RESOURCES IN DATA GENERATION/CREDENTIALS AND ROLES OF THE RESEARCH TEAM

The views presented in this study are mainly those of the co-researchers. The co-researcher identified among themselves a coordinating team and a coordinating team leader. The leader of the coordinating team was the researcher. They set up the coordinating team according to their strengths and abilities because they knew one another. They represented the wider group affected by the problem under investigation. The coordinating team comprised learners, parents, education officials, foundation phase HoD, nurse, librarian, police, and pastor as part of the coordinating team were invited through a written letter sent to parents through their children. A letter was sent to the HoD of the foundation phase, the educator of Grade 3 learners, the circuit manager, the nurse, police, businesspeople, librarian, and the pastor. The topic of the study was included in the letter. The aim was to ensure that they understand the nature of the study and ethical considerations that need to be adhered to beforehand, which includes confidentiality, anonymity, and freedom to participate and withdraw from the study. During the first meeting, consent and assent forms were distributed, and all who are willing to participate signed the forms. The coordinating team formulated a working plan for meetings and discussions. The plan outlined that the team would meet once a week for a period of two months. Each session would last no longer than 45 minutes. The team was also responsible for identifying key areas of the study that needed urgent attention to achieve the set goals of the study. Key inputs from researchers were added to the plan for execution.

Table 3.1: Profile of Co-researchers

Co-researcher portfolio	Co-researchers credentials	Pseudo name
1. Grade 3 class teacher	Qualified teacher with more than twenty years teaching experience. Has a teaching diploma and an advanced certificate in education. Between the ages of 45 and 55.	Mrs. Baloyi
2. HoD	A qualified teacher with a teaching diploma and an Honors degree. Been a head of department in the foundation phase for ten years.	Mrs. Makhubele
3. Parents	They are between the age of 25 -65 (17 parents altogether).	Mrs. Mdluli Mrs. Maleka Mrs. Mathebula Parent 1. Parent 2. Mrs. Makukule And other parents
4. Learners	All in Grade 3 (17 learners altogether).	Lerato Matimba Sandile Other learners
5. Curriculum implementer	A life skills C.I. who works in the district office. Qualified as a teacher. Motivator and coordinates life skills programme in the district.	Mrs. Malumana
6. Community librarian	Works in the community library and assist with school programme related to the library. Interested in curbing cyber bullying.	Victoria
7. Teacher at the school	Qualified teacher who works at the school.	Mrs. Sekatane Mrs. Ubisi
8. The researcher	Works at the school, the principal of the school, qualified as teacher, has an SPTD in education, BA Education, BEd	

	Honours in Education, ACE in Technology Education.	
9. Research coordinator	An IT specialist who coordinates and organise activities of the research study.	Mrs Kubayi

3.11.1 The study coordinator

The study coordinator's role is explained above. The coordinator acts as the team leader of the co-researchers. The team leader was guided by the principles of posthumanist theory that guided the study. Posthumanist theory pushes for the need to take indigenous knowledge seriously, because if not, it means putting space for western institutions on top of a knowledge production pyramid at the expense of the indigenous ontologies of the Global South (Diaz de Liano & Fernandez-Gotz, 2021:543).

3.11.2 The parents

The 17 parents involved in the study were mainly young mothers aged between the age of 20 and 35. One of them is a grandmother, a guardian to one of the Grade 3 learners who is keen to assist and support her grandchild's education. Most of them passed Grade 12. One is a teacher at the same school. They were invited into the study aimed at improving the teaching and learning of mathematics Grade 3 using cell phones with the collaborative support of parents and teachers through a letter. They signed consent forms and assent forms for their children. As co-researchers and co-knowledge builders, the parents took part in the process of finding solutions to the problem. They gained their freedom and a better understanding of how mathematics instruction could be enhanced. One of the parents used to send her daughter to the meetings when she was not around so that she did not miss out on the progress of the research process. She is working and participated when she was on leave. The team leader was one of the young parents. Overall, the parents felt valued when the challenges were presented to them, and solutions sought in a collaborative manner. The end- of-year results (2021) and Term 1 and Term 2 work were presented to them, and they all agreed that a strategy needed to be developed to enhance the teaching of mathematics in Grade 3. The parents were strongly in favour of the strategy and

permitted their children to take part in the additional classes as part of carrying it out. They assisted their children when they brought tasks home and regularly communicated with the grade teacher.

3.11.3 The Grade 3 class teacher

The Grade 3 teacher was invited to participate in the study so she could take part in the initiatives to improve the Grade 3 mathematics teaching and learning. A letter outlining the requirements for participating in the study was used to invite the teacher. As a Grade 3 class teacher she is also the mathematics teacher in the same class. She has been teaching the Grade 3 class in the same school for 12 consecutive years. She can be viewed as a master teacher due to her teaching experience in teaching the grade. She is a qualified teacher with an Advanced Certificate in Education.

3.11.4 The Foundation Phase HoD

The Foundation Phase HoD was invited into the study through a letter. She signed a consent form. She has been teaching Grade 1 in the foundation phase for 20 years. She is responsible for monitoring the curriculum in the foundation phase and keeps records of performance. She has been instrumental in showing how the teaching of mathematics in Grade 3 is a challenge. She showed us the targets for the year and how the Grade 3 class did not manage to reach the expected target for the year.

3.11.5 The Grade 3 learners

The Grade 3 students minors, so for them to take part in the study, the researcher had to first get their parents' consent by sending them letters requesting that they do so. For parents to comprehend consent documents, they were prepared in the pupils 'home language, hence Xitsonga was used. Learners contributed and participated in the study by writing tasks, practicing mathematics skills using a cell phone, and assisting one another using cell phones with tasks. Learners were grouped into six groups because the team managed to gather six cell phones/tablets for use in class. For later transcription, analysis, and interpretation, their reflections were extracted

from video recordings and written assignments. Learners engaged in practical mathematics activities by using a cell phone and the IXL program. The program helped them to practice the skills their teacher taught them. It gave them feedback instantly and explained when they did not get it right. The positive engagement of learners exhibited both challenges and successes of the strategy to enhance mathematics instruction in a grade 3 classroom. The learners were excited and willing to share the skills they acquired with other learners. This was an indication of collaboration as peers.

3.11.6 The district curriculum implementer/subject advisor

The subject advisor from the district office was responsible for life skills. She had been a foundation phase teacher for many years. As a subject advisor for Life Skills, she was deeply concerned about parents' involvement in their children's education. She was invited to join the

study through a written letter that invited her to participate in the study and explained the conditions of her participation. The curriculum implementor was very instrumental in encouraging parents to work together with teachers to help learners. She spoke to them telephonically and her voice and video recording of the parents captured her engagement. She allowed parents to ask questions and open a discussion on how best they could do it, since some of them are old and uneducated. One old grandparent indicated to her that she greatly wishes to assist her child, but the child did not cooperate. She indicated to her that she needed to be patient with the child, not lose hope and continue supporting the child.

3.11.7 The community librarian

She was invited into the study through a written letter, and she signed a consent form to participate in the study. She is a stakeholder in the school because she was already a member of the school QLTC committee and an ex-officio member of the school library. The librarian was very instrumental in encouraging parents to work together with teachers to help learners. She indicated that technology is very good in assisting learners to learn; however, there are many challenges that accompany the using cell

phones in the classroom. She discussed with the parents the dangers of cyber bullying, how they can see the signs in their children. She discussed the dangers of harmful content and side effects of prolonged use of technological devices. The parents and teachers listened and engaged positively, saying they were not even aware of the dangers of giving children cell phones without monitoring usage.

3.12 COMMON VISION

A shared vision encourages organized team members to focus their efforts on achieving a single objective, which enhances practice and enables all team members to participate and suggest future actions. When directed by a common vision, members of a coordinated team are united and eliminate personal interest to focus on their current reality and envisaged destination. At their initial meeting the co-researchers discussed their common goal and the need to establish a coordinated team.

3.13 STRENGTHS / WEAKNESSES / OPPORTUNITIES AND THREATS (SWOT) ANALYSIS

To determine the study's strengths, weaknesses, opportunities, and threats connected to the success of the strategy, a SWOT analysis is a strategic planning and management technique that can be employed. The plan was then able to identify the strengths and opportunities that will eventually balance out the threats and weaknesses after identifying these elements. The SWOT analysis helped the team prioritize and plan their strategy.

3.13.1 Strengths

During their initial meetings, the team identified areas where they had expertise and developed strategies to strengthen the expertise. The team consisted of members with knowledge about ICT, parent involvement and knowledge about the mathematics curriculum. This greatly enriched the study. The community librarian offered mobile devices for use in class, offered talks about cyber bullying and ICT lessons to the

Grade 3 teacher. The district official, who was a Life Skills curriculum implementor, encouraged parents to participate in the education of their children. The school clerk offered her ICT skills for the research project as well as for the Grade 3 class.

3.13.2 Weaknesses

They identified as their weakness the challenges of teaching mathematics Grade 3 and realized that team teaching, and collaboration could be their strength. As a result, team members used the expertise they had. One of the weaknesses identified was age and literacy levels of some parents/guardians. However, the team spirit that existed allowed for mitigating strategies to solve the problem.

3.13.3 Opportunities

Team members used their varying expertise to teach mathematics Grade 3. Their varied educational backgrounds and line of work were seen as assets to the team, particularly the participation of the librarian, the subject advisor, and the administrative clerk with IT knowledge.

3.13.4 Threats

One of the threats that emerged during the study was power dynamics between the team members. The traditional belief that teachers and officials are superior made it difficult for parents to share their views. A general discomfort when they were together was evident; they were hesitant to ask questions and to air their views.

3.14 STRATEGIC PLAN

The team needed to formulate a strategic plan and an implementation plan. For that to happen they had to set clear priorities to make sure that higher needs are met by investigation and evaluation of issues that are faced. Team members negotiated which problem do they need to start with in their strategic plan. In this study the team unanimously agreed to start with research team formulation that will serve as the

coordinating team and creates space for presentation and untangling of problems. The coordinating team will organize the lesson planning sessions and the lesson presentation and later evaluate by discussing concerns arising from co-researchers' classroom activities, particularly those pertaining to pedagogical difficulties and briefings related to the importance of supporting learners as parents. As teachers, they decided to have workshops on safeguarding the health, physiological as well as psychological wellbeing of the learners when implementing the strategy.

Table 3.2: Action Plan

PRIORITIES	ACTIVITY	ORGANISING PERSON	RESOURCES	TIME FRAMES	MONITORING
Priority 1 Empower teachers to use cell phones	Initial planning and goal setting. Identify challenges and mitigation factors	Study coordinator and the team	Classroom	1-hour meetings over a period of two weeks One session in a week	Engage in discussions
Priority 2 Empowering parents to be involved	Discuss possible solutions to the challenges Parents meet on a weekly basis to discuss way Forward.	Team members, district official Team members/ parents	Meeting room Pamphlets	2 hours 1-hour weekly meetings for a period of three months	Discussions: the district official gives a talk about parent involvement in education. Parents meet and engage in discussions to use the strategy. The librarian talks about cyberbullying and how

					parents can see the signs.
Priority 3 Empower learners to use cell phones	Discuss conditions favourable to the success of the strategy.	Grade 3 teacher, librarian and the study coordinator.	Cell phones and tablets	2 hours in a week of lesson presentation and reflection over a period of three months.	Teacher does lesson presentations. Team reflects on the lesson.
Priority 4 Enforce collaboration between parents' teachers and learners	Discuss the strategy and reflecting on the success.	Grade 3 teacher, Foundation Phase HoD and the school clerk.	Cell phones, tablets, learners' workbooks.	1-hour meetings every week for a period of three months.	Learners' workbooks and tasks assessed to check progress. Reflections. Plan for new activity.
Priority 5 Critical thinking	Learners learn using cell phones.	Grade 3 teacher, learners, and librarian	Cell phones, tablets	1 hour daily	Learners engage in lessons using cell phones

The co-researcher and available researchers analysed the lesson presented together with the learners. In a way of evaluating the lesson a platform was created for learners to share their experiences of the lessons. Gaps were identified and suggestions for improvement were made.

The co-researchers discussed the narrative account of what happened during the lesson. The aim was to make sense of the team's interpretation and understanding of their situation and how it can be improved.

Researcher: *Looking at the lessons we observed other days and today's lesson, what do you think is the difference?*

Lulani (learner): *The difference is that some days we just listen to the teacher and after that answer questions, but today we were given cell phones, we could see the coins, and money papers with colour on the phone, the exercises that we were doing on the cell phone are interesting, the feedback is nice, for instance it tells me fantastic, or*

well done or excellent, if I get it wrong the explanation is given immediately.

Researcher: *What do you think we can do to make the lesson more interesting?*

Vunene: *I really enjoyed the lesson, we were able to discuss the answer with my group, we could lough together when we get it wrong and correct where we didn't understand, we were able to work on our own without the teacher. I enjoy the IXL program so much.*

Andile: *I enjoyed because I could switch from the IXL program to the calculator to find the correct answer quickly.*

This encounter between the researcher and learners indicated the excitement the use of cell phones in the teaching of mathematics in the classroom.

3.15 DATA ANALYSIS THROUGH CRITICAL DISCOURSE ANALYSIS (CDA)

Critical Discourse Analysis (CDA) was utilized in this study to analyze and interpret the data. When properly applied, CDA aids in empowering the oppressed communities to identify any attempt by the powerful to perpetuate, enact, and legitimize injustice to keep up their cycle of oppression and supremacy over them (Fairclough, 2013:1). Three layers of data analysis were used in this investigation.

3.15.1 Textual level

At the textual level of analysis, the use of certain linguistic features such as pronouns, specific vocabulary, scientific words, and technical words was aimed at including the team members by also using the dominant linguistic features and semantics of the dialogue at that time (Al Falaq & Puspita, 2021:66).

The team focused mainly on the lesson preparations presented, the mathematics workbooks of the learners in Grade 3 when analysing the texts. This also included the written and oral material that was gathered in the classroom to investigate the teaching and learning process, the interactions between the teacher and the learners, and the interactions amongst the learners themselves.

According to research, our thoughts are where knowledge is stored, hence text analysis affects our knowledge (Al Falaq & Puspita, 2021:62). When the team analysed

data, they had it in their minds that limiting their analysis to a mere synthetic analysis would make them lose meaning, as there are some linguistic features that cannot be grasped verbatim. It was noted that certain members of the team were advanced in age and illiterate and would not

understand some of the technical language used, as opposed to the younger generation of parents.

3.15.2 Discursive level

In critical discourse analysis, the discursive practice level refers to the process of producing, receiving, and interpreting a message using social norms, rules, and mental models of appropriate behaviour in particular circumstances, roles, or relationships. It consists of both spoken and unspoken laws. Its main purpose is to make co-researchers feel and realize that things are as they supposed to be. The discursive level when using the Fairclough model of analysis is also concerned with how the public consumes the text at production, distribution, and consumption level (Al Falaq & Puspita, 2021:62).

For this study, the discursive practice level was according to community norms and values of learners and parents' respect towards the teacher and learners freely engaging with the teacher. The introduction of a cell phone to teaching and learning brought about a feeling of acceptance after parents had been taken through a process of how it will be done and how they should be involved as a support structure to both the teacher and the learners.

3.15.3 Social level of analysis

According to Mogashoa (2014:104), CDA is motivated and particularly interested in understanding urgent social concerns that affect marginalized populations, as suggested by Van Dijk (2006:252). Analysis at the social level is concerned with the notion of the text being more than just words but discloses rights and obligations by avoiding contradictions in the text. It cannot be rejected or deemed risky; it is free of discrimination and toxic masculinity (Al Falaq & Puspita, 2021:63; Mogashoa,

2014:106). Mogashoa (2014:106) further indicates that the goal of CDA is to connect the dots between the actual text, discursive practices, the broader social environment, power enactment and discourse production, and the socio-cognitive interface between production and domination to understand their relationships. To investigate and uncover the power dynamics restraining social inequality, this study uses CDA to better comprehend the mathematics classroom discourse at the school and to uncover power dominations that prevent and stop people from identifying dominant ideologies and escape from such oppressive discourses that disempower them from acquiring alternative solutions to their social problems.

3.16 SUMMARY OF THE CHAPTER

The research design of the study was the main topic of the chapter, with PAR serving as the best approach to direct it. The co-researchers' roles and duties were the emphasis of the research design to accommodate data generation and facilitate planning, implementation, and reflection. It emphasized the part played by the researcher and their interaction with other researchers. This was done to demonstrate that everyone was on an equal footing with everyone else and that no one was superior to them. Data were generated using audio and video recordings, pictures, observation, and free attitude interviews. Data were analysed using CDA focusing on textual, discursive, and social analyses. Data analysis was in line with the theoretical framework guiding the study, posthumanism. Data analysis, data presentation, and conclusion interpretation are covered in the following chapter.

CHAPTER 4 :

ANALYSIS OF DATA, PRESENTATION, AND INTERPRETATION OF RESULTS

4.1 INTRODUCTION

The purpose of this study was to develop a strategy for teaching Grade 3 mathematics using cell phones with the help of parents and teachers. A review of the data analysis is presented in this chapter, followed by an explanation of how the results were interpreted to improve the teaching and learning of mathematics in Grade 3. According to the study's five objectives, the data are presented, analysed, and interpreted. Pictures, written text, and scenario-based presentations will all be used to present it. this will be carried out in accordance with the theoretical framework for the investigation and the governing laws from earlier studies.

Data will be analyzed using CDA at three levels: the text, the discursive practice, and the social structure. Teele et al. (2020:109) claim that CDA can be used to glean the deeper meaning of a text in order to support the need for using the strategy to teach mathematics in Grade 3 with the help of parents and teachers and to examine the difficulties encountered when using the strategy in order to develop strategies to use in improving the teaching and learning of mathematics using cell phones.

To make sure that the success indicators and benefits of utilizing this technique are consistent with the strategy, the conditions under which it can be employed successfully are analysed. To further understand the co-researchers' statements from a perspective that supports equality, democracy, and social justice in relation to the data, it will be evaluated via a posthumanist lens. With the assistance of parents and teachers, this study aims to create a strategy for teaching Grade 3 mathematics using cell phones. This chapter provides a discussion of the data analysis, followed by an explanation of how the conclusions were used to enhance the grade 3 mathematics curriculum.

The data are presented, examined, and evaluated in accordance with the study's five objectives. It will be presented using graphics, textual text, and scenario-based presentations. This will be done in accordance with the investigation's theoretical framework and regulating laws from previous investigations. to comprehend the use

of the significant other in the instruction and learning of mathematics using mobile devices. To better understand the evidence and ensure that the strategy's solutions are based on an understanding of how to improve teaching and learning in the digital age, we will also interpret the evidence using the connectivism concept, emphasizing the use of mobile technologies and learning through connections and social networks. For each of the research's goals, the procedure will be repeated.

4.2 IDENTIFICATION OF CHALLENGES TO THE IMPLEMENTATION OF THE STRATEGY

Data related to the key components of the strategy, before the establishment of the team, all members met to discuss the problems experienced by the Grade 3 mathematics teacher and to propose a possible solution. The first meeting of the team identified five components.

- Challenges faced when teaching mathematics Grade 3 without the use of cell phones with collaboration of parents and teachers;
- Solutions to the challenges experienced when teaching mathematics grade without the 3;
- Conducive factors that contribute to the effective teaching of mathematics Grade 3;
- Possible challenging threats that may arise and the success indicators of implementing the strategy or the solutions; and
- Evidence that the strategy is working.

4.2.1 Failure to recognize the power the cell phone has in improving the teaching and learning of mathematics

The cell phone has been regarded by many countries and departments as an unwanted tool that is disruptive and not needed in the classroom. However, the cell phone is generally loaded with beneficial applications that support learners in their studies in many ways that save them time and are less effort (Tawafak, Alfarsi & Jabbar, 2021:2). The negative attitude of parents, teachers, and the Ministry of Education at large towards using cell phones at school is seen as a big challenge

restricting the usage of mobile devices in the classroom (Tawafak et al., 2021:2).

The research team in the study during their initial meetings were against the use of cell phones in the classroom for teaching and learning. This was evident when the HoD, the teacher and parents engage.

Mrs. Makhubele: *If I may ask, do children bring cell phones in the school for learning, or does the school provide for learners? Here, we don't want to see cell phones, when we find a learner having a cell phone, we confiscate it and the parent will be called to fetch it and the learner disciplined.*

Mrs. Mdluli: *You can allow them to bring cell phones at school that will be the beginning of trouble for the school, I tell you.*

Researcher: *What is your view of the many applications that the cell phone has and can assist learners learn mathematics?*

Mrs. Mdluli: *The cell phone can only cause disruption it cannot be allowed at schools.*

Mrs. Sekatane: *If I may ask Mam [referring to the researcher] can you explain how the cell phone can help us because my son is doing very bad when it comes to mathematics.*

Researcher: *We can all look at our cell phone screens and see the features which can be helpful.*



Figure 4.1: *Cell phone screen*

Figure 4.1 above illustrates the many applications that can be used for mathematics teaching. The applications include the calculator, the calendar, the clock, the camera, voice recorder, SMS, WhatsApp, google map and other applications that can benefit the teaching and learning of mathematics in a remarkable way.



Figure 4.2: Cell phone calculator

Figure 4.2 above shows how the cell phone calculator app can help the learners calculate, including measures of time and metric measures. It can help learners verify their basic operations answers. This figure is an example of many applications that can be used to better improve the teaching and learning of mathematics.

The research team after long discussions about the matter concluded that a cell phone is a very good tool that can be used to improve the teaching and learning of mathematics. This is in line with the posthuman nature of the study which promotes hybridity in education. They managed to help each other familiarize themselves with the basic applications that can assist their children to learn mathematics. They include the calculator, the clock, the calendar and the Google Map.

They agreed to learn more on how the internet, the voice recorder and other related applications can assist during the study. This supports the concept of connectivism that guides the study as its conceptual framework. Connectivism sees learning as the use of connections and networks to access information.

4.2.2 Challenges faced when teaching mathematics without the collaboration of parents

Parents and teachers' knowledge and expertise in instructional methodologies and assessment techniques are necessary for the development of effective schools. The involvement of teachers and parents need effective communication strategies with one another for shared decision-making and to recognize and adhere to their shared interests and responsibilities (Adams et al., 2016:59).

In their follow-up meetings, the team of co-researchers discussed the challenges that come with the mathematics instruction and learning in Grade 3. They identified lack of

collaboration between parents and teachers in teaching Grade 3 Mathematics as a serious challenge.

The team identified and invited a Life Skills curriculum implementer to talk and motivate parents about this issue. Due to work-related commitment, she was not available physically, but she addressed and engaged telephonically with the parents (that again was an indication of the power of the cell phone). The district office's curriculum implementer shared her personal observations of what happens when parents are not involved in the teaching and learning process. She explained that children feel unsupported; they feel disempowered when parents are not involved; and they are excluded from the education of their children. At the same time, teachers feel overwhelmed with all the responsibilities that rest solely on their shoulders.

Mrs. Malumana [curriculum implementer]: *Dear Parents, for the success of the education of our children, parents and teachers need to work together, sometimes as parents we feel it is the responsibility of the teachers only; however, this is not the case, when our children are given homework, we need to support and help them, we need to come when we are invited to the school and when we have to support learners.*

Parents asked the curriculum implementer how an uneducated parent could assist their children because they could not read or write.

Mrs. Sekatane: *Here Mam, there guardians who are very old, what do you suggest they can do help their grandchildren.*

Mrs. Malumana: *The grandparent of the learner can go and seek advice from the teacher and the teacher will find a way of supporting the older parent and the child. Being uneducated cannot stop a parent from supporting their children.*

Mrs. Mdluli: *We are all neighbours here, va ri nwana a hi wa unwe [let us help each other as parents].*

Posthumanism, the theory that guides the study, allows for an active approach in education and for experiences of agency and ownership of one's learning for both teachers and learners. Hence the learners and teachers need the collaboration of parents to achieve the sense of ownership and agency of learning. This is possible through social networks and connections. The study, guided by the conceptual framework of connectivism, brought to the fore the realization that through network connections the learning of mathematics in Grade 3 classes can be enhanced. This

was evident when learners in the classroom and possibly outside the classrooms connect to online platforms for the teaching and learning of mathematics.

Data show that parents were not active in their children's teaching and learning processes before the commencement of this study, it was very evident that parents and teachers did not work together. This was evident in the first meeting of the research team. This is what Mrs. Mdluli said:

“Yoo! You know I did not take it seriously; my children were coming in and out of school every day I didn't even bother to ask how was school?”

This confession did not only apply to Mrs. Mdluli but to many of the parents. Before the commencement of the study most of the parents never bothered with supporting their children with schoolwork. The teacher, Mrs. Baloyi confirmed this by saying,

“When you give learners homework or projects, most of them will come to school without having done the work or with incomplete work. This made work difficult for me because I have to repeat that work several times until it is done by all learners.”

The teacher also did not invite parents to the school or communicate with them their challenges. She confirmed this by saying the following when asked about the level of engagement with parents:

Researcher: *How often do you invite parents to the school or communicate with them?*

Mrs. Baloyi: *I normally don't invite them, I mostly invite them when their children are involved in fights and other forms of ill-discipline, for teaching related matters even if you can invite them, they don't come.*

Learners feel disempowered when parents and teachers don't work together; they are essentially left in charge of the teaching and learning process. Because they are excluded, parents are unaware of their responsibility for their children's education. Ultimately, the students' performance declines.

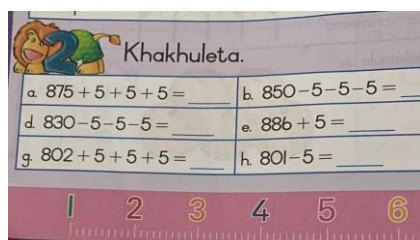


Figure 4.3: *Work a learner was to do at home*

Figure 4.3 represent an example of a learner's workbook who was constantly not doing her work because of lack of support at home. This example applied to many other learners.

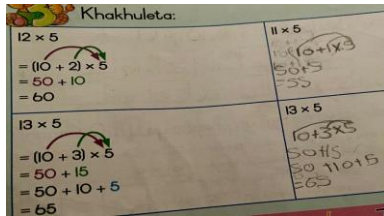


Figure 4.4: Showing work of a learner struggling alone

The posthumanism theory, guiding this study, views learners as entangled and connected and responsible to themselves alongside other people, humans, the non-humans, and the environment, thus justifying the need for parents to get involved and for technology to be used. In this study there was no before the study. The team came to understand the advantages of teamwork in math teaching and learning. The use of cell phones will not only benefit the learners' teaching and learning but can also be used as an effective communication tool between parents and teachers as well as between teachers and learners.

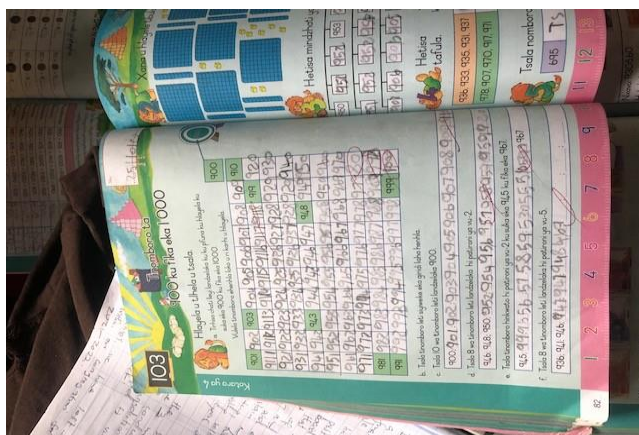


Figure 4.5: Learners' work before the study began

Figure 4.1 illustrate an example of a learner's work whose parents are not involved. Several other exercises are the same. It is a symbol of a child who is not supported,

left alone to struggle with schoolwork. The learner is disempowered, not coping on his or her own. The teacher just marked the work, completing her day duty, not caring much whether the learner was progressing or not. This is because she has a specified number of tasks per week. She expressed that she had a lot of work and that there was an expected number of tasks she needed to complete in a week and therefore had no time for individual learners.

4.2.3 Failure to set goals related to teacher's needs.

Using technological devices for teaching and learning remains a big challenge for most educators, especially the older generation. Their inability to use technological devices for teaching and learning makes them to have less self-confidence and resort to traditional methods of teaching which they are comfortable with (Ogabo et al., 2019:16). The study revealed that the Grade 3 mathematics teacher was between the age of 45 and 50 and was not confident in using technological devices for teaching and learning. Her class is equipped with an IWB, while she only uses the chalkboard. When asked why she did not use the IWB, she said:

Researcher: *You have a modern class with an IWB.*

Mrs. Baloyi: *Yes, we do have an IWB, but we don't use it. Researcher: why are you not using it?*

Mrs. Baloyi: *Ah! I was only trained for 2 days and its difficult for me to use it, besides its time consuming I have a lot of work to finish, using IWB is just wasting my time instead of pushing the curriculum.*

Researcher: *other than the IWB do you use any technological devices for learning?*

Mrs. Baloyi: *We used to have tablets, but I don't know if we still have them, they were never used, you know mam here we just teach traditionally and use posters and pictures only*

Researcher: *What is your view on using cell phones for teaching mathematics?*

Mrs. Baloyi: *After the meetings we had with the other researchers I concur that it is worth trying, it will make work easier for me and collaboration with learners' parents more effective.*

The confession above is a clear indication that when planning, the school does not cater for the needs of the teachers to effectively teach. They have a limited number of resources but were never utilized. The co-researchers in this team realized that it is important to put the needs of the teacher to work effectively as a priority. They agreed that the school should look at how best they can assist their teachers to improve not only mathematics but also other subjects.

After the meeting, the research coordinator and available team members visited the Grade 3 classroom for lesson observation during the mathematics period. After the lesson, following the principles of PAR, the challenges must be solved with the help of the co-researchers. The team sat down to analyze and reflect on the lesson observed and come with suggestions to improve the lesson. They first analysed the strengths of Mrs. Baloyi's lesson presentation, followed by her weaknesses. Her strengths included the fact that her class was well organized and well managed. Her interaction with the learners was her other strength. Her weaknesses included not using resources to augment her teaching and to make the lesson interesting, it was agreed that the lesson needed to be an active engagement between the learners and the teacher, rather than the teacher just imparting knowledge to the learners. The available team members, together with the Grade 3 teacher, sat down to plan the next lesson. The research coordinator and the librarian would bring cell phones to the classroom for learners to practice the mathematics skills they learned. The team members available would help the teacher facilitate the lesson.

4.2.4 Teacher development

School management, teacher development and school culture, also need to be considered. To prevent difficult classroom management, Bjørgen et al. (2021:348) argue that the teacher's position as a facilitator, supervisor, and class manager becomes increasingly essential. This requires for digital didactic design that outlines learning objectives and assessment criteria. This brings to the fore the question of teacher development because using cell phones for mathematics instruction comes with both ability and how it impacts on transforming how we think about learning, our expectations and how human skill should be cultivated.

The team in this study realized that the school had no plan for developing teachers as far as incorporating and integrating mobile technologies like the cell phone in the teaching and learning process was concerned. Furthermore, the school had no policy for ICT in the school. It only focused on the traditional way of teaching. The SMT represented by the Foundation Phase HoD realized the importance of teacher development, even at school level. She also realized that the school needed a policy on the use of ICT for teaching and learning. This is evident in the conversation of one meeting:

Researcher: *Do we have an ICT policy at the school?*

HoD: *no, we don't have, all we used to do in the past was that if a teacher wants to use ICT you bring your own laptop, but it was very rare, we also have two IWB, but we never use them, only two teachers were trained for few days in the afternoon.*

Researcher: *How do you develop your teachers here at the school?*

HoD: *When we do IQMS now QMS we usually recommend for teachers to be developed either by peers or the department, but we don't follow it up.*

Researcher: *If I may ask, why it is not followed up?*

HoD: *It's because of time, we have lots of things to do at school and some of the things we just take for granted.*

The team decided to discuss the importance of teacher training at school level to empower the Grade 3 mathematics teacher to have confidence in using mobile technologies for teaching and learning, The community librarian who is a team member volunteered to come and assist the teacher with ICT skills. She also invited the learners to come to the library, with a teacher's supervision to teach them basic computer skills that will enable them to use the cell phone effectively. A timetable was set for when she would come and assist the teacher and when she would assist the learners.

Table 4.1: Grade 3 Mathematics Timetable

Date	Activity	Time
22 November 2022	ICT skills training (grade 3 teacher)	14:00–14:30
30 November 2022	Learners' ICT skills training	14:00–14:30
6 December 2022	ICT practical (learners and teacher)	14:00–14:30
17 January 2022	ICT use in classroom (all)	14:00–14:30

To successfully integrate and make use of cell phones for teaching and learning, it is vital to invest in teacher development. It influences how learners learn. A knowledgeable teacher can create a positive learning environment and understands the interplay between the use of mobile technologies and intentions, didactic and pedagogical matters, and organizational frameworks (Bjørgeren et al., 2021:359).

After several meetings, the SMT came to understand that teacher development is important. The HoD also indicated that when they finalized QMS scores for the year 2022, the recommendations for development would be taken into consideration and there would be a follow-up.

4.2.5 Protection against harm

The data generated indicated that most co-researchers, parents, and teachers were ignorant of the dangers of excessive use and prolonged exposure of children to digital devices. This is evident during the reflection of the co-researchers after the librarian had brought to the fore some of the challenges that come with children having to use cell phones over a long period.

Victoria (librarian): *There are many problems that come to the fore when children use cell phones on their own, they use them for a long time, in secret, they put security pin on their cell phones so that you as a parent don't see what they are up to, they are jumpy and grumpy when you approach them ... as parents we need to monitor our children's use of cell phones.*

The librarian further spoke about the dangers of cyberbullying.

Victoria: *Cyberbullying among children is when learners send mean messages to another learner to humiliate or intimidate her, it includes hacking into someone's phone, pranking and spreading lies about someone online, it's a form of a terrible harassment of the other that may cause depression leading to suicidal behaviour or aggressive fights among learners.*

The librarian tried to explain in detail the dangers of cyberbullying and how it happens among learners without them realizing it. Some parents confirmed that they were ignorant of such things. They were happy that they were made aware of this and would be able to help their children. The parents further suggested that this topic needed to

be discussed not only with Grade 3 parents and learners, but with the entire school realizing how important it is.

4.3 IDENTIFICATION OF SOLUTIONS TOWARDS THE CHALLENGES FACED BY GRADE 3 TEACHERS WHEN TEACHING MATHEMATICS USING CELL PHONES

After all the challenges have been identified, the research team sat down in a meeting to mitigate solutions to the challenges.

4.3.1 Solutions to challenges of not recognizing the power using cell phones in the teaching and learning of mathematics

The team and co-researchers in this study met multiple times to try to identify the school's resources and staffing strengths, shortcomings, opportunities, and threats. A committed team was formed because of these talks with the intention of advancing efficient instruction. They must understand the significance of prior knowledge, which is used as a basis for modification, expansion, and building. Mrs. Baloyi, the class teacher of Grade 3, together with the dedicated team, analysed the way she was teaching mathematics, and had her strengths and weaknesses identified. A strategy that would be beneficial to both the teacher and learners was identified, taking into cognisance prior knowledge. The team decided to relook at the way the lessons were presented and then change the way the lessons were planned and presented as well as the methods they used to assess the performance of learners.

The dedicated team planned their lesson using the cell phones focusing on IXL programme. They practiced the skill of using the programme before and got comfortable with it. A team member was familiar with the programme. The collaboration of the team helped Mrs. Baloyi as she had to present the lesson.

Table 4.2: Lesson planning

Using IXL	Benefits	Remarks
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<p>The teacher informed the learners when they are going to have an extra mathematics lesson after normal school hours.</p> <p>Date:</p> <p>Time:</p>	<p>Work communicated to both learners and parents using WhatsApp and messages. Parents and learners can communicate with the teacher to ask for help</p>	<p>Some parents were not on WhatsApp.</p>
<p>Learners were to do activities using the cell phones brought by the teacher and the librarian.</p> <p>The lesson was planned for the day.</p> <p>The activities would be done using IXL</p>	<p>IXL activities gave them instant feedback and instantly explained when they get answers wrong</p>	<p>Enjoyable, fun, and exciting for learners.</p> <p>The lessons went on for three months. The teacher was excited and willing to continue beyond the study period</p>

4.3.3.1 Lesson presentation

The following day the team members visited the Grade 3 classroom for the planned lesson presentation. The Grade 3 educator presented the lesson about money, focusing on coins and paper money. She presented the learners with picture money for them to see what it looked like. However, the picture money remained in her hands. She did not give it to the learners to touch, see and feel the money. She then asked oral questions. Learners participated actively. She gave learners activities using cell phones. The other team members initially assisted the learners with the cell phones, but the learners quickly grasped how it was done and started operating the phones on their own. The lesson got interesting, and learners engaged with the phone and with one another. According to Buchholtz (2020:81), mathematics learning is supposed to bring joy and interest among learners, so incorporating mobile devices bring about those joyous rewards.

By giving the learners cell phones to explore and practice, the teacher wanted to instill in them the skill of adding money, the concept of rands and cents, and the right way to use the decimal comma. The program they used managed to give that and more. This method was consistent with the study's connectivism conceptual framework, which shares the conviction that technology-enhanced learning opens new forms of instruction and sheds light on fresh competencies that help students succeed in the

digital age (Kotze, 2021:16).

Because of limited resources, their answers were wrong when they used a full stop and were correct when they used a comma. The feedback the cell phone gave them, e.g., *fantastic, well done, excellent*, made the learners feel proud and appreciated. The learners were given workbooks to complete tasks at home with the assistance of parents. The work was also sent to parents via their phones for them to assist their learners. After the lesson presentation, some learners, available co-researchers, and the research coordinator sat down to evaluate the lesson.

The research coordinator asked the team how the lesson went:

Lerato: *Ma'am, today the lesson was awesome! Did you see how many answers I got right, when are we using the phones again mam, will my mother's phone also be able to have this programme?*

Matimba: *You see ma'am, the cell phone also has a calculator, can we use it to calculate big numbers.*

Sandile: *I didn't know that we can use a cell phone to learn mathematics, I will ask my father to buy me a good phone.*

4.3.3.2 Assessment and remediation

The following day, the team checked the learners' progress by looking at their homework and do corrections together with the learners, most of the learners got their answers correct. Some of the workbooks had parent signatures to show that they did assist their children.

The collaboration between parents and teachers showed that it can greatly enhance learning. The cell phone was not only used as a tool for teaching and learning, but also as a tool for communication between school and home. The learners were again given the cell phones to practice their money calculation skills as tabled below.

Table 4.3: Learners' money calculation skills

Counting coins up to R5	More money	Putting amounts in order
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<p>They answered questions based on several coins one had, e.g., Maddie has one R5 coin and three R1 coins: How much money she does have?</p> <p>The learners wrote their answers on the phone and got immediate feedback.</p>	<p>The IXL program gave learners' various pictures of coins on the screen, and they added up the money.</p>	<p>The learners were given different amounts of money to arrange in ascending and descending order, e.g., R2,20; R2,50; R2,44.</p>
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4.3.3.3 Feedback on assessment

When analysing learners' workbooks after the lesson presentations, there was clear evidence of improvement, also at the end of Term 3. Compared to performance during Term 1 and Term 2, there was improvement:

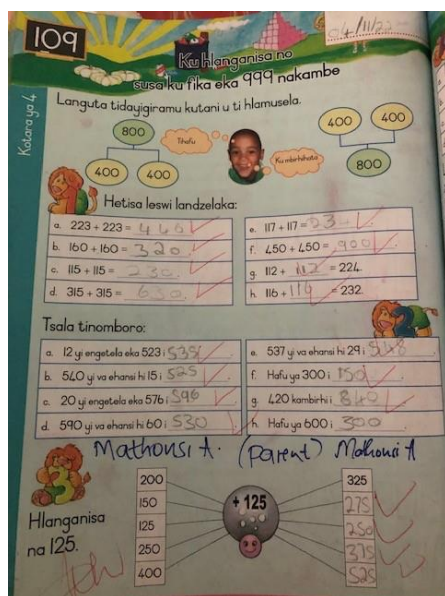


Figure 4.6: A learner's workbook

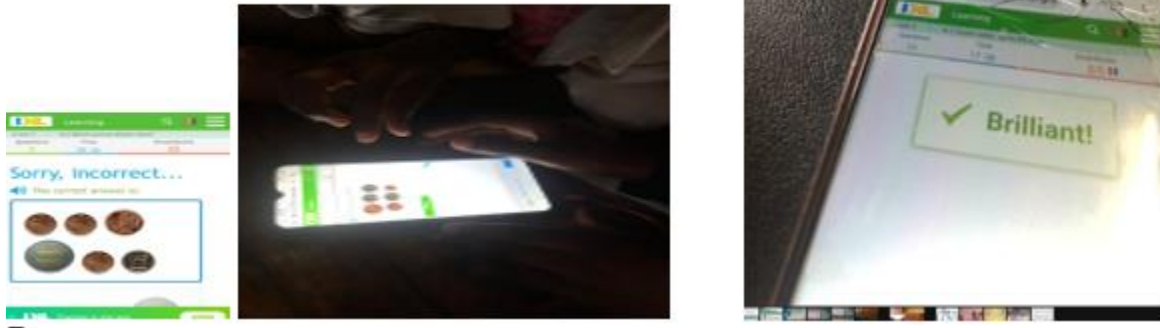


Figure 4.7: Instant feedback given to learners when using the IXL mathematics online program

4.3.2 Solutions to Parental involvement

Parental involvement is an important factor in the education of young learners. It promotes mutual feelings of trust and helps the school to set up a structured way of collaboration, because when collaboration is not structured, there might be challenges related to power relations between the teachers and learners (Aouad & Bento, 2020:2). They Further suggest that for parent-teacher collaboration to be successful, there should be a two-way communication between the teachers and parents, this involves the commitment to addressing the social, cultural, economic, and physical requirements of both parents and instructors as promoted by the posthuman philosophy that directs the study.

The team realized that for the strategy to be successful parents needs to be involved and play an active role. They realized the importance of a two-way communication. They attested to the fact that before the study, communication from the school inviting them for meetings or one-on-one sessions with the teachers were not taken seriously and that in most cases they would ignore the invitations. The fact that they realized the importance of parental involvement was evident when some of the co-researchers' sent representatives when they could not attend meetings.

Parental involvement has several benefits, including increased academic performance and lower dropout rates. In this study it was evident that Parents from the younger age generation are more likely to be involved in their kids' schooling., this attitude encouraged the older generation of parents and guardians. This was evident

when the younger generation of parents, who were resourceful were willing to outsource their resources to older parents who were not as privileged as they were.

4.3.3 Solutions to Setting goals related to parents and teachers' needs

The team in this study realized the importance of setting realistic goals for parents and teachers. They discussed that whatever they planned, it should be something that could be executed practically. They decided to avoid setting goals that could only be theoretical. This was evident in their discussions during meetings:

Researcher: *How do we ensure that all parents get messages from the school?*

Parent 1: *My phone is just an ordinary phone; I am not on WhatsApp, and I don't know how to operate a smartphone.*

Parent 2: *Sorry, ma'am, I do have a smart phone but most of the time I don't have data.*

Researcher: *Well, I don't know; what do you suggest we do in this case?*

Parent 2: *Why don't the teacher send learners work and other important communication using messages and WhatsApp? She can even give the child a copy of the work.*

Parent 1: *I also agree with that, so that we all get to support the children and to communicate with the school. The key factor here is supporting the children and communicating with the school.*

The team realized the goals of the study, namely supporting the children using cell phones and collaborating with the teachers and the school. The team also realized that since they were in the same neighbourhood, they could assist one another and share whatever information they received from the school as neighbours, friends, and community members.

4.3.4 Teacher development

To prepare for classroom-based instruction in a posthuman understanding of teacher development, the intersection of school policies, structures, mandates, and institutional cultures significantly contributes. Teachers' background, beliefs, and pre-

service learning do inform practices in this way (Strom & Martin, 2022:1). This is possible through the recognition of the importance of the use digital technologies.

The team realized the importance of teacher development as discussed above. The SMT took notice of all teacher development workshops organized by the Department to encourage their teachers to participate. They investigated the skills that their teachers had and organized empowerment meetings where they shared information.

The Foundation Phase HoD organized subject meetings on a weekly basis to discuss challenges and to help one another where there were difficulties. The team of co-researchers available attended all the meetings. The teacher in this study realized the different levels of teacher development and understood that she too could develop herself by taking online courses, using YouTube and asking a peer to assist. She could develop herself by registering at a college or university. She and other teachers came to the realization that ongoing development was necessary for their teaching profession.

4.3.5 Solutions to Protection against harm and unwanted content

According to research, there are many difficulties associated with using digital tools like cell phones for teaching and learning. This encompasses difficulties with society, the body, and the mind. As mentioned in Section 4.2, the usage of cell phones in the classroom benefits all learners as well as the teaching and learning process.

4.3.5.1 Solutions to social challenges

Ibrahim and Kadiri (2018:9) view the challenges caused by mobile technology use by learners as challenges that can be mitigated by monitoring the use of this resources by parents at home as well as mandatory keen observation at school by teachers, to avoid diverting attention to other things. Furthermore, when teachers plan their lesson carefully to fully engage the learners, it will ensure that cell phones are only used for learning.

Zahra and Alanzi (2019:152) advocate the need for teachers, parents, and therapists to work together to mitigate the adverse effects technological devices have on young children. This may include alienating oneself from others, mood swings, and temper.

The research team clearly understood that for the strategy to work properly, they need to fully support their children with proper use of cell phones. This was evident in one of their meetings.

Mrs. Mdluli: *I understand all what the librarian taught us about the dangers to look out for when our children use cell phones, personally after 7pm I will take the cell phone from my child, that is after she is done with her homework.*

Mrs. Sekatane: *I support that, we need to monitor their cell phone use and watch out for unusual behaviour.*

Mrs. Baloyi: *I think when the learners are in class, I need to monitor at close range what they are doing with the phone, these children are clever and when it comes to technology, they know more than us.*

4.3.5.2 solutions to physiological challenges

A study conducted by Zahra and Alanzi (2019:152) recommends that screentime and prolonged use of media tools like the cell phone have adverse results on children; therefore, increased health awareness messages delivered in accessible media like TV can contribute immensely to health education. The health-awareness messages should be accompanied by detailed data on the impacts the digital devices have on children. The research team confirmed this in their conversations below.

Mrs. Mdluli: *Hey I am just worried about their eyes; they will be always on the screens, but I fully support the idea.*

Mrs. Sekatane: *You are right, we need to be extra diligent as parents.*

4.3.5.3 Solutions to psychological challenges

The use of mobile devices by children has a huge psychological impact if unmonitored. Research indicates some of the psychological challenges. It is therefore important for parents and teachers to work together. After being alerted to the dangers that come

with the excessive use of cell phones, the team deemed it necessary to discuss some of the challenges, as discussed previously. The team discussed cyberbullying, watching of harmful and unwanted content depression and health-related matters. The discussion below confirms the fears parents have:

Mrs. Makukule: *I am just happy because you (referring to the librarian) you spoke to us about what to look to when our children are in danger of cyberbullying or other harmful behaviour caused by cell phones.*

Mrs. Ubisi: *This information is very helpful, we already witnessing incidents of violence caused by cyberbullying. And we read of suicidal behaviour, but we didn't understand how bad it can be.*

Mrs. Baloyi: *As a teacher I am happy and looking forward to working with you in enhancing the teaching of mathematics in my class, your collaboration will be helpful to me and the learners. If we collaborate, we can fight together all the harmful effects that might jeopardise the use of the strategy.*

Various resources are needed to pursue the strategy. It includes both human resources and material resources such as the library, finances, cell phones, computers, and other types of resources. The resources need to be collected and managed to support the strategy. As discussed previously, resources that were pooled by the team included human resources such as the admin clerk, the librarian and other members who formed part of the dedicated team. Material resources included the mobile cell phones/tablets pooled from the library by the librarian. It was made clear to the team that the tablets were available for use by the learners any time if they were brought back in good condition immediately after use. This is a clear benefit of collaboration; the school will continue collaborating with the library in future because of this understanding. This manner of collaboration will bridge the gap between the poor and the rich, as all learners will be able to use the tablets if they are unable to access cell phones at home. Furthermore, parents who cannot afford to buy data can accompany their children to the library or communicate with the librarian to assist them.

This posthuman nature of the study advocated fighting for social justice and equality. Furthermore, posthumanism raises an opinion that there is no longer clear distinction between the human and machines; therefore, the use of cell phones in this regard

suggests a posthuman notion that a machine can give an equivalent output like that of humans and more (Pepperell, 2005:10) This is possible in a cell phone which is able to deliver lessons through videos, websites, and other methods.

The school decided to continue with the collaborative relationship with the library, they had had that relationship before, but it had not been as dynamic as now. The school admin clerk offered to assist with ICT skills and resources available in her office. She availed herself to be of assistance for whatever ICT problems the teacher and the class had.

4.4 ANALYSING CONDUCIVE CONDITIONS CONTRIBUTING TOWARDS THE TEACHING AND LEARNING OF MATHEMATICS GRADE 3 USING CELL PHONES

The team in this study understood the goals of the research beyond its time frame, they are discussed. The conditions discussed are the following: conditions that result in teachers and learners sharing collaborative learning activities; conditions that emphasizes the extracurricular playful learning; conditions that enhance effective healthy academic, emotional, and social development of learners; and conditions that ensure effective communication between parents and teachers.

4.4.1 Conditions that result in teachers and learners sharing collaborative learning activities

Through discussions and sharing information the team managed to create a situation where teachers and learners were able to share information using cell phones. Most of the learners had no cell phones but used those of their parents. The teacher was able to send work to learners and parents and to communicate solutions and feedback.

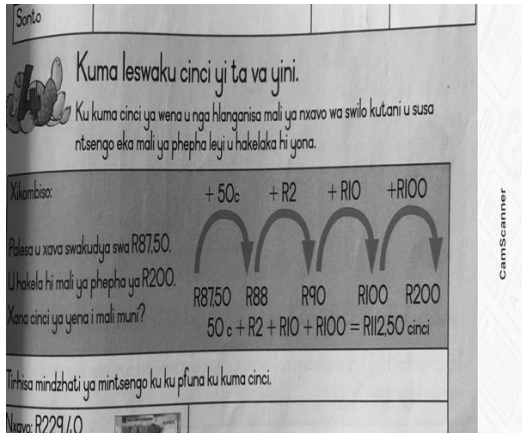


Figure 4.8: Learners' work communicated to parents through WhatsApp

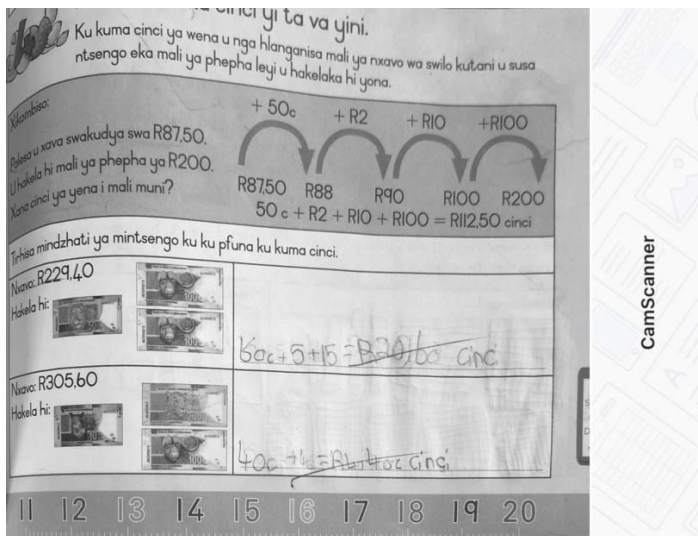


Figure 4.9: Feedback communicated to parent and learner through WhatsApp

4.4.2 Conditions emphasizing the extracurricular playful learning.

According to Fessakis et al. (2018:50), mathematics learning should be fun and bring joy to the learners. Mobile technologies can offer the playful and fun part of learning using a variety of mathematics applications and modelling. In this study the team was able to display such playful part of learning mathematics and more. This playful manner of learning is very important in fostering positive student-centred learning, with learners taking control of their own learning, leaving teachers to focus on one-on-one learning with learners who are struggling (Barrientos, 2021:634).

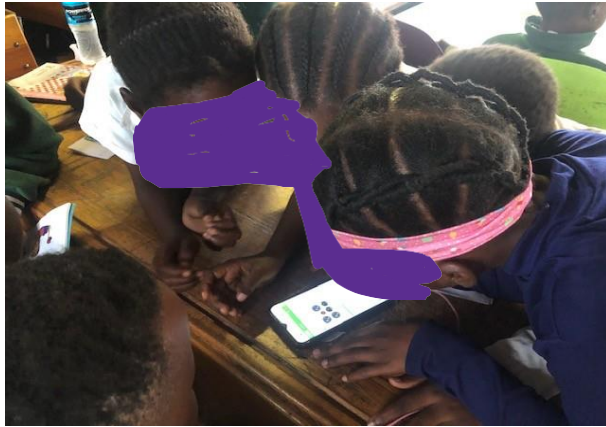


Figure 4.10: Learners having fun and enjoying the mathematics lesson

The picture illustrates the third step of learning in connectivist environments where learners are expected to practice the skills, they learned in step one and step two as indicated.

Active learning is seen as an important aspect of mathematics learning. The Curriculum and Assessment Policy Statement (CAPS) encourages students to learn mathematics critically.

and actively. Instead of acquiring predetermined truths using rote learning, it promotes an active and critical approach to learning. Additionally, when teaching mathematics, it is important to uphold social justice, human rights, and awareness to concerns of deprivation, injustice, racism, gender, language, age, handicap, and other aspects (DBE, 2011:5). The classroom atmosphere is made more favourable for teaching mathematics when mobile devices like cell phones are used.

4.4.3 Conditions that enhance effective healthy academic, emotional, and social development of learners

Literature indicates that collaboration between parents and teachers plays a major role in enhancing the effective, healthy academic, emotional, and social development of learners (Mwarari et al., 2020:201). Furthermore, when parents and teachers collaborate as a team it ensures that learners emotional and social problems are dealt with in a collaborative way. Team members in this study, through the encouragement of the life skills curriculum implementer, created a space where they were able to share

their experiences and value one another's views and ideas. This was evident when one elderly parent voiced her opinion:

Researcher: *Dear Parents, how do we support our children?*

Mr. Maleka: *I love and enjoy supporting my grandchild; however, i don't know what is wrong with the child or with me, the child doesn't take me seriously, I feel discouraged to continue supporting her.*

Researcher: *How do we help this situation?*

Mrs. Mathebula: *You don't have to feel bad about the reaction of the child, be patient with her, once she understands that you mean no harm and that you want her to succeed at school she will cooperate.*

4.4.4 Conditions that ensure effective communication between parents and teachers

Effective communication enables teams to achieve their goals with ease. It is an important factor contributing to collaboration and motivation. Effective communication in a team ensures effective learning practices. The team in this practice practices effective communication with the medium of a cell phone, this optimizes communication; even if the parent does not get the message instantly, he or she can get the message later. The benefits of teams that communicate effectively is that they largely contribute to healthy relationships which leads to

positive learning spaces evident through learners excelling in their work (Javier & Jubay, 2019:201). The aim of the study was to show that parent teacher collaboration can enhance the teaching of mathematics curriculum using a cell phone.

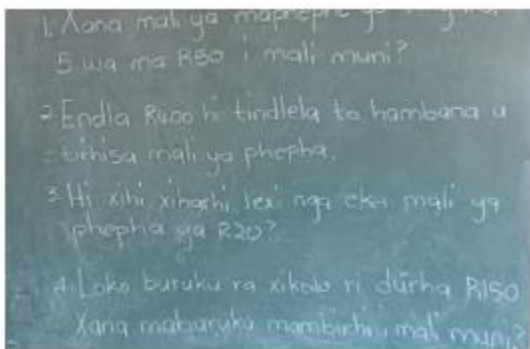


Figure 4.11: Homework given to learners and communicated through WhatsApp and SMS to

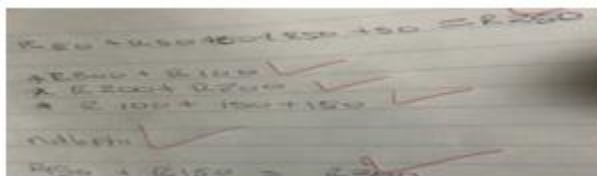


Figure 4.12: Feedback of homework given to a learner and communicated to her parents' using cell phone

4.4.5 Conditions that allow for a properly managed school environment with shared responsibility between parents and teachers

When parents and teachers share the responsibility of the teaching and learning in schools, it becomes easier to manage the school environment. Research indicates that parent-teacher collaboration significantly improves learning. It enables the team to pull their resources together, share responsibilities and ultimately create a positive learning environment. When the team work together, they learn to depend upon and trust one another. This enables the team to implement the strategy beyond the study and across grades.

The research team in this study agreed that the strategy need to follow a systematic well managed plan where there is. Proper preparation of lessons and systematic assessment. This will be possible when the team planned together. Planning together probably as the foundation phase mathematics educators might help develop a well-managed school and allows for the sharing of responsibility between parents and teachers.

4.5 IDENTIFICATION OF POSSIBLE THREATS WHEN USING CELL PHONES IN TEACHING GRADE 3 MATHEMATICS CURRICULUM USING CELL PHONES

This section focuses on the risks to the strategy's implementation and how they might be avoided. Global dangers, effective mathematics pedagogical approaches to teaching, inadequate teacher preparation, teacher efficacy, and inadequate parent-teacher communication are some of the strategy's components that will be examined.

Prejudice and resistance to change are two international risks that have an impact on the strategy's implementation.

4.5.1 Prejudice and resistance to change as threats to the implementation of the strategy

Teachers' attitude and beliefs play a major role in using mobile technologies for teaching and learning. Research indicates that teachers' beliefs about the use of technologies for teaching and learning are second-order barriers (personal) to lack of access to technologies and lack of training, which are first-order barriers or institutional barriers (Hoyles, 2018:1). This was evident upon realizing that the Grade 3 classroom is equipped with IWB which the teacher, according to her, was trained on two or three times, but never tried to use it for the benefit of learners. She just felt comfortable with the traditional way of teaching. The study focused on using cell phones for teaching mathematics. However, it was of paramount importance to check if the available ICT resources were utilized, especially because the challenge of not using ICT, even if they are available, is a global one, is referred to as a second-order barrier.

4.5.1.1 Resistance to change

Research indicates that the main cause of resistance to change is teachers feeling overwhelmed by the rapid change associated with the use of ICT in teaching and their own ability to manage the situation due to lack of ability, lack of confidence and self-efficacy. However, UNESCO promotes the use of mobile devices in education (Kőrösi & Esztelecki, 2015:99). This was evident during the study. However, during the course of the study, after the teacher realized the benefits of using mobile technologies and there were signs of future use, this was evident in her comments after the lessons:

Mrs. Baloyi: *My mathematics lesson was lively today; I could see that my learners are excited and were enjoying the lesson.*

4.5.2 A need for sound mathematical pedagogical approaches

According to Wambiri and Ndani (2016:3), research indicates that for teachers to use cell phones effectively in instruction and learning of mathematics there is a need for sound mathematical pedagogical approaches, furthermore, this will help them to design effective learning experiences that can successfully transform mathematics instruction and learning of mathematics. On its list of recommended resources, the

Foundation Phase CAPS document does not currently make mention of the cell phone or other mobile technologies in the teaching and learning of mathematics objectives, thus determining their common strategies to achieve the objectives.

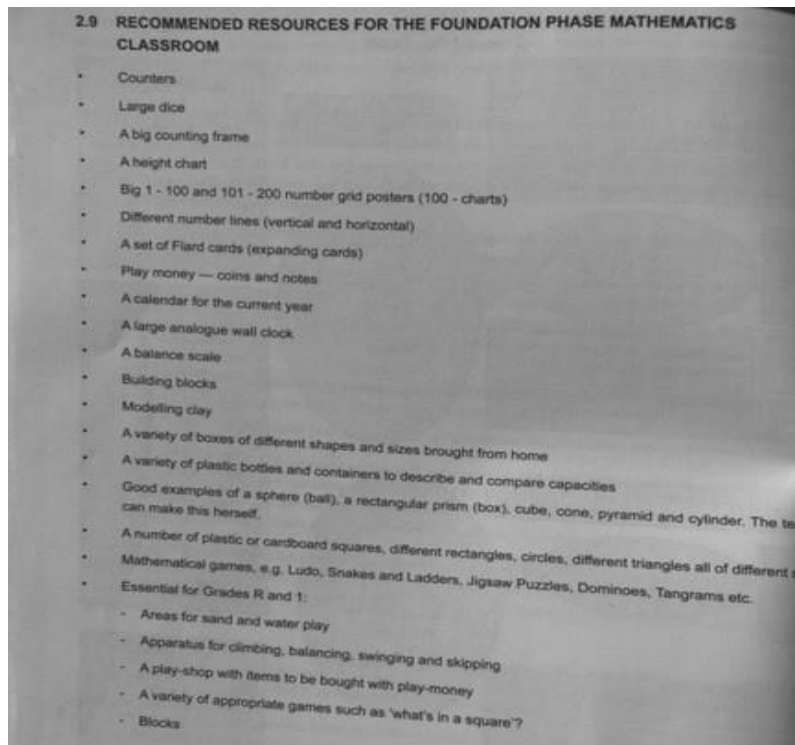


Figure 4.13: List of recommended resources from CAPS document (excluding ICT resources)

4.5.3 The need for cooperation between parents and teachers

This includes using effective communication strategies, managing the class and curriculum well, improving the subject knowledge and developing good communication skills. The Department of Basic Education's National Development Plan 2030 practical guideline on how parents can actively support their children's academic performance, which highlights the value of school-parent community connections, is supported by this.

The posthuman nature of the study support the collaboration between parents and teachers by naturing the hybrid nature of communication. It is easy and effective when parents communicate using social media applications like WhatsApp and messages.

4.5.4 Poor planning by teachers

The fact that teachers themselves are not well trained to integrate mobile technologies into their teaching and learning processes leads to poor lesson planning by teachers (Wambiri & Ndani, 2016:12). They further suggest that to enhance teacher preparation, teacher training methods need to be revised to include content pedagogy that will focus on developing teacher's skills and knowledge to teach using mobile technologies and computers. This study focused on cell phones; however, there are many other mobile technologies and ICT resources.

Poor planning contributes to not integrating cell phones and other mobile technologies for teaching mathematics. The grade 3 teacher in this study used lessons which were years in the file, simply because there are no changes in the curriculum however if she was planning every day her lessons could have been better, she could even go with the times.

The research team in this study even suggested that when planning lessons, short videos of concept explanations should form part of planning to assist parents at home. The admin clerk and the librarian were readily available to assist. This is evident in their conversations during meetings as they say:

Mrs. Mdluli: *Mam, if possible, for us to be able to understand how we can assist the children can you take short videos or voice recordings of concept explanation.*

Mrs. Sekatane: *That will be very helpful.*

Mrs. Baloyi: *I am not promising to do every day, but I will try.*

4.5.5 Lack of self-efficacy by teachers and learners

In this study, self-efficacy refers to the teacher's belief in her skill and ability to use mobile technologies for teaching and learning with a special focus on her own judgement on what she can do. Research indicates that lack of self-efficacy leads to lack of self-confidence in performing the task. Research by Wambiri and Ndani (2016:3) indicates that teachers with high self-efficacy will most probably use mobile technologies often and with more confidence than those with low self-efficacy.

In this study the research team realized that the teacher was full of self-doubt in the beginning, but because of the support the team gave her, she regained her self-consciousness and realized that she can use technology in her teaching and learning with ease.

This was evident in her comments in one meeting:

Mrs. Baloyi: *I wish I could have realized that cell phones are powerful tools to teach long ago, I have seen change in performance of my learners. They are very proud and engaged when learning mathematics.*

The foundation phase educator also confirmed that when the teacher is confident, it is possible to use the strategy beyond the study this is evident when she said:

Mrs. Ubisi: *If we continue using the strategy not only in grade 3 but the whole of the foundation phase we will get better results, but we need to start by building our own confidence.*

4.6 PRESENTATION OF THE SOLUTIONS TO THE CHALLENGES THAT HAS BEEN TESTED AND PROVEN TO BE WORKING

The process of developing a strategy to teach Grade 3 mathematics using cell phones was discussed above. Basically, there was a need to identify a strategy aimed at improving collaboration between teachers and parents by identifying the challenges faced by the Grade 3 mathematics teacher. Objective number 2 of the study related to exploring the solutions to the challenges faced by Grade 3 teachers when teaching mathematics Grade 3 using cell phones. The third objective had to do with analysing the conducive factors contributing towards the effective use of the strategy. The fourth objective concentrated on the threats to the strategy's successful execution and how they were mitigated. The success and efficiency of the plan were the subject of the fifth goal.

4.6.1 Effectiveness of teaching and sharing of knowledge

This study investigated that when parents and teachers collaborate effectively in the teaching and learning process, effectiveness in teaching is noted. This happens at

best when a cell phone is used both as a communication tool as well as a teaching and learning tool. This is possible because teachers can send homework and other tasks to the learners through their parents' contacts and to the learners who have their own cell phones. This ensures that learners are assisted both at home and at school. The two-way communication between parents enables teachers to practice curriculum differentiation with ease, because learners learn at different rates.

By collaborating with parents, teachers can better their own instructional methods through learning from the parents and evaluating the effective practice of the strategy. This will be able to involve specialists in the subject and to involve other stakeholders with ease. The ease of involvement will be brought about through using the cell phone.

4.6.2 Setting goals together

Grade 3 learners are still very young and need continuous support from their parents and teachers. Therefore, it is important for parents and teachers to set goals together. This will enable both the teacher and the parents to determine their common objectives, thus determining their common strategies to achieve the objectives. This includes using effective communication strategies, managing the class and curriculum well, improving the subject knowledge and developing good communication skills. This supports the aims and objectives of the Department of Basic Education, National Development Plan 2030 practical guideline on “How parents can contribute meaningfully to the success of their children in schools”, which emphasizes the importance of school-parent-community partnerships.



Figure 4.14: School-parent-community partnerships

4.6.3 Teacher development

Teacher development is not only a government responsibility; teachers themselves and the school have a responsibility to develop a teacher. A teacher can be developed by peers, by seniors like the HoD, deputy principal and the principal. Teachers can be developed by the school-based support team and curriculum implementors. There is evidence of teacher

development on the side of the teacher after talks with the curriculum implementor and the involvement of the community librarian with ICT skills. Teachers are encouraged to use resources available to them at the school and outside the school.

4.6.4 Partnerships to overcome resource scarcity

The general concern at most schools when it comes to resources is lack of resources. However, Schools can manage their limited resources in a way that positively affects both teaching and learning. Teachers have the flexibility and decision-making power to manage human resources. They teach in groups, allowing their students to share resources. They can outsource resources from other places for temporary use. This includes taking learners to places where these resources are or taking the resources where the learners are.

The full implementation process of the study reaches to beyond this study.

CHAPTER 5 :

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS FOR DESIGNING THE STRATEGY

5.1 INTRODUCTION

The study's goal was to create a teaching strategy for grade 3 math with the help of teachers and parents. This chapter discusses the conclusions that support the study's goals, the strategy's constituent parts, the circumstances that make it applicable, and potential risks. The study's components are then given, based on the findings, with a view to incorporating cell phones into Grade 3 mathematics instruction and learning with the help of parents and teachers. The limitations are stated with the idea that the study's gaps are highlighted for potential future solutions. The chapter outlines the way forward considering what has been learned at its end. In a Grade 3 class using cell phones and working with parents and teachers, a commentary is given on the study's relevance to math learning and teaching.

5.2 BACKGROUND

The main aim of the study was to formulate a strategy to teach mathematics Grade 3 using cell phones with the collaboration of parents and teachers. Mathematics is one of the key school subjects in schools and the subject is deemed problematic for many learners (Viberg et al., 2021:21). It is, therefore, essential to understand and find ways of making the subject easier to teach, learn and understand. This study shows that using the cell phone with the collaboration of teachers and parents can significantly improve the teaching and learning of mathematics, especially in Grade 3.

Mathematics teachers in South African schools generally use traditional methods, namely direct instruction. At the same time, other innovative teaching methods can be used, including the use of mobile technologies, especially cell phone, because it is easily accessible to every learner, teacher, and parent (Umugiraneza, Bansilal & North, 2017:2). The 2021 annual results for mathematics Grade 3 of the school under study was at 73%, which was 22% lower than the target, 95%. Research indicates that there is a need to integrate and use technology with the curriculum for learning mathematics

to be improved (Viberg et al., 2021:22). Consequently, parents and teachers need to collaborate in using the cell phone as a teaching and learning instrument for the improvement of mathematics Grade 3 and as a communication tool between parents and teachers as well as teachers and learners. The literature was reviewed to identify excellent practices from other nations and learn from them. The goal of the study was to develop a framework pertinent to developing the strategy that will aid in teaching and learning mathematics in a Grade 3 classroom using cell phones with the collaboration of parents and teachers. To accomplish this goal, the literature review was compared with the data collected from the participants.

5.2.1 Challenges caused by lack of collaboration between teachers and parents

The study revealed non-collaboration between the Grade 3 teacher and the parents of the Grade 3 learners. This was revealed during the team's initial meeting to establish their strengths and weaknesses.

The fact that there was a lack of collaboration was evident when the parents/team members showed evidence of not taking the monitoring and assisting of their children with schoolwork seriously. They indicated that they thought supporting the children with schoolwork was solely the responsibility of the teachers. Some team members said it was difficult for them as they were uneducated. At first, some team members showed they never cared even to look at their children's workbooks. Furthermore, the parents were not even keen to come to the school when invited; they regarded coming to school as a disturbance and a waste of their time.

The teacher also showed signs of being unconcerned when parents do not participate in their children's education. Her parents' visit register showed that she had invited only a few parents to her class, and that it was just for behavioural problems, not academic ones. This lack of collaboration between the parents and teachers denied the learners an opportunity to be assisted and supported, which is necessary for learners of their age.

This lack of collaboration between the parents and teachers implied that the learners were on their own, creating a feeling of not being cared for by the school and parents. It was clear from the early meetings that there was an urgent need for parents and

teachers to work together after realizing the challenges brought about by the lack of collaboration. The following recommendations were advanced as a result.

5.2.1.1 Recommendations

The study recommended that the strategy's effectiveness depends on the various stakeholders interested in enhancing mathematics in Grade 3 working together as a team, irrespective of their age or level of education. The team needs to ensure collaboration between all the team members: the parents, the teacher, all the other stakeholders and the learners.

The coordinated team must create and implement the strategy to enhance the teaching and learning of mathematics, focusing on Grade 3. The team needs to ensure collaborative planning and reflection among the parents, teacher, and learners, taking into cognizance the socio-economic status of each parent and learner and the learners' abilities, considering their strengths and weaknesses, knowledge gap and general academic performance.

In their planning, it is recommended that the team consider the CAPS document and the prescribed annual teaching plan. Furthermore, the coordinated team must be institutionalised to enable the coordinated team to concentrate on the actual teaching and learning process as well as group planning and reflection on the experiences they face. The team should meet once every second week for an official session focusing on replanning and mitigation of the strategy.

For the strategy to succeed, there is a need for collaboration between parents and teachers. Most importantly, it depends on integrating the cell phone as a teaching tool and a communication tool between parents and teachers as well as teachers and learners. Teachers must communicate mathematics work to parents and learners, including assessment of the work and extra teaching material. Teachers need to communicate and assist parents and caregivers with low levels of literacy and those that are advanced in age. The school's management must assist the team and all stakeholders related to the school if the plan is to succeed in the end, which will enable the team to create a positive learning environment and promote active learning of mathematics.

5.2.2 Failure to promote active learning

The study established that the teacher could not promote active learning by integrating technologies into her daily mathematics teaching and learning. The teacher does not see value in using mobile technologies to improve learners' performance in mathematics which was made clear when she did not use the technology infrastructure in her classroom. The situation was exacerbated by school management not ensuring or encouraging the teachers to use the ICTs they have at the school, which is evident in the school timetable, which does not reflect times when learners use ICT or the teachers' lesson preparation that does not include technological devices as resources for teaching and learning.

The above contributed to mathematics lessons not providing for active learning, thus causing performance not to improve. The same daily routine and methodology make learners lose interest and get bored, and this was apparent when the team did lesson observation. The routine was that learners were given workbooks, the teacher used the materials to teach, then asked questions, and the learners wrote. Interaction between the teacher and the learners was inadequate; the learners were not fully engaged in lessons except for answering questions and writing tasks.

The conclusion that can be drawn from this was that before the study, the teacher did not use cell phones to teach mathematics; therefore, there was no evidence that active learning led to the lessons not being interesting and fruitful, hence no improvement in learner performance in mathematics. The implication is that there was no interest in finding alternative ways of improving the teaching and learning of mathematics in Grade 3.

5.2.2.1 Recommendations

The study recommends that the team consider using the cell phone as a teaching and learning tool to improve the teaching and learning of mathematics in Grade 3. To succeed, the team and the school should recognize and acknowledge that the cell phone is a readily available tool for all learners and teachers. Research indicates that nearly all households in South Africa own a cell phone. They should also recognize that cell phone is loaded with mathematical applications which can assist the learners

in improving their learning; there are mathematics websites and platforms that the learners and teachers can use.

The study further recommends that using cell phones in teaching and learning mathematics can only be successful through the collaboration of parents and teachers through communication using the cell phone. The use of cell phones should be monitored by parents at home and teachers at school to avoid negative consequences that might come with the help of cell phones for teaching and learning.

The study experimented with using the IXL online program to teach money concepts in the Grade 3 classroom. The learners were quite active and engaging during the lesson. This brings the idea of recommending online learning programs that promote active learning. It suggests that schools investigate the idea of finding resources to enable the learners to access these platforms easily for both the learners and teachers. Parents need to be updated on the use of these learning platforms to help learners access the programs and assist in pooling resources for their children.

5.2.3 Lack of ongoing teacher development

The study showed an unacceptable lack of teacher development and a failure to recognize the importance of teacher development, even at the school level. Their recommendations for development on their QMS reports indicate that teachers need to be developed with various aspects of their teaching and learning process. However, there is no indication of when, how and on what the development will be based.

The Grade 3 teacher belongs to the age group of between 45 and 55. She was never trained to use digital devices or ICTs in teaching and learning. Even though the school has access to digital tools and her class has an IWB, the teacher and the school never bothered to ensure that they were used to benefit the learners. The school failed to understand the need to use digital devices to enhance teaching and learning in general and teaching and learning of mathematics.

The school should have conducted school-based teacher development to assist teachers unfamiliar with using digital devices for teaching and learning. The timetable of the school and the teachers' lesson planning should reflect the use of digital devices for teaching and learning. Teachers sometimes fail to attend workshops organized by

the education department for teacher development because they happen to be in the afternoons or over weekends. They fail to understand the importance of developmental workshops. This led to their failure to incorporate the use of digital technologies in the classroom, leading to learners' results in mathematics going down.

The Department of Education is the leading provider of teacher development activities. The study recommends that the department emphasise providing development related to the integration of mobile technologies or, specifically, the use of cell phones in the teaching and learning process, specifically in the teaching and learning of mathematics.

5.2.3.1 Recommendations

The study recommends ongoing teacher development regarding teaching and learning using digital devices like cell phones. This will help the teachers at the school familiarize themselves with the various digital devices they can use to improve the teaching and learning of mathematics.

Teacher development will help teachers embrace the use of technologies in their teaching and learning. In turn, they will be able to motivate their learners to use technologies for teaching and learning, especially the cell phone, which many parents and households have, thus making the cell phone an easily accessible teaching and learning device with many applications, websites and online platforms that can assist in the teaching and learning of mathematics.

The school management needs to work with the teachers to plan and engage teachers for development. When the school management supports teachers, it will motivate them to gather more skills and knowledge that will contribute to their professionalism in their daily teaching and learning activities which was reflected by the Grade 3 teacher who indicated that the school did not care whether they integrated technologies in the classroom or not. The fact that the school had resources that were not used is a clear indication of a lack of support and ignorance on the part of the school.

5.2.4 Lack of sufficient lesson planning

The study revealed that the lesson planning was insufficient; a lesson plan needs to indicate the lesson objectives, activities, and assessment tasks or strategies. However, there were no lesson plans in this case, and lesson objectives were unclear. The Grade 3 mathematics workbook was followed without a proper plan; the teacher simply looked at what the Annual Teaching Plan indicated should be taught on a specific day and what page of the departmental workbook provided to the learners. There were no extra tasks where the workbook was limited.

The HoD of the foundation phase, who monitors curriculum implementation, failed to recognize the need for proper lesson planning that ensures transparent, measurable objectives and the development of multiple activities that ensure learners understand what they are taught. In the foundation phase, educators needed to meet and plan their lessons together for continuity and as recommended by the cluster leaders; however, this did not happen at the school.

The teacher did not see lesson planning as vital since she had taught Grade 3 mathematics for many years. She regarded herself as knowing everything; therefore, planning was unnecessary. Even though the curriculum management plan of the school indicates that the HoD will monitor educators' files weekly, it seems that it was only done for fulfilment as there was no evidence of adequate lesson planning.

This situation needed the intervention of the HoD and the principal to support the educator in planning her lessons effectively and support with relevant resources.

5.2.4.1 Recommendations

The study recommends that the SMT ensure sufficient lesson planning is monitored and supported by them. Lesson planning can be done collaboratively by the foundation phase educators to ensure continuity. The study also recommends that the lesson planning indicate when the cell phone will be used, how it will be used, and for how long. It should reflect evidence of the use of cell phones.

In the SMT and the foundation phase, teachers are encouraged to embrace technology in their teaching process. The best way to do that is to involve parents and other

stakeholders. The team discussed at length during their meetings that teachers need to prepare themselves thoroughly and that they should get involved and ask them for help when they need parental intervention.

Lesson planning is vital in teaching and learning; therefore, the study recommends thorough preparation that will enable the teacher to translate the curriculum into practical learning activities, align the learning learning learning goals to the planned assessment tasks, and address the individual needs of the learners thoughtfully.

The coordinated team in this study managed to plan lessons jointly. The team lesson proved successful because the results improved the learners' performance. The study recommends team planning or phase planning.

5.2.5 Conditions conducive to the strategy to be implemented successfully

5.2.5.1 Collaboration between parents and teachers

The study revealed that for the strategy to be successful, parents and teachers need to collaborate. In the discussions held during the study, it emerged that for the success of the strategy, there is a dire need for collaboration through communication between the parents and teachers during school hours and after school. It emerged that while the learners use the cell phone for learning, the parents and teachers can also use them for communication. Collaboration in this study was regarded as an attribute that values commitment to assigned responsibilities with virtues of networking, negotiating tolerance and managing emotions. Collaboration was viewed and regarded as a factor that, if ignored, could hamper the success of implementing the strategy.

5.2.5.2 Teamwork

The study established that teamwork is one of the conditions conducive to the strategy to improve the teaching and learning of mathematics successfully. Team commitment enforces easy pooling of resources and allows members to offer whatever they have for the strategy's success. Teamwork ensured successful lesson planning and presentation, resulting in providing active learning.

Team success is based on the spirit of trust, confidence and sharing of ideas. It is also based on sharing and embracing a common vision for the school.

5.2.6 Threats to implementing the strategy

5.2.6.1 *Time management*

The study revealed that using cell phones in teaching and learning mathematics could be affected negatively by improper time management for both the learners and the teacher, as well as at home and school. At the school, it could be as the lesson gets interesting; time may go unnoticed and affect other subjects. The learners can get carried away at home and use their cell phones excessively for long hours, negatively affecting their health. The study revealed a dire need for monitoring learners' use of cell phones at school and home.

5.2.6.2 *Exposure to harmful unwanted content*

The study established that while using cell phones for teaching and learning, learners can be exposed to harmful and unwanted content when connected to the internet. They can even share what they encounter, which may exacerbate the problem which is discouraging to all the team members; however, the team also realized through this study that this could be mitigated through education; hence, the librarian was brought into the study to give education related to the proper use of the internet. Her topics included cyberbullying and emotional problems caused by too much use of digital resources.

The parents were relieved after the workshop offered by the librarian, as they learnt what they should do to protect their children against harm. It became necessary for ongoing learner support on using phones and other mobile devices properly. Achieving all the set goals depends on an atmosphere that does not threaten the learners' well-being physically or emotionally.

It emerged from the discussions that using cell phones poses other threats: trouble with vision, hearing, obesity, and other emotional problems that cause children to isolate themselves because they always want to be on their phones.

Parents need to be on the lookout for all the signs mentioned above for the strategy to succeed.

5.3 VALUE OF THE STUDY

The study aimed at developing a strategy to improve the teaching and learning of mathematics in Grade 3 using cell phones with the collaborative support of parents and teachers. The study's most important value was working with the co-researchers, the ones affected by the challenges, in their learning environment setting. The study brought an enormous wealth of knowledge to the co-researchers for whom it was their first time to engage in a research project. The study analyzed data using PAR. This displayed the value and necessity of working together as a team which brought about mutual participation and a feeling of team spirit. All the research team members were actively involved and collaborated throughout the research process.

Using PAR as a research approach enabled the co-researchers to gain new insights, share their knowledge, and motivate one another to participate and finish the study. The co-researchers were empowered to gain skills that could be used to advance their daily life activities. Using PAR ensured continued collaboration among the team members, including the school and parents. Since parents and teachers were involved in the study, they both were able to collaborate in pooling resources to support the strategy. It was challenging but also very interesting for the research team to work together, plan together, organize together, look for resources together, and ultimately implement the strategy together. The team spirit the co-researchers displayed ensured the continuity of using the strategy.

In this study, the co-researchers realized their limitations. The parents could raise their concerns, and the teacher could present the lesson in the presence of the dedicated team, which can reflect on the lesson, together with limitations, with the teacher. The limitations of the teacher, who could not use a cell phone or other mobile technologies for teaching and learning mathematics, were compensated for by the presence of the school clerk and the community librarian who worked with the teacher. The aged guardians could find assistance from the younger generation of parents.

Integrating cell phones and other mobile technologies for teaching and learning mathematics brought about active learning for the learners. The sharing of resources enabled the learners to work together and be able to assist one another. Learners were exposed to the power of the internet using an online learning programme, allowing them to realize the power of connectivity and the possibility of self-teaching using posthuman practices.

The involvement of parents as co-researchers advanced awareness of the importance of parental involvement in improving the teaching and learning process. Parents were able to realize the critical role they needed to play in their children's education. Parents realized that they did not necessarily need to be physically present at the school, but they could communicate with the school using a cell phone. The power of the cell phone in this study was displayed in assisting teaching and learning and ensuring communication and collaboration between the school and home, between parents and teachers, and between teachers and learners. The study showed that learners could be masters of their learning using the cell phone as the cell phone is a powerful learning tool that needs to be looked at by schools and parents as well as the Department of Education.

5.4 RECOMMENDATIONS FOR FUTURE RESEARCH

The study was conducted in a rural community in the poorest poor areas of Mpumalanga province in the Bohlabela district. It allowed the stakeholders to participate in finding a strategy that will improve mathematics teaching among Grade 3 learners, which is a challenge not only for Grade 3 learners. Suppose the study is done in other rural communities. In that case, it can contribute more towards community empowerment, social justice, and solidarity in finding mutual solutions to some of the challenges societies face. The DoE in Mpumalanga province needs to create plans for awareness in providing technological resources to schools that help to improve the teaching of mathematics without them having to give finances by bringing together different stakeholders in education. This study proved that a cell phone, available in every household, can be used to teach mathematics. The study used PAR as a research approach; it could, however, be done in other formats producing varying results.

5.5 LIMITATIONS OF THE STUDY

5.5.1 The study co-researchers

The team members/co-researchers were orientated regarding their roles in the study, including establishing the strengths, weaknesses, opportunities, and threats. The study objectives were reached, and the strategy to improve the teaching and learning of mathematics among Grade 3 learners with the collaborative support of parents and teachers was designed successfully. However, limitations to the study were encountered. The presence of high-ranking officials like the community librarian and the district official limited the confidence of the co-researchers for them to express themselves freely in their presence, as they were senior and appeared so much more knowledgeable than themselves.

5.5.2 Time

Time posed a threat, as the meetings were held in the afternoons not to disturb school hours, making it difficult for other co-researchers because they were at work, while some had to mind their younger children when they returned from school. The learners were expected to add more school time and could be exhausted by then. The study took place at one school in a rural area, and the impact of the study might bring a more desirable effect if many schools participated.

5.6 CONCLUSION

The study aimed to design a strategy that will improve the teaching and learning of mathematics among Grade 3 learners using cell phones with the collaboration of parents and teachers. The background of the study and relevant literature that was influenced by its objectives were covered in Chapter 1. The theoretical framework, posthumanism, guiding the study was introduced. The conceptual framework: that is, connectivism, was also introduced. Furthermore, PAR was discussed as the research approach and how data will be generated outlined. CDA as a method of analysing data was explained, and the chapter also presented the ethical considerations and the value of the research. The layout of the chapters was given after the chapter.

In Chapter 2, posthumanism was presented as the study's theoretical framework. The chapter discussed the origin of the theory, its evolution, the formats, and the objectives theory. It examined the principles of posthumanism and how it relates to education. The study's conceptual lens, connectivism, was discussed in this chapter, as well as its origin, evolution, and guiding principles. Furthermore, the related literature was reviewed as informed by the objectives of the study, looking at the challenges experienced, solutions to the difficulties, conducive conditions to the study, possible threats that may hinder the success of the strategy to be developed, and the evidence that the strategy is working. The literature review drew some insights from other countries from the African continent, international countries, and South Africa.

In Chapter 3, PAR was defined as a research methodology. Its historical background, as well as its characteristics, were discussed. The action plan and operational activities were outlined in this chapter. Furthermore, co-researchers credentials were captured, and the resources used to generate data were clarified. Emphasis was put on ethical considerations and clarified in this chapter. CDA was the strategy used to analyze data in this study; it was discussed at three levels: textual, discursive, and social.

Chapter 4 presented the study's results; the results were interpreted, analysed, and discussed towards developing a strategy to improve the teaching and learning of mathematics amongst Grade 3 learners with the collaboration of parents and teachers. The chapter classified the data into the five objectives of the study and analysed the data according to the literature in Chapter 2.

Chapter 5 recapped the problem statement and the background to the study; The chapter also recaptured the aims and objectives of the study and the research question. The research findings and the literature alluded to were attested to by the empirical data. The solutions to the challenges were discussed, and recommendations were made. The strategy was strengthened through collaboration with the co-researchers and networking with relevant stakeholders, resulting in a shared common vision among the team members and improved strategy implementation.

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APPENDICES

APPENDIX 1: ETHICAL CLEARANCE LETTER FROM UNIVERSITY OF MPUMALANGA

Research Ethics Clearance Letter

UMP



RESEARCH ETHICS CLEARANCE LETTER

Ref: UMP/NG Ndlovu/MEd/2022

Date: 28 September 2022

Name of Researcher: Nikiwe Gift Ndlovu

Student number: 220234728

Supervisor: Professor M. G. Mahlomaholo

School / Department: Department of Early Childhood Education

Faculty: Faculty of Education

RE: APPROVAL FOR ETHICAL CLEARANCE FOR THE STUDY:

PARENT-TEACHER COLLABORATION IN TEACHING GRADE 3 MATHEMATICS USING CELL PHONES AT A SELECTED SCHOOL IN MPUMALANGA

Reference is made to the above heading.

I am pleased to inform you that the Chairperson has on behalf of the University of Mpumalanga's Research Ethics Committee, **approved ethical clearance** of the above mentioned study.

Please note:

Any alteration/s to the approved research protocol i.e. questionnaire/interview schedule, informed consent form, title of the project, location of the study, research approach and methods, must be reviewed and approved prior to its implementation.

A handwritten signature in blue ink, appearing to read "EB", with a horizontal line underneath.

Prof Estelle Boshoff

Chairperson: University of Mpumalanga's Research Ethics Committee.

Date: 28 September 2022



APPENDIX 2: APPROVAL TO CONDUCT RESEARCH: DoE MPUMALANGA



Ikhanga Building, Government Boulevard, Riverside Park, Mpumalanga Province
Private Bag X11341, Mbombela, 1200.
Tel: 013 766 5552/5115, Toll Free Line: 0800 203 116

I.liko le Temfundvo, Umnnyango we Fundo

Departement van Onderwys

Ndzawulo ya Dyondzo

Name and surname: Ndlovu Nikiwe Gift
University of Mpumalanga
Contact number: 0732718009
Email : ndlovunikiwegift@gmail.com

RE: "PARENT TEACHER COLLABORATION IN TEACHING GRADE 3 MATHEMATICS USING CELLPHONES AT A SELECTED SCHOOL IN MPUMALANGA BOHLABELA DISTRICT".

Your application to conduct research study was received and is therefore acknowledged. The title of your research project reads: **"Parent Teacher collaboration in teaching grade 3 mathematics using cellphones at a selected school in Mpumalanga Bohlabela district"**.

. I trust that the aims and the objectives of the study will benefit the whole department especially the beneficiaries. Your request is approved subject to you observing the provisions of the departmental research policy which is available in the department website. You are requested to adhere to your university's research ethics as spelt out in your research ethics.

In terms of the research policy, data or any research activity can be conducted after school hours as per appointment with affected participants. You are also requested to share your findings with the relevant sections of the department so that we may consider implementing your findings if that will be in the best interest of the department. To this effect, your final approved research report (both soft and hard copy) should be submitted to the department so that your recommendations could be implemented. You may be required to prepare a presentation and present at the departments' annual research dialogue.

For more information kindly liaise with the department's research unit @ 013 766 5124/5015 Or c.maphanga@mpuedu.gov.za


The department wishes you well in this important project and pledges to give you the necessary support you may need.


MRS LH MOYANE
HEAD: EDUCATION

09 / 09 / 2022
DATE



APPENDIX 3: PERMISSION FROM CIRCUIT MANAGER DoE MPUMALANGA TO CONDUCT RESEARCH

 **education**
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

Building No. 5, Government Boulevard, Riverside Park, Mpumalanga Province
Private Bag X11341, Mbombela, 1200.
Tel: 013 786 5552/5115, Toll Free Line: 0800 203 116

Litiko le Temfundvo, Umnyango we Fundo Departement van Onderwys Ndzawulo ya Dyondzo

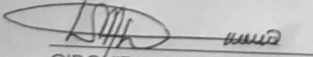
Enquiries: MTHETHWA L
Cell : 0721173442
Email : mthethwalawrence@gmail.com

TO: Ndlovu Nikiwe Gift (220234728)
University of Mpumalanga


FROM: THE CIRCUIT MANAGER
MANYELETI CIRCUIT OFFICE

SUBJECT : APPLICATION TO CONDUCT RESEARCH ON PARENT-TEACHER COLLABORATION IN TEACHING GRADE 3 MATHEMATICS USING CELLPHONES AT SELECTED SCHOOLS IN MANYELETI CIRCUIT.

1. This office acknowledge receipt of your application to conduct research study at our schools.
2. Your request is granted subject to it not interfering with the business of the schools, i.e the activity should be after school hours.
3. We would appreciate if your findings could be shared with our schools.
4. The Circuit management wishes you well in this endeavor and promise to give you the necessary support.


CIRCUIT MANAGER
MTHETHWA L

2022/09/28
DATE


MPUMALANGA
THE PLACE OF THE RISING SUN

Scanned with CamScanner

APPENDIX 4: REQUEST TO CONDUCT RESEARCH: HEAD OF DEPARTMENT

Name and surname: Ndlovu Nikiwe Gift Contact number: 0732718009 SUPERVISOR:
Mahlomaholo S.G

Date: 25 August 2022

The Head of Department Mpumalanga Department of education Bohlabela district

Request for permission to conduct research at a selected school in Bohlabela district

Dear Sir/ Madam

I, Ndlovu Nikiwe Gift, a master's degree student at the university of Mpumalanga doing research under the supervision of Professor Mahlomaholo, humbly request permission to conduct research at a selected school in Bohlabela district Mpumalanga province. My student number is 220234728.

The title of the study is **“Parent Teacher collaboration in teaching Grade 3 mathematics using cell phones at a selected school in Mpumalanga Bohlabela district”**. The school was selected because it is ideal for gathering information about the benefits of using cell phones in the teaching of mathematics curriculum in Grade 3 classroom. The study aims to formulate a strategy to improve the teaching and learning of mathematics Grade 3 using cell phones with the collaborative support of parents and teachers.

The study will entail working together with teachers, HoDs, parents, businesspeople, librarian, Education specialist (curriculum implementer) and the police. This study is not supposed to be risky, and no risky situation is expected during this study. Participation in the study is entirely voluntary and participants (co-researchers) have a right to withdraw without any repercussions from participating in the study anytime if a situation arises and make you feel comfortable. There will be no reimbursement or any incentives for participation in the research. Feedback will be given in a form of written letters, emails, word of mouth as well as SMS.

Thanking you in advance.

Yours sincerely

Ms. N.G. Ndlovu

APPENDIX 5: REQUEST TO CONDUCT RESEARCH: CIRCUIT MANAGER

Name and surname: Ndlovu Nikiwe Gift Contact number: 0732718009 SUPERVISOR: Mahlomaholo S.G.

Date: March 2022

The Circuit Manager Manyeleti circuit Bohlabela district

Request for permission to conduct research at one of your Primary Schools

Dear Sir

I, Ndlovu Nikiwe Gift, a master's degree student at the university of Mpumalanga doing research under the supervision of Professor Mahlomaholo, humbly request permission to conduct research at your institution. My student number is 220234728.

I am requesting to conduct research at your school and inviting you to participate in the study entitled "Parent Teacher collaboration in teaching Grade 3 mathematics using cell phones at a selected school in Mpumalanga Bohlabela district". Your school was selected because it is ideal for gathering information about the benefits of using cell phones in the teaching of mathematics curriculum in Grade 3 classroom. The study aims to formulate a strategy to improve the teaching and learning of mathematics Grade 3 using cell phones with the collaborative support of parents and teachers.

The study will entail working together with teachers, HoDs, principal and parents, businesspeople, and the police. This study is not supposed to be risky, and no risky situation is expected during this study. Participation in the study is entirely voluntary and you have a right to withdraw without any repercussions from participating in the study any time if a situation arises and make you feel comfortable. There will be no reimbursement or any incentives for participation in the research. Feedback will be given in a form of written letters, emails, word of mouth as well as SMS.

Thanking you in advance

Yours sincerely

Ms. N.G. Ndlovu

APPENDIX 6: CONSENT FORM FOR THE PRINCIPAL, HoD, TEACHER AND EDUCATION SPECIALIST

Request for you to participate in research study

Dear Prospective Co-researcher

I, Ndlovu Nikiwe Gift, a Master's degree student at the university of Mpumalanga doing research under the supervision of Professor Mahlomaholo, humbly request you participate in a research study that I am conducting. My student number is 220234728.

I am requesting you to participate in the study entitled "Parent Teacher collaboration in teaching Grade 3 mathematics using cell phones at a selected school in Mpumalanga Bohlabela district". You are selected because you are an ideal candidate for gathering information about the benefits of using cell phones in the teaching of mathematics curriculum in Grade 3 classroom. The study aims to formulate a strategy to improve the teaching and learning of mathematics Grade 3 using with the collaborative support of parents and teachers. The study will entail working together with teachers, HoDs, principal and parents, businesspeople, and the police. This study is not supposed to be risky, and no risky situation is expected during this study. It will be explained to co-researchers that they have a right to withdraw from participating in the study anytime. There will be no reimbursement or any incentives for participation in the research. Feedback to participants will be given in a form of written letters, emails, word of mouth as well as SMS. I can also be contacted at: ndlovunikiwegift@gmail.com

Thanking you in advance

Yours sincerely

Ndlovu Nikiwe Gift

APPENDIX 7: ASSENT FORM FOR MINORS

My name is Gift Ndlovu. a master's degree student at the university of Mpumalanga doing research under the supervision of Professor Mahlomaholo, humbly request you to participate in the research study that I am doing. My student number is 220234728.

The topic of the study is: Parent Teacher collaboration in teaching of Grade 3 mathematics using cell phones at a selected school in Mpumalanga Bohlabela district". Your child's school was selected because it is ideal for gathering information about the benefits of using cell phones in the teaching of mathematics curriculum in Grade 3 classroom. The study aims to formulate a strategy to improve the teaching and learning of mathematics Grade 3 using cell phones with the collaborative support of parents and teachers.

The study will entail working together with teachers, HoDs, principal and parents, children, businesspeople, and the police. This study is not supposed to be risky, and no risky situation is expected during this study. It will be explained to co-researchers that they have a right to withdraw from participating in the study anytime. There will be no reimbursement or any incentives for participation in the research. Feedback to participants will be given in a form of written letters, emails, word of mouth as well as SMS.

You should know that

- You do not have to be in this study if you do not want to
- You may stop being in this study anytime if you feel uncomfortable
- Your parents/ guardian was asked if its ok for you to participate in this study. Even if they said yes, it is still your right to decline if you don't want to participate
- You can ask any questions you have now or at a later stage
- You or your parents can contact me any time if you need any clarity on any issues regarding the study

Sign this form only if you

- Understood what you will doing for this study
- Have all your questions answered
- Have spoken with your parents / guardian about this study
- Agree to take part in this study.

Child signature: _____

Name: _____

Date: _____

Parent signature: _____

Name: _____

Date: _____

Researcher signature: _____

Name: _____

Date: _____

APPENDIX 8: CONSENT FORM FOR PARENTS

Dear Parent

My name is Gift Ndlovu. a master's degree student at the university of Mpumalanga doing research under the supervision of Professor Mahlomaholo, humbly request your child to participate in the research study that I am doing. My student number is 220234728.

The topic of the study is: Parent Teacher collaboration in teaching of Grade 3 mathematics using cell phones at a selected school in Mpumalanga Bohlabela district". Your child's school was selected because it is ideal for gathering information about the benefits of using cell phones in the teaching of mathematics curriculum in Grade 3 classroom. The study aims to formulate a strategy to improve the teaching and learning of mathematics Grade 3 using cell phones with the collaborative support of parents and teachers.

The study will entail working together with teachers, HoDs, principal and parents, children, businesspeople, and the police. This study is not supposed to be risky, and no risky situation is expected during this study. It will be explained to co-researchers that they have a right to withdraw from participating in the study anytime. There will be no reimbursement or any incentives for participation in the research. Feedback to participants will be given in a form of written letters, emails, word of mouth as well as SMS.

One of the course requirements is to complete a classroom lessons and tasks in the classroom. The lessons and tasks will be done with minimum interference to the regular undertakings in the classrooms. I appreciate your willingness to accommodate this request. If you have any questions or concerns, you may contact the head teacher and the Ministry of Education and Training. I may also be contacted at my email address: Ndlovunikiwegift@gmail.com

you are planning about allowing your child to participate in this study. Your signature below indicates that you have read the information provided above and have decided to allow him or her to participate in the study. You may keep a copy of this letter.

Name of child: _____ Parent/guardian's name (print)

Parent/guardian's signature: _____

Researcher's name (print) _____ Researcher's signature _____

Date: _____

APPENDIX 9: CONSENT FORM FOR POLICEMAN

Request for you to participate in a research study

Dear prospective co-researcher

I, Ndlovu Nikiwe Gift, a Master's degree student at the university of Mpumalanga doing research under the supervision of Professor Mahlomaholo, humbly request you participate in a research study that I am conducting. My student number is 220234728.

The study will need participation of a police official. I am requesting you to participate in the study entitled "Parent Teacher collaboration in teaching Grade 3 mathematics using cell phones at a selected school in Mpumalanga Bohlabela district". You are selected because you are an ideal candidate for gathering information about the safety of using cell phones in the teaching of mathematics curriculum in Grade 3 classroom. The study aims to formulate a strategy to improve the teaching and learning of mathematics Grade 3 using cell phones with the collaborative support of parents and teachers.

The study will entail working together with teachers, HoDs, parents, businesspeople, and the police. This study is not supposed to be risky, and no risky situation is expected during this study. It will be explained to co-researchers that they have a right to withdraw from participating in the study anytime. There will be no reimbursement or any incentives for participation in the research. Feedback to participants will be given in a form of written letters, emails, word of mouth as well as SMS.

Thanking you in advance.

Yours sincerely

APPENDIX 10: CONSENT FORM FOR LIBRARIAN, RELIGIOUS LEADER, AND BUSINESSPEOPLE

Request for you to participate in a research study

Dear Prospective Co-researcher I, Ndlovu Nikiwe Gift, a master's degree student at the university of Mpumalanga doing research under the supervision of Professor Mahlomaholo, humbly request you to participate in a research study that I am conducting. My student number is 220234728.

I am requesting to participate in the study titled "Parent Teacher collaboration in teaching Grade 3 mathematics using cell phones at a selected school in Mpumalanga Bohlabela district". You are selected because you are an ideal candidate for gathering information about the benefits of using cell phones in the teaching of mathematics curriculum in Grade 3 classroom. The study aims to formulate a strategy to improve the teaching and learning of mathematics Grade 3 using cell phones with the collaborative support of parents and teachers. The study will entail working together with teachers, HoDs, parents, businesspeople, and the police. This study is not supposed to be risky, and no risky situation is expected during this study. It will be explained to co-researchers that they have a right to withdraw from participating in the study anytime. There will be no reimbursement or any incentives for participation in the research. Feedback to participants will be given in a form of written letters, emails, word of mouth as well as SMS.

Thanking you in advance Yours sincerely

APPENDIX 11: MINUTES OF PARENTS MEETING HELD ON THE 13TH OF JULY 2022

Agenda items were as follows.

1. Opening
2. Welcome
3. Purpose of the meeting
 - 3.1 Formulation of the research team
 - 3.2 Programme of action
 - 3.3 Next activity
 - 3.4 Date of next meeting
4. Closure

1. The meeting was opened by Mrs. Ubisi with a prayer.
2. The researcher welcomed all and explained the purpose of the meeting.
3. Rollcall was circulated for all to sign.
4. The research team was formed, and research coordinator identified.
5. programme of action was developed and to be amended if needs arise. Roles and responsibilities was shared among the team members. All the challenges and fears were addresses to the satisfaction of all issues of ethics and trustworthiness were discussed and conditions for the coresearchers to participate in the study were outlined to them. Their rights were explained to them, and all their questions were addressed
6. the date of next meeting was the 20th of July 2022 after school hours at the very same venue.

The meeting was closed by Mrs. Makhubele with a prayer



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AGENDA FOR A MEETING WITH PARENTS

1. OPENING
2. PURPOSE OF THE MEETING
3. FORMULATING THE TEAM
4. DRAWING A PROGRAMME OF ACTION
5. IDENTIFYING NEXT ACTIVITY
6. DATE OF NEXT MEETING
7. CLOSURE



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ATTENDANCE REGISTER: MEETING WITH PARENTS AND OTHER CORESEARCHERS
DATE: 13-07-2022

NAME	SURNAME	CELL NUMBER	DESIGNATION	SIGNATURE
1. Ntlovu				
2. Adelaide	Cetate-e	064 732 857		<i>AS</i>
3. Merciful	Ubisi	0722869752		<i>[Signature]</i>
4. Mndruw	Shabangu	0160802602		M. Shabangu
5. Diga	Mkansi	0824268517		<i>[Signature]</i>
6. SIFE	Makule	0607104199		G. Mak
7. Sibangile	Mkamsi	079 9394 922		S. M
8. G.R. TA	MHLANGA	0721236527		<i>[Signature]</i>
9. Ubisi	Mansa	0163618543		<i>[Signature]</i>
10. Fionah	Mdini	0608215007		Fiona
11. Lic	Mthasi	0637435565		<i>[Signature]</i>
12. Veronica	Mechate	072 0316 935	Hlangua Public Library	<i>[Signature]</i>
13. SUNDI	SHUBANE	0837346469		<i>[Signature]</i>
14. Makhubele	M	060431 7307		M. Makhubele
15. Mphahlele	S.W	08 5555 168		M. Phahlele

LETTER FROM 1st LANGUAGE EDITOR

CORNELIA GELDENHUYS

0683 2877088
corrieg@mweb.co.za

29 December 2022

TO WHOM IT MAY CONCERN

Herewith I, Cornelia Geldenhuys (ID 521114 0083 088) declare that I am a qualified, accredited language practitioner and that I have edited the following dissertation:

PARENT-TEACHER COLLABORATION IN TEACHING GRADE 3 MATHEMATICS USING CELL PHONES AT A SELECTED SCHOOL IN MPLIMATANGA

by

Nikiwe Gift Ndlovu
Student number
220234728

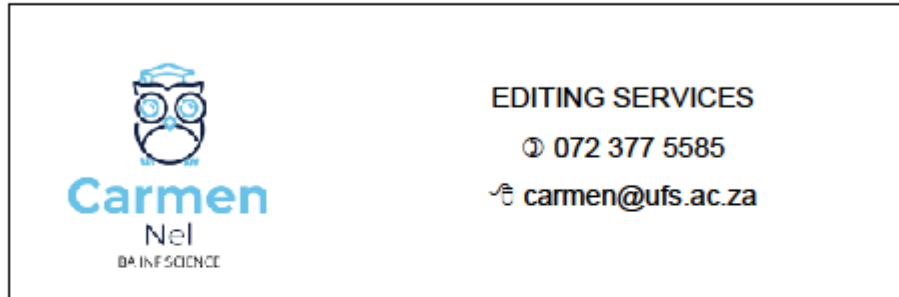
All changes were indicated by track changes and comments for the author(s) to verify, clarify aspects that are unclear, make the necessary adjustments and finalise. The editor takes no responsibility in the instance of this not being done. The document remains the final responsibility of the author(s).



.....
C GELDENHUYS
MA (Lin) cum laude, MA (Mus), HOD, HDL, UOLM

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Full member/Volêre lid, Professional Editors Guild (PEG, Membership GE1001)
Mediterranean Editors and Translators (MET, Membership 02/55)
European Association of Scientific Editors (EASE, Membership 5523)

LETTER FROM 2nd LANGUAGE EDITOR



CERTIFICATE OF LANGUAGE EDITING

This letter certifies that I have edited the work detailed below for language as well as technical issues.

Title:

PARENT-TEACHER COLLABORATION IN TEACHING GRADE 3 MATHEMATICS
USING CELL PHONES AT A SELECTED SCHOOL IN MPUMALANGA

by

Nikiwe Gift Ndlovu

Student no. 220234728

Regards

Carmen Nel

9 April 2023