

Teacher Leadership and the Fourth Industrial Revolution: Stories of Teachers Working in Diverse School Contexts

by

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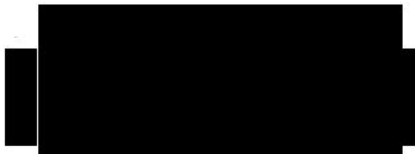
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Belief is the cornerstone upon which we build our lives, serving as the foundation for our aspirations and identities. My faith in Jesus Christ provided a solid anchor amidst the inherited lenses of previous societies, which often cast shadows that obscure our true selves. Through questioning and introspection, this faith transformed my uncertainty into a structure of purpose and ambition. This PhD stands as a testament to the transformative power of belief as it directed unknown potential into actualised achievements. I honour the faith that has shaped my path toward endless possibilities.

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DEDICATION

I dedicate this inquiry to my Lord and Savior, Jesus Christ. Your spiritual word of *truth* has been a lamp to my feet and a light to my path (Psalms 119:105). Your promises have transcended my understanding and surpassed my expectations of this life. This study represents the culmination of my best work during this season of my life, and I offer it to You.

ABSTRACT

In 2016, Charles Schwab, architect of the Fourth Industrial Revolution (4IR), envisioned billions of people interconnected through mobile devices with unmatched processing power, storage, and knowledge access. He foresaw advancements in artificial intelligence, robotics, IoT, 3D printing, nanotechnology, biotechnology, and quantum coding revolutionising all facets of society. Less than a decade later, this vision has been actualised. The education sector, including South Africa, is no exception to these transformations. In the South African educational landscape, integrating 4IR technologies presents substantial potential alongside multifaceted challenges. Harnessing technology's transformative power across varied school contexts necessitates an understanding of the pivotal role of teacher leadership. The South African educational spectrum ranges from well-resourced, world-class institutions to profoundly dysfunctional schools, where teacher leadership emerges as a catalyst for implementing and steering educational innovations in the 4IR. This inquiry delves into the lived experiences of South African teacher leaders from diverse school contexts who pioneer technological innovations in teaching and learning within the 4IR. The study's objectives are threefold: firstly, to chronicle the narratives of teacher leaders driving innovation across varied contexts; secondly, to elucidate their leadership practices in promoting technological innovation; and thirdly, to explore why teacher leadership is significant for advancing technological innovation in the 4IR. The research employs the teachers as leaders framework, adaptive leadership theory, and social realism to elucidate this phenomenon, positioning itself within the critical realist paradigm. Methodologically, the study adopts narrative inquiry, utilising narrative interviews, photovoice, and collage inquiry to generate field texts. These narratives were co-constructed through narrative analysis, and the constant comparative method, supported by Delve software, was employed to discern key themes. The findings indicate that teacher leadership is profoundly shaped by the contextual realities within which teachers work. Utilising the teachers as leaders framework and social realism, this study identifies the mechanisms underpinning teacher leadership for technological innovation. Three key findings are highlighted: adaptive technological integration tailored to resource availability, strategic collaborations extending beyond school confines to bolster technological practices, and a resolute commitment to equity, leveraging technology to bridge socio-economic disparities. The findings illustrate how teacher leadership advances innovative and equitable educational practices in the 4IR. Furthermore, the study underscores the importance of cultural intelligence for contextual adaptation, ethical tech leadership to mitigate the digital divide, and data-driven practices to transform educational outcomes. Collectively, these elements demonstrate how teacher leaders act as agents of change, integrating technology to enhance teaching and learning across diverse educational settings.

Keywords: Leadership, management, teacher leadership, teacher agency, school culture, school structure

LIST OF ABBREVIATIONS/ACRONYMS

4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
CCM	Constant Comparative Method
CPD	Continuous Professional Development
CR	Critical Realism
DBE	Department of Basic Education
HOD	Head of Department
ICT	Information and Communication Technology
IDEAS	Initiating, Discovery, Envision, Actioning and Sustaining
IoT	Internet of Things
KZN	KwaZulu-Natal
NGOs	Non-Profit organisations
PhD	Doctor of Philosophy
SA-SAMS	South African School Administration and Management System
SGB	School Governing Body
SR	Social Realism

TABLE OF CONTENTS	
CONTENTS	PAGE
Declaration	ii
Supervisor's Authorisation	iii
Acknowledgements	iv
Dedication	vi
Abstract	vii
List of Abbreviations	viii
Table of Contents	ix
Appendices	xviii
List of Figures	xix
List of Tables	xxi

CHAPTER ONE	
MAPPING THE STUDY'S TERRAIN: CONTEXTUALISING THE INQUIRY	
Contents	Page
1.1. Introduction	1
1.2 Background to this inquiry	1
1.3 Research problem	4
1.4 Rationale for the study	5
1.4.1 Personal justification	6
1.4.2 Practical justifications	7
1.4.3 Theoretical justification	8
1.5 Research puzzle	8

1.5.1 Primary research puzzle	9
1.5.2 Related sub-puzzles	9
1.6 Key concepts	9
1.6.1 Leadership	9
1.6.2 Management	10
1.6.3 Lived experiences	10
1.6.4 The Fourth Industrial Revolution (4IR)	10
1.6.5 Technological Innovation in teaching and learning	11
1.7 Chapter Organisation	11
1.8 Conclusion	14

CHAPTER TWO	
EXPLORING TEACHER LEADERSHIP IN THE 4IR: A REVIEW OF LITERATURE	
Contents	Page
2.1 Introduction	15
2.2 The context of South African Education and leadership	15
2.2.1 The educational and school leadership landscape during apartheid	16
2.2.2 The current education system and school leadership	18
2.2.3 The diverse educational contexts in South Africa	20
2.3 Teacher Leadership	23
2.3.1 Distributed leadership and the emergence of teacher leadership	23
2.4 Understanding teacher leadership	25
2.4.1 Teacher leadership as position	25
2.4.2 Teacher leadership: Beyond the boundaries of the school	26

2.5 Teacher leadership: Contested notions	27
2.5.1 Formal teacher leadership	27
2.5.1.1 Authorised distributed leadership	28
2.5.1.2 Restricted teacher leadership	28
2.5.2 Informal teacher leadership	29
2.5.2.1 Dispersed distributed leadership and emergent teacher leadership	29
2.5.2.2 Democratic distributed leadership and developed teacher leadership	29
2.6 Teacher leadership landscapes: Culture, structure and agency	30
2.6.1 School cultural threads: Weaving the threads of teacher leadership	31
2.6.1.1 Collaborative cultures for teacher leadership	32
2.6.1.2 Professional Learning Communities for teacher leadership in the 4IR	34
2.6.2 Architects of school change: school structure and teacher leadership for the 4IR	35
2.6.3 Teacher leadership and agency for the 4IR	37
2.6.3.1 Teacher leadership agency and the South African context	38
2.6.3.1 Building teacher leadership agency for the 4IR	40
2.7. The 4IR and education	41
2.7.1 Understanding the Industrial Revolutions	41
2.7.2 Perceptions and utility of the 4IR in the education sector	44
2.7.3 Barriers to implementing the 4IR in South African schools	46
2.8 Conclusions	48

CHAPTER THREE	
THEORETICAL FRAMEWORK: A BLUEPRINT FOR UNDERSTANDING TEACHER LEADERS FOR INNOVATION IN TEACHING AND LEARNING IN THE 4IR	
Contents	Page
3.1 Introduction	49
3.2 Teachers as Leaders Framework	49
3.2.1 Emergence of the Teachers as Leaders Framework	50
3.2.2 Outlining the six constructs of the Teachers as Leaders Framework	53
3.2.3 Application of the Teachers as Leaders Framework in diverse contexts	54
3.2.4 Employing the Teachers as Leaders Framework in my inquiry	55
3.3 Adaptive Leadership Theory	55
3.3.1 Emergence of Adaptive Leadership	56
3.3.2 Key processes of Adaptive Leadership	58
3.3.3 Studies employing Adaptive Leadership	60
3.4 Social Realism Theory	61
3.4.1 Social Realism: Why it matters for my research inquiry	61
3.4.2 Critical realism: A Meta-theory to Social Realism	62
3.2.4.1 Ontological and epistemological claims for the critical realist: The independent reality	63
3.4.3 A stratified layer of reality	64
3.4.3.1 The domain of the empirical	64
3.4.3.2 The domain of the actual	65
3.4.3.3 The domain of the real	65
3.4.4 Understanding Social Realism for this inquiry	66
3.4.4.1 Understanding Archer's notion of structure	66
3.4.4.2 Understanding Archer's notion of culture	67

3.4.4.3 Understanding Archer's stratified notion of agency	67
3.4.4.4 Analytical Dualism	69
3.4.4.5 Understanding emergent properties	69
3. 5 The theoretical assemblage for this inquiry	71
3.6 Conclusion	73

CHAPTER FOUR	
MY RESEARCH METHODOLOGY TOOLBOX	
Contents	Page
4. 1 Introduction	74
4.2 Research paradigm: Tracing my paradigmatic shift to Critical Realism	74
4.2.1 Working within other paradigms	75
4.2.2 Critical Realism as my paradigm	76
4.3 Research design: A qualitative approach to studying lived experience	78
4.4 Research methodology: Narrative inquiry as a unique way to study experience	79
4.4.1. Three commonplaces of narrative inquiry	81
4.4.2. Narrative inquiry as both phenomenon and methodology	82
4.4.3 Ontological and epistemological commitments in narrative inquiry	82
4.5 Selection of site and participants	84
4.5.1. Participant biographies	85
4.6 Generation of field text	86
4.6.1 Narrative Interviews	87
4.6.1.1 Using Zoom Interview	88
4.6.2 Photo-voice-inquiry and the need to consider photo-voice elicitation	88
4.6.3 Collage inquiry	90

4.6.4 Data generation plan	92
4.6.5 Reflections: Pre and post experience of working with the participants	93
4.7 Analysis of field texts	97
4.7.1 Narrative analysis	97
4.7.2 Analysis of Narratives.	99
4.7.2.1 Reflection of using CCM and Delve software for my analysis	102
4.8 Ethical issues	103
4.9. Trustworthiness	104
4.9.1 Verisimilitude	104
4.10 Conclusion	107

CHAPTER FIVE FROM QUINTILES TO QUANTUM LEAPS: UNVEILING THE NARRATIVES OF TECHNOLOGICALLY INNOVATIVE TEACHER LEADERS ACROSS QUINTILE 1, 2 AND 3 SCHOOLS IN THE 4IR LANDSCAPE	
Contents	Page
5. 1 Introduction	108
5.2 Cindy's Story: Empowering minds- Unleashing teacher leadership	109
5.3 Zama's Story: The social justice inspired teacher leader	118
5.4 Evalina's Story: The tech-savvy pioneering teacher leader	128
5.5 Conclusion	138

CHAPTER SIX	
EMERGING CATALYSTS: THE DIGITAL ODESSEY OF QUINTILES 4 AND 5 TEACHER LEADERS IN THE TECHNOLOGICAL FRONTIER OF THE 4IR	
Contents	Page
6. 1 Introduction	140
6. 2 Kirstern’s story: Optimising opportunities	140
6.3 Simitha’s narrative: Innovative teacher leader	150
6.4 Conclusion	160

CHAPTER SEVEN	
LEADERSHIP PRACTICES OF TEACHER LEADERS FOR TECHNOLOGICAL INNOVATION IN TEACHING AND LEARNING IN THE 4IR	
Contents	Page
7. 1 Introduction	162
7.2 Leading student learning through educational technology	163
7.2.1 Leading student learning through educational technology in a quintile 4 and 5 schools	163
7.2.1.1 Unearthing the generative mechanism for leading student learning through educational technology in a quintile 4 and 5 schools	167
7.2.2 Leading student learning through education technology in quintile 1-to-3 schools	169
7.2.2.1 Unearthing the generative mechanisms for leading student learning through education technology in a quintile 1-to-3 schools	170
7.3 Leading innovation in teaching and learning through networks and projects	172
7.3.1 Project-based networking beyond the borders of the school	172
7.3.1.1 Unearthing the generative mechanisms of project-based networking beyond the borders of the school	174
7.3.2 Interschool networking to enhance teaching and learning	176

7.3.2.1 Unearthing the generative mechanisms for interschool networking to enhance teaching and learning	177
7.4 Innovation through improvements in communication networks for enhancing teaching and learning	178
7.4.1 Innovative communication: a relationship between the teacher and learner	179
7.4.1.1 Unearthing the generative mechanisms for innovative communication: A relationship between the teacher and learner	181
7.4.2 Innovative Communication: A Relationship Between the Teacher and Parents	182
7.4.2.1 Unearthing the generative mechanisms for innovative communication: A relationship between the teacher and parents	183
7.4.3. Innovative collaborative communication between teachers and their colleagues	184
7.4.3.1 Unearthing the generative mechanisms for innovative collaborative communication between teachers and their colleagues	186
7.5 Leading transformation of teaching and learning by addressing social challenges in the context of the 4IR	188
7.5.1 Thuma mina: teachers going the extra-mile	188
7.5.1.1 Unearthing the generative mechanisms for thuma mina: Teachers going the extra-mile	191
7.6 Conclusion	192

CHAPTER EIGHT	
TEACHER LEADERSHIP AS A SIGNIFICANT PRACTICE TO ADVANCE TECHNOLOGICAL INNOVATION IN TEACHING AND LEARNING IN THE 4IR	
Contents	Page
8. 1 Introduction	193
8.2 Cultural intelligence in teacher leadership: A bridging factor	193
8.2.1 Motivational dimension of cultural intelligence by teacher leaders in the 4IR	194
8.2.1.1 Unravelling the generative mechanism for the motivational dimension of cultural intelligence by teacher leaders in the 4IR	196

8.2.2 Metacognition and cognitive dimension of cultural intelligence by teacher leaders	198
8.2.2.1 Unearthing the generative mechanism of metacognition and cognitive dimension of cultural intelligence by teacher leaders	200
8.2.3 Behavioural dimension of cultural intelligence in teacher leadership	202
8.2.3.1 Unearthing the generative mechanism of the behavioural dimension of cultural intelligence in teacher leadership	203
8.3 Ethical technological teacher leadership for digital gap mitigation	204
8.3.1. Digital gap mitigation through resource accessibility and usage	205
8.3.1.1 Unearthing the generative mechanism of the digital gap mitigation through resource accessibility and usage	208
8.3.2 Digital gap mitigation by teacher skills development and attitude towards technology	209
8.3.2.1 Unearthing the generative mechanism for digital gap mitigation by teacher skills development and attitude towards technology	213
8.4 Teacher leadership for empowerment through mentoring	214
8.4.1 Unearthing the generative mechanism of teacher leadership for empowerment through mentoring	217
8.5 Data driven schools: Teacher leaders drive data use in schools	218
8.5.1 Unearthing the generative mechanisms for data driven schools: Teacher leaders drive data use in schools	221
8.6 Conclusion	222

CHAPTER NINE	
FORESEEING TEACHER LEADERS IN SOUTH AFRICA'S 4IR TERRAIN: CONCLUSIONS AND CONTRIBUTIONS OF THIS INQUIRY	
Contents	Page
9. 1 Introduction	223
9.2 A synopsis of the inquiry	223
9.3 Conclusions and theses of the inquiry	227

9.3.1 What are the stories of teacher leaders in diverse contexts for innovation in teaching and learning in the context of the 4IR?	227
9.3.2 What are the leadership practices of teacher leaders for technological innovation for teaching and learning in the 4IR?	231
9.3.3 Why is teacher leadership a significant practice to advance technological innovation in teaching and learning in the 4IR?	233
9.4 Inside the journey: My reflective account of this inquiry	235
9.4.1 Contending with expectations and self-doubt in my academic journey	236
9.4.2 Developing a notion of teacher leadership in diverse contexts	238
9.5 New insights and original contributions of the study	239
9.5.1 Educational leadership scholarship	239
9.5.2 Educational Leadership Theory	241
9.5.2.1 Contribution to the Teachers as Leader Framework	241
9.5.2.2 Contributions to the Adaptive Leadership Theory	242
9.5.3 Research Methodology in Education Leadership	245
9.6 Implications for further studies	246
9.6.1 Geographic expansion	246
9.6.2 Theoretical enrichment	246
9.6.3 Policy development	247
9.7 References	248

APPENDICES

Contents	Page
Appendix A: Teachers as Leaders Framework	284
Appendix B: Narrative interview plan	285
Appendix C: Photovoice inquiry	289

Appendix D: Collage inquiry directions	290
Appendix E: Ethical clearance certificate	292
Appendix F: Approval from the DoE to conduct research in KZN	293
Appendix G: Gate keeper permission letter	194
Appendix H: Informed consent to participate in research	196
Appendix I: Informed consent declaration	298
Appendix J: Language clearance certificate	299
Appendix K: Turnitin report	300

LIST OF FIGURES		Page No.
Figure 1.1	Podcast: Imagining classrooms of the future	7
Figure 3.1	Assemblage of theories	71
Figure 4.1	Domains of critical realism	77
Figure 4.2	Facebook messenger	84
Figure 4.3	Map of KZN	85
Figure 4.4	Zama's google photo album	90
Figure 4.5	Simitha's digital collage	91
Figure 4.6	Diary entry prior to entering the field	93
Figure 4.7	Reflection on my second session with Simitha	94
Figure 4.8	Reflection on my second session with Zama	95
Figure 4.9	Data reflection song: Participant and researcher we met one day	97
Figure 4.10	Kirstern's storyboard	99
Figure 4.11	Using Delve software	101
Figure 4.12	Coding for sub-puzzle 3	101
Figure 4.13	Bank of codes	102
Figure 4.14	Example of member checking by participant: Zama	104
Figure 4.15	Example of member checking by participant: Cindy	105
Figure 4.16	Request for peer validation	106
Figure 4.17	Peer validation from Dr. A	106
Figure 4.18	Peer Validation from Aney	106

Figure 4.19	Audience validation	107
Figure 5.1	Photo elicitation- Eco-school certificate	110
Figure 5.2	Collage inquiry- Crowed classrooms	111
Figure 5.3	Collage inquiry- Math's games	112
Figure 5.4	Photovoice- School values	113
Figure 5.5	Photo elicitation- Strengthen ties with the community	113
Figure 5.6	Photovoice- Buglar bars	116
Figure 5.7	Collage inquiry- Tavern	117
Figure 5.8	Photovoice- Addressing female learners on teenage pregnancy & alcohol abuse	117
Figure 5.9	Collage inquiry- Loadshedding	118
Figure 5.10	Photovoice- School population	119
Figure 5.11	Collage inquiry- Creating a culture of teamwork	121
Figure 5.12	Photovoice- WhatsApp group	122
Figure 5.13	Photo elicitation- Certificate	123
Figure 5.14	Photovoice- Library in a cupboard & record book	123
Figure 5.15	Photovoice – Our students placed 3 rd in a competition	124
Figure 5.16	Photovoice- Using PowerPoints	126
Figure 5.17	Photovoice- Workshopping new teachers	127
Figure 5.18	Metaphorical photo-Keys of influence	128
Figure 5.19	Photo elicitation- My dorm room	128
Figure 5.20	Photo elicitation- Map of rural Richmond	129
Figure 5.20	Collage inquiry- Digging into my own pockets	130
Figure 5.21	Photo elicitation- Schools historical booklet	131
Figure 5.22	Photo elicitation- Awards day	131
Figure 5.23	Collage inquiry- Equality, equity and justice	132
Figure 5.24	Collage inquiry- Leadership structure	132
Figure 5.25	Collage inquiry-Technology transition	134
Figure 5.26	Science & Technology centre	135
Figure 6.1	Collage inquiry- Going beyond	141
Figure 6.2	Collage inquiry- Bringing staff together	142
Figure 6.3	Photovoice- Computer App	144
Figure 6.4	Collage inquiry- Unlocking the innovation	145

Figure 6.5	Collage inquiry- Education system: no focus on innovation	146
Figure 6.6	Collage inquiry- School change	147
Figure 6.7	Collage inquiry- Traditional classroom	148
Figure 6.8	Collage inquiry- Modern day classroom	148
Figure 6.9	Photo elicitation- School quiz	148
Figure 6.10	Metaphorical photo- The well-put-together teacher	151
Figure 6.11	Metaphorical photo- Fully resourced school	152
Figure 6.12	Collage inquiry- Memorial building	153
Figure 6.13	Collage inquiry- Top-down leadership	154
Figure 6.14	Collage inquiry- Merging components	155
Figure 6.15	Photovoice- Google classroom	156
Figure 6.16	Collage inquiry- Untangling complex situation	156
Figure 6.17	Photovoice- Smartboards	159
Figure 6.18	Photovoice- Chromebook use	159
Figure 6.19	Photovoice- QR- Codes	160
Figure 6.20	Collage inquiry- Gaming and editing clubs	160
Figure 9.1	Thesis image	228
Figure 9.2	Journal excerpt	236
Figure 9.3	Journal excerpt	237
Figure 9.4	Journal excerpt	238
Figure 9.5	Adaption of the Teacher as Leaders Framework	242
Figure 9.6	Adaption of the Adaptive leadership Theory	244

LIST OF TABLES		Page No.
Table 4.1	Data generation plan	93
Table 4.2	Peer validation- List of critical friends	105

CHAPTER ONE

MAPPING THE STUDY'S TERRAIN: CONTEXTUALISING THE INQUIRY

1.1 INTRODUCTION

In 2016, the pioneer of the Fourth Industrial Revolution, Charles Schwab, envisioned a world in which billions of people are connected by mobile devices, with unprecedented processing power, storage capacity, and access to unlimited knowledge (Schwab, 2016). He proclaimed at the time that breakthroughs in the fields of artificial intelligence (AI), robotics, the internet of things (IoT), 3D printing, nanotechnology, biotechnology and quantum coding would revolutionise every aspect of society. Less than ten years later, this vision has become a reality (Carrim, 2022). The education sector was no exception to this change. The founding tenets of education globally are experiencing a major transformation. Traditional education systems dwelling on imparting knowledge and rote learning in structured environments are rapidly becoming obsolete (Moloi & Mhlanga, 2021). Education in the Fourth Industrial Revolution (hereafter referred to as the 4IR) integrates the digital, physical, and biological spheres of technologies to develop learners with 21st century learning skills which prioritise critical thinking, creativity, collaboration, and application of knowledge to real-world contexts.

In the landscape of South African education, the integration of the 4IR stands at a juncture of immeasurable potential and multifaceted challenges. Utilising the transformative power of technology within diverse school quintiles requires a nuanced understanding of the significant role played by teacher leadership. While the South African education context is marked by a spectrum ranging from well-resourced world-class schools to profoundly dysfunctional schools (Naicker et al., 2013), teacher leadership emerges as a catalyst for implementing and leading innovation in education in the 4IR. Resultantly, this inquiry focuses on the lived experiences of teacher leaders from diverse school contexts in South Africa who lead technological innovation for teaching and learning in the 4IR. This chapter navigates the study's landscape, contextualised by the study's background and research problem. Subsequently, I expound on the inquiry's justifications to highlight the study's novelty and need for the required research. The research puzzle is then outlined to provide a micro-focus for the study. Following this, key concepts vital to this inquiry are defined. To conclude this chapter, I present an overview to encapsulate the trajectory of this study.

1.2 BACKGROUND TO THIS INQUIRY

The 4IR has been recognised globally by policy makers, educators, and researchers as one of the most effective approaches for preparing students for the future world of work (Sehlako et al., 2023). Integrating

novel technologies by blurring the lines between the digital, physical, and biological spheres, the 4IR has propelled education curricula into a dimension of modern teaching and learning (Schwab, 2016). Resultantly, governments around the world have made concerted efforts to incorporate the 4IR into their education systems (Sehlako et al., 2023). This has given rise to different forms of education delivery, including e-learning, online learning, blended learning, virtual learning, AI learning, lifelong learning and much more (Chibambo & Divala, 2022; Schwab, 2016). The 4IR is believed to improve education by optimising engagement, collaboration and interaction among learners, teachers, and leaders within the classroom and beyond the classroom (Oke & Fernandes, 2020). In addition, other scholars have argued that the 4IR could personalise learning experiences for individuals since they can access content anywhere, anytime, and anyhow, thus promoting democracy in education (Ng'ambi et al., 2016; Reaves, 2019). In addition, reflecting on the development trajectory of AI technology, it is clear how it could revolutionise learning. By analysing individual data, it can provide individualised learning opportunities. This indicates that teachers might take on new roles in the future of education.

In response to the 4IR, the Department of Basic Education (hereafter referred to as the DBE) (2021) in South Africa has welcomed this revolution by affording it high priority. The DBE had recently scheduled to initiate a four-year plan to introduce the 4IR robotics and coding curriculum in schools (Department of Education, 2019). Despite interruptions caused by the COVID-19 pandemic to the pilot program, the implementation of the 4IR in selected pilot schools across the country has taken root. In addition, the DBE has undertaken extensive initiatives to digitalise schools in the direction of the 4IR by adopting several projects. Some of these projects included the *Gauteng Online Project*, the *Khanya Project*, the *Google Education Project*, *School Net Project*, *SA-SAMS* (South African Administration and Management System), *DigiSchool program* and *ICT4RED* (ICT for Rural Education Development). However, the ambitious implementations of many of these projects were met with numerous shortfalls (Sehlako et al., 2023). In response to these shortcomings, *Operation Phakisa Online Initiative* emerged as a novel policy framework to guide the implementation and understanding of 4IR in basic education. Despite this new policy, scholars remain sceptical about whether the inadequacies from previous initiatives have been adequately developed to drive the 4IR across various contexts in South Africa (Butler-Adam, 2018; Carrim, 2022; Keyembe & Nel, 2019; Sehlako et al., 2022).

In the South African context, scepticism around teacher skills, pedagogy, funding, resources, and curriculum development are serious concerns and limitations to the implementation of the 4IR (Carrim, 2022, Keyembe & Nel, 2019; Torres & Giddie, 2020). The literature indicates that the nature of teaching and learning has not been effectively transformed through digital technologies alone in South Africa

(Beetham & shape, 2018; Han & Kim, 2018; Ng'ambi et al., 2016). To augment this view, Ng'ambi et al., (2016) writing in the South African context observed that teaching and learning remain practically static despite the availability of smart technology and social media. However, a closer look into the context paints a different picture. Various studies have noted the disparities in the preparedness, acceptance, and implementation of the 4IR in different school contexts. The study by Moloi and Mhlanga (2021) concluded that the basic education sector was not geared for the 4IR, however, they noted pockets of excellence in private schools and some urban schools. A notable discrepancy emerged within the teaching cohort, revealing a substantial competence gap between educators in rural and urban areas, with rural teachers exhibiting comparatively lower levels of proficiency regarding the 4IR. This view gains further reinforcement by the research put forward by Sikhakhane et al. (2021) who noted that while teachers in the rural area are optimistic about the 4IR, substantial evidence of effective implementation and comprehensive understanding within diverse contexts remains limited.

To compound challenges further, scholars in South Africa argue that the DBE's insufficient preparatory measures for the 4IR implementation are poised to intensify social injustices, given the prevailing socio-economic disparities in the country (Keyembe & Nel, 2019; Sehlako et al., 2022). The DBE seemingly adopted the quintile model to redress historical inequalities inherited from the apartheid-era education system (Naicker, 2006; van Dyk & White, 2019). This model ranks schools into quintiles, with quintile one representing the most economically disadvantaged schools situated in underprivileged areas, and quintile five encompassing the affluent schools located in economically wealthy areas (Naicker, 2006; van Dyk & White, 2019). The model aimed to allocate a large portion of the education budget to finances and provide resources to no-fee paying schools (quintile 1 and 3). Consequently, quintiles 4 and 5 schools receive less financial support from the DBE but are allowed to leverage school fees. Despite its primary aim, research into the quintile model reveal a systemic failure in addressing issues of equity and equality (Mestry & Ndhlovu, 2014; Naicker, 2006; van Dyk & White, 2019). Rather than minimising the inequity gap between schools, it has exacerbated existing challenges by propagating a cycle of affluence for well-endowed schools and deprivation for those in economically disadvantaged areas (Mestry & Ndhlovu, 2014; Mestry, 2020). Reasons for this gap can be attributed to poor service delivery in lower quintile schools, the reluctance of trained teachers to work in such schools, the presence of ineffective leaders and the prevalence of poorly educated communities in lower quintile areas (du Plessis & Mestry, 2019; Mestry, 2020).

To zoom in on the magnitude of the contextual diversity concern, Torres and Giddie (2020) noted that 60% of children in South Africa attended no fee-paying public schools. The schools that leverage school

fees seemingly have additional resources and improved infrastructure compared to no fee-paying schools (Torres & Giddie, 2020). These schools can use school fees, to provide additional resources, hire more teachers, pay teachers more and offer extracurricular activities (Naicker & Ncokwana, 2016; Naicker et al., 2020). These differences clearly impact the teaching and learning experiences for both teachers and learners. Torres & Giddie (2020, p. 119) described the current context well, when he mentioned that “after 20 years of democracy, a fortunate few receive a world-class education; for the majority, a basic education remains a hope rather than a reality”. Given these inherent issues, the prospective of implementing innovative teaching practices in the context of the 4IR poses serious obstacles. However, despite these challenges, many teachers and education leaders in South Africa have often been described as resilient individuals who are known for going above and beyond their duties (with little to no financial compensation) to ensure that their schools/classrooms function at an optimum level (Grant 2006; Makoelle & Makhalemele, 2020; Msila, 2020). I believe that these individuals are key agents who play a pivotal role in an education system that experiences multiple challenges.

Nevertheless, there seems to be a growing body of research conducted in South African schools which delves into how schools in challenging contexts are defying the odds and functioning at an exceptional level despite experiencing challenging circumstances (Chikoko et al., 2015; du Plessis & Mestry 2019, Msila, 2021; Naicker & Govender, 2020; Naicker et al., 2016; Naicker et al., 2020). Among all these studies, a common thread underpinning the success of these schools lies in effective leadership. Notably, these studies are gaining traction by unravelling effective leadership approaches that adeptly address contextual issues and replace historical leadership measures. While various leadership styles were discussed in these studies, forms of teacher leadership, distributed leadership, shared leadership, and participative leadership have emerged as key contributors. Specifically, credence for teacher leadership has not only enabled formal leadership but has underscored the significance of informal leadership, thus enabling teacher agency at all levels of the school. Teacher agency in turn drives the likelihood of teachers fostering change and implementing innovation in practice. Hence, the attributes of teacher leadership (Katzenmeyer & Moller, 2009; Frost, 2016) bares immense potential to catapult practical innovation in teaching and learning in the 4IR, particularly in the diverse South African educational context.

1.3 RESEARCH PROBLEM

Drawing on the above, the integration of innovation for teaching and learning in the context of the 4IR faces multifaced challenges in South African education. Despite governmental efforts, significant gaps persist in understanding how teachers in diverse contexts adapt their pedagogy and skills to leverage

these technologies effectively in the context of the 4IR. Disparities between rural and urban educators highlight the need for comprehensive research, while uncertainty surrounds the adequacy of existing policies. More significantly, socio-economic inequalities could exacerbate the implementation of the 4IR within the different quintile schools. The challenges are multifaceted, encompassing issues of service delivery, teacher reluctance, leadership inefficacies, and community education levels in lower quintile areas. These barriers pose significant obstacles for implementing innovative teaching practices aligned with the 4IR across different contexts. However, amidst these challenges, emerging research has highlighted exceptional schools in challenging contexts, showcasing their success rooted in effective leadership. Notably, teacher leadership has emerged as crucial components fostering teacher agency, thereby enabling the drive for change and innovation within schools. Remarkably, up to the time of this study, I have not encountered any national or international studies unpacking the roles of teacher leadership for innovation in teaching and learning in the context of the 4IR across diverse school landscapes.

Given the above problem, my study seems to be the first to focus on the experiences of teacher leaders for innovation in teaching and learning in diverse contexts in South Africa in the 4IR. The purpose of my study is triadic. Firstly, to explore the leadership practices of teacher leaders in diverse school contexts of technological innovation in teaching and learning in the 4IR. Secondly, to explore how structure, culture and agency influence technological innovation in teaching and learning in the 4IR of teacher leaders. Finally, make visible why teacher leadership is an important practice to advance technological innovation in teaching and learning in diverse school contexts in the 4IR.

1.4 RATIONALE FOR THE STUDY

This section underpins the rationale for this study. This study adopted a narrative inquiry methodology (Clandinin & Connelly, 2000). Within the practices of this methodology (see chapter 4.4, pg. 79), I aim to justify the inquiry based on my personal, practical, and social justifications for conducting this study (Clandinin, 2013). The personal rationale contextualises the inquiry within my own life experiences, thus outlining its importance to the inquirer (Clandinin, 2013). The practical justification shows the potential implications this inquiry might have on professional practice (Clandinin, 2013). The social justification discusses the broader impact and theoretical contribution this inquiry may offer to the academic field (Clandinin, 2013).

1.4.1 Personal Justification

My dad stood as a significant leadership figure in my life. He served as Chief Petty Officer for the South African Navy from the 1980s to the early 2000s. His high-ranking role often led him to share heroic stories of his passionate leadership, illustrating how his division functioned efficiently. From problem solving to the analytical analysis of his department, I quickly valued the role of leadership as an important facet of life. I always believed that given the opportunity, I too could lead departments effectively. After completing my B.Ed. degree at the age of 22, I immediately focused my postgraduate degrees on Education Leadership and Management. I wanted to get involved in leadership at the earliest opportunity. However, little did I know that leadership entailed more than a formal position (Wenner & Campbell, 2017). After reading the literature on teacher leadership during my master's degree, I found myself deeply immersed in informal leadership roles at the schools I worked at. In addition to leading my classroom as a teacher, I was leading CPDs, organising events at school, serving on the school governing body, initiating projects linked to technology, raising funds, developing school-wide action plans and much more. In essence, I was an effective Teacher Leader (Katzenmeyer & Moller, 2009). I recall in 2016 and still an early-career teacher at the time, my school principal recognised the impact of my leadership on the school and willingness to lead.

My principal created an opportunity to explore implementing the 4IR in our government quintile 4 school. I swiftly collaborated with various organizations to secure technology and train learners. However, embedding the 4IR as a permanent practice in our school was a difficult task for a teacher leader. This led me to reflect on my childhood experiences within government schools during the mid-'90s and early 2000s. My schooling occurred within a community previously designated for Indians under apartheid rule. Innovation in teaching and learning was non-existent. Returning to this community as a teacher, I was struck by the stagnation. Textbook-based teaching, dependence on worksheets, and pedagogy focused on rote learning and lectures persisted. Technological integration in education was virtually non-existent. I assumed this was the standard for education across South Africa. However, my realisation dawned when I discovered schools just beyond my community boundaries that offered an education compared with world-class standards. As I endeavoured to drive technology innovation at my school, I came across teachers in other disadvantaged schools who were also trying to drive innovation. Their efforts inspired me to make a difference and share my knowledge. I then registered for my PhD. It was for such reasons; I became committed to understanding how teacher leaders drive innovation in teaching and learning at their schools.

During my PhD commencement in 2020, I relocated from South Africa to teach at a British International school in the Middle East. Within two years, my role changed from teacher to head of humanities, enabling me to lead the integration of technology and innovation across lessons. The school's vision prioritised innovation and critical thinking in teaching and learning as core factors in its approach to education. To stay in touch with the South African

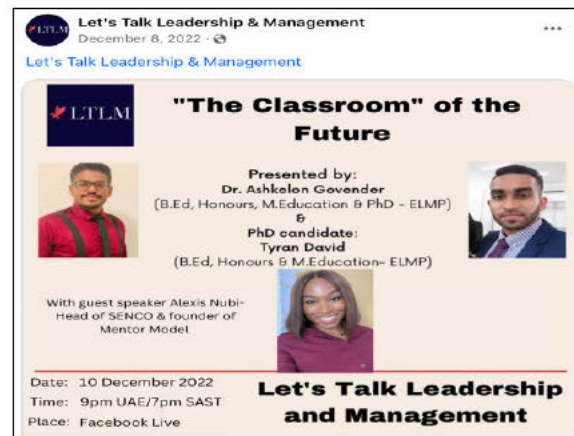


Figure 1.1 Podcast- Imagining classrooms of the future

context, I committed to sharing my knowledge with the South African community. To achieve this, in 2020 a critical friend (Samaras & Roberts, 2011) and I started a Facebook podcast called 'Let's Talk Leadership and Management' in which we shared our leadership knowledge with the South African community. On this platform we hosted academic guests and discussed current topics (see figure 1.1). During our shows we would engage with the South African community through live text-chats to inspire them and learn from their contexts. Figure 1.1 highlights a select podcast we hosted. In these sessions we delved into current issues which drive the 4IR and we envisioned future classroom landscapes (see figure 1.1). We have hosted multiple shows on the idea of technology, the 4IR and leadership. Personally, immersing myself in this inquiry motivated my commitment to understanding how teacher leaders drive innovation in teaching and learning in the 4IR at their schools, despite their context.

1.4.2 Practical Justification

In 2017, I was involved in a project with a senior educator and community activist to promote the 4IR in the senior primary school phase in the Durban area. Together with a team of teachers in the community, we mapped a project to enhance mathematics and science in young academics. We secured funds to provide these learners with training in coding, 3D printing and robotics. It was interesting to note how none of the teachers involved in this project occupied formal leadership positions, yet in retrospect we were leading in a revolutionary manner. We worked as teacher leaders to launch this 4IR project.

In addition to this experience, in 2020 I started a new job as a teacher in an affluent school. Due to the COVID-19 pandemic, the school took to a full-time online platform. Teachers began to utilise technology related to the 4IR to promote innovation in teaching and learning. My initial encounter with this system was fraught with great challenge. Utilising the technology and relevant platforms was initially difficult to adjust to. However, I witnessed how many teachers in my school took to the forefront to lead this innovation. These teachers held regular gatherings to empower new teachers on how to use these

technologies. Additionally, other teachers spontaneously held online meetings to educate the team on new discoveries that could aid our teaching using technology. These teachers took the initiative to become change agents (Angelle & DeHart 2011; Berry, 2019; Harris, 2003; Lowery-Moore et al., 2016). It was through these encounters I was able to witness the need for teacher leadership in driving technological innovation in the 4IR.

Teacher leadership further plays an important role in helping the organisation accept and adapt to these technologies in time of change. Additionally, teacher leadership enabled teaching practices to be shared. Therefore, it becomes important to understand the role that teacher leaders play in technological innovation for teaching and learning in the 4IR in diverse contexts.

1.4.3 Theoretical Justification

Scholars have described teacher leadership as a sleeping giant, that has great potential for school improvement (Katzenmeyer & Moller, 2001). However, this potential remains unrealised due to systemic barriers such as hierarchical school structures, limited professional autonomy, and a lack of recognition for teacher leaders (Harris & Jones, 2019). While scholarship on teacher leadership has been gaining momentum internationally, in many instances, findings describe teacher leadership as amorphous and ambiguous in practice (Cheung, Reinhardt, Stone & Little, 2018; Lowery-Moore et al., 2016). Resultantly, what teacher leadership means for South African education continues to be an area of ongoing research. Various South African scholars have written about teacher leadership in South Africa over the past decade (De Villiers & Pretorius, 2011; Grant, 2006; Grant et al., 2018), but none have written about teacher leadership and the 4IR. Butler-Adam (2018) confirms that the scholarship on the 4IR in South African basic education is almost non-existent. Oke and Fernandes (2020) explicate that the possibilities of the 4IR have been extensively observed in first world countries. From the existing literature in South Africa, one can note that no study has been done yet to understand the practices of teacher leaders in technological innovation in the 4IR. As a result, my study aims to fill the gap in the literature by studying the experiences of South African teacher leaders in the context of the 4IR.

1.5 RESEARCH PUZZLE

Clandinin (2013) contends that as narrative inquirers, we do not have research questions. Research questions need explicit definitions or expected solutions, whereas research puzzles require searching, re-searching, and searching again (Clandinin, 2013). Research puzzles embrace ambiguity and complexity, inviting deeper exploration through searching, re-searching, and questioning again (Clandinin, 2013). This approach aligns with the narrative inquiry's commitment to understanding lived

experiences as evolving, relational, and contextually situated (Clandinin, 2013). As a result, I refer to this part as research puzzles.

1.5.1 Primary Research Puzzle:

What are the lived experiences of teacher leaders from diverse school settings of technological innovation in teaching and learning in the 4IR?

1.5.2 Related sub-puzzles:

- What are the stories of teacher leaders in diverse contexts for innovation in teaching and learning in the context of the 4IR?
- What are the leadership practices of teacher leaders of technological innovation in teaching and learning in the 4IR?
- Why is teacher leadership a significant practice to advance technological innovation in teaching and learning in the 4IR?

1.6 KEY CONCEPTS

In this section, I outline key concepts related to my study. The aim is to clarify how these concepts are used in this inquiry.

1.6.1 Leadership

Globally, organisational success has been clearly attributed to leadership (Bush, 2015). Given this effect of leadership, one would assume that a utopian definition of leadership would exist. However, how leadership is defined remains a contested concept in research (Bush, 2015; Bush, 2020; Bush & Glover, 2016; Fullan, 2007). Some scholars relate leadership to a 'process whereby an individual influences a group of individuals to achieve a common goal and vision (Andriani et al., 2018; Webber, 2021). Bass (1990), posits that leadership must inspire and motivate followers to achieve set goals and extraordinary outcomes. Taking it further, others viewed leadership as a process of influencing others to understand and agree about what needs to be done and how to do it, especially when implementing change (Bush, 2020; Bush & Glover, 2016; Fullan, 2007). Scholars such as Harris (2004), McDowall-Clark and Murray (2012) and Spillane (2005) noted that leadership has evolved to represent a group of individuals who possess energy, skills, and creativity to drive the leadership agenda forwards and make positive change by sharing decision making power. Notably, other scholars understood leadership as a contextual practice (Harris, 2003). This insinuates, that leadership which works well in one context may not be effective in another context.

Drawing on these vast understandings of leadership, I use leadership to indicate individuals (both teachers and leaders) who exert influence over others by motivating them and inspiring them to achieve goals and work towards a set vision. In addition, I also use leadership to indicate those individuals who can navigate through change by strategizing and implementing solutions to specific contexts that will champion teaching and learning. Lastly, leadership involves distributing decision making power by creating opportunities for teacher leadership to emerge.

1.6.2 Management

Management closely overlaps with leadership (Bush, 2003). Metaphorically, management and leadership are regarded as two sides of the same coin. Management involves the task of creating effective and efficient systems to attain organisational goals and visions (Bush & Glover, 2016; Daft & Marcic, 2016). Further, management is about maintaining organisational homeostasis (Naicker & Chikoko, 2021). Prasad (2020) identified five management functions: leading, organising, planning, controlling, and directing. Furthermore, management is the process by which managers execute and manage school policy (Bush, 2016). In this inquiry, I use management to refer to teachers who apply the five management functions to progress their teacher leadership practices within their schools to attain goals and visions that they set or that their leadership team sets for them. Management in this inquiry further refers to school managers who have formal roles within the school to carry out managerial tasks.

1.6.3. Lived Experiences

In the context of narrative inquiry, Clandinin (2013) defines 'lived experiences' as the subjective, first-hand accounts of individuals' lives. This involves people living, telling, retelling, and reliving experiences (Caine et al., 2013). The term "living" relates to past and present experiences that people have had or are having (Clandinin, 2013). These experiences are deeply rooted in personal stories and narratives that people construct to make sense of their lives and the world around them. In addition, it further involves the way individuals respond to those experiences (McIntosh & Wright, 2019). Clandinin (2013) underscores the significance of lived experiences as a core aspect of narrative inquiry, highlighting how these stories reveal individuals' perspectives, emotions, beliefs, and the context in which these experiences occur. For this inquiry, I studied the lived experiences of South African teachers across diverse contexts who drive technological innovation in teaching and learning in the 4IR.

1.6.4 The Fourth Industrial Revolution (4IR)

The 4IR is a novel term which precedes the third industrial revolution. Current definitions of the 4IR centre around economic and technological discourse. For instance, Schwab (2016), the founder of the World

Economic Forum and pioneer of the 4IR, explains the 4IR as a fusion of digital, physical, and biological realms. Scholars stress the transformative potential of emerging technologies like artificial intelligence, robotics, the Internet of Things (IoT), genetic engineering, and other advancements, stating that these innovations are not only altering industries but also blurring the lines between the physical, digital, and biological spheres (Schwab, 2016). However, a clear definition of what the 4IR means in basic education is not yet blatantly clear (Butler-Adam, 2018). However, education institutions in the 4IR are expected to equip students with the skills needed to function in the future world of work in the 21st century (Reaves, 2019). For this study the context of 4IR signifies equipping learners with skills relevant to the digital era, such as critical thinking, problem-solving and digital literacy. In addition, I also refer to the context of the 4IR to indicate a shift from traditional rote learning toward more interactive, collaborative, and technologically championed learning approaches.

1.6.5 Technological innovation in teaching and learning

Technological innovation in teaching and learning includes the integration and effective use of new technologies to enhance educational outcomes (Han & Kim, 2018). This includes using tools such as digital platforms, computer devices, software programmes, the internet, and other advanced technologies that enhance modern educational practices (Kayembe & Nel, 2019; Moorhouse & Wong, 2022).

1.7 CHAPTER ORGANISATION

This segment presents an overview of all nine chapters in this inquiry.

1.7.1 Chapter One- Mapping the study's terrain: Contextualising the Inquiry

This chapter establishes the foundation of this study by delineating the background of teacher leadership for innovation in teaching and learning in the 4IR. It concisely outlines the justifications and research problem. The research puzzle and sub-puzzles underscore the trajectory of this study. Subsequently, the chapter introduces key concepts, ensuring a clear comprehension of terminology used throughout this inquiry.

1.7.2 Chapter Two: Exploring teacher leadership in the 4IR: A Review of Literature

This chapter delves into a comprehensive literature review, exploring current debates related to teacher leadership and innovation in teaching and learning in the 4IR. Chapter two is divided into three sections. The first section examines the diverse educational terrain in South Africa. It then analyses existing literature on teacher leadership, thereby investigating several theories and practices to comprehend its

role in educational innovation. Finally, I discuss the elements of the 4IR and its impact on education. Specifically, I examine the reality of the 4IR in South African education.

1.7.3 Chapter Three. Theoretical Dimensions: A Blueprint for Understanding Teacher Leadership for Innovation in Teaching and Learning

Chapter three outlines the assemblage of three theories. This includes the *Teachers as Leaders Framework*, *Adaptive Leadership Theory* and *Social Realism Theory*. The *Teachers as Leadership Framework* was used to understand teacher leadership practices for technological innovation across quintile schools (sub-puzzle two). Adaptive leadership theory provided insights into why teacher leadership is crucial for advancing technological innovation in teaching and learning (sub-puzzle three). Finally, social realism was employed throughout the analysis to uncover the generative mechanisms underlying these practices. The chapter delves into the genesis of each theory, it then provides a description of the theories key tenants, and it outlines how the theories have been utilised in other studies. Lastly, I discuss how the theories will be used in my study.

1.7.4 Chapter Four: My Research Methodological Toolbox

In Chapter four I provide a comprehensive display of the methodological tools utilised in this inquiry, starting with a discussion on my paradigmatic position in critical realism (Bhaskar, 1975). This paradigm offered a lens to study the stratified reality of my participants by exploring the level of the empirical, actual, and real. Subsequently, the research design is elaborated upon, with emphasis on embracing a qualitative approach to research. I then discuss narrative inquiry as a methodology, highlighting its ontological and epistemological commitments for the aim of this inquiry (Clandinin, 2013). The chapter then delves into a detailed explanation of the methodological procedures, providing direction into the process of participant and site selection, data generation methods and analysis of field text. I discuss how I make use of digital forms of storytelling to elicit field texts. Finally, ethical considerations and the assurances of trustworthiness are discussed.

1.7.5 Chapter Five: Narratives of Teacher Leaders in Quintile 1,2 and 3 Schools

In this chapter I undertake the first level of analysis, focusing on narrative analysis (Polkinghorne, 1995). The overall purpose of this chapter is to answer the first research sub-puzzle: *What are the stories of teacher leaders in diverse contexts for innovation in teaching and learning in the context of the 4IR?* I piece together the stories using the various digital sources used to capture the participants field texts. In addressing the research sub-puzzle, this chapter captures the riveting stories of teacher leaders from quintile one, two and three schools, commonly known as no-fee-paying schools. It is through these

teachers' co-constructed narratives that I gain insight into their leadership practices for innovation in teaching and learning observed at the *level of the empirical*.

1.7.6 Chapter Six: Narratives of Teacher Leaders in Quintile 4 and 5 Schools

This chapter mirrors the approach taken in chapter five by presenting the narrative analysis of teacher leaders from quintile four and five schools. This draws our attention to the other end of the quintile spectrum. These schools are permitted to leverage school fees and are generally located in well-developed urban areas. This chapter answers the first research sub-puzzle: *What are the stories of teacher leaders in diverse contexts for innovation in teaching and learning in the context of the 4IR?* To capture the essence of this research sub-puzzle, I outline the co-constructed stories of specific leadership strategies used to imbed innovation into teaching and learning in the context of the 4IR. The analysis reveals the cultural, structural, and agential factors shaping the reality of teaching and learning at the *level of the empirical*.

1.7.7 Chapter Seven: Leadership Practices of Teacher Leaders for Technological Innovation in Teaching and Learning in the 4IR

By providing a second level of analysis, chapter seven builds upon the re-storied narratives from chapter five and six. This chapter aims to present possible answers to my second research sub-puzzle. This chapter offers an in-depth examination of the leadership practices of teacher leaders for innovation in teaching and learning by using the *teachers as leader's framework* (Crowther et al., 2009). In addition, this chapter delves deeper into the complexities of the interplay between culture, structure, and agency, by employing a social realist (Archer, 1995) and critical realist (Bhaskar, 1975) framework. This framework enabled the identification of emergent properties and generative mechanisms, thereby providing a nuanced understanding of the participants stratified reality.

1.7.8 Chapter Eight: Teacher Leadership as a Significant Practice to Advance Technological Innovation in Teaching and Learning in the 4IR

This chapter continues the second level of analysis, however, this time addressing the third research sub-puzzle. Using the Adaptive Leadership framework (Heifetz et al., 2009), this chapter provides an in-depth exploration into why teacher leadership is an important practice for innovation in teaching and learning. In a similar fashion to chapter seven, I utilise a social realist (Archer, 1995) and critical realist (Bhaskar, 1975) framework to understand the interplay between culture, structure, and agency of my participants' reality. This further revealed emergent properties and generative mechanisms influencing the reality of my participants.

1.7.9 Chapter 9: Foreseeing Teacher Leaders in South Africa's 4IR Terrain: Conclusions and Contributions of this Inquiry

This chapter serves as the thesis chapter, synthesising the key findings, learnings, and contributions of the inquiry. The chapter begins with a critical analysis of the findings to present well defined conclusions for each research sub-puzzle. The chapter then provides a creative reflection of my study by exploring the evolution of my past and present self throughout this academic journey. Subsequently, I discuss the contributions my study makes to education leadership scholarship, theory, and methodology. The inquiry then concludes by presenting implication for further studies.

1.8 CONCLUSION

In this introductory chapter, I established the groundwork for this inquiry by detailing a background and identifying the research problem, thereby demonstrating the inquiry's necessity. The inquiry's justifications were then unpacked, outlining my personal, professional, and theoretical endeavours for embarking on this inquiry. The chapter then outlined the research puzzle and subsequent research sub-puzzles for this inquiry. Following this, key concepts are explained for its application within this inquiry. Lastly, this chapter provided a synopsis of each subsequent chapter in this inquiry. Overall, this chapter critically captured the need for exploring teacher leadership and its role in driving innovation in teaching and learning in the novel 4IR. As the South African education system gears to integrate components of the 4IR, the chapter emphasised the significance of exploring leadership practices, challenges, and opportunities crucial for this aspiring integration. The next chapter presents a review of literature, exploring current debates related to teacher leadership and innovation in teaching and learning in the 4IR.

CHAPTER TWO

EXPLORING TEACHER LEADERSHIP IN THE 4IR: A REVIEW OF LITERATURE

2.1. INTRODUCTION

Chapter one grounds the context and focus of my inquiry by providing a detailed background and justifications for this research. The chapter further presented the research puzzle and subsequent sub-puzzles, which shaped the focus of this inquiry. Thereafter, I moved on to discuss the key concepts that are central to understanding the studied phenomenon. This chapter seeks to explore and extend an engagement with the literature on teacher leadership within the 4IR across South Africa's diverse school contexts. This chapter draws on debates and discussions from both national and international scholarship, which are examined under three critical themes: The diverse South African educational landscape, teacher leadership and the implication of the 4IR. These three broad headings emerged from the three research sub-puzzles guiding this inquiry. Finally, the chapter concludes by recapping the key learnings.

2.2 THE CONTEXT OF SOUTH AFRICAN EDUCATION AND SCHOOL LEADERSHIP

Today South Africa is a constitutionally fully-fledged democracy established on both participative and representative democratic ideologies (Meier & Hartell, 2009; Smit & Oosthuizen, 2011). Following South Africa's first democratic election in 1994, an extensive range of democratic policies emerged to reflect the nation's commitment to and its vision to redress the injustices of the apartheid regime (Grant, 2006). The education sector was one main area that received major attention in South Africa at the time. On the surface, the new educational policies might appear to create a utopian, one size fits all framework for South Africa's diverse educational landscape. However, in practice the reality in the South African context is far more dynamic and deeply influenced by the country's inequalities (Jansen, 2019). Heystek (2015) argued that these policy interventions which are aimed to improve the quality of education are taking place in a country still transitioning into a fully-fledged democracy. Consequently, Christie (2006) noted that the outputs of the public schooling system remain unevenly diverse thereby perpetuating a stratified educational structure despite these efforts.

The narrative surrounding South Africa's historical landscape is fraught with societies perpetuating inequality based on race, class, and gender. To understand the nature of South Africa's historical inequality, Christie (2008) argues that periodisation and a critical examination of the concept of legacy are vital for understanding both the apartheid period the post-apartheid period. Wölpe (1972) stressed

that periodisation is important to understand the nature and conditions of change in different periods, including structural transformation, discontinuities, tensions, and contradiction produced in each period. As a result, it can be assumed that different periods leave different legacies, which Christie, (2008) postulates can be economical, political, social, and discursive. These legacies not only differ but are also perceived differently across different times and spaces, depending on the experiences and interpretations of those variously positioned in society. Therefore, to understand the current educational landscape in South Africa, it is vital to delve into its educational legacies. By adopting Christie's (2008) framework which postulates the necessity for situating educational developments within broader economic and political processes and viewing educational change as part of a complex social reality of long-term change, continuity, contestation, and contradiction, I am better positioned to understand the implications of teacher leadership for innovation in teaching and learning in the 4IR in diverse contexts. In the following subsections, I explore the educational context during and post-apartheid.

2.2.1 The Educational and school leadership landscape during Apartheid

The apartheid era was preceded by a legacy rooted in decades of segregation which served as a springboard for a formalised racially divided education system mirroring societal inequalities (Christie, 2013). During apartheid, education was legally segregated across four racial groups in South Africa, namely White, Indian, Coloured and Black (Jansen, 2019). Each group was confined to racially exclusive areas and schools (Mhlauli et al., 2015). The systemic disparities initiated from the previous legacy extended beyond mere segregation and is reflected in stark contrast in school management, teacher qualifications, teacher-pupil ratios, funding, infrastructure, and technological equipment, which differed widely based on race (Fataar, 1997; Jansen, 2019). The impacts of these policies were profoundly observable. Schools become mirror images of social inequity perpetuating conditions of privilege and poverty. For example, Clark and Worger (2016) pointed out that during the inception of apartheid, 30% of black schools did not have electricity, 25% had no running water and half experienced severe plumbing issues. Alarming, these conditions intensified as apartheid progressed from its inception to its demise in 1994 (Fataar, 1997). The 1996 Register of Needs Survey found that this condition worsened with 40% of schools having no access to piped water, 57% lacked electricity, 50% used pit latrines and 72% had no library book collections (Sibanda, 2017). Consequently, it can be argued that the democratic government in 1994 inherited an enigmatic education system that required revolutionary redress (Jansen, 2019). In keeping with the primary focus of this discussion, it must be noted that in stark contrast, the education for whites utilised 50% of education spending during apartheid (Clark & Worger, 2016). This indicates that the per capita spending on a white child was eight times more the spending allocated for a black child (Clark & Worger, 2016). Sibanda (2017) argued that while it was compulsory for whites (ages

7-16), Indians and coloureds (7-15) children to go to school, the substandard education for black children (ages 7-13) was seen as a privilege and not a right.

This notable inequality necessitated diverse management and administrative systems across schools serving different racial groups, consequently, creating a fragmented education system in great need of education reform. The 1984 Tri-cameral Parliament which aimed to restructure political representation for non-White populations, deliberately excluded blacks thereby perpetuating racial discrimination and resource inequality to ultimately influence national education outcomes (Christie, 2006). For instance, Christie (2006) pointed out that the National Education Policy Investigation of 1993 found that 80% of White and Indian learners entering schools were expected to complete grade 12, in comparison to merely 20% of Coloureds and Blacks who were expected to finish grade 12. This thereby underscores the disparities in educational attainment linked to the imbalance of resource distribution amongst racial groups (Mestry & Ndhlovu, 2014). Furthermore, these results do not rule out the influence of other factors in inequalities in school administrative departments. A key disproportion highlighted in the scholarship relates to the efficient network of communities-including teachers, parents and trustees who supported the functioning of White schools (Mestry & Ndhlovu, 2014). This network was formally recognised and endorsed by the Department of Education, whilst non-white schools typically lacked support structures (Jansen, 2019). The apartheid policies and practices not only created a racially divided education landscape but inevitably laid the foundation for the challenges and dynamics faced by educational personnel in the era of the 4IR. The leadership styles initiated during apartheid, were directly transplanted into educational contexts thereby shaping the administrative and leadership frameworks that continue to influence the current educational reforms in South Africa (Christie, 2013; Makoelle & Makhalemele, 2020).

The apartheid ideology pivots on the Afrikaans term 'Baaskap' or dominance which essentially shaped the educational landscape in South Africa, especially with the passing of the Bantu Education Act in 1953 (Ndimande, 2013). Bantu education signifies education for subservience and cultural domination precisely by imposing outmoded tribal customs, languages, and governance onto unwilling blacks (Ndimande, 2013). Central control over education ensured that schools reflected a microcosm of an apartheid society, with Williams (2011) claiming that the authoritarian nature of education departments was replicated in schools. The authority vested in principals was constrained by the top-down leadership style that characterised the apartheid governance, thereby leaving them as simple executors of higher-order instruction from above (Styne, 2002). Notwithstanding the imbalances of power and authority, Grant (2006) described that during the apartheid period, leadership was characterised as headship in schools.

This indicates that leadership was recognised in terms of position, status, and authority. Bush and Glover (2016) describe this as formal models of leadership and management whereby heads possess authority legitimised by their formal positions within the organisation and are accountable to sponsoring bodies.

This traditional view of leadership, primarily focusing on the formal appointment of leaders and managers, was pertinent during apartheid. According to Harris (2014), leadership viewed through the traditional lens, is perceived exclusively as the domain of those appointed to management positions, under the assumption that only the individuals have the capability and authority to lead. During apartheid, principals led in an authoritarian style which reinforced a hierarchical and non-participative approach to school leadership and governance (Ndimande, 2013; Steyn, 2002). Spillane (2005) describes this view of leadership as the gallant acts, in which schools have a few appointed leaders who have major decision-making power and everybody else simply plays a supporting role. This style of leadership is centred on the notion of the 'great man' theory in which leadership effectiveness is seen as a direct influence of a singular appointed leader (Muijs & Harris, 2003). Within this notion, leadership is synonymous with management since it focuses on maintaining order and compliance rather than promoting autonomy in leadership (Leithwood, 2021; Leithwood et al., 2020). Drawing on the work of Bush (2007), he mentions that managerial leadership is a strong component in hierarchical and bureaucratic systems. In the South African context, several studies have confirmed that many school leadership teams continue to employ autocratic leadership styles inherited from the apartheid era (Makoelle & Makhalemele, 2020; Naicker & Mestry, 2013; Sibanda, 2017; Ziduli et al., 2018), thereby indicating a persistent legacy in educational leadership practices across South Africa. This managerial approach to leadership is suited for a centralised education system like that of the apartheid system which emphasises the execution of tasks and adherence to external directives, neglecting the possibility for visionary leadership which is essential to drive the educational innovations necessary for the 4IR.

2.2.2 The Current Education System and School leadership

The current education system is established on deep democratic principles as enshrined in the *Constitution of the Republic of South Africa Act, 108 of 1996* following the demise of apartheid in 1994. Policies like the *South African Schools Act, 84 of 1996* (SASA, 1996) marked a transition from historical headship and the great man theory to decentralised, school-based management systems, aimed at transforming traditional hierarchical schools into democratic and participative environments (Grant, 2006). As a supplement, the Norms and Standards for Educators (2000) policy catalysed this transition by expanding the educator's role to include broader leadership and management responsibilities within the school and beyond. This shift towards democratic forms of leadership is also evident through the

implementation of a school-based management in which a distribution of leadership roles and responsibilities are encouraged (Grant, 2017). This approach is in alignment with the contemporary leadership scholarship on distributed leadership, teacher leadership and transformational leadership, which highlight the significance of leadership being shared and collaborative (Harris et al., 2007; Harris, 2003). Various scholars agree that these theories resonate deeply in South African literature (De Villers & Pretorius, 2011; Grant et al., 2010; Grant, 2017).

However, the reality in schools as depicted in empirical studies illustrates a significant contrast between policy and practice (Grant, 2019; Msila, 2020). Bush and Glover (2016) explicated that while transformational and distributed leadership have become popular themes within the South African educational literature, their practical application was often hindered by bureaucratic structures and autocratic cultures. Scholars have argued that this is further exacerbated by a lack of adequate professional development for principals and school leaders to transition from traditional autocratic models to more collaborative participative approaches to leadership (Grant, 2017; Sebastian et al., 2016). Other scholars have highlighted that slow adaption of democratic forms of leadership is due to cultural, ethical and gender biases that remain pervasive with school communities (Pillay, 2015; William, 2011). Such environments contribute to a leadership approach, that despite democratic policies, still favour top-down decision-making approaches and limit participation from all stakeholders within the school. The shift towards democratic leadership approaches required principals to engage in a fundamental transformation in how they interact and respond to the individuals they lead. This includes principals addressing both extrinsic and intrinsic motivation to enhance opportunities, empower stakeholders and facilitate participation in the decision-making processes (Ash & Persall, 2000; Heystek, 2015; Marks & Printy, 2003). While democratic forms of leadership are highly favoured by leaders themselves (Harris & Jones, 2019; Moller & PanKake, 2006), transitioning from an autocratic approach to democratic approaches is challenging for those who have become accustomed to hierarchal top-down approaches. Singh and Lokotsch, (2005, pg. 286) explain this tendency to revert to familiar top-down approaches as remaining within a 'comfort zone' of practice, a clear legacy of the apartheid era's approach to leadership.

Studies within the Western Cape illustrate that despite policy changes, principals continue to exert significant control through autocratic leadership on school governing bodies (SGBs) and teaching staff, thereby indicating a lack of training on democratic leadership and reluctance to fully embrace participative leadership models (Ziduli et al., 2018). Furthermore, other studies confirm that many principals employ traditional and hierarchical leadership practices to govern and lead schools, with clear characteristics of an autocratic leadership style (Bush & Glover, 2016; Msila, 2021; Naicker & Mestry, 2013; Sibanda, 2017;

Swart et al., 2021). Grant (2006) explicates that this is attributed to South African education leadership being embedded in an authoritarian mentality with a fear of losing power and the influence of rooted school cultures that show ingrained attitudes, values and biases related to ethnicity, culture, and gender. The studies mentioned here underscore the historical roots of such leadership. This suggests that while historical practices provide context for current behaviours, they do not necessarily justify the continued application for such models in a rapidly changing education landscape. The enduring nature of traditional leadership models not only undermine the transformative possibility of current educational policies but hinder the efficient implementation of democratic leadership principles that are needed to drive innovation in teaching and learning in the context of the 4IR.

2.2.3 The Diverse Educational Contexts in South Africa

A core aspect of this inquiry focuses on the varying contexts represented by the five quintile schools in South Africa. Resultantly, understanding the particular educational landscapes in which these schools function in, are crucial for making sense of what this may mean for teacher leadership for technological innovation for teaching and learning in the 4IR. Various scholars agree that despite a uniform policy guiding education, the schooling system remain highly diverse and unequivocally unequal (Carrim, 2022; Fataar, 2020; Jansen, 2019). The diverse nature of South African schools is aptly captured in the work of Naicker, Chikoko and Mthiyane, (2013, p. 138) who mention that:

'If one considers the schooling system as a continuum, on the one end there are first class schools, which can compare with the best in first world countries. On the other extreme we have dysfunctional schools where a culture of teaching and learning is barely existent. In the middle of the continuum there are numerous disadvantaged schools, which, despite the socio-economic challenges they face, display a great degree of resilience, and perform at levels comparable to first class schools.'

This epigraphy indicates the vastly diverse realities experienced in South African schools. Grant (2006) affirms this reality by noting that urban ex-model C schools (former white) generally have well qualified teaching staff with majority of such schools having ample resources, while contrastingly, 85% of schools in rural areas are significantly under-resourced. Other studies reaffirm that these trends persist, with formerly white schools continuing to outperform others in the grade 12 national examination (Sibanda, 2017). Biko (2013) asserted in his study that most schools perform according to their apartheid conditions, with former white and Indian schools excelling academically while rural and township schools lag behind. These enduring inequalities indicated that post-apartheid democratic policies have not fully achieved

bridging the educational divide in South Africa. One could take it further by arguing that the gap between these advantaged and disadvantaged schools has widened. This prompts a critical question: have policies failed to adequately address historical inequalities or has the implementation of such policy been effective in select contexts.

Mestry and Ndhlovu (2014) argue that former white schools, generally located in urban areas, have successfully used post-apartheid policies in their favour to enhance efficiency through increased school fees to supplement teacher salaries and enrich the curriculum. However, scholars contend that previous disadvantaged/non-white schools have not been able to use these policies in a similar way due to financial limitation from parents, insufficient resources, overworked teachers, and SGBs that lack effective leadership (Mestry & Berry, 2016; Mestry, 2016; Naicker et al., 2020). Conversely, one could counter this by arguing that the Amended National Norms and Standards for School Funding (2006), outlined the implementation of the school funding quintile system which aimed at reducing educational inequalities across all contexts. This policy document necessitated the ranking of schools based on unemployment and literacy rates of the community within which schools are located. Schools are ranked on a scale from 1 to 5 within this funding framework, with quintiles 1, 2 and 3 making up the poorest schools and quintile 5 denoting the wealthiest. The cohort of schools categorised as quintiles 1,2 and 3 are legally not permitted to leverage school fees, while schools in quintiles 4 and 5 are regarded as fee-paying schools (Sayed & Motala, 2012). This system not only grouped schools based on socioeconomic factors but also directly determined the distribution of government funding (Mestry & Ndhlovu, 2014). Resultantly, schools in lower quintiles, which are generally under-resourced, received a larger portion of the government's educational budget in an attempt to redress historical inequalities and improve education quality (Naicker et al., 2020). The quintile system not only demonstrated the diverse contexts in which teaching, learning and leadership occur but further highlight that schools rely on government funding as a tool to address entrenched historical injustices. I find two significant concerns with this approach:

Firstly, schools located in impoverished areas (quintiles 1, 2 & 3) will continue to face funding challenges due to their sole dependency on government funding. Communities found around quintile 1 2 and 3 schools generally have higher unemployment and lower literacy rates, thereby complicating the development of financial literacy and effective SGBs (Mestry, 2018). The findings in Dyk and White's (2019) study concur that inaccuracies in the quintile system have resulted in inadequate funding allocations, thereby negatively impacting schools' maintenance and, teaching and learning. To take it a step further, Bush and Heystek's (2006) findings highlight that principals and SGBs don't have the necessary financial management skills to use allocated funds, a challenge further exacerbated in

communities with illiterate SGB members (Sibanda, 2017; Williams, 2011). In addition, principals have reported significant delays in pay-outs from the department of education (Naicker & Ncokwana, 2016). This situation was felt most by quintile 1, 2 and 3 schools (no-fee-paying schools) who depended solely on funding from the governments. It was noted by Ahmed and Sayed (2009) that no-fee paying schools are predominantly attended by children from low-income homes and these schools continue to remain under-resourced. It must be noted that with the fall of apartheid, majority of citizens remained in their racially demarcated residential areas, which continued to define their economic status and educational options for their children (Mestry, 2018). In contrast, schools in quintile 4 and 5 not only received government funding but also boosted their resource through fees (Mestry, 2016). The SGBs in these schools are also more affluent regarding management and governance (Mestry 2016). Consequently, democratic policy documents like the Amended National Norms and Standards for School Funding (2006) have had minimal transformative impacts on previously disadvantaged schools. In fact, the discussion above indicates that such policies may have widened the inequality gap (Ahmed & Sayed, 2009, Mestry, 2020) in terms of access to quality education in the modern technological age.

The second issue surrounding the quintile system and its focus on equitable funding, is the assumption that funding alone can resolve existing contextual challenges. The literature has consistently emphasised that effective leadership is inevitable for both school improvement and transformation (Bush, 2007; Grant, 2017; Jansen, 2019). I believe that such policy documents like the Amended National Norms and Standards for School Funding (2006) often overlook the significant role of leadership in addressing challenges and introducing change like the 4IR across diverse educational settings. Bush and Heystek's (2006) study concurred that there is a dire need for systemic leadership training for principals and school managers. It was further revealed that the Advanced Certificate in Education and the further Diploma in Education, recommended by the DOE for school leaders were deemed inadequate for practical leadership. The research reported that 14-16 % of principals who participated in these courses reported insufficient preparation in key areas such as financial, administrative and community management (Bush & Heystek, 2006). This indicates a significant gap in preparing leaders to manage schools in the South African context. I strongly believe that poor leadership has contributed to a large portion of South African schools being classified as dysfunctional. Studies in South Africa have identified a significant correlation between school decline and ineffective leadership (Mthiyane, Bhengu, & Bayeni, 2014; Mthiyane, & Chiororo, 2020), manifesting as learner migration, teacher emigration, teacher apathy and poor academic performance by learners. Conversely, a growing body of literature in South Africa has documented how effective leadership is transforming some of the most disadvantaged and under-resourced schools into thriving institutions for teaching and learning (Botha & Triegaardt, 2014; Grant et al., 2010; Naicker,

Chikoko & Mthiyane, 2013; Naicker et al., 2016). The above discussion illustrated that the context in South African schools vary widely, making it an understatement to regard them as anything close to uniform. It was noted that while all schools are governed by the same democratic policies, they have varying effects across schools within the educational landscape. This diverse landscape has inevitably influenced leadership, management, and teaching and learning that occurs in a school. Therefore, my inquiry focuses on understanding teacher leadership for innovation in teaching and learning in the context of the 4IR, using the quintile ranking as an indicator to explore diverse experiences within these contexts. The literature review now moves on to a discussion on teacher leadership.

2.3 TEACHER LEADERSHIP

The focus of this study is on teacher leadership. However, teacher leadership is not a standalone or isolated theory, instead it emerges as a form of distributed leadership (Grant, 2017; Harris, 2003; Harris, 2013; Muijs & Harris, 2007). It is therefore necessary to highlight the underpinning of distributed leadership to understand the manifestation of teacher leadership in its entirety.

2.3.1 Distributed Leadership and the Emergence of Teacher Leadership

The idea of distributed leadership has its origins in organisational theory dating back to the mid-1960s (Harris, 2013). Until the 21st century, perspectives on leadership remained heavily individualistic (Bottery, 2006). However, theories on leadership have recently undergone a major paradigm shift from the traditional view of leadership centred in the individual role to leadership theories which emphasise multiple sources of leadership (Harris & Jones, 2019; Williams, 2011). Harris (2004) added that this shift expresses a move from the traditional transactional versus transformational dichotomy to a more sophisticated amalgams of theoretical lenses. Distributed leadership is one of those theoretical lenses which claims that leadership is not the exclusive domain of one individual or the 'great man' but leadership resides in many people (Angelle, 2017; Spillane et al., 2003). Harris et al. (2022) makes the point that distributed leadership practice is fundamentally about capacity building rather than control, it relies on the mobilisation of others to lead through collective engagement and action. Woods et al. (2004) further articulated that distributed leadership gives prominence to the social dynamics that emerge from the combined agency of people sharing ideas and responding to challenges collectively to build the organisation. There is a consensus among scholars that distributed leadership shifts away from the over reliance on a single leader to multiple sources of guidance and direction following the forms of expertise in an organisation, made coherent through a common culture (Elmore, 2000; Spillane & Camburn, 2006, Harris, 2003; Harris et al., 2022). Evidently, distributed leadership aims to weaken traditional leadership

roles and move towards less hierarchical, more decentralised, and networked leadership cultures (Azorin et al., 2020).

Similar to leadership trends noted in the business sector, educational leadership has experienced a shift from individualistic approached to a more distributed form of leadership (Harris et al., 2022). This evolution has garnered attention from educational leaders, teachers and policy makers advocating for more shared and distributed forms of leadership (Grant, 2017; Harris & Jones, 2019). Despite its growing popularity, scholarship on distributed leadership in the field of education has only recently begun to emerge (Harris et al., 2022). This emerging focus raises the crucial questions about 'how distributed leadership can transform educational practice. According to Botha and Triegaardt (2014) distributed leadership is based on the premises that all teachers can and must lead and contribute to leadership. Such perspectives blur the lines between leader and follower (Naicker et al., 2016), thereby creating spaces where informal leadership can emerge and function alongside formal leadership. This supports two critical points: leadership is inherently a group activity and this group of leaders often emerge from within a group due to their specific expertise (Harris & Jones, 2019). These insights set the foundation for understanding how teacher leadership emerges.

Within the schooling context, distributed leadership implies that leadership activities are spread throughout the institution (Harris, 2014). Grant (2010) further extends this idea by distinguishing distributed leadership as including both a group-plus perspective and a practice perspective. This indicates that as a leader distributes leadership, the more likely it becomes for teachers to take up informal leadership (Grant, 2010, Spillane, 2005). Spillane (2005) asserts that distributed leadership is central to the teaching and learning process and this involves two key aspects, leader-plus and practice. This framework challenges the traditional leader-follower dualism by acknowledging multiple individuals as leaders, hence the term leader-plus.

It's evident from the above discussion that distributed leadership is not about delegation. As Spillane (2005) discusses, this leadership approach views leadership as fluid, shifting according to the expertise required to solve challenges. Woods et al. (2004) highlight three distinct elements of distributed leadership. It is firstly viewed as an emergent property of the group, then it assumes an openness to the boundaries of leadership and lastly it involves concerted actions. These elements are crucial in providing clarity around the notion of teacher leadership for three reasons. Firstly, it incorporates the activities of multiple groups of individuals in a school who guide staff in the instruction process (Harris, 2003, Harris & Jones, 2019). Secondly, it implements a social distribution of leadership that advocates the stretching

of leadership function across the school in which individuals work collectively to accomplish tasks (Harris et al., 2022; Spillane, 2005). Thirdly, it denotes interdependency by how leaders (formal and informal) of various kinds and in different roles share responsibility.

However, while Muijs and Harris (2007) acknowledge the close relationship between teacher leadership and distributed leadership, they argue that it is both narrower and broader. They described teacher leadership as narrower because it is concerned exclusively with leadership roles of teaching staff. Yet, it is broader than the practical operations of distributed leadership, which focus on formal leadership positions like middle managers to stress the emergence of collaborative leadership (Muijs & Harris, 2007). In this instance, teacher leadership focuses on emergent and collaborative leadership, viewing it as an outcome of distributed practices. Distributed leadership thus provides an empowering avenue for teachers to take on leadership, embodying the principle that leadership is an agency distributed among all members in the school (Harris & Jones, 2019).

2.4 UNDERSTANDING TEACHER LEADERSHIP

While there is no universally accepted definition of teacher leadership, the literature indicates a range of overlapping and competing definitions (Schott et al., 2020; Wenner & Campbell, 2017). I assert that these various and competing definitions arise from the distinct contexts in which they emerge. In the following paragraphs I will explore the multiple meanings and understandings of teacher leadership.

2.4.1 Teacher Leadership as Position

The literature on defining teacher leadership is often fraught with definitions that narrow teacher leadership to a positional role. This notion highlights teacher leaders as those who are selected to engage in leadership task (Neumerski, 2012; Al Suwaidi & Schoepp, 2015). This one possible interpretation is often underscored in the literature with Frost and Harris (2003) explicating lead teachers as appointed teacher leaders tasked with specific roles. For example, in the USA and UK, national reform initiatives have led to the appointment of experienced practitioners focused on improving teachers performance at the classroom level (Frost & Harris, 2003). According to Angella and DeHart (2011) these teacher leaders act as agents of change who engage in organisation diagnosis, building collaborative relationships and coaching peer teachers. These teachers are also called semi-detached teachers or advisory teachers because they still retain a large percentage of their time committed to classroom teaching.

In addition, in the UK, teacher leadership umbrellas the notion of positions such as head of department, subject leaders, subject coordinators and pastoral leaders (Angelle & Dehart, 2011; Frost & Harris, 2003;

Tsai, 2015). These teacher leaders develop strategic direction for subjects, monitor and evaluate teaching and manage staff and resources, thereby aligning with the traditional hierarchical view of leadership in schools (York-Barr & Duke, 2004). Katzenmeyer and Moller (2009) highlight this conventional view by characterising teacher leadership as a collective effort where teachers gain expertise through collaboration with senior leaders, with a strong emphasis on developing middle managers for leadership roles.

2.4.2 Teacher Leadership: Beyond the Boundaries of the School

In contrast to the above discussion in section 2.4.1, Wenner and Campbell (2017) build on the seminal work of York-Barr and Duke (2004) by identifying four pertinent themes that refine teacher leadership beyond formal positions and titles. The first theme highlights that teacher leadership extends beyond the classroom walls. Various scholars agree that teacher leadership is not confined to leadership solely within their classroom, but also through the school and surrounding community (Grant et al., 2010; Asma, 2023; Wenner & Campbell, 2017). This notion of teacher leadership being practiced beyond the classroom has grown into a core element in research conducted across the globe, including Australia, New Zealand, Ireland, Scotland, USA, Canada, Mexico, Spain, Colombia and South Africa (Angella, 2017; Cameron & Lovett, 2015; Fierro-Evans & Fortoul-Olliever, 2021; Frost & Durrant, 2003; Grant, 2017; Harris, 2003, Harris & Jones 2019). Even though the notion of teacher leadership is gradually emerging in countries such as China and Turkey, the idea of leadership beyond the classroom is a significant determinant for teacher leadership (Angelle, 2017; Gülbahar, 2017; Schott et al., 2020).

The second and third theme outlined by Wenner and Campbell (2017) define teacher leadership by the actions teacher leaders take beyond classroom boundaries. These included supporting professional learning within their schools and the practical involvement of teacher leaders in policy development and decision making (Wenner & Campbell, 2017). Eckert and Daughtery (2019) noted that in the USA, teacher leadership involves professional learning and policy development at both school and district levels. Similarly, other scholars have also equated teacher leadership to forming professional learning networks across schools and districts (Azorín et al., 2020; Harris & Jones, 2019). Accordingly, scholars allude to teacher leadership as influence at several levels which extend beyond the classroom (Chew & Andrews, 2010; Grant, 2010). The notion of influence as a crucial element in defining teacher leadership actions is supported by several researchers (Neumerski, 2012; Schott et al., 2020; Wenner & Campbell, 2017). York-Barr and Duke (2004) expressed teacher leadership as a process in which teachers, both individually and collectively, influence their colleagues, principals and other members of the school community to improve teaching and learning practices. Similarly, other scholars emphasise teacher

leadership as an influential, non-supervisory process focused at improving instructional practice beyond the individuals classroom (Danielson, 2006; Öqvist & Malmström, 2016; Spillane, 2005). These perspectives highlight teacher leadership as individuals, regardless of position, engaged in a process of influence with the aim of improving teaching and learning.

This coincides with the final theme which is central in defining teacher leadership as it focuses on improving student learning and success (Wenner & Campbell, 2017). Teacher leaders aim at gaining deep understanding of teaching practices and their roles within the educational systems they navigate both locally and globally (Wenner & Campbell (2017). Through these understandings, teacher leaders devise and produce innovative systems to improve student learning and drive change (Schott et al., 2020). Teacher leadership in this context does not hold formally designated leadership positions within the school (Grant et al., 2010; Wenner & Campbell, 2017). In this instance, teacher leaders show a proactive engagement in leadership tasks, such as leading new initiatives and leading professional learning activities, among others (Neumerski, 2012; Wenner & Campbell, 2017). These teacher leaders take on such tasks because they have a passion for leadership and through their actions aspire to improve teaching and learning in their schools. In the following section, I delve deeper into the contested notions of teacher leadership.

2.5 Teacher Leadership: Contested Notions

Now that the lines between leader and follower have been blurred (Naicker et al., 2016), it is crucial to distinguish how teacher leadership manifest both formally and informally. To gain a functional understanding of this debacle between teacher leadership as formal and informal, I draw on Gunter's (2005) ideology of power sources in distributed leadership. This is done because teacher leadership is conceptually linked to distributed leadership. Resultantly, Gunter (2005) describes three notions of distributed leadership which impact on how teacher leadership is practised. This notions can be described as authorised, dispersed and democratic. Additionally, I looked at Harris and Muijs (2007) characterisation of teacher leadership as restricted, developing or emergent to make meaning of teacher leadership as being formal or informal.

2.5.1 Formal Teacher Leadership

In this section I argue that formal teacher leadership adopts a form of authorised distributed leadership (Gunter, 2005) and is therefore inherently restricted (Muijs & Harris, 2007).

2.5.1.1 Authorised distributed leadership

Formal teacher leadership emerges from the notion of authorised distributed leadership. Gunter (2005) describes this notion as leadership where work is distributed from the principal to others and is usually accepted because it is seen as legitimate within the hierarchy. In this notion, agency is enabled through the hierarchy and affords status to the person who takes on the work (Gunter, 2005; Grant & Singh, 2009). Teacher leadership in this instance is authorised by the principal because power is vested in him and can only be delegated by him (Grant, 2017). This results in the creation of formally recognised positions (see section 2.4.1, pg. 25), since all of which carry legitimate agency derived from leaders higher-up in the hierarchy. Interestingly, this notion of distributed leadership frames the launching point for teacher leadership. Grant (2017) made the point that while authorised leadership may occupy the lowest (but broadest) level in the pyramidal hierarchy of distributed leadership, it is intentionally designed as a starting point for establishing teacher leadership, particularly in South Africa. The evidence indicates that authorised teacher leadership is widely practiced in South Africa (Grant, 2017; Gumede, 2010, Mancoko, 2015).

2.5.1.2 Restricted Teacher Leadership

When distributed leadership is authorised in a schooling context, teacher leadership is most likely to be characterised as restricted (Muijs & Harris, 2007). This means that teacher leadership is bound to leadership in the classroom or specific levels/grades and may involve extra-curricular activities (Muijs & Harris, 2007). Grant (2017) concurred through her findings that teacher leadership was initially described solely within the confines of the classroom and later across the grade through collaboration of teachers in curriculum matters and extra-curricular activities. Within this restricted nature of teacher leadership, some teacher leaders set goals, implemented procedures, guided, facilitated and inspired learning within their classroom (Grant, 2017). Other teacher leadership operated as 'curriculum leaders, grade heads or leaders of committees (Grant, 2017). Teacher leadership was restricted in this nature not only because it was formally distributed but because teacher leaders were often left out of whole-school development decisional making opportunities. However, it is important to note that restricted teacher leadership cannot be likened to delegation because it still has an emergent quality. Harris (2003) also cautioned that if heads distribute leadership responsibilities to the teachers, then this equates to nothing more than informal delegation. To reiterate by drawing on Gunter's (2005) disposition of authorised distributed leadership, it can be believed that restricted teacher leadership is a necessary first step in a context like South Africa (Grant, 2017) given its authoritarian political past. In this case, restricted teacher leadership is a catalyst to shift the school climate from one of authoritarianism, to one which is little more empowering to teachers as leaders.

2.5.2 Informal Teacher Leadership

In this section I argue that informal teacher leadership takes on a dispersed and democratic distributed leadership (Gunter, 2005) form and is therefore emergent or developed (Muijs & Harris, 2007).

2.5.2.1 Dispersed Distributed Leadership and Emergent Teacher Leadership

Teacher leadership as informal seems to locate itself in dispersed and democratic distributed leadership. Dispersed distributed leadership occupies the middle of the pyramid above authorised distributed leadership in the pyramidal hierarchy of distributed leadership sequential framing (Grant, 2017). In this level leadership is not restricted by the rigid hierarchy, but is instead more focused on flatter structures, bottom-up approaches, collaborative leadership, and teacher agency (Grant & Singh, 2009). Within this dimension, formal hierarchies do exist with clear job descriptions for management roles, however, in practice people work together outside of the vertical relations prescribed in a hierarchy (Gunter, 2005). Woods and Gronn (2009) aptly described that a heterarchical division of labour can coincide with a hierarchical division of rights and authority. Resultantly, Grant (2017) drawing on the South African context described this leadership as more autonomous and emergent and accepted due to developing their work in groups through shared knowledge and skills.

When distributed leadership is dispersed in the school, teacher leadership can be described as emergent (Muijs & Harris, 2007). It is emergent because in this case it is less about control and focuses more on participatory decision-making. In emergent teacher leadership there is strong emphasis placed on creating a group with common values (Lumby, 2003). Muijs and Harris (2007) explain that groups in emergent teacher leadership embrace new initiatives in a climate of trust and mutual learning. This leads to numerous informal group discussion and real collaboration in which teachers work collegially (Muijs & Harris, 2007). It is also worthy to note that in emergent teacher leadership, teachers are not always included equally in the collaborative practice (Lumby, 2003). Therefore, scholars highlight the essence of being alert to structural and cultural conditions which serve to marginalise teacher participation (Liu, 2021; Muijs & Harris, 2006). Grant (2017) points out a pertinent example by drawing on the South African context which captures how teachers are excluded from distributed leadership based on gender, race, class, language, or age.

2.5.2.2 Democratic Distributed Leadership and Developed Teacher Leadership

As mentioned earlier, democratic distributed leadership encourages the notion of informal teacher leadership. Democratic distributed leadership is the highest level of distributed leadership and occupies the pinnacle in the pyramid of distributed leadership framing outlined by Grant (2017). According to Gunter

(2005) democratic distributed leadership is similar to dispersed distributed leadership in that both have an emergent character where creativity and resourcefulness are eminent. Nevertheless, it is different in that it engages critically with organisational and societal values and goals and it encourages questions of inclusion and exclusion (Gunter, 2005). Grant (2017) described this as a form of leadership which encourages individual/groups to challenge issues of power related to inclusion and exclusion. Precisely it enables school leadership regardless of position to challenge the status and raise issues of social inclusion and exclusion.

Therefore, when distributed leadership is democratic, teacher leadership can be expressed as developed (Muijs & Harris, 2007). In this regard teacher leadership is taken up convincingly and sustained within the school due to support of an enabling school culture and relevant structures (Grant, 2017). It is through these cultures and structures that teacher leadership can emerge fluidly and naturally in a school. Developed teacher leadership views power as the capacity to act and calls on activism of the collective (Grant, 2017). Emergent teacher leaders further transcend the boundary of the school and become observable in the larger school community (Crowther et al., 2009) In this regard, teacher initiatives and collective teacher activism is strongly supported through active teams. These teams meet regularly to discuss, plan, and implement their work (Hairon & Goh, 2015). It is important to note that when teacher leadership is developed, these informal leaders have the tendency to put people first to bring about positive change. This type of leadership further places strong emphasis on valuing diversity. Developed teacher leadership truly blurs the lines between leaders and follower. In addition, it is at this level of leadership that informal teacher leaders can enact positive influence within the classroom, within the school and beyond the boundaries of the school to affect change.

2.6 TEACHER LEADERSHIP LANDSCAPES: CULTURE, STRUCTURE AND AGENCY

Muijs (2011) stresses that leadership should be viewed as a contextual practice, which is interconnected with agential, structural, and cultural components. To remind the reader, this inquiry's theoretical framework is built on social realism (see chapter 3.4, pg. 61) which endeavours to unearth generative mechanisms resulting from the interplay between structure, culture, and agency. Therefore, it is vital to explore how teacher leadership influences and is influenced by these components. The following section delves into a discussion into the teacher leadership landscapes, with its role that school culture, school structure and agency play in relation to teacher leadership.

2.6.1 School Cultural Threads: Weaving the Threads of Teacher Leadership

De Villiers and Pretorius (2012) fittingly characterise school culture as the underground stem of norms, values, beliefs, traditions, and rituals that have built up over time as people work together. This view is echoed by Yusof, Osman and Noor (2016) who concur that culture comprises of philosophy, ideology, beliefs, feelings, assumptions, expectations, behaviours, and shared values that determine the operational dynamics of a school. Likewise, Owens (2004) expressed culture as the enduring traditions in the workplace that assist in establishing behavioural norms for members in an organisation. Drawing on these views, it becomes evident that culture is multidimensional in any organisation. By this, I imply that culture extends beyond mere physical appearance to the deeply entrenched behaviour that make up the ethos of an organisation. Hence, the title of this section underscores how culture weaves the underlying threads essential for leadership success.

Schein's (2004) model of organisation culture closely ties in with this multi-dimensional understanding of culture. Schein (2004) highlights three distinct levels of organisational culture, namely: artefacts, values, and assumptions. Artefacts represent the tangible manifestation of culture, including dress code, technology and speech which result from human behaviour. Values are both stated values and those conveyed implicitly. These play a role in shaping how new members represent the organisation and what is taught to new members, which include mission statements, visions, and principles. Lastly, assumption represent the less tangible, deeply embedded behaviour that form the essence of an organisations' culture and is often captured in the phrase, 'this is the way we do things around here' (Schein, 2004). Within this model, it is evident that the leadership practices within an organisation, like a school, are significantly influenced by the interplay of artefacts, values, and assumptions. Therefore, culture not only moulds but establishes the normative standards in a school, thereby impacting leadership dynamics.

In addition, its crucial to recognise that organisational culture is not static, but inevitably evolves over time as it responds to various stimulus (Archer, 1995; Ellinas et al., 2017). This evolution of culture can present both opportunities and threats. For example, deeply entrenched dysfunctional cultures can persist, thereby hindering progress and innovation within organisation. Conversely, it can provide opportunities for the development of positive, adaptive cultural frameworks that support organisational growth. As a result, Senge (1990) argues that embracing cycles of deep learning is important for organisations to adapt to and drive change effectively. This process is particularly important in educational settings, where democratic forms of leadership necessitate a preparedness for innovative practices, such as teacher leadership. According to Senge (1990) deep learning cycles includes five cultural elements that influence each other: beliefs and assumptions, established practices, skills and capabilities, networks of

relationships, and awareness and sensibilities. In my inquiry, these theoretical insights provide a crucial lens for examining the specific dynamics of teacher leadership for innovation in teaching and learning in the 4IR.

More specifically, multiple studies highlight the impact of school culture on the emergence of teacher leadership. According to Peter and Deal (2009), a positive school culture has the potential to nourish leadership traits among teachers. Echoing this, Wenner and Campbell (2017) found that teacher morale and motivation improves in school cultures that support the growth of teacher leadership. Kabler's (2013) study emphasised the substantial relationship between school culture and teacher leadership, noting that not only does a positive culture pave the way for teacher leadership, but teacher leadership can in turn reshape school and enhance school culture. This reciprocal influence is documented in the study by Barry (2019) who found that principals played a significant role in creating cultures that encourage the emergence of teacher leadership. In turn, these teacher leaders created a culture of innovation for teaching and learning thereby improving teaching and learning practice. Yusof, Osman and Noor (2016) stated that any kind of reformation is impossible or difficult to attain without a supportive cultural foundation required to carry it out. This implies that the beliefs, values, attitudes and assumptions of individuals in the school should align with the desired change. Yusof, Osman and Noor (2016) suggest that if a positive culture is created, the outcomes of reforms efforts are likely to be positive, thereby showing how culture is both shaped by and shapes its community.

This leads one to a critical point from Fullan (2007) who highlighted the importance of context in understanding organisational culture. He highlights that context not only describes the culture and structures within which individuals work but also explains why certain innovations may succeed in one context but fail in another. This implies that beliefs, assumptions, values, and other cultural aspects will manifest differently across various contexts. Central to the cultural foundation of teacher leadership is the presence of collaborative cultures, which will be the focus of the next subsection.

2.6.1.1 Collaborative Cultures for Teacher Leadership

According to Muijs and Harris (2003) the take-up of teacher leadership is dependent upon a school culture that is etched in collaboration and shared decision making. This view is supported by Harris and Lambert (2003), who argue that such a culture must co-exist within a culture of mutual trust, support, and inquiry. Significantly, teacher leadership should be seen as collective set of behaviours and practices, fundamentally concerned with the creation of relationships and connections within the school community. (Muijs & Harris, 2007). This collective approach to leadership was highlighted in a study by Harris et al.

(2007) which emphasised that effective teacher leadership is not about asserting power but rather about mobilising the untapped attributes of teacher strengths through real collaboration. The findings from that study suggested that optimal results in teacher leadership are embedded in a contextually tailored form of shared leadership that is part of the daily life of the school. Similarly, this aligns with the findings from Lieberman and Miller (2004) and Angella (2017) who discovered in diverse contexts such as the USA, Scotland, and Ireland, that teacher led settings enhance collaborative learning cultures, thereby impacting the entire school community. In Australia, the IDEAS project which focused on developing teacher leadership, noted collaboration as a primary tool for developing teacher leadership and improving school-wide outcomes (Crowther et. al, 2009). Likewise, in South Africa, research has shown how collaboration through professional learning communities and leadership networks amongst teachers have played a significant role in improving educational quality in both advantaged and disadvantaged contexts (Grant, 2017; Naicker et al., 2016).

The above discussion thus far captures that collaborative school cultures not only enable but is propelled by teacher leadership. Day and Harris (2002) described the necessity of a collaborative culture, explaining several dimensions of teacher leadership that contribute to a conducive cultural environment. They explain that the first dimension is the role of teachers in translating the tenets of school improvement into actionable strategies within their individual classrooms (Day & Harris, 2002). This brokering role ensures that links within the school are secure and that opportunities for meaningful development among teachers are maximised (Day & Harris, 2002). Regarding this inquiry's research puzzle, the role of teachers as brokers of school improvement initiatives can be examined to assess how practices are being adapted in South African schools facing the 4IR. One could question the extent to which current practices are sufficient in creating the integration of new technologies and pedagogies or are additional modified leadership roles needed? The current literature does not delve deeply into specific challenges and opportunities that the 4IR present for such integration in the South African context. Resultantly, this inquiry potentially explores how established dimension of teacher leadership can be adapted to support innovation in teaching and learning in the 4IR.

The second dimension extends to participative leadership, where all teachers are integrated into the process of change, thereby developing a collective sense of ownership (Day & Harris, 2002). Harris and Muijs (2003) related this dimension to teacher leaders who may assist other teachers to correspond around a particular development area and to create more collaborative ways of working. The mediation role comprises the third dimension in which teacher leaders serve as a key expert, vital for school progress (Day & Harris, 2002). While teacher leadership is instrumental in mobilizing untapped strengths

through collaboration, the literature often overlooks how these leadership roles can specifically drive the 4IR in diverse contexts. Therefore, these two dimensions are extremely beneficial for guiding schools through technological transition through collaboration.

Lastly, the fourth and possibly the most important dimension of teacher leadership involves the creation of close relationships that support mutual learning among colleagues (Harris & Muijs, 2003). This dimension is crucial since it underscores the relational aspect of leadership that is critical for sustainable educational innovation. A collaborative relationship is vital for spreading new ideas and practice (Schott et al., 2020; Wenner & Campbell, 2017). However, the impact of these relationships may vary significantly across contexts in South Africa. Therefore, this diversity presents a critical area of research, linked to the influences of cultural, structural, and agential factors on teacher leadership for innovation in teaching and learning.

2.6.1.2 Professional Learning Communities for Teacher Leadership in the 4IR

Evidently, teacher leadership is essentially premised on principles of professional collaboration, development, and growth (Harris and Lambert, 2003). Scholars such as Katzenmeyer and Moller (2001) posit that professional learning communities (thereafter referred to as PLCs) are a significant arena to foster a culture of teacher leadership. Grant's (2010) study supports this assertion, noting that teacher leadership tends to emerge within collaborative settings. This discussion prompts the exploration of how PLC's potentially enable the kind of collaborative cultures that underpin effective teacher leadership for innovation in teaching and learning in the 4IR.

Barry (2019) explained that when a culture of collaboration is set, teachers displayed notable efforts to step forward and organise PLC in their grades or subject or analyse data and improve student outcomes. This distributed approach to leadership, where learning/roles/responsibilities are shared across communities, aligns with Kabler's (2013) six domains of where teacher leadership can impact school culture. These domains included teaching and learning, collegiality, context, continuous learning, management of change and a sense of moral purpose. These domains are essential foundations for teachers to assume a broader role in culture building through PLC's. Lambert (2003) further added that teacher leadership involves actions that enable community participants to realise their potential in a trusting environment, inquire into practice and to construct meaning based on new behaviour. This transformative process is supported by Wilson's (2016) study which illustrated how PLCs develop as teachers collaboratively address issues, share best practices, and commit to shared decision making.

In other studies, Ronfeldt et al. (2015) drew on several years of data from close to ten thousand teachers in Florida (USA) to illustrate that teachers improve their practices within high-quality collaborative environments offered by PLCs. Likewise, Lieberman and Miller (2011) noted how professional communities played a role in moving teachers along a continuum of the individual teacher to collegiality. Their study displayed how professional learning communities moved teachers from occasional opportunistic contact (help and assistance) to sharing (exchange of materials, strategies, and ideas) and finally to joint work (collective action based on shared responsibility). These insights are valuable for understanding how PLCs, networking and other collaborative avenues might be used to promote teacher leadership for innovation in teaching and learning within the 4IR in South Africa. Due to the diverse challenges and opportunities presented by the 4IR in South Africa, this inquiry will look into collaborative efforts by teacher leaders as identified in these studies and assess whether it is sufficient or requires adaption to meet the specific needs of the South African landscape.

2.6.2 Architects of School Change: School Structure and Teacher Leadership for the 4IR

In addition to school culture, structural conditions are essential for the emergence of teacher leadership (Muijs & Harris, 2007; Nguyen et al., 2019). While some researchers contend that the relationship between organisational structure and teaching remains underexplored (Rutherford, 2006), others have advocated that changes in organisational structure can significantly establish teacher professionalism and leadership (Smylie & Perry 2005). The scholarship concurs that organisational structures contribute to organisational effectiveness by clearly defining roles and facilitating coordination of goals (Rutherford, 2006; Sebastian et al., 2016; Smith & Oosthuizen, 2011). This prompts an examination of what an organisational structure looks like within a school.

Structure delineates the formal pattern of relationships among staff, in which they hold official positions which in turn influence their behaviours and interactions (Szczesniul & Huizenga, 2015). Kamaruzaman et al. (2020) outlined that structures exist in an organisation to facilitate the coordination of work and workers and to provide control over activities within the organisation. Within educational institutions, formal structures include policy documents, leadership hierarchies, curriculum planning, development of school wide plans and establishing networks for collaboration with external institutions like universities (Rutherford, 2006). Structures which are supportive and flexible create conditions that nurture teacher leadership and innovation by recognising and valuing teachers' contributions (Muijs & Harris, 2006). On the contrary, a heavily top-down, rigid and opaque structure hinders teacher leadership (Nguyen et al., 2019). Katzenmeyer and Moller (2009) claimed that changes in organisation structure, specifically in decision-making processes, directly impact the presence of teacher leadership within schools.

To facilitate the acceptance of teacher leadership, school management teams must implement policy structures that support and develop this role (Harris et al., 2017). According to Muijs et al. (2005) policy documents should focus on creating opportunities for continuous professional development for teacher leaders to develop their leadership skill. Katzenmeyer and Moller (2009) claimed that teacher leaders need to improve their teaching skills continuously, specifically by participating in school decision making and engaging in professionally developing their colleagues. It is through effective professional development, that teacher leaders engage with skills encompassing collaborative work, mentoring, teaching adults and action research (Kenzenmeyer & Moller, 2009; Wenner & Campbell, 2017). Within the South African context, numerous studies have recommended professional development and training as crucial component for integrating the 4IR into education (Sikhakhane et al., 2020; Mhlanga & Molo, 2020; Kayembe & Nel, 2019). However, some scholars contended that preparation for teacher leadership tasks are often impeded by a lack of follow-up (Frost, 2008; Nguyen et al., 2019). Wenner and Campbell's (2017) study indicated that while many professional development programmes provided vital information, it is often once-off events lacking the capacity to build longstanding collaborative teaching and learning structures. This underscores the necessity for ongoing support and systematic follow-up to ensure the positive impact of professional development structures on teacher leadership.

Recent studies express the need for schools to form structures that link schools with the universities to create sustainable support systems for leadership and innovation (Harris et al., 2023). These links can provide both newly qualified teachers and current teachers with knowledge and practical tools (Azorín et al., 2020) to awaken the sleeping giant of teacher leadership (Katzenmeyer & Moller, 2001). Furthermore, universities may help deconstruct the role played by traditional leadership models which dominated our schooling system. Owing to the significance of teacher leadership, Wenner and Campbell (2017) reported that universities in the USA have shown an increase in courses related to teacher leadership development. Wenner and Campbell (2017) mentioned that these reforms were aimed at supporting school reform. In the South African context, various scholars stressed that university partnership with schools is crucial for driving technological innovation in education for the 4IR, claiming that such partners serve as catalyst for effective leadership and pedagogical development (Lubinga et al., 2023; Mhlanga & Molo, 2020). This indicates an urgency to establish university-school partnerships in the South African context to embed both teacher leadership and innovation into schools. Investigating how this partnership can be formed and sustained will provide insights into effective leadership practices that support and sustain the 4IR in the South African context. Through this inquiry, I can examine how my participants form networks with professional bodies to enhance both their teacher leadership and innovation for teaching and learning. Resultantly, this study can identify why teacher leadership is essential for

integrating 4IR into teaching and learning. This includes understanding how teacher leaders with training and support can drive educational reforms and technological integration in the diverse context of South Africa.

For teacher leadership to have a lasting effect on integrating any form of change in education, it is important to prioritise time for developing and maintaining teacher leadership in a school. Time must be set aside to develop structures for professional development and collaborative work (Nguyen et al., 2019). On one hand, Harris & Muijs (2003) stressed that planning time, building teacher networks, and visiting classroom is crucial for teacher leadership development. On the other hand, early reports indicated that teachers experienced reduced time for lesson planning and preparation once they assumed teacher leadership roles (Wenner & Campbell, 2017). When time is not prioritised for teacher leadership development, teachers noted negative effects of teacher leadership on their roles. For instance, Nguyen et al., (2019) documented increased stress levels and negative peer relationship as a result of these added responsibilities. Teacher leaders are left frustrated by the instructional demands and the ambiguous nature of their ill-defined roles of a teacher leader (York-Barr & Duke, 2004). Wenner and Campbell (2017) describe peer reluctance to accept teacher leaders due to perceived shifts in power and authority. Therefore, without allocated time for collaboration and relationship-building, colleagues may perceive teachers as having excessive power (Wenner & Campbell, 2017; Liu, 2021).

The need for structured time allocation and network support from institutions (such as universities) underscore vital structures and cultural factors impacting teacher leadership to drive innovation in teaching and learning in South Africa. This inquiry explores how these elements can be utilised in South African schools across the quintiles to support teacher leadership in the context of the 4IR. Understanding barriers related to structural and cultural dynamics will provide a comprehensive view of the conditions needed for teacher leadership for innovation in teaching and learning.

2.6.3 Teacher Leadership and Agency for the 4IR

At this junction, its vital to note that school culture and structure are inextricably linked to each other, thereby influencing each other. However, both school culture and school structure can only be activated by the agency individuals possess within an organisation (Allen, 2018; Szczesiul & Huizenga, 2015). We find that there is a growing recognition that teacher agency is a critical component in the pursuit of school improvement (Harris et al., 2017). Furthermore, the potential for teacher leadership is central to reform and change (Harris & Jones, 2019). Such a possibility is reflected in the literature and firmly argued that teachers should undoubtedly play a central role in influencing decision making and policy reformation.

With the advent of the 4IR for 21st century schools, scholars argue for 'flipping the system' (Harris et al., 2017) thereby positioning teachers as instigators, creators, and implementers of educational change.

The 4IR in schools will foreseeably introduce new policies, require reskilling and new pedagogical approaches for teaching and learning across the school community (Schwab, 2016; Sehlako, et al., 2023). It is therefore crucial to explore how teacher leaders can act as change agents in the context of the 4IR. To begin this discussion, I want to illustrate the connectedness of leadership and teacher agency. In its most rudimentary state, agency can be described as the capacity to act on behalf of others or power to effect change (Butler et al., 2014). Therefore, transferring the concept to teacher leadership, agency equates to the power to act within educational settings. It is for such reasons Harris and Lambert (2003) highlight that effective organisational contexts enable leaders to harness their capacity as agents to enhance their leadership capabilities.

Drawing back on the dimensions of teacher leadership, it is evident that teacher leadership involves influence, action and its role in developing pedagogical excellence within and beyond the classroom (Day & Harris, 2002; Harris & Jones, 2019). The concept of agency in leadership is supported by numerous researchers underscoring the importance of teacher leadership as a form of influence and agency (Grant, 2017; Harris et al., 2017; Szczesiul & Huizenga, 2015; Tsai, 2015; Wenner & Campbell, 2017). Harris (2003) postulated that teacher leadership as a form of agency that is widely shared or distributed within or across an organisation, thus challenging traditional forms of leadership practice. In addition, Grant (2019) described teacher leadership as inextricably linked to school reform because it equates leadership with agency where leadership is not merely about roles or functions but a dynamic between individuals within an organisation. Based on this premise, teacher leaders have the potential to instigate change and influence others about policy reform, curriculum improvement and effectiveness of teaching and learning (Grant, 2017; Harris et al., 2007; Harris & Jones, 2019; Muijs & Harris, 2006). Therefore, there is a strong argument for teacher leaders to use their agency amidst changes by the 4IR to influence teaching and learning for innovation.

2.6.3.1 Teacher Leadership Agency and The South African Context

In a flourishing democracy like South Africa, one might expect a swift awaking of the sleeping giant (Katzenmeyer & Moller, 2001). However, the concept of teacher leadership has not been fully actualised in practice in South African schools (Grant, 2019). Grant (2019) attributes this shortfall to two points: firstly, the inequality in economic and education provision inherited from apartheid policy and secondly the perceptions of school leaders as a positional construct limited to formal roles. While the former has

significant implications (refer to section 2.2.3, pg. 18 & 2.4.1, pg. 25), this discussion further elaborates on how the latter impacts teacher leadership as agency.

The conception of teacher leadership is a pertinent implication for teacher agency. How teacher leadership is perceived and understood by fellow teachers, School Management Teams (SMTs) members and district offices affects its potential to drive change. Lui (2021) found that teachers equate leadership with formal authority and do not recognise leaders without official titles or roles. Similarly, De Villiers and Pretorius (2012) found that district officials and circuit managers barely recognised the concept of teacher leadership, thereby offering minimal support for teacher leaders. While teachers conceptionally support teacher leadership roles (Grant, 2019), various studies reveal that such roles are generally confined to classroom activities and barely venture into the broader school and community (Grant, et al., 2010; Makoelle & Makhalemele, 2020, Msila, 2020). For instance, Grant's (2010) model of leadership, describes much of South African teacher leadership agency primarily restricted in zone 1 (classroom) and 2 (outside classroom in extra-curricular activities) while barely reaching zone 3 (whole school development) or zone four (beyond the school into the community). Understanding teacher leadership as agency underscore its crucial role in educational innovation as one shifts away from traditional educational methodologies. In this inquiry, I explore the leadership practices that can empower teachers to drive the 4IR-related changes. I believe that teacher leadership is vital for integrating new technologies and reskilling educators to meet the demands of the 4IR.

The centralisation of power within SMT's significantly impacts teacher leadership agency (Makoelle & Makhalemele, 2020; Goddard et al., 2015). Grant's (2010) study found that in various mainstream school communities, SMT's are positioned as the 'rightful leadership titleholders' who lay claim to agency due to the symbolic capital acquired through position. Various studies supported the notion of a restricted form of teacher leadership in South African schools due to the centralisation of power (Du Plessiss & Mestry, 2019; Grant, 2010; Msila, 2020). Other studies concurred that autocratic leadership styles by the principal and strong organisational hierarchies with strong autocratic decision-making (Gumede, 2010; Naicker & Mestry, 2013) restricted teachers from acting or becoming agents. The research further indicates that teacher agency is often opposed by SMT members who view it as a threat to their authority (Wenner & Campbell, 2017). Naicker & Mestry (2013) found that SMT members often override decisions made by teacher leaders. The reluctance of SMT members to share leadership due to accountability concerns, highlights the need for policies that redistribute power to be implemented effectively (Naicker & Mestry, 2013). This Inquiry will examine how these structures and cultural views can be transformed to support teacher leadership for technological innovation in teaching and learning. Understanding the

pressures and findings ways to address this centralisation of power is crucial for promoting effective teacher leadership for the 4IR.

2.6.3.1 Building Teacher Leadership Agency for the 4IR

To counteract the restriction on teacher leadership agency, all teachers should be viewed as potential sources of leadership despite rank or years of experience (Grant, 2019). The capability of teachers involved in leading initiatives or change should be accepted. Grant (2019) advocates that for teacher leadership agency to thrive, there must be a process whereby teachers become aware of and take on both informal and formal leadership roles both in and beyond the classroom. Msila (2021) argues that teacher leadership agency is attained when teachers are professionally matured for leadership, indicating that teachers must shift from isolated work to collaborative work, build a positive school climate and instil a vision that supports teacher leadership and learner success (Msila, 2021). Harris & Jones (2017) outlined that teachers ought to be continuous learners if they are to transform their practices and be matured teacher leaders. In a study by Naicker et al., (2016) the findings revealed that teachers who involve themselves in the life of the school act as strong social actors (instead of remaining as primary agent) capable of driving change in disadvantaged school contexts. Therefore, when teachers (including SMT) are regarded as potential sources of leadership and begin to take accountability of their roles, they enhance their agency within schools.

The importance of understanding teacher leadership as a broad practice, in which all teachers are potential leadership sources, are crucial for implementing technological innovation in teaching and learning. This challenges one to explore how leadership roles can be expanded and supported within the educational structures and cultures to develop technological advancements in education. The role of SMT is crucial in promoting teacher leadership agency (Barry, 2019; Goddard et al., 2015; Nguyen et al., 2020). Resultantly, principals together with other SMT members must create an environment that supports teamwork, reinforces collaborative relationships, and encourages participation to work towards shared norms and a common vision (Harris & Jones, 2019; Marks & Printy, 2003; Nguyen et al., 2020). Other scholars argue that principals should encourage a bottom-up approach to leadership valuing teacher's knowledge and expertise to boost their self-confidence and willingness to innovate (Berry, 2019; Kılınç et al., 2021; Heystek, 2015; Marks & Printy, 2003). Teachers experience a sense of belonging when they are supported by their SMT (Kılınç et al., 2021; Wenner & Campbell, 2017). When SMTs support teacher leadership, it creates a culture of trust and innovation, thereby encouraging teachers to take risks and act as change agents (Harris & Jones, 2019). Such environments form the basis for teachers to act and become strong active agents in their school who will be able to meet the challenges

of ever-changing educational systems (Grant, 2010). Grant (2019) aptly captures this sentiment of teacher leadership, stating that the hope of transforming South Africa's education lies in developing active teacher leaders. In other words, the agency of teacher leaders can permeate all aspects of the school by influencing pedagogical practices, curriculum matters, innovation in teaching and learning and community relations. Therefore, exploring how teacher leaders are supported in their schools highlights the structural and cultural shifts needed for effective leadership in the 4IR. Exploring the dynamics and complexities of support, trust and collaboration within schools will provide insights into creating educational settings where teacher leadership can thrive in the 21st century of education.

2.7 THE 4IR AND EDUCATION

Drawing on the above discussions, it is evident that teacher leadership plays a crucial role in implementing novel ideas within the educational field. Teacher leadership has proven to be a significant leadership model for meeting the educational needs of the new millennium (Rutherford, 2006). In many instances it is described as one of the most suitable leadership models for leading change, offering a potent alternative to traditional leadership styles (Angella, 2017; Ash & Persall, 2000; Berry, 2019). Harris (2007) argued that traditional settings must change to integrate technological advances effectively into education. With the expeditious arrival of the 4IR, there is a clear imperative for global education systems to adapt to utilise the potential disruption brought about by 4IR technology (Fomunyam, 2019). Keyembe and Nel (2019) assert the 4IR requires the reinvention of education and the development of strategic approaches to establish creativity and innovation. In this context, I posit that the emergence of teacher leadership in South African schools has the potential to drive innovation in teaching and learning and align with the disruptions from the 4IR. This section starts by outlining an understanding of the four industrial revolutions. I then explore the perceptions and utility of the 4IR for education. Lastly, I outline the barriers for implementing the 4IR in South African schools.

2.7.1 Understanding the Industrial Revolutions

The 4IR is perceived as a fusion of many technologies that blur the boundaries between the physical, digital and biological spheres (Schwab, 2016). The coining of such a term is credited to Klaus Schwab, the chairperson of the World Economic Forum who characterised this new revolution by a more ubiquitous and mobile internet, smaller and more powerful sensors, and advancements in artificial intelligence (AI), and machine learning (Schwab, 2016). In more rudimentary terms, some describe the 4IR being characterised by technologies such as AI, autonomous vehicles, robotics, 3-D printing, nanotechnology, materials science, quantum computing and the internet of things (IOT) which merge with human physical lives (Mhlanga, 2020; Moll, 2023; Zeeshan et al., 2022). Multiple scholars agree that

the 4IR will have extensive implications for all aspects of our daily lives, transforming how people interact with technology and alter how we perform work related tasks (Fartaar, 2020; Moloji & Marwala, 2020; Mhlanga & Moloji, 2020; Schwab, 2016). Despite its growing significance and relevance, there remains a lack of consensus to precisely qualify its attributes (Oke & Fernandes, 2020). While we are currently in the 4IR also known as industry 4.0, Moloji and Marwala (2020) argue that to understand and conceptualise the 4IR, one must appreciate the context of the first three industrial revolutions (IR).

The first industrial revolution (1IR) began in 1760 during the late 18th century in Britain. This revolution was driven by the development of the steam engine, which coupled with the invention and expansion of canal and railway networks, significantly improved communication and mechanised manufacturing processes thereby leading to the creation of factories (Aggarwal et al., 2019). While the 1IR was predominantly located in Britain, many European countries soon followed suit. This revolution exponentially increased household incomes and is credited with helping many European countries emerge out of the Dark Ages (Mhlanga, 2020).

The second industrial revolution (2IR) was a direct continuation of the 1IR at the end of the 19th century (Kayembe & Nel, 2019). It was marked as a period of major technological developments in steel, chemicals, and electricity (Pouspourika, 2019). Due to such inventions, the 2IR led to mass production across industries. This IR also hosted the invention of the lightbulb, internal combustion engines and the telephone (Fomunyam, 2019). Primarily the 2IR was characterised using machines, which were mostly powered by electricity (Pouspourika, 2019). This revolution was also credited for the invention of the automobile and plane (Pouspourika, 2019). Owing to these inventions, Mhlanga (2020) asserted that this was one of the most important revolutions.

The digital revolution typified the third industrial revolution (3IR) in the mid-1900s (Moloji & Mhlanga, 2021). The 3IR was characterised by massive advancements in semiconductors, personal computers, and the internet (Aggarwal et al., 2019). Evidently, it was clear that the first three revolutions were triggered by technological advancement. It was during this revolution that technology became inextricably linked to individuals' lives. Technology in this revolution gave societies new abilities and capabilities that potentially changes individuals' lives (Kayembe & Nel, 2019). For instance, the personal computer enhanced educational learning opportunities for the average person in the comfort of their homes. However, Marwala (2022) outlined two key differences between the 4IR and the other three industrial revolutions. Firstly, he asserts that the boundaries between the digital, physical, and biological boundaries are increasingly blurred, to an extent that it is difficult to differentiate between them. This indicates that

individuals are now able to interact with one another between digital domains with the use of technology to assist and manage life (Kayembe & Nel, 2019). Secondly, the rate at which technology is changing is faster now than ever before (Marwala, 2022).

Therefore, defining the 4IR in education necessitates considering the integration of technological innovation and institutional innovation as the building blocks (Lee et.al, 2018). In this instance the interaction of human and technology is applied to increase operational efficiency, including teaching, while enhancing socioeconomic and environmental performances (Lee et.al, 2018; Oke & Fernandes, 2020). However, in education the use of technology is primarily restricted to a didactic approach of teaching and learning, whereby teaching and learning is facilitated with the use of a personal computer and the provision of electronic teaching material (Sehlako et al., 2023; Sikhakhane et al., 2021). However, it must be highlighted that the 4IR cannot be limited to such an approach. In fact, the 4IR is beyond the use of computers and e-materials and should be compatible with a learner-centred approach, integrating advanced technologies that support active and personalised learning experiences (Lubinga et al., 2023).

Therefore, a starting point for understanding the 4IR's role in facilitating teaching and learning practices is to have adequate knowledge of its different components. Rüßmann et. al (2015) outlined nine pillars of digital innovation for the 4IR, including: (1) autonomous robots, (2) simulation, (3) horizontal and vertical system integration, (4) internet of things, (5) cybersecurity, (6) cloud, (7) additive manufacturing, (8) augmented reality, and (9) big data and analytics. The nine pillars outlined by Rüßmann et al. (2015) suggest that the 4IR is not confined to the use of a computer, particularly in the education sector and may involve the development of an ecosystem that may facilitate sharing of learning material and data analytics to understand learners teaching needs. It therefore becomes plain to see that 4IR will essentially disrupt and change the current approach to many operational processes and will present an opportunity to improve how we teach and learn (Rüßmann et al., 2015; Oke & Fernandes, 2020).

While there may be no general consensus around an absolute definition of the 4IR for education, this inquiry models its understanding of the 4IR after Schwab (2016). Resultantly, the 4IR is defined as the integration of human and technological intelligence systems that fuse the physical, digital and biological worlds. This integration holds unprecedented consequence across different educational disciplines, and pose pertinent challenges to how we learn, teach and work.

2.7.2 Perceptions and Utility of the 4IR in the Education Sector

On a global scale the 4IR is perceived to change how we learn, teach and work through the use of current technology infused into our daily habits (Schwab, 2016). Faloye and Ajayi (2021) state that in the field of education, technology of the 4IR is also being applied globally. However, given the limited research on the 4IR in education, the extent to which technology for the 4IR is applied and understood is still in its infant stages (González-Pérez & Ramírez-Montoya, 2022). The perceptions and utility of the 4IR vary significantly depending on context (Sehlako et al., 2023). Generally, these perceptions swing over two notable sides. For some the 4IR is an avenue to advance growth across all sectors of a country (Schwab, 2016; Moloji & Mhlanga, 2021), while others view it as a threat which will lead to job loss and widen inequalities in society as some will not be able to keep up with 4IR technology (Oke & Fernandes, 2020; Sehlako et al., 2023). Both of these views are also perceptions experienced by educators globally.

Drawing on the research by Han & Kim (2018), it is evident that the 4IR technologies are being used to transform education into the age of smart education. In this regard, education in the 4IR is perceived to transform education from a teacher-centred to a student-centred learning approach, where the relationship between the teacher and learners becomes more horizontal and all educational participants are digitised and interconnected (Han & Kim, 2018). In various first world countries, education is being seen through the lens of smart education (Thang et al., 2011; Zeeshan et al., 2022). Progress in e-learning, new pedagogical techniques and novel technologies is adding to this emerging trend in education (Zeeshan et al., 2022). In this era, contemporary ICT exert enormous influence on education by promoting smart education practices due to the 4IR. For instance, big data analytics and technologies could be applied for collecting multiform information on students learning, which can then be used to create personalised learning (Zeeshan et al., 2022). In addition, smart technology will work alongside teachers. Han and Kim (2018) describe that in the 4IR era, the inability of teachers to use smart devices may not be a big issue since cyber physical systems can assist to teachers handle smart devices for educational purposes.

Numerous schools added that education in the 4IR makes use of big data, artificial intelligence (AI), robotics, internet of things (IoT), three-dimensional printing and quantum computing (Zeeshan et al., 2022). Oke and Fernandes (2020) affirmed that with computer-based learning, especially through e-learning, there is an opportunity to facilitate teaching and training anywhere and anytime, thereby reducing costs related to logistical issues and face-to-face classroom teaching.

Mhlanga (2020) described the era of teaching and learning in the 4IR being fundamentally embedded in blended learning. Blended learning in the 4IR emphasises the integration of e-learning and classroom-based learning (Naidoo & Singh-Pillay, 2020). When comparing the traditional face-to-face classroom teaching with education in the 4IR using blended learning, the internet and other forms of emerging technology facilitates competency-based and self-directed learning while increasing the assortment, including the speed at which information is provided to learners irrespective of their location (Naidoo & Singh-Pillay, 2020). In line with Beetham and Sharpe (2019), digital technology goes beyond the facilitation of interaction between the teacher and learner; it also augments and transforms the teaching and learning process by enhancing pedagogy and engagement. The 4IR technology has certainly revolutionised this one perception of education. The introduction of 4IR technologies have undoubtedly revolutionised the perceptions of education by advancing the traditional methods in which education has been embedded in. However, more economically developed nations have shown a rapid transition in embracing and utilising the 4IR in education when compared to less economically developed nations.

The extent to which the 4IR is perceived and utilised in the South African education system is slowly gaining momentum. The Department of Basic Education (2021) has been making tremendous efforts to pilot a 4IR curriculum across select South African primary schools. However, drawing on the limited research conducted on the 4IR and education in South Africa, varying perceptions of its relevance arise. Oke and Fernandes (2020) document mixed perceptions among teachers regarding the 4IR, noting that participants believed that the 4IR will have both positive and negative consequences on the education sector, especially on teaching and learning (Oke & Fernandes, 2020). While there is strong understanding that AI could enhance learners experience and employability, there is a gap between the perceived importance and the actual deployment of 4IR components in education (Oke & Fernandes, 2020). Despite the significance of the 4IR for education, many teachers still view it as limited to online teaching and the digitisation of learning material (Chisango & Marongwe, 2021; Sishuba & Odhav, 2023; Torres & Giddie, 2020). These varied perceptions of the 4IR highlight the need for effective leadership practice that can bridge the gap between the 4IRs perceptions and its practical deployment. Therefore, investigating how teacher leaders facilitate the adoption of 4IR technologies at different levels in South African schools is important. This includes understanding the strategies needed to overcome barriers to its implementation.

Interestingly, while South African teachers view the 4IR as a necessity for education in this era, one can question the extent to which teachers understand the 4IR and its implications for teaching and learning. Moloi and Mhlanga's (2021) study found that majority of the participants struggled to provide a fitting definition of what the 4IR is, with rural teachers being less knowledgeable and competent compared to

their urban counterparts. In urban areas, there is evidence to suggest that teachers make use of technologies to enhance teaching and learning (Carrim, 2022), yet the adoption remains on a basic level when compared to the mass integration in first-world countries. However, Torres and Giddie (2020) contended that the use of technology varies significantly between advantaged and disadvantaged schools in the South African context. Scholars highlight that technological platforms for teaching and learning are extremely limited in rural schools (Kayembe & Nel, 2019; Ng'ambi et al., 2016; Sishuba & Odhav, 2023). The research identified nine different types of technologies that teachers used to facilitate teaching and learning in the 4IR in South African schools (Moloi & Mhlanga 2021). These technologies included smartphones, smartboards, televisions, printer/copies, Wifi/Data, projectors, WhatsApp/google classroom/YouTube/licencing, Office365 licencing/MS Teams/ and computing Equipment/Laptops (Moloi & Mhlanga, 2021). On this note it is important to highlight that while some schools have the technology needed to support the 4IR, the utilisation of this technology is often limited. The findings Sikhakhane et al. (2021) concur that computer technology was irregularly and insignificantly used in schools. Resultantly, teacher leadership could be vital in promoting a deeper understanding of the 4IR and its implications for education in South Africa. The inequalities between urban and rural schools in using 4IR technologies highlight the need for structural and cultural changes towards technological use. This inquiry will explore the impacts of cultural and structural implications on the implementation of technology for innovation in teaching and learning.

2.7.3 Barriers to Implementing the 4IR in South African Schools

One of the major concerns surrounding the 4IR in schools is the implementation of the above-mentioned technology. The South African Department of Basic Education has a poor reputation for providing the necessary resources required by schools (Carrim, 2022; Sikhakhane et al., 2021). While there has been a surge of basic computing infrastructure for public schools, Moloi and Mhlanga's (2021) study indicated that there has been insufficient procurement of technology infrastructure specifically for teaching and learning to keep abreast with changing landscapes due to the 4IR. Their study indicated that 63% of schools mentioned funding as a common barrier, hindering the procurement of technology and disrupting its integration into teaching and learning. On a similar note, Kayembe and Nel (2019) documented a lack of funding as a primary challenge to the successful implementation of the 4IR in education in South Africa. While funding for education has exponentially increased since the apartheid era, many scholars have argued that it is still insufficient for the full functioning of education in South Africa (Sikhakhane et al., 2021; Yende, 2021). This challenge emphasises the need for effective leadership practices that can improve on available resources and advocate for additional funds. Exploring how teacher leaders'

manoeuvre and manipulate financial resource constraints to advance technological innovation in education will provide valuable knowledge for its implementation in diverse school contexts.

Coupled with funding issues is the necessity to reskill teachers for education in the 4IR. Referring to the above discussion (section 2.7.2), it is clear that most teachers in South Africa do not have an accurate understanding or perception of the 4IR (Oke & Fernandes, 2020; Sishuba & Odhav, 2023). Currently there has been minimal training for teachers in schools that have procured technology for the 4IR. The study by Moloï and Mhlanga (2021) found that 92% of schools in the Eastern Cape and 100% of schools in the Northern Cape reported receiving no training. Furthermore, over 75 % of schools in other provinces reported a lack of training for technological use in the 4IR (Moloï & Mhlanga, 2021). As a result, there is consensus among scholars in South Africa emphasising the need to train and reskill teachers to address the demands of education in the 4IR (Kayembe & Nel 2019; Moloï & Mhlanga, 2021; Sishuba & Odhav, 2023). The training is needed to cover central issues for education in the 4IR which include; ICT training, technological education pedagogies, utilising technological applications, using online platforms, enabling learner-centred education approaches and promoting critical thinking skills (Lubinga et al., 2023; Torres & Giddie, 2020; Zeeshan et al., 2022). Training presents an essential opportunity for re-culturing and restructuring education for technological innovation in teaching and learning in the 4IR. Teacher leadership is vital for driving reskilling and professional development (Schott et al., 2020; Wenner & Cambell, 2017) in the 4IR. Therefore, I assert that strategic teacher leadership can identify pedagogical gaps, promote ICT skills, and facilitate with accessing 4IR technologies.

In addition to training, the utilisation, availability, and implementation of policy documents related to the 4IR are a crucial driving force for its success in education for teaching and learning. The current White Paper on Science, Technology, and Innovation (Department of Science and Technology, 2019) is a revised policy of the White Paper published in 1996. The latest revisions emphasise the 4IR as a pivotal component in growing science, technology, and innovation in a prosperous and inclusive society. In response, the Department of Basic Education produced a policy paper called the Digital Skills Framework Grade R to 9 (2019) which incorporates strong 4IR framing language (Fataar, 2020). Despite these documents, there remains limited policy direction for basic education in the 4IR. The literature makes it evident that majority of schools have expressed disdain due to the limited support they received from district offices pertaining to policy direction on the 4IR (Moloï & Mhlanga, 2021). Given the immense disruption of 4IR technologies on education, teachers as agents of change have been left out from the policy and development process (Moloï & Mhlanga, 2021). Early discussions in this chapter emphasised the crucial need to acknowledge teachers as agents within their schools (refer to section 2.6.3 pg. 37). If

teachers are not recognised as agents in the implementation of 4IR policies, this could result in limited participation for innovation and engagement in driving the 4IR for teaching and learning. At the time of writing, there has been no studies conducted yet to explore teachers as agents of change in the 4IR. Therefore, this inquiry will explore the impact of teacher leadership on the development of technological innovation for teaching and learning, as well as how they are influenced by, and influence policies related to technological innovation in their schools.

2.8 CONCLUSION

This chapter presented a comprehensive review of literature on three pertinent themes: the educational context in South Africa, teacher leadership and the fourth industrial revolution. The initial section examined the diverse educational landscape of South Africa by exploring its historical underpinnings and their implications for education in the post-apartheid era, particularly in the context of the 4IR. Subsequently, the chapter discussed the concept of both formal and informal teacher leadership, examining the interplay of school structure, culture, and agency on teacher leadership for technological innovation in teaching and learning in the 4IR. Finally, I assessed the understandings, perceptions, and barriers to the 4IR within South African education by exploring current scholarship on education and the 4IR in South Africa. Throughout this literature review, I identified gaps that this research could potentially address. The next chapter presents the theoretical framework for this inquiry, pivoting on three fundamental theories: The Teachers as Leaders Framework, Adaptive Leadership, and Social Realism. These theories make up my theoretical framework which provides a conceptual foundation for this inquiry.

CHAPTER THREE

THEORETICAL FRAMEWORK: A BLUEPRINT FOR UNDERSTANDING TEACHER LEADERSHIP FOR INNOVATION IN TEACHING AND LEARNING IN THE 4IR

3.1 INTRODUCTION

Chapter two delved into a broad exploration of the literature underpinning this study. In chapter two I navigated through three extensive topics in the literature: the diverse context South African education, the dynamic concept of teacher leadership and the implications of the 4IR in education. To delve deeper and address my research question more effectively, the utilisation of conceptual tools is a necessity. Conceptual tools refer to theoretical frameworks that guide the analysis and interpretation of complex phenomena. Therefore, in alignment with my studies objectives, the theoretical underpinning of this inquiry is constructed around three crucial theories. Firstly, I draw on the *Teachers as Leaders Framework* (Crowther et al., 2009) to dissect and comprehend the teacher leadership practices in the context of the 4IR. Subsequently, the *Adaptive Leadership Theory* is employed to understand how teachers solve adaptive and technical challenges in their endeavours to thrive in changing environments. (Heifetz, Grashow & Linsky, 2009). Finally, the study draws on Archer's (1995) *Social Realist Theory* to explore the interplay between structure, culture, and agency in teacher leadership. Through this theory, I seek to unearth the generative mechanisms at play which inform a stratified reality of teacher leadership for innovation in the 4IR. This chapter unfolds with a thorough exploration of each theory, providing an exposition of its genesis, outlining key components of each theory, detailing how each theory is applied to my study and examines its use in previous research studies.

3.2. TEACHERS AS LEADERS FRAMEWORK

This study pivots on the Teachers as Leaders Framework developed by Crowther et al. (2009). Its serves as a lens, guiding my understanding of the teacher leadership practices for innovation in teaching and learning in the 4IR. This framework, focuses on six constructs, proving insights into the evolving role of the teacher leader. Specifically, it aligns with the *third wave* of teacher leadership (explained in section 3.2.1, pg. 50), elevating teachers as vital sources of leadership (Silva et al., 2000) and fitting the modern image of teachers (Andrew & Crowther, 2006). This framework is vital as principals alone find leading today's ever-evolving schools challenging (Berry, 2019). The framework outlines teachers as change agents, extending leadership beyond formal designated roles, aligning with Harris and Jones (2019) and Katzenmeyer and Moller's (2009) notion on influence and agency. Therefore, this theory stretches leadership across both formal and informal platforms of leadership.

In contrast to other teacher leadership theories, the *Teachers as Leaders Framework* (Crowther et al., 2009) proves effective for its innovative and broad view of teacher leadership in the 21st century of leadership. For instance, Grant (2010) explored the *zones* in which teacher leadership takes place while Yuet et al., (2016) examined teacher leadership competencies. The *Four Factor-Model* by Angelle & Dehart (2016) and the *Leadership Development for Teacher Model* by (Katzenmeyer & Moller, 2009) studied how teachers can influence, assess themselves and contribute to school transformation. Other notable contribution includes Frost and Harris (2003) who presented pertinent insights into the conditions which nurture teacher leadership. The *Teachers as Leaders Framework* of Crowther et al. (2009) provides a holistic view, by integrating international research and findings from their decade long project which emphasises the transformative process of teacher leadership for school and community reform.

3.2.1 Emergence of the Teachers as Leaders Framework

Among the evolving educational demands, Crowther et al. (2009) identified the heightened need for individualised learner programmes made pertinent by new research in learning and child development and underscored by national expectations. Such an expectation inevitably places immense pressure on the leadership of a school to meet such demands. Despite the heightened capabilities, credentials, and qualifications of modern teachers (Andrews & Crowther, 2006), the potential of teacher leadership remains largely untapped (Harris, 2003). The 21st century concept of teachers has increasingly evolved to recognise teachers as self-managed individuals, collaborative partners and those who can address socio-economic and cultural challenges (Harris & Jones, 2019). Drawing on these grounds, Crowther et al. (2009) recognised that a new paradigm of the teaching profession was needed. It included a shift that necessitates a role that extends teaching to include leadership, particularly for school revitalisation. The Teacher as Leaders Framework responds to this need by representing a novel structure of teacher leadership of today's dynamic educational setting. To understand and effectively appreciate this theory's integration into my study, we must explore its emergence. The development of this theory emerges from the three waves of teacher leadership (Angella & DeHart, 2011; Cheng, 2011; Silva et al., 2000).

The inception of the first wave of teacher leadership emerged in the 1980's as a direct response to the escalating demands on school leadership. (Silva et al., 2000). As schools grappled with dynamic and complex school environments, the necessity for leadership capacity also grew. During this wave, administrators looked to teachers to perform leadership and managerial functions (Silva et al., 2000; York-Bark & Duke, 2004), which included formal managerial position such as department heads (refer to chapter 2.5.1, pg. 27 for a discussion on formal roles). This wave documented the first formal recognition of teachers as part of the school-based management team (Angella & Dehart, 2011). In South African

context similar trends were noted, with teachers occupying formally assigned roles (Grant, 2006). These roles emphasised managing respective subject departments, leading to a division between teachers and leaders and resulting in a closer supervision of teachers by teacher leaders (Silva et al., 2000). In a nutshell, teacher leaders in this wave were primarily seen as an extension of the administration, focusing on efficiency of school practices, rather than initiators of change (Wasley, 1991). While teachers were gradually becoming discerned as potential sources of leadership, it was however restricted to formal functions in this wave.

The second wave surfaced in the late 1980's and shifted the focus of teacher leadership to capitalise extensively on instructional expertise (Silva et al., 2000). This wave expected teachers to develop scope and sequence, pacing guides and material to ensure that standards were addressed (Hollan et al., 2014). York-Barr and Duke (2004) described the second wave as an expanded role for teacher leaders, involving responsibilities such as curriculum leader, staff developers and mentors. In the South Africa context, middle managers' roles were also extended to include developing curriculum plans, pedagogical strategies, and teacher mentors (Silva et al., 2000). These roles were highly formal in nature, maintained hierarchal order and teachers received compensation for performing such roles (Grant & Singh, 2010; Berry & Ginsberg, 1990).

The third wave of teacher leadership is more actualised now, than in the seminal writing of York-Barr and Duke (2004). This wave has significantly evolved to address the complex demands of re-culturing schools, a goal initially envisaged in the second waves (Silva et al., 2000). This development, outlined by Silva et al. (2000) demonstrates a deeper understanding of the need for organisational culture that creates collaborative opportunities and promotes continuous learning for instructional improvements. Hollan et al. (2014) view teachers in this wave as agents who are creators and re-creators of school culture, thereby highlighting their role as leaders both inside and outside the classroom (Ash & Persall, 2000). Within this wave of teacher leadership, teachers participate in school decision- making processes, embracing a bottom-up- approach (Lieberman & Miller, 2011; Silva et al., 2000; Spillane, 2005) In the South African context, the end of apartheid, marked by key legislation such as the *South African Schools Act of 1996* and the *Norms and Standards for Educators Act of 2000* has enabled teacher leadership to align with the principles of the third wave.

It is within the third wave of teacher leadership that the *Teachers as Leaders Framework* was developed (Murphy, 2005). Both Murphy (2005) and Crowther et al. (2009) identify several key factors that contributed to the framework's development. For instance, this included Murphy's (2005) view on

community development through teacher leadership nurturing democracy and that teacher leadership empowers educators to spread their influence school-wide to affect change. Finally, Murphy (2005) himself described teacher leadership as a multiplicative contributor to school improvement, advocating for collaborative leadership at various school levels. Building on these foundations, Crowther et al. (2009) incorporate three provoking proclamations from research. They acknowledge Muijs and Harris (2003), who found that the impact of principals' leadership on outcomes is mediated through the exercise of teacher leadership. Crowther et al. (2009) suggest that holistic school reform must recognise teacher leadership to build leadership capacity effectively. Lastly, Crowther et al. (2009) build on the findings from a Hong Kong based researchers, Katyal and Evers in 2004, highlighting the dual pedagogical and social nature of teacher leaders in influencing student engagement. These principles form the cornerstone of the framework (Crowther et al., 2009) signalling its emergence from a decade of research and aligning with the notions that teachers are potential sources of leadership and agents of change.

In addition, it is crucial to mention the significant contribution of Australia's IDEAS project in refining the Teachers as Leaders Framework. The IDEAS project commenced in 1997 and has been implemented in over 400 schools (Crowther et al., 2012). Known for its focus on school reform and revitalisation, the IDEAS project (Innovative Design for Enhancing Achievements in School) a joint initiative of Education Queensland and Leadership Research Institute (Crowther et al., 2012), operates on five vital principles: teachers are key to successful school revitalisation; professional learning is best thought of as a shared practice in schools; a no blame mind set should encompass organisational problem-solving; a success breeds success approach should guide teachers and a strong alignment to collective school responsibilities (Andrews & Crowther, 2006). These principles come into effect through four structural concepts: The Research-based Framework for Enhancing Schools Outcomes; the Three-dimensional pedagogy; the IDEAS process of professional inquiry and parallel leadership. It is within this structure that the Teachers as Leaders Framework has been developed and refined. While this study does not focus on the IDEAS project, it is vital to highlight the notion of parallel leadership due to its compelling relevance for understanding the Teachers as Leaders Framework.

The Teachers as Leaders Framework is embedded in parallel leadership (Chew & Andrews, 2010). This form of distributed leadership encompasses three distinct qualities which include mutual trust, shared purpose, and allowance for individual expression, all contributing to enhanced organisational and community capacity building and the promotion of democratic practice (Crowther et al., 2009). This theory further displays the amalgam of teacher leaders and their principals for collaboration to strengthen leadership capacity. What does this mean for the Teacher as Leaders Framework? The essence of the

Teacher as Leaders Framework lies in acknowledging the teachers' role as parallel leaders in holistic development of the school.

3.2.2 OUTLINING THE SIX CONSTRUCTS OF THE TEACHERS AS LEADERS' FRAMEWORK

The six constructs of this theory (Crowther et al., 2009) are intended to help me understand: *What are the leadership practices of teacher leaders for innovation in teaching and learning in the context of the 4IR in South Africa.* The reason I refer to them as constructs is based on the idea that it contains various conceptual elements. In other words, these constructs were established on arranging many parts (as discussed in the preceding paragraphs). The following is a brief description of each construct, with a more detailed summary provided in the appendices (Refer to appendix A, pg. 284).

The first construct, '**conveying conviction about a better world**', involves teacher leaders articulating a positive future for their students by showing a sincere interest in their students' lives. This construct recreates the image of a teacher as a professional who not only influences the school but also extends their impact to the broader community by demonstrating tolerance for challenging situations. The second construct focusing on '**striving for authenticity in their teaching, learning and assessment practices**'. Crowther et al. (2009) posit that this construct entails creating learning experiences based on students' needs and aligning these experiences with their future aspirations. Furthermore, this construct emphasises the importance of teacher leaders in gaining a deep understanding of tacit teaching and learning processes and acknowledges the critical role of teaching in shaping meaning systems.

The third construct, '**facilitating communities of learning through organisation-wide processes**', focuses on teachers promoting a shared, school-wide approach to pedagogy. These teacher leaders view professional learning as an approach to raising-consciousness about complex issues, thereby promoting understandings across diverse groups while simultaneously respecting individual differences. Dialogue and activities are fundamental to this construct as it synthesises new ideas from colleagues. The fourth construct involves '**confronting barriers in the school's culture and structure**'. This is done when teacher leaders test the boundaries rather simply accept the status quo. They assess political processes both within and outside of the school, engaging with administrators who are viewed as potential sources of assistance and advocacy when addressing cultural and structural issues. In this instance, teacher leaders stand up for children in marginalised and disadvantaged circumstances.

Construct five focuses on teacher leaders *'translating ideas into sustainable systems of action'*.

This construct acknowledges teacher leaders' adeptness in organising complex tasks effectively while simultaneously nurturing networks of support. In addition, it underscores their proficiency in managing both time and pressure within educational contexts. The final construct emphasises the role of *'teacher leaders who nurture a culture of success'*. The teacher leader is known for acting on opportunities for others to gain success and recognition. Central to this construct is being collectively responsible for issues by adopting a no blame culture. Within this construct the teacher leader creates a sense of community identity and pride as he/she goes about their work as a teacher.

3.2.3 APPLICATION OF THE TEACHERS AS LEADERS' FRAMEWORK IN DIVERSE CONTEXTS

Drawing a few research studies, I demonstrate how this theory has yielded results in different geographical contexts across the world. My proclivity to focus on varied geographical themes aims to illustrate the theory's effective adaption across diverse regions.

In the Singaporean and Australian context, Chew and Andrews (2010) reported on a three-year IDEAS project from 2005 to 2007. Using the Teacher as Leaders Framework, researchers found that teacher leaders promote pedagogical reflection and discussion, increased collaboration, increased involvement in decision-making, improved teacher morale and changed teaching practices to achieve school reform (Chew & Andrew, 2010). Significantly, this framework served as a tool to develop a shared meaning system which related to the cultural nuances of that specific community (Chew & Andrew, 2010). In a much earlier study conducted by Crowther (2011) in Australia, they noted how the framework goes beyond an exploratory system to capture individual leadership approaches. These scholars exhibited how individuals reflected uniqueness of personality, belief, and context using the six constructs.

Moving to the Asian context, Cruz (2018) adopted the six constructs of teacher leadership in a study of public schools in the Philippines. Cruz (2018) found that using the six constructs were fundamental to teacher practices, demonstrating their vital impact on student learning and achievements. The six constructs further underscored the importance of creating a culture of collaboration, innovation and continuous improvement in adapting school-wide programs to meet evolving educational needs. Remaining in the Asian context, Pandaram (2018) explored teacher leadership in the United Arab Emirates, focusing on the six constructs. The research revealed that English teacher coordinators, serving as informal leaders, effectively integrated the six constructs into their daily practice, thereby improving the English results within their department.

Honing in on the South African context, Govender (2022) examined the transnational experiences of teacher leaders in his doctoral research. His study revealed that South African teachers possess multiple selves comprising a personal and professional self, which are instrumental in fulfilling the various constructs of the teacher leadership framework. Govender (2022) briefly highlighted how these constructs facilitated a progression in teacher agency, from primary to corporate agents.

3.2.4 EMPLOYING THE TEACHERS AS LEADERS' FRAMEWORK IN MY INQUIRY

To provide context, my first research sub-puzzle asked: What are the stories of teacher leaders in diverse contexts for innovation in teaching and learning in the context of the 4IR? Using narrative analysis, these stories were crafted and represented in Chapters 5 and 6, forming the first level of analysis. Building on this, I primarily use the *Teachers as Leaders Framework* (Crowther et al., 2009) to answer my second research sub-puzzle: *What are the leadership practices of teacher leaders of technological innovation in teaching and learning in the 4IR?* Resultantly, I analyse the leadership practices of my participants using the six constructs within the framework. This theory enables me to explore how teacher leaders convey their beliefs about the potential of technological innovation to positively impact teaching and learning in the 4IR (construct 1). Furthermore, the constructs delineated within the framework enable the exploration of how teacher leaders facilitate learning communities around technological innovation, thereby providing insights into collaborative approaches for adopting new technologies to enhance teaching and learning (construct 2). Delving deeper, I also use the constructs to facilitate an exploration of how teacher leaders strive for excellence as they integrate technology into pedagogical practices (construct 3). Contextualising this analysis within the South African educational terrain, I use the constructs to understand how teacher leaders confront barriers related to school culture and structure as they aim to drive technological innovation (construct 4). The theory will also be used to explore how teacher leaders translate ideas about technological innovation into actionable strategies, both short term and long-term, to establish sustainable technological integration (construct 5). The constructs will also be used to unravel how teacher leaders create cultures of success around technological innovation, thereby influencing the advancement of teaching and learning practices (construct 6). Overall, through this framework's lens, I make sense of the leadership practices of teacher leaders for innovation in teaching and learning in the 4IR.

3.3 ADAPTIVE LEADERSHIP THEORY

The *Adaptive Leadership Theory* by Heifetz et al. (2009) serves as a lens to understand why teacher leadership is an important practice for innovation in teaching and learning in the 4IR. Research has revealed a shift in organisational leadership needs, moving away from traditional, top-down authoritative

models that developed during the earlier industrial era (Muijs & Harris, 2006). These models have grown increasingly ineffective for addressing the complex problems of modern organisations (Berry, 2019; Chew & Andrews, 2010; Harris & Jones, 2019). Adaptive leadership therefore becomes suitable as a contemporary model for driving organisational change and tackling unrelenting problems. This theory is a framework for navigating and leading in complex and changing environments (Heifetz et al., 2009). This framework effectively focuses on distinguishing between technical and adaptive challenges, in which technical issues have known answers and adaptive challenges require new learning and innovation. Specifically, in the educational context, schools face challenges of revolutionising their practices, while dealing with escalating demands and limited resources (Cheung et al., 2018). This inquiry focuses on teacher leaders who must work through and adapt to these changes to establish innovation in teaching and learning within the 4IR. This work involves solving both technical and adaptive challenges (Heifetz et al., 2009) as teachers implement technological innovations in teaching and learning to thrive in a changing environment. Since adjusting to change is not experienced as a once-off event, but rather a process, it is effective to view leadership as a dynamic and innovative process (Coakley & Randall, 2006).

Adaptive leadership is one such theory that presents a sustainable and context-responsive leadership method (Heifetz et al., 2009). It emphasises diagnosing and addressing systemic issues by challenging the status quo to provoke change (Heifetz et al., 2009). This theory is relevant for teacher leaders aiming to innovate and provoke change in diverse educational contexts. Furthermore, the depth of this theory lies in its examination beyond the physical components of leadership. This theory looks at three critical aspects of adaptation: *structure*, *culture*, and *defaults* (Heifetz et al., 2009). Adaptive leadership attempts to discover structural implications and find supportive and impeding structures. Simultaneously, the adaptive leader understands cultural norms and forces within the organisation. Finally, these leaders recognise default interpretations and behaviours to understand its adaptability. This theory complements the social realist theory (Archer, 1995) adapted for this study by drawing on generative mechanisms such as structure and culture to help make sense of teacher leadership practices. In the paragraphs to follow, I unpack the emergence of this theory.

3.3.1 EMERGENCE OF ADAPTIVE LEADERSHIP

This theory was originally coined by Heifetz (1994) and has been gradually advancing since. His theory developed from efforts to understand in practical ways the relationship among leadership, adaptation, systems and change in organisations (Heifetz et al., 2009). Adaptive leadership is therefore based on the premise that leadership should be understood as a process or activity rather than individual personal capabilities (Heifetz, 1994). In this way it distinguishes leadership from authority. Coakley and Randall

(2006) described that this process/activity of leadership requires people to focus on their specific problems (technical or adaptive) at hand and to modify the way they worked in the past. Hence, this theory compels stakeholders/team involved to work towards a solution through debate and creative thinking, identifying the rewards, opportunities and challenges they face. By viewing adaptive leadership as a process rather than a single event, suggests that collective knowledge is crucial for elevating an organisation, as it secures employee commitment, thereby encouraging active participation in identifying and implementing solutions to emerging issues (Heifetz and Linsky 2011; Hlalele et al., 2015). This theory assumes that actively engaging people as participants in the change process, provides a route to navigate past historical constrains that traditionally shape change implementations (Bosch, 2021).

Heifetz and Linsky (2011) aptly put it when they mentioned that adaptive leadership advocates the activity of mobilising people to tackle tough/new challenges and 'thrive'. Since this theory has its roots in scientific efforts to explain the evolution of human life (Heifetz et al., 2009), the notion of 'thrive' is central to its premise. Drawing on evolutionary biology, 'thriving' in adaptive leadership involves three underpinning characteristics. Firstly, it preserves the DNA essential for the species continual survival. Secondly, it discards or reregulates DNA according to current need and thirdly, it creates DNA arrangements necessary for the species to flourish in new ways. What does this advocate for the analogy of leadership in an organisation? To answer this question, the theorists explain that successful adaption requires building on the past and observing what is expendable or extraneous as changes are made while still recognising the 'heritage' of an organisation (Heifetz et al., 2009).

Heifetz and Linsky (2002) state that leaders are confronted by two types of challenges specific to adaptive leadership. These challenges are known as *technical* and *adaptive challenges*. Distinguishing between the two problems are quintessential for success as an adaptive leader. Technical challenges as those that can be dealt with by procedures, authority, purchasing resources or leadership expertise. However, adaptive challenges cannot be solved by using technical options. Adaptive challenges by contrast are those that require experimentation, new discovery, new behaviour, and adjustments in order to be overcome (Heifetz & Linsky, 2011).

Educational transformation may be classified as an adaptive problem (Hlalele et al., 2015). In other words, procedures and authority (technical) used to help teachers become innovative in teaching and learning will not sustain long-term effects for educational transformation. However, an adaptive approach which infuses experimentation, new discovery, new behaviour, and adjustment will enable leaders to deal with new policies, incoming innovation such as the 4IR and sudden unpredicted changes such as COVID-

19 to establish long-term positive outcomes for the organisation. This implies for my study that as schools embrace the inevitable 4IR, leaders are going to encounter numerous 'adaptive challenges' that require leadership which can thrust a changing system forward while steadily adapting to such change.

3.3.2 KEY PROCESSES OF ADAPTIVE LEADERSHIP

Adaptive leadership hinges on six key processes (Heifetz et.al, 2009). These processes provide a lens to understand leaders as they attempt to make adaptations. In this case, this theory makes meaning of teacher leadership as an important core for innovation for teaching and learning in the novel 4IR. Below, I will unpack the six tenets of adaptive leadership. The first process draws on adaptive leadership which encourages change that enables the capacity to thrive. This factor emphasises that new initiatives, programmes, and environments require new strategies, abilities and leadership to mobilise them to fruition. Therefore, with regards to teacher leadership, this consist of leaders who develop new initiatives/programs/resources and policies to establish the 4IR in schools. However, Heifetz et al. (2009) emphasises that new initiatives are developed collaboratively with various stakeholder to protect the *voices of leadership from below*. Such an approach ensures that the top-down leadership model is not reinforced. In essence, this process focuses on identifying the type of problem and developing solutions to the problem.

In the second process of adaptive change, leaders build upon the organisation's historical foundations, like biological adaption in which minuscule yet critical DNA modifications enable a species to thrive. Heifetz et al. (2009) assert that leaders must pay attention to key issues by securing commitment from those who will help you sell the initiative. This process highlights the importance of concentrating on essential issues and gaining the support from vital individuals, while also involving those who are initially resistant to change (Heifetz et al., 2009). For this study, the adaptive leader in the context of the 4IR recognises the need to preserve certain remaining/current values/beliefs/behaviours/structures that are essential for its continuation in the current context.

Thirdly, the adaptive leaders adopt an *experimental mind-set*. The implication of this process for teacher leadership illustrates the leader as one who engages in numerous trials to find the most appropriate action plan that best fits the success of the 4IR in schools. The adaptive leader does this by *creating holding environments*. According to Heifetz et al. (2009) holding environments are structured to offer support, resources, and time essential for individuals and groups to address complex problems, explore possible solutions, and implement change. The concept of *holding environments* is based on the notions that adaptive change is not restricted to behaviour and role changes, but also includes values and beliefs,

which can be unsettling for those involved (Heifetz et al., 2009). This environment is crucial for managing stresses and disturbances that arise when people are pushed out of their familiar zones (Heifetz et al., 2009).

Fourthly, adaption relies on *diversity*. It is noted in evolutionary biology that by diversifying the gene pool, the species has an increased ability to survive/thrive in a changing ecosystem. Similarly, this process advocates for strengthening the knowledge pool by diversifying the workforce. In diversity, the organisation/school has a deeper pool of expertise to draw from when they face adaptive challenges. For this study, this could include the teacher leader's ability to promote collegiality, shared decision making and collective intelligences. In addition, this indicates that teacher leaders make attempts to establish a culture that values diverse views and relies less on a central leader.

The fifth process highlights that new adaptations significantly *displace, reregulate, and rearrange* some old DNA. This factor implies that leaders in the 4IR are required to discard certain redundant values/beliefs/behaviours/structures and replace it with new ones which will thrust the school forward. Furthermore, this leader can recognise opposing defence patterns from individuals and develop strategies to work with such opposition. This indicates that the leaders are focused on a higher purpose while confronting conflict which may derive from both personal and professional issues (Heifetz et al., 2009).

The sixth process states that adaption takes *time*. The adaptive leader is not hasty but allows new sets of norms and processes to consolidate over time. Heifetz et al. (2009) appositely describes this as the 'discovery process' in which leaders need to step back for a moment and see the bigger picture. This concept is illustrated through the metaphor of dance floor and a balcony (Heifetz, 1994; Heifetz et al., 2009; Heifetz & Linsky, 2002). They describe that on the dance floor you find action and interaction taking place. It's important to note that on the floor, one person's position only enables him to see what's going on in his immediate surrounding. However, one can gain a broader perspective if he/she steps onto the *balcony*. In this manner, the leader is at a vantage point to observe patterns of interaction and behaviour. Such a tactic can aid the group to better apprehend the system dynamics and discover supplementary suitable solutions to challenges (Heifetz et al., 2009). Resultantly, this leader is persistent and fully aware that culture changes slowly.

Collectively, these six processes outline leadership as an engaging process. This theory is vital for understanding why teacher leaders may employ adaptive tenants to cope with challenges and changes.

Adaptive leadership provides that lens which explains how teacher leaders employ innovation to their teaching and learning despite the various contexts evident in the South African educational environment.

3.3.3 STUDIES EMPLOYING ADAPTIVE LEADERSHIP

Given that adaptive leadership is a relatively new theory, there are limited studies (Dunn, 2020) that have employed its approach and even fewer in the field of education. Despite limited usage in the literature, adaptive leadership theory has proven to be effective across multiple fields including psychology, biological studies, medicine, the military, and administration (Heifetz & Linsky, 2009). I draw on a few studies to demonstrate how adaptive leadership has potential to advance leadership in the education field and prove applicable for my inquiry.

A study conducted by Shea et al. (2022) focused on healthcare leaders, but its insights are relevant to the education context. These scholars recommended five critical activities based on the adaptive leadership framework (Heifetz et al., 2009), focusing on engaging and supporting employees amidst the volatility and ambiguity of the healthcare system. The activities demonstrated the continuous nature of the set activities, therefore emphasising their importance in uncertain environments (Shea et al., 2022). The researchers integrated change leadership principles of adaptive leadership with practical suggestions, showing how leaders can adaptively navigate complex systems. This concept can be transferrable to the education context to understand how educational leaders must navigate complexities in diverse settings for technological integration in the 4IR.

In the education context, Jayan et al. (2016) focused on leadership effectiveness in Sarawak schools. Their study explored how adaptive leadership (Heifetz et al., 2009) related to leadership capabilities and their impact on leadership effectiveness in educational settings. This study was significant for providing insights into the practical application of adaptive leadership in the school context. This study offers perspective for my inquiry as it shows how adaptive leadership principles can be applied to 21st century educational challenges.

Within the South African context, Preece (2016) examined community engagement and services learning initiatives at a South African university. This study employed the adaptive leadership theory to understand and work through complexities of multidisciplinary community engagement. The essence of this study was to investigate how adaptive leadership can be applied to create effective collaboration, communication and problem solving in community-based educational projects. The key insights revealed how multidisciplinary challenges can be managed and how adaptive leadership facilitates shared learning

experiences that benefit the community. The study also revealed the practical application of adaptive leadership in higher educational settings, precisely in projects involving external community partnership. This study offers perspective for my inquiry as it demonstrates how educational leaders can apply adaptive leadership strategies to manage complex projects, improve collaborations and work with external partners to facilitate change in education for the 4IR.

3.4 SOCIAL REALISM THEORY

In this section, I unpack Social Realism as the third theoretical lens guiding my inquiry. Archer's (1995) *Social Realism Theory*, while highly complex, offers a robust framework for dissecting social reality, particularly within the educational context. The extensive literature on this theory is intellectually thought-provoking, presenting a temptation to incorporate all aspects of this theory into my inquiry. Nevertheless, my studies objectives, necessitated a more targeted application of this theory's tools. Within this section I outline a brief rationale for selecting this theory, followed by an exposition of Critical Realism as a meta-theoretical backdrop for understanding social realism. I then unpack the specific aspects of social realism that have been utilised to analyse the nuances of my research sub-puzzles.

3.4.1 SOCIAL REALISM: WHY THIS MATTERS FOR MY RESEARCH INQUIRY

Both the *Teachers as Leaders framework* (Crowther et al., 2009) and Adaptive Leadership Theory (Heifetz et al., 2009) are respectively utilised to explore teacher leadership practices and their importance for innovation in teaching and learning within the 4IR. While these theories are pivotal for identifying and explaining prevalent practices, they offer limited insights into the causal mechanism that enable or constrain teacher leadership in the 4IR. This limitation promoted a deeper exploration from a *Critical Realist* view (Bhaskar, 1975), a perspective suited to explore the stratified reality of educational settlements (refer to chapter 4.2.2, pg. 76 for my paradigmatic position). This shift led to the adoption Archer's (1995) *Social Realism Theory*. This theory provides the tools for exploring the interplay between structure, culture, and agency, thereby unearthing the generative mechanism that influences and shape each participant's stratified reality. I use this theory to employ a multi-layered analytical approach. I initially use the *Teachers as Leaders Framework* to analyse sub-puzzle one and the *Adaptive Leadership Theory* for sub-puzzle two. I then incorporate social realism for a more in-depth analysis of the two research sub-puzzles.

Like Archer (1995), I too, believe that a social realist framework is pivotal in analysing the development and extension of knowledge about society, culture, and human agency, offering insights into how or why changes occur (morphogenesis) or remain unchanged (morphostasis) in society. This approach is

fundamental for the structure/agency debate, underscoring the necessity to understand the interplay between social structures and human agency (Westaway et al., 2019). While I acknowledge the relevance of the social constructionist perspective, which outlines that our understanding of self and the world is shaped through social interactions rather than an *objective reality* (Berger & Luckman, 1996), it is crucial to note that this viewpoint often conflates questions of how we know something (epistemology) with what is (ontology) (Elder-Vass, 2008). This conflation as argued by Westaway et al. (2019) posits that this makes it challenging to examine the structural and cultural mechanism influencing a phenomenon, in this case, teacher leadership. For such reasons, I look to the *social realist framework* which transcends the observatory domain of the *empirical* to uncover underlying generative mechanism at deeper levels of reality. Unlike social constructionism, this theory explores the interplay between structures, culture, and agency in teacher leadership practices by delinking them (Archer, 2003), allowing for an analysis of each element's influence. Social realism facilitates me in identifying the structural and cultural mechanisms that enable or constrain teacher leadership for innovation in teaching and learning in the 4IR. However, to effectively understand and utilise social realism, I discuss its emergence and embeddedness within the *Critical Realist* framework (Bhaskar, 1975).

3.4.2 CRITICAL REALISM: A META-THEORY TO SOCIAL REALISM

Critical realism (hereafter referred to as CR) serves as an under labourer for this inquiry as it offers a framework at the crossing point between education theory and education practice. CR is a philosophical approach intended to under-labour social science research (Slemmings, 2019). It plays a significant part in translating critical realism principles into substantive theory within educational research, thereby enabling a deeper understanding of educational processes. Although framed by CR (refer to chapter 4.2.2 pg. 76) this inquiry used Social Realism (hereafter referred to as SR) to expound on why certain educational conditions and practices are the way they are. In the of context SR, it aided me in explicating underlying generative mechanism within the educational context.

Not only is CR an under-labourer to the CR theory, but it also serves as the paradigm for this study. The introduction of CR in this chapter is crucial, given SR's roots in this philosophical theory. CR is a philosophical theory developed by Roy Bhaskar in the 1970's and marks a progressive shift in philosophy and the human sciences, distinct from positivism, with its focus on emergence and ontological realism (Slemmings, 2019). CR evolved out of Bhaskar's *Transcendental Realism* and his theory of *Critical Naturalism* (Slemmings, 2019). Transcendental realism is a general theory of science focusing on the nature of reality and its structures while, Critical Naturalism applied these ideas to social sciences (Clarke,

2010; Bhaskar, 1998) Such a foundation is important for understanding the structures and application of SR in this inquiry.

A social realist engages critically with knowledge about self, social structures, and cultural systems, whereas CR offers perspective into making sense about reality itself (Slemming, 2019). In this regard critical realists claim that there exists a reality that can be known, despite it not always being immediately perceptible, given its differentiated, structured and stratified nature (Denemark et al., 2002). In CR, reality is also stratified to a natural or social world. The natural world is made up of the physical realm, while the social world consists of social structures, cultural systems, and agents (Archer, 2005). Archer (1995) argued that only with understanding that reality exist on different levels and in different domains, that knowledge about reality can be developed. Drawing on Archer (1995) and Bhaskar (1998), I set out to explore the domain of the social world in the educational context, as their perspectives align closely with my world view. I too believe that there is a deeper, more profound reality that prevails independent of my perceptions of events in the world, therefore indicating the necessity of depth ontology. Given the credence to ontology for the critical realist, it becomes important to outline the ontological underpinning for this theory.

3.2.4.1 ONTOLOGICAL AND EPISTEMOLOGICAL CLAIMS FOR THE CRITICAL REALIST – THE INDEPENDENT REALITY

The genesis of CR in this inquiry stems from its fundamental focus on ontology (Bhaskar, 1975). For the critical realist the social world is pre-constructed, emphasising the essence of being over mere knowledge of the world. The critical realist distinctively emphasises the peculiarity between *epistemology*, a theory of knowledge of the world, from ontology, a theory of being (Slemming, 2019). In contrast, a *social constructionist* assumes that research does not describe a prior reality, but rather constructs it (Elder-Vass, 2008). Elder-Vass (2008) describes this as a flat ontology which limits reality to what can be observed (empirical domain). This view suggests that reality is shaped by individuals' perceptions, a concept Bhaskar (2008) describes as an 'epistemic fallacy', which overemphasizes 'how we know' over 'what is'. This flat ontology ignores the existence of a reality independent of our knowledge of it. Alternatively, CR expounds on a layered reality (Archer, 1995 & Bhaskar, 1975). In other words, the ontological claim is that there is an external reality that exists, and the epistemological claim is that this reality is independent of our conception of it. To illustrate, observing teachers' reluctance to assume leadership duties in a school may overlook deeper mechanisms influencing such reluctance.

The central premise of critical realist ontology is that the world is an *open system*, where multiple generative mechanisms complicate the predictability of outcomes. Establishing connections between causes and effects in society is challenging due to the diversity, structure, differentiation, stratification and constant change of the world, as people's interpretations and implementations vary (Archer, 1995). Resultantly, Bhaskar (2008) places emphasis on emergence, where new phenomena arise from interactions of two elements. Thus Archer (1995) informs us that this interaction culminates into the emergence of a new *sui generis* social practice, each endowed with distinct properties and powers. It is for such reasons that Archer (1995) describes the world of knowledge as fallible or corrigible, thus claiming we can never know it fully due to this open system.

Therefore, in considering CR as a theory of being, we must question the properties that societies and people possess, making them objects of knowledge (Bhaskar, 1975). To avoid the epistemological fallacy of confusing the nature of reality with our knowledge of reality, Bhaskar (1975) considers two dimensions of knowledge: transitive (changing) and intransitive (enduring and unchanging). Transitive knowledge encompasses the *level of the actual* shaped by historical and social context. It also includes the level of the empirical, which is experienced/observed by our senses (Bhaskar, 1975). In contrast, intransitive knowledge objects exist in the domain of the real, including any material/spiritual/natural objects exists in both the natural and social world, often beyond what people can control or even have knowledge of (Bhaskar, 1975). Resultantly, this suggests that our knowledge of the world is limited by concepts we use to describe, thereby encouraging researchers to dig deeper to uncover causal mechanisms. In my inquiry, I cannot accept the apparent worth of what is being said in the interviews (during the data generation stage) as the ultimate truth, but rather use it to delve into deeper interpretations of reality. By adopting Bhaskar's (2008) '*objective critique*', this moves the researcher beyond the observation to unearth mechanisms that are known at any particular time in society. To access this layered reality, it is critical to explore the various strata composing it (1975).

3.4.3 A STRATIFIED LAYER OF REALITY

Bhaskar (1975) posits a stratified view of reality by drawing a clear distinction on three ontological domains (also referred to as layers) known as the *empirical*, the *actual* and the *real*. As I previously gestured, this stratified ontology enables the researcher to unravel the underlying generative mechanism at the deepest level of reality. The three levels/domains of reality are discussed below.

3.4.3.1 The domain of the empirical

The empirical is tied to the observable world in which we live and can experience with our senses (Danermark et al., 2002). In this domain people's experiences are noted. People's accounts are viewed by Bhaskar (1998) as the most basic evidence available to use. Knowledge objects in the empirical are *transitive* because they can be seen/experienced directly or indirectly. Both Bhaskar (1998) and Archer (1995) posit that experiences and perceptions only constitute one level of reality -the empirical- and warn against considering this as the absolute truth, citing this as an *epistemic fallacy*. Therefore, critical realists move beyond this surface layer, using empirical data to investigate deeper layers of reality (Danermark et al., 2002).

3.4.3.2 The domain of the actual

This domain encompasses phenomena that occurs independently of our observation (Danermark et al., 2002). Slemming (2019) relates the *actual* to events that can be experienced whether we participate or know of them. This occurs because there are mechanisms at the *level of real* which produce behaviours and *events* in the social world that are evident in the *actual* and expresses what transpires when the real is activated (Bhaskar, 2008). Mechanism such as laws, beliefs, policies, ideologies, rules, cultural principles are working below the surface to bring about *events* and *experiences* into reality. Consequently, the level of the actual is characterised by transitive knowledge objects, shaped by changing historical and social contexts and includes events irrespective of direct experience. In the school context, mechanisms like these shape how leadership is practiced. As a result, it's crucial for me to delve beyond the levels of the actual and empirical to unearth the mechanisms driving these events and experiences (Slemming, 2019).

3.4.3.3 The domain of the real

This is the deepest domain of reality which constitutes mechanisms with generative power (Bhaskar, 1978). This domain has casual powers from which events in the *actual* emerge or from which generative mechanism can be activated. In other words, *the level of the real* explicates why things are the way they are at the levels of the *actual* and the *empirical* (Naicker, Grant & Pillay, 2016). Danermark et al. (2002) describe that at this layer is where generative mechanisms are located and influences events and our experiences of the events. Simultaneously, one does not have control over this domain as it exists independently of human influence and knowledge of both the social and natural worlds (Case, 2013). For such reasons, this layer has *intransitive-knowledge objects*. Therefore, it is possible to unearth additional fundamental casual mechanisms to help us make sense of and explain levels of reality. It is at this level; people's explanation and accounts are considered as the entry point to understand what structures and

mechanism are influencing what is transpiring in the world. To illustrate an example, Naicker et al. (2016, p. 2) describes:

...at the level of the real, there may be an organisational structure in place that is hierarchical and only recognises formally appointed leaders. This structural constraint may, in turn, generate events where subject committee meetings are not chaired by ordinary classroom-based teachers. Consequently, at the level of the empirical, we may observe and perceive teachers not participating in the leadership practice of the school.

This example shows that even though mechanisms are not observable, we can speculate about them in order to understand the world in a particular time and context. For such reasons, Bhaskar (2008) reminds us that knowledge of the world is corrigible. As mentioned early, I cannot accept the apparent worth of what is being said in the interviews or observed as the ultimate truth. Instead, the data I generate is used to probe deeper to untie the most suitable interpretation of reality. However, Bhaskar (2008), further indicates that change is only possible if we identify mechanisms. Bhaskar (1975) indicated that recognising and identifying generative mechanisms is vital for enabling change. By understanding these mechanisms, agents in schools can effect social change, paving the way for emancipation (Bhaskar, 1975).

3.4.4 UNDERSTANDING SOCIAL REALISM FOR THIS INQUIRY

Under-laboured by a CR philosophy, SR accepts the reality exists independently of our knowledge of it, yet our understanding of it remains fallible and thus always open to review (Bhaskar, 2008). Archer (2003) understood society to be made up of structural, cultural, and agential properties, each with inherent relationships to each other. It has been contended that while each of these concepts are analytically separable, their interplay, especially between agency and culture and/or agency and structure -facilitate meaningful analysis (Slemming, 2019). Westaway et al. (2020) stated that structure, culture, and agency are autonomous, ontologically and temporally distinct, possessing unique properties and powers that shape each other. It is also believed that in doing so this can help the researcher become reflexive (Bhaskar, 2008). Archer (1995) highlights reflexivity as a means to improve society. As I investigate the generative mechanisms at *the level of the real* and their influence on teacher leadership for innovation in teaching and learning in the context of the 4IR, my focus extends to understand the underlying structural, cultural, and agential constrains and enablers. As I analyse the interplay between structure, culture, and agency, I can reveal the emergent properties and powers expressed as agents interact with structures and cultures in their schools.

3.4.4.1 Understanding Archer's Notion of Structure

Leading from the notion that society precedes the individual and that society is already made for the individual born into it, Archer (2003) defines *structure* as encompassing social institutions, social practices, roles, and positions. Archer (2003) argues that society or the social world consist of *parts*- the prevailing social structures- and the *people* who interact with these *parts*. In the education context, *structures* encompass roles, positions, rules, and policies such as school codes of conduct, vision statements that influence leadership practices and organisational dynamics. Additionally, structure might include the school's organogram, detailing formal and informal leadership positions and roles along with policies that regulate staff interaction. Considering the concept of temporality (Archer, 2003), I explore these structures with the understanding they not only predate the actions of agents but also postdate them, indicating that they are formed before such actions occur and are subsequently altered by them. Resultantly, this concept is vital in understanding how teacher leaders interact with and transform existing structures in educational settings.

3.4.4.2 Understanding Archer's Notion of Culture

Archer (1995) separates structure from culture by defining cultural mechanisms as ideational, including discourses, language, knowledge, ideas, and social beliefs. Archer (2003) perceives cultural as a part, made up of cultural systems, characterised by stratification and existence independent of whether people are aware of them, believe in them or agree with them (Quinn, 2012). Culture manifests gradually from ideas, beliefs, values, policies, and social symbolism within a cultural system. This study draws on culture to refer to beliefs, values, norms ethos, symbols, signs, and traditions/rituals that underpin school leadership and practice. Together with structure, these cultural *parts* make up the events and experiences observed in the school and can only be acted upon by *people*.

3.4.4.3 Understanding Archer's Stratified Notion of Agency

The *people* are referred to as the agents and who operate within a particular structural or cultural system (Archer, 1995). Since the *parts* precede the actions of people, these agents have the ability to act, manipulate or influence a current situation (Archer, 1995). For this study, the agents are *people* in the school who operate within a particular structural and cultural system. Slemming (2019) states that emergent properties and powers arise from the interplay between structure, culture, and agency, occurring as agents engage with structure and culture. It is for such reason Archer (1995) describes a stratified approach to agency.

Archer (1995) explicates that agents, as collectives sharing the same-life chances, are *primary agents* at birth, already immersed in societies riddled with structural and cultural properties. These *primary agents* are inevitably influenced by the properties of the system into which they are born or enter (Archer, 1995). Some *primary agents* see a need for transformation and *enroute* of change they begin to use their emergent powers to become *corporate agents*. Archer (1995) mentioned that *cooperate agents* emerge as a result of primary agents developing their agency by working with others to transform themselves. As cooperate agents interact through social influence, they bring innovative ideas which are used to address or retain the structural and cultural mechanism (Elder-Vass, 2008). This is illustrated briefly in schools when teachers consistently take on leadership roles for the improvement of the schools and in doing so transform themselves from primary to cooperate agents (Naicker et al., 2016).

Archer (1995) alludes to one more level of agency, known as the *social actor*. Unlike the primary and cooperate agent, the *social actor* has the highest access to resources and is in the best bargaining position to transform themselves. Archer (1995) points out that the relationship between resources and the bargaining position of agents is a determinant for agent transformation. By way of illustration, Archer (1995) shows how agents with low access to resources will be in a poor bargaining position and will remain primary agents, while agents with some access to resources will be in a more prominent position and would become corporate agents. Following this trend, we find that agents with access to high levels of resources are in a strong position of bargaining to become social actors. Archer (1995) explicates that social actors exist in the singular and therefore emerge possessing a unique identity. Social actors are those individuals who find a suitable role in which they can invest themselves and take on a social identity culminating from that role (Archer, 1995).

At this junction it is important to note that structure, culture, and agency are both relational and independent, with distinct properties and powers attributed to both structures and agents (Slemming, 2019). Archer (1995) noted that the existence of people as emergent entities and the reality of structural and cultural emergent properties are interconnected, leading to a relational development between them. Emerging at this intersection are agents and actors both accounting for social identity (Archer, 2003). Therefore, it is crucial to study the interplay between culture, structure, and agency separately and in their interactive dynamics, focusing on how their emergent properties influence and shape each other within the social realm (Elder-Vass, 2008).

3.4.4.4 Analytical Dualism

In examining and analysing the interplay between structure, culture, and agency in this study, it is essential to delink them to analyse the influence of each on the other (Archer, 1995). In doing so, one must reject the social constructionist view of conflation. Central to their view of ontology is the fallacy of conflation, which merges structure and agency, in which the two are viewed as mutually constitutive (Westaway et al., 2020). In contrast, analytical dualism suggests that the *parts* and *people* are ontologically distinct and have properties and powers which are irreducible to each other (Archer, 1995). In other words, Archer (1995) argues that structure/culture and agency operate on different times scales and should therefore be analysed independently. While the *parts* and *people* function in tandem with each other, Archer (1995) advocates that analytical dualism is a temporary task which enables culture, structure, and agency to be understood independently and then the interplay between them needs to be studied. Therefore, through the separation of *parts* and *people*, for methodological purposes (Westaway et.al, 2020), the interplay between the individual and the social in practice of teacher leadership for innovation for teaching and learning can be identified. For my study this will mean identify the mediating entities that emerge in terms of structural, cultural, and agential properties. In my study, I unearth the emergent properties by focusing on the structural domain which is made up of roles, positions, rules and policies; the cultural domain which consists of beliefs, values, norms ethos, symbols, signs and traditions/rituals and agency which looks at the teacher leader's ability to act and manipulate a current situation through their leadership practice. Through analytical dualism, I examine how structures and cultures set the conditions for action and then separately analyse how teacher leaders (agents) respond to and interact with these conditions.

3.4.4.5 Understanding Emergent Properties

Engaging in analytical dualism uncovers the underlying mechanism and enables the interplay to be studied as separate entities. It is the interplay which displays how a society has become into a particular state. In addition, through the interplay, one is able to note that each concept of culture, structure and agency contains each property which enable or constrict a practice. Archer (1995) mentions that mechanism act autonomously, either constraining or enabling each other at the level of the real which leads to events. For Archer (1995) emergence is embedded in interaction dealing with systems of interlinked components that can only be defined in terms of the interrelations of each of them in an ongoing developmental process that generates emergent phenomena. Emergent properties are therefore relational; they are not contained in the elements themselves, but could not exist apart from them (Elder-Vass, 2007).

Archer (1995) expresses that there are properties that exist in the *parts* which lay a foundation for which later generations of agents will function and confer vested interests on people according to the position they hold. While agents may influence a social condition based on their bargaining power and resources for any social elaboration, Carter and New (2004) note that *people* choose what they do, but they make their choices from a structurally and culturally generated range of options. In similar likeness, Archer (1995) explicates that *people* contain emergent properties and powers and are capable of resisting the structural and cultural emergent properties in unpredictable ways. Therefore, in this study, I consider the properties that each concept of structure, culture and agency contains in order to understand how the mechanisms at play enable or restrict the leadership practices of teacher leaders for innovation in teaching and learning in the 4IR. Archer (1995) further highlights that while it is important to analyse the emergent properties separately, it must be noted that they are linked and some properties may be more dominant than others. The three emergent properties are structural emergent properties (SEPs), cultural emergent properties (CEPs) and personal emergent properties (PEPs).

The emergent of SEPs depend essentially on material interest and resources which also include people (Archer, 1995). Danermark et al., (2002) further exemplifies this distinction by arguing that structures are stratified, ontologically preceding and autonomous from people. The different strata of structures have emergent properties and have sets of internally related objects (Danermark et al., 2002). To draw on an example, an individual in a leadership position role is influenced by the job description which is independent of the person (Westaways et al., 2020). Therefore, social roles have structural emergent powers which are internally related to other roles and to material requirements (Archer, 1995). Archer (1995) also makes us aware that the roles are influenced by the personal qualities that the agents bring. Additionally, structures have emergent properties because structural elaborations post-date actions from previous generations.

CEPs can come about as changes in ideas, beliefs, and values among other cultural factors become a part of the cultural landscape (Archer, 1995). CEPs are a result of an institutions longstanding beliefs, norms, values, and traditions (Slemming, 2019). Like structural systems, cultural systems also pre-date the agent. The cultures that form in schools for instance are either accepted and persevered or could be challenged by an agent with a vested interest and sufficient bargaining power and resources (Archer, 1995). Archer (1995) alludes that while culture pre-dates the agent, the agent has emergent properties to *elaborate* upon the current cultural system. Agents have the ability to shape the cultural context in which they are located in. Finally, Archer (1995) draws our attention to PEPs which can emerge as people

interact in different contexts where they are required to exercise different sets of power, either as part of a new group or where their interactions are challenged within the social realms of society.

3. 5 THE THEORETICAL ASSEMBLAGE FOR THIS INQUIRY

I assemble the three distinct theories using a metaphorical image of a *futuristic school built on several layers or strata* (refer to figure 3.1 below). This method of using a metaphorical image was utilised in Govender’s (2022) doctoral research to demonstrate the interconnected nature of his theoretical framework. Like Govender (2022), I too use a metaphorical image to help visualise how the three theories utilised in this inquiry work in tandem with each other. The image captures the impact of leadership theories for establishing innovation in teaching and learning in the 4IR. It demonstrates, what we see on the surface is highly influenced by deep underlying mechanism. To explain:

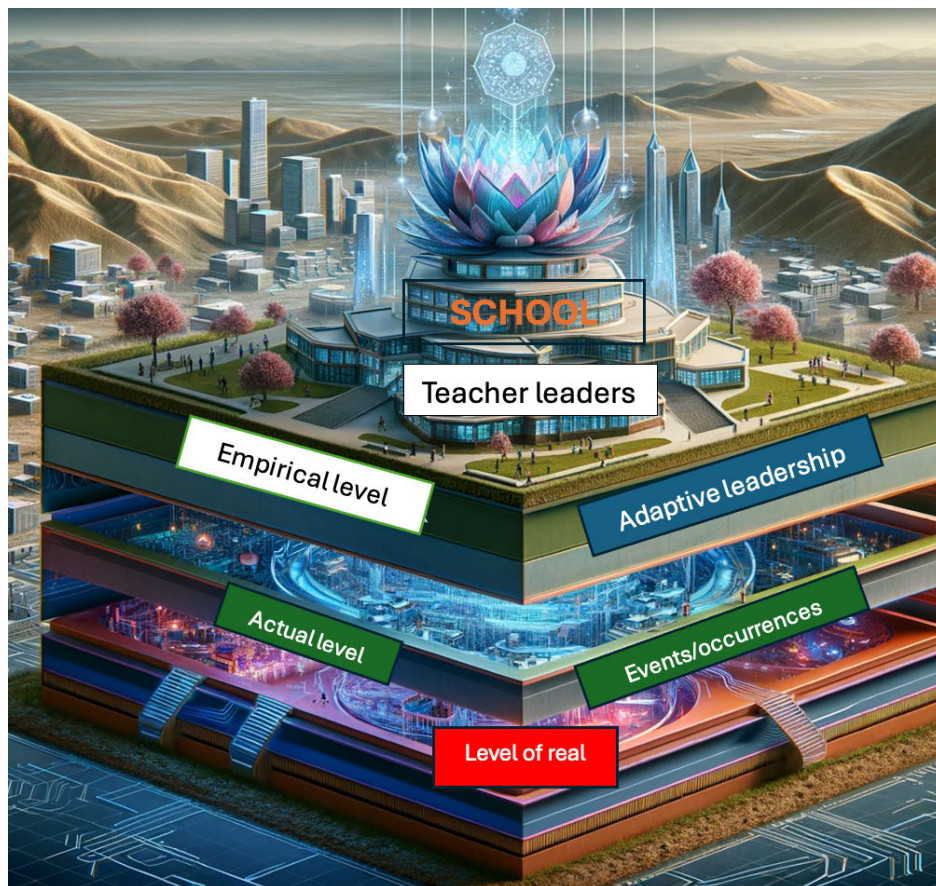


Figure 3.1 Futuristic school- Assemblage of theories

Adapted from Crowther et al. (2009); Heifetz et al. (2009); Archer (1995); Bhaskar (1975)

The futurist design of the school on the surface (*empirical layer*) demonstrates how teacher leaders as agents potentially transform schools. Drawing on the role of an architect, who advances buildings to develop ‘smart’ innovative cities in the 21st century, teacher leadership is about guiding educational

practices towards future readiness, in the 4IR. This surface layer acknowledges the *structures* and *cultures* within which teacher leaders perform their daily tasks, including roles, positions, policies, and norms. The Teachers as Leaders Framework (Crowther et al., 2009), provide the tools for teacher leaders to transform schools into innovative environments. The constructs of the theory hold potential for this transformation.

The first layer below the school represents a blend of digital and organic strata, indicating the theory of Adaptive Leadership (Heifetz et al., 2009). This layer is reflective of teacher leaders integrating traditional leadership approaches with new-technologically driven methods to navigate the adaptive and technological challenges presented by the 4IR. This shows *culture*: values, norms and traditions that are being reshaped by the 4IR as new technology and pedagogical styles change. This foundation demonstrates the leadership processes of managing and directing change in the context of the 4IR within South Africa. Adaptive leadership provides teacher leaders with tools to initiate change by addressing challenges, creating holding environments, experimenting with solutions, encouraging diversity, regulating/reregulating key principles for change and recognising the temporality of change processes (Heifetz et al., 2009).

The environmental landscape surrounding the school represents SR (Archer, 1995). SR demonstrates how *structural* and *cultural* contexts shape and influence teacher leadership (Archer, 1995). The landscape in this image shows that educational practice for innovation in teaching and learning are grounded in and responsive to the wider social environment. The landscape demonstrates the notion that culture and structure exists independently of the teacher leader but are changeable through agential influence (Bhaskar, 1975; Archer, 1995).

Delving into deeper layers, the circuitry and holographic symbol, represent CR. Circuitry is an arraignment of circuits in a device. These circuits are usually found inside a device and are not visible to the naked eye. However, these hidden circuits allow electrical energy to flow through them, enabling the device to function in a particular way on the surface. Likewise, the circuitry and holographic elements in the picture show a deeper reality (structures, forces, norms) that influence the empirical and actual layer of reality (Bhaskar, 1975). It is here that the interplay between structure, culture and agency lies (Archer, 1995). The structures and cultures in a school predate and post-date the actions of teacher leaders, thereby implying a continuous process of change and development (Archer, 1995). The image shows a stratified layer of reality, to correspond with the different levels of reality in CR. At the *empirical level*, we see the observable practices and adaptations in education. The *actual layer* represents the events and occurrences

within the education setting. Lastly, the *layer of the real* shows the underlying generative mechanism that shape both what is experienced on the level of the *actual* and observed on the level of the *empirical* (Bhaskar, 1975).

3.6 CONCLUSION

This chapter discussed the three theories which informed this inquiry: The Teachers as Leaders Framework, Adaptive Leadership, and Social Realism. Each theory contributes to answering the research puzzle underpinning this inquiry. Through the lens of the Teacher as Leaders Framework, I am able to delve into the leadership practices of teacher leaders for innovation in teaching and learning in the 4IR. The adaptive leadership theory provides a lens to explore why teacher leadership is an important practice for innovation in teaching and learning. The social realism theory enabled me to investigate how the interplay between structure, culture and agency impacts the stratified realities of my participants. The assemblage of the three theories demonstrates the transformative role of teacher leaders in shaping education in the context of the 4IR. It also shows how underlying mechanism shape and influence the leadership practices of teacher leaders in different contexts. The next chapter pivots on the methodological underpinnings for this inquiry. It discusses the underpinning of critical realism as a paradigm for this inquiry, the qualitative design for this research, the narrative inquiry methodology and the research methods.

CHAPTER FOUR MY RESEARCH METHODOLOGICAL TOOLBOX

4.1 INTRODUCTION

In chapter three I discussed the theoretical underpinnings for this inquiry, foregrounding the Teachers as Leaders Framework, Adaptive Leadership and Social Realism as an explanatory lens. These theories facilitated an in-depth investigation of the primary research puzzle: *What are the lived experiences of teacher leaders from diverse school settings of technological innovation in teaching and learning in the 4IR?* In addition, chapter three introduced critical realism as a metatheory to social realism (refer to chapter 3.4.2, pg. 62). In this chapter I reaffirm critical realism as the overarching paradigm and pivot to outline the methodological framework for this inquiry. The term 'methodological toolbox' in the title of this chapter metaphorically represents the variety of research tools that underpin the foundation of this inquiry. The chapter unfolds systematically, starting with a discussion on my paradigmatic position in critical realism. Thereafter, I detail the qualitative research design, highlighting its critical role in the facilitation of attaining in-depth and meaningful data from participants in this inquiry. Subsequently, I discuss the utilisation of narrative inquiry as the chosen methodology, offering a pertinent lens through which experiences of teacher leaders can be understood. Following this, the chapter presents the specific research methods implemented in this inquiry. Lastly, I outline a detailed discussion on issues of trustworthiness, ethics, and the limitations of this study.

4.2 RESEARCH PARADIGM: TRACING MY PARADIGMATIC SHIFT TO CRITICAL REALISM

In this study, Critical Realism (thereafter referred to as CR) was employed as my paradigmatic lens, informed by prior research experiences within the positivist and interpretivist paradigm. In this section I briefly recount those experiences, highlighting how they shaped my decision to work within the critical realist paradigm. To remind the reader, chapter three discussed CR as a metatheory for social realism (refer to Chapter 3.4.2, pg. 62).

The choice of a research paradigm is essentially a philosophical decision that shapes a researcher's perspective of the world (Kivunja & Kuyini, 2017). My experience with research has shown me that a research paradigm informs how I make meaning of reality and how knowledge of that reality can be ascertained. Nieuwenhuis (2013) notes that in social sciences, research paradigms serve as intentionally selected lenses for observing and understanding reality. I deliberately chose my research paradigm based on the beliefs and assumptions it holds about social reality, the nature of reality and how this reality is understood and interpreted (Creswell, 2012). This results in a distinct or specific worldview as a researcher. A paradigm therefore is more than just a theoretical lens, it's a lens through which we

construct and interpret our world, profoundly shaping our understanding of the participants' reality in a study. Denzin and Lincoln (2000) explicated that paradigms are human constructs founded on beliefs and assumptions that guide research. In my study I employed the critical realist paradigm to organise my beliefs and assumptions into a coherent perspective, allowing me to narratively portray the world of my inquiry. The following paragraphs discuss reasons for selecting my paradigm.

4.2.1 Working within other paradigms

For several years, I served as a Geography subject coordinator in a secondary school. My primary role involved leading and managing teachers towards enhancing the geography curriculum, with a crucial focus on the final grade 12 learner results. Within the South African context, grade 12 marks final year of secondary schooling and culminates in a National Examination vital for university, colleges, and internship application in South Africa and abroad. These examination results reflect the learners' academic achievements and serves as a yardstick to measure the school's educational quality and growth. In other words, the National Examination results are often used as a benchmark for school achievement. Upon assuming the coordinator role, I was instructed by my Departmental Head to create a plan to improve and sustain Geography performance by analysing the grade 12 results. This included examining the average percentage achieved by students, the distribution of grades from A to F symbols, and the mean and mode of the results. While this may be a pleasing way to observe factual trends and results, it tends to separate the researcher and the researched object by suggesting that they cannot influence each other (Bertram & Christiansen, 2014). I felt as if this method of analysing the data neglected the voices of the teachers and learners.

As a leader, I recognised the need to delve deeper into the multiple realities to understand the factors impacting our learners' results. Therefore, I set out to speak with the teachers that I was leading in an endeavour to hear their experiences of what might be causing the results to be as it is. Their insights showed various issues that statistical data alone could not cover, such as outdated resources, ineffective teaching methods, and the impact of excessive extra-curricular on instructional time, alongside limited opportunities for professional development. This experience underscored the limitation of a purely objective, distant approach to ontology, typical of the positivist paradigm (Bertram & Christiansen, 2014; Cohen et al., 2007). Guba and Lincoln (1994) define the positivist paradigm as a reality governed by indisputable natural laws, a perspective I found inadequate for fully interpreting results in school.

My successful experience as a leader in interpreting individuals' realities and truths led me to explore the Interpretivist paradigm for my master's degree in education (David, 2017). This paradigm allowed me to delve into the individual 'idio' cases for understanding the participant's subjective meanings of their lived

experiences (Crotty, 1998, p. 67). This paradigm enabled me to interpret lived experiences and see things as my participants saw them (Creswell, 2008; Guba & Lincoln 1989). Interpretivism is constructed on the assumptions that there are multiple realities (Cohen et al., 2007). The interpretivist paradigm, premised on the notion of multiple realities, seeks to understand human experience in context, within participants historical and cultural settings (Creswell, 2012; Guba & Lincoln 1989). While this paradigm was effective for my master's studies, I felt a need in this study to explore deeper in order to unravel generative mechanisms which shed light and give reasons for why things occur as they do at the level of the *empirical* (Bhaskar, 1975).

4.2.2 Critical Realism as my Paradigm

My exploration of both positivist and interpretivist paradigms led to two key realisations. While the positivist paradigm offered valid results, it often lacked depth in understanding a problem. Conversely, the interpretivist paradigm offered depth in understanding a problem but often left the validation of results in question (Westaway et al., 2019). Therefore, I sought to make a shift from primarily reflecting or describing a particular reality at face-value to developing in-depth causal explanations for outcomes, considering various factors that may have played a causal role in a particular reality. Bhaskar (2008) describes this as *objective critique*, which involves going beyond observation to unearth the generative mechanisms shaping society at a given time. As a result, I embraced the CR paradigm, which leverages elements of both positivism and interpretivism (Westaway et al., 2019). CR acknowledges both the subjective knowledge of social actors and the existence of independent structures and cultures that shape actors' actions within particular settings (Sayer, 2000). Like critical realist who emphasises depth, I too am of the intrinsic belief that there is a deeper, more profound reality that prevails in terms of how things occur in the world and this reality is independent of human experience.

To remind the reader, CR draws on realist ontology which encapsulates that the real world exists independently of our alleged knowledge about reality (Bhaskar, 1975). This implies that the observed reality is not all that it visually appears to be, and as such must be understood as an expression for deeper-lying processes (Bhaskar, 1975). As such, reality is therefore stratified for the critical realist indicating a multi-levelled reality as opposed to a flat one (Slemming, 2019). Working within the critical realist paradigm consists of an ontological map made up of the three domains namely, the real, the actual and the empirical (Bhaskar, 1975). As a critical realist, my objective is to delve beyond empirical observation to uncover and gain insight into the underlying mechanism and processes.

Working within this paradigm emphasises the centrality of causality (Westaway et al., 2019). As a researcher this paradigm enabled me to explain phenomenon by identifying and understanding the causal relationship between various factors. CR focuses on describing causality by detailing the means or process by which events are generated by structure, actions, and contextual conditions involved in a particular setting. Similarly, Clandinin (2013) expresses that as a researcher, one should not only seek to valorise an experience but should also explore the social, cultural, familial, linguistic, and institutional narratives that frame an individuals' experience. Resultantly, for my study, this paradigm enabled me to critically explore underlying mechanisms (structural, cultural, and agential) that affect the reality displayed on the surface.

Working within this paradigm, ontology is perceived through three stratified layers, namely: the levels of the *empirical*, *actual*, and *real* (Bhaskar, 1975). While an in-depth discussion of each layer was provided in chapter 3, section 3.4.2 (pg. 62), I briefly reiterate each level. The *empirical level* consists of those events we experience or observe with our senses either directly or indirectly (Bhaskar, 2008). The next level, the level of the *actual* occurs when causal powers of structure and entities are enacted regardless of whether we experience them or not (Bhaskar, 1985). Finally, the level of the *real* explicates why things are the way they are at the level of the *actual* and *empirical* by exposing the interplay of generative mechanisms. This is the deepest dimension where generative mechanisms can be found. To illustrate, if we consider school structures at the level of the *real* as hierarchical and formally leader-centric, this may manifest at the *actual* as subject committee meetings not being held by teachers (Naicker et al., 2016). Resultantly, one may observe teachers' disengagement in leadership participation at the level of the *empirical*.

To make this visually clear, let us apply this to the following diagram adapted from Anderson (2020). Referring to figure 4.1, we can assume that at the domain of the *real* there are social structures and generative mechanism that exists beyond the site of the researcher. As mentioned above, this could include policies which only enable formal leaders

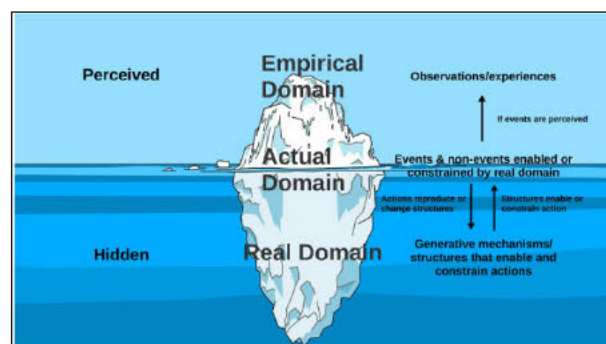


Figure 4.1 Domains of Critical Realism

to participate in leadership. These structures therefore distribute resources and authority to different people within social settings, which in turn enables or constrains actions (Slemming, 2019). Consequently, these actions now create events or non-events in the *actual* domain, in this case teachers do not participate in leading committee meetings. Finally, at the tip of the iceberg (the smallest part), is

the domain of the *empirical* which is open to observation and perception for the researcher. Therefore, as the largest part of the iceberg is found beneath the level of the water or beyond visual site (level of the real), one must use data generated from the surface levels to unearth the mammoth generative mechanisms causing the occurrences in the level of the *actual* and what we see at the level of the *empirical*.

Therefore, exploring reality from this angle allowed me to use the reasons and accounts offered by participants as a basis to establish what the structures and mechanisms are that influence events and experiences. In this way, Bhaskar (2008) advises the researcher to make speculations about the mechanisms while bearing in mind that they are not something we have absolute knowledge of. It is for such reasons, I acknowledge that working in this paradigm, one holds the belief that we can never claim to know the world fully and that knowledge of the world is corrigible when we begin to understand the underlying mechanisms that gives rise to experiences (Sayer, 2000). Drawing on CR (Bhaskar, 1975) as my paradigm, I can unearth the generative mechanisms and therefore give an account of the real and why things are the way they are at the level of the *empirical* and *actual*.

4.3 RESEARCH DESIGN: A QUALITATIVE APPROACH TO STUDYING LIVED EXPERIENCE

For this study, I opted for a qualitative research design. Working within a selected research design lays out the research procedures adopted by the researcher to direct their inquiry (Creswell, 2012). According to Flick (2007) a research design umbrellas the intersection of philosophy, strategies of inquiry and specific methods. Bearing such in mind, my research paradigm which seeks to unravel generative mechanisms in a stratified ontology by studying participants' experiences, I opted for the qualitative research design. Simultaneously, qualitative methods of generating and analysing field texts are adopted.

In a qualitative study, the researcher aims to study real-life settings such as communities, schools, and people in society with the goal of understanding human experience and the meanings they give to such contexts (Flick, 2007). In my study, I look at the five school quintiles and the meanings the participants give to their contexts based on their experiences in these contexts. In exploring their experiences, I can gather rich descriptive field texts of my participants' conversations, their place of employment, and their communities which is not easily handled by statistical data (Bogdan & Biklen, 1998).

Working within the CR paradigm involves unearthing generative mechanisms at the level of the *real* (Bhaskar, 1975), a task which requires sustained contact with the participants. Qualitative research enables me to keep in frequent contact with my participants by meeting with them over several occasions

to generate field texts (Cohen et al., 2007). In this way, qualitative research allows me to enter the world of my participants and “get to know them” and “earn their trust” while systematically keeping a detailed written record of what is conversed and observed (Bogdan & Biklen 1998, p. 157). Qualitative research is frequently called naturalistic because the researcher frequents places where the events, he/she is interested in is naturally occurring (Guba, 1978). In this inquiry, I can study the participant’s experiences in the school quintiles as a direct source of data (Creswell, 2008). As a result of qualitative research being naturalistic (Guba & Lincoln, 1994), I entered and spent considerable time in the school with participants to learn about educational concerns. Therefore, qualitative research places emphasis on the context. Bogdan and Biklen (1998, p. 5) effectively emphasised that “action can best be understood when it is observed in the setting in which it occurs”. These settings enabled me to gain an understanding of the historical context of the school in which the participants are a part of. This point integrates well with critical realists who also believe that individuals are born/enter into pre-existing societies with pre-existing cultures and structures which have an inevitable impact on how people experience their worlds (Archer, 1995).

As I gestured above, qualitative research enables one to generate descriptive data. Descriptive data is generated in the form of words or pictures (Golafshani, 2003). I therefore opted for qualitative research as it offered me various methods to generate field texts. In a nutshell, qualitative research was employed as it complements my paradigmatic research position since individuals’ experiences can only be explored qualitatively (Cohen et al., 2007; Crewell, 2012). It is important to note, that some may argue that quantitative research advocates causal determination, prediction, and generalisation of findings (Bogdan & Biklen 1997). Other scholars such as Flick (2008) stated that the limitation to qualitative studies in the social sciences are the low degree of transferability of findings. However, these limitations do not create a barrier for my study. My study aim was not to produce object results or reflect a reality at face value, instead I focus on developing in-depth causal explanations for outcomes, considering various factors that may have played a causal role in a particular reality. This is achieved in my study by acknowledging a stratified ontology of the participant’s experiences.

4.4 RESEARCH METHODOLOGY: NARRATIVE INQUIRY AS A UNIQUE WAY TO STUDY EXPERIENCE

For this study, I use narrative inquiry as my research methodology, a decision informed from extensive review of various methodologies in the field. This choice was carefully done to ensure alignment with my research paradigm and research design. Initially I found myself at a crossroad between a case study and narrative inquiry. As described by Creswell (2012), a case study is as an in-depth exploration of a, specific

and bound system. Flick (2007) adds that case studies are generally time and context specific, focusing on particular events. However, what ultimately drew me to narrative inquiry was its unique way to delve into participant's personal and professional experiences in a way unmatched by other methodologies. This approach is aptly captured in the title of this sub-section, emphasising *narrative inquiry as a unique way of viewing experience* (Clandinin, 2013). Narrative inquiry builds on John Dewey's inspired view of experience premised on interaction and continuity (this is unpacked in greater detail in the paragraphs to follow) (Clandinin, 2013).

Like many who are new to narrative inquiry, I initially viewed it simply as a compelling means to represent my research, not fully grasping its unique view on experience (Clandinin, 2013). However, a closer look showed narrative inquiry's focus on experience, relational ontology, interaction, and storytelling (Clandinin, 2013). Narrative inquiry offered me a methodological means to carry out research in a qualitatively naturalistic fashion (see section 4.3 pg. 78) because it is believed that individuals live storied lives. The following epigraph in the words of Clandinin and Roseik (2007, p. 35) aptly capture how individuals colour their lives through stories:

'...human beings have lived out and told stories about living for as long as we could talk. And then we have talked about the stories we tell for almost as long. These lived and told stories and the talked about stories are one of the ways, that we fill our world with meaning and enlist one another's assistance in building lives and communities.'

Drawing on the above epigraph, I recognise narrative inquiry as a method that explores experience through listening, observing, and writing about people naturally constructing meaning of their lives in the stories they tell. As Clandinin (2013) fundamentally states, narrative inquiry is essentially about studying individuals' experience, nothing more and nothing less. However, key to narrative inquiry is a specific view of experience which is grounded in the ontological and epistemological assumption underpinned by a John Dewey concept of experience as 'interaction and continuity' (see section 4.4.1, pg.80) (Clandinin & Connelly, 2000). This view explicates that experience itself is a narrative composition, an embodied narrative life composition (Clandinin, 2013). As a result, narrative inquiry is a way of understanding and inquiring into my participants' experiences through collaboration between the researcher and participant over time, place, or a series of places and in social interaction with milieus (Clandinin & Connelly, 2000).

4.4.1. Three Commonplaces of Narrative Inquiry

More specifically, narrative inquiry enabled me to understand my participants experiences through stories by attending to three commonplaces. Clandinin (2013) describes these tri-dimensional commonplaces as *temporality*, *sociality*, and *place*. Firstly, temporality as a commonplace recognises that experiences are not fixed. Instead, temporality refers to attending to the past, present and future of people, places things and events in the study (Clandinin, 2013). It is for such reasons that Webster and Mertova (2007) described that narratives are constantly being restructured against recent occurrences because narratives are context-bound and influenced by long-term individual and narratives of the community. This indicates that the experiences of the teacher leaders in my study are in temporal transition driven by contextual influences of the past, present and future forces.

Secondly, narrative inquiry delves into the commonplace *sociality* by attending to both personal and social conditions simultaneously. By personal conditions, Connelly and Clandinin (2006) refer to the feelings, hopes, desires, aesthetic reaction, and moral disposition of participants while the social conditions refer to the settings under which experiences unfold such as cultural, social, institutional linguistic and familial narratives. Inquiring into personal condition enabled me to turn inwards by attending to my participant's emotions, aesthetic reactions, and moral responses (Connelly & Clandinin, 2006). Simultaneously, I could attend to how these are shaped by familial narratives, family stories, cultural narratives, social narratives, and more importantly, institutional narratives in their school. This enables me to turn outward by attending to what is happening to the events and people in our experience. The third commonplace, known as *place*, encompasses concrete, physical and topological boundaries of a place or series of places where the inquiry occurs (Clandinin, Pushor & Orr, 2007; Clandinin, 2013). Since this study focuses on teacher leadership across the five quintiles, place as a commonplace enables me to capture experiences/events which are inherit to the physical location.

To illustrate, let me describe how I approached the writing of Kirstern's narrative by paying attention to the three commonplaces. In Kirstern's narrative, the commonplace of temporality was made visible as he moved from initially struggling with outdated teaching resources to gaining digital tools through networking efforts at his school. He now demonstrates how he adapts his teaching to incorporate modern digital tools, while contemplating future integrations of technology to drive the 4IR in his school. The aspect of sociality was demonstrated by Kirstern balancing his personal passion with the challenging realities of his under-resourced school, which has been slow to adopt technological innovation for teaching and learning. In this instance, Kirstern's narrative intertwines his emotional resilience with the

changing school support for innovation. Lastly, the commonplace of place in his narrative takes note of the school's quintile four ranking. This highlighted the physical and economic context of the school.

4.4.2. Narrative inquiry as both phenomenon and methodology

Narrative inquiry operates as both a phenomenon and a methodology (Clandinin 2013). According to Clandinin and Caine (2008), as a phenomenon, narrative inquiry is a way of understanding people's experiences and as a methodology it is narratively inquiring into experiences and studying of individuals closely over time and in context. In other words, narrative inquiry is about understanding and investigating experiences (Clandinin & Rosiek, 2007), recognising that my participants' experiences are shaped by various narratives of life. This method extends beyond the individuals' experiences to include the social, cultural, and institutional narratives that frame and shape these experiences (Clandinin, 2013).

Therefore, in this study, narrative inquiry enabled me to converse with the teacher leaders about their experiences about innovation for teaching and learning within the 4IR, thereby studying their experiences in their world (Clandinin & Rosiek, 2007). It allowed for a deep understanding of each participants' experience as well as their interactions within broader social contexts (Clandinin, 2013), especially over the five school quintiles. Clandinin (2013) further places weight on the need for the inquirer to collaborate with participants over time, in places or series of places and in social interactions with environments, to understand their experiences. Resultantly, through narrative interviews conducted over time, I gained in-depth, relational understandings of my participants experience about their teacher leadership experiences for innovation in teaching and learning in their schools.

4.4.3 Ontological and Epistemological Commitments in Narrative Inquiry

To use narrative inquiry is to adopt a view of continuity of experience which is a fundamental category from which every inquiry proceeds. Clandinin and Connelly (2000) express continuity as the idea that experiences grow out of other experiences, and experiences lead to further experiences. As an ontological matter, narrative inquirers perceive experiences as continuously changing because both people and context in which they interact change (Clandinin & Connelly, 2000). It is through a relational ontology that continuity of experiences enables us to understand that each point in an experience has a past experiential base and leads to and experiential future. In short, Clandinin (2013) drives the idea that we live by stories, and we live in stories. For the former, these words direct our attention to who we are and how we are becoming, an idea that has been thought of as a set of complex relationships among knowledge, context, and identities (Clandinin, 2013). The latter indicates the interconnected and nested stories in which we live. This looks at the cultural, temporal, institutional and personal stories that shape

an individual. By these two driving points, narrative inquiry opens the possibility to think about research in relational ways. For me this is an important point since it creates an avenue to significantly know my participants and enter their world of experience. In this way, I explored the experience of my participants in relation to their contexts over time (Clandinin & Rosiek, 2007). The words of Clandinin (2007, p. 23) aptly capture the relational means which drives this inquiry:

...it inquires where lives meet in storied ways, where spaces between open up and create the possibility of world travelling and loving perceptions that where being in relation allow us to travel to other worlds and understand what it is to be the other and what it is to be ourselves in others eyes.

An important aspect of narrative inquiry is how it enables the exploration of participant's experiences through a relational or transactional, continuous, and social lens. Based on this principle, people, both individual and collectively, lead storied lives (Connelly & Clandinin, 2006); stories become crucial way to interpret and understand experiences. Connelly and Clandinin (2006) posit that people shape their lives and understand their past through stories, thereby making stories a portal into the participants' worlds and by which their experience of the world can be interpreted and made meaningful. Caine, Estefan and Clandinin (2013) view stories as the only way in which people can make meaning and understanding of other people's experience. Thus, stories are a fundamental part of narrative inquiry because experiences are perceived as storied phenomenon (Clandinin, 2013). This aligns with the epistemological commitment of narrative inquiry, whereby knowledge emerges from experience (Clandinin, 2013). Using stories for this study complements the South African individual since stories have always played a vital role in how knowledge about history, culture, tradition, or religion was passed down from generation to generation (Osei-Tutu, 2022). Globally, this view is shared by Clandinin and Rosiek (2002) who describe that storytelling has long been a part of human experience.

To stimulate the story telling process, I recognised that building rapport with my participants are central to narrative inquiry. Clandinin (2013) informs the readers of coming alongside their participants during the study. It is for such reason, I planned to meet with my participants on several occasion to build a relationship of trust. I also planned to share with participants my experiences as a teacher leader in the various schools that I have worked at. My aim was to create an environment in which the participants felt comfortable enough to share stories about their experience in a fluid and natural sense. Developing a relationship with participants was vital in this study because narrative inquiry is about people in relation, studying people in relation (Clandinin, 2013).

4.5 SELECTION OF SITE AND PARTICIPANTS

Narrative research, as emphasised by Clandinin (2013), seeks to understand lived experiences from the perspective of those who have lived them. Consequently, the selection of participants for this study was a careful process aimed at including teacher leaders from all five school quintiles. This process, known as sampling (Maree, 2007), involved making explicit decisions to choose participants who possessed predetermined characteristics. For this study, I purposefully selected five participants. Purposive sampling, as described by Rule and John (2011, p. 64), involves intentionally choosing individuals who are well-suited to advancing the research objectives. This approach is also referred to as judgment sampling (Rubin & Babbie, 2009). Moreover, scholars have demonstrated that purposive sampling ensures the selection of knowledgeable and experienced individuals.

Some participants were identified when I came across innovative and successful stories shared by teachers about their teaching and leadership practices on their

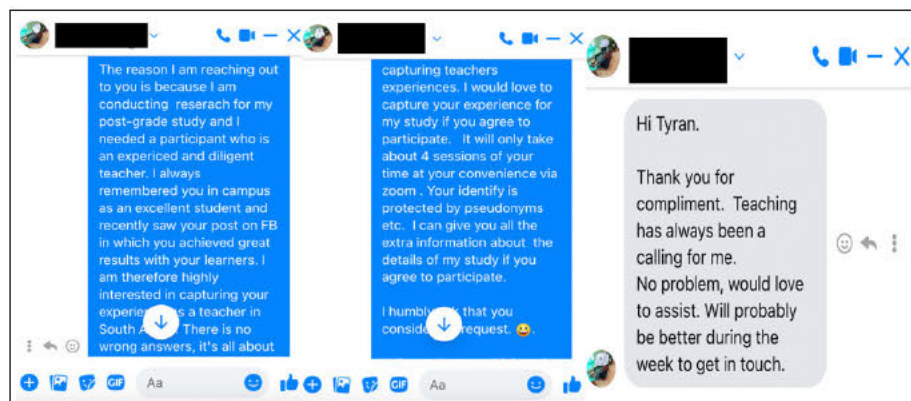


Figure 4.2. Facebook Messenger

Facebook pages. Intrigued by their achievements, I reached out to them through Facebook Messenger. Figure 4.2 depicts a Facebook Messenger chat between Simitha (a participant) and myself. This method allowed me to recruit three participants. Facebook Messenger proved invaluable in connecting with teachers whom I would not have been able to contact otherwise. However, recruiting other participants, particularly teacher leaders from the lower quintiles, proved to be more challenging. To address this, I leveraged my involvement in a 2018 program focused on promoting the Fourth Industrial Revolution (4IR) among aspiring mathematics and science learners. As part of a team of four teacher leaders, I worked to impart advanced mathematics, robotics, 3D printing, and coding skills to Grade 7 learners in primary schools. Through this program, I established a network with other teachers, which ultimately facilitated the recruitment of the remaining two participants for my study.

In selecting participants, I was mindful of including schools from each quintile that were conveniently located in KwaZulu-Natal (KZN). This approach, known as convenient sampling, as explained by Marshall (1996), involves selecting the most accessible sites or subjects. By adopting this method (Rule & John, 2011), I was able to keep transportation costs low. Moreover, the proximity of the selected schools

allowed for frequent meetings thereby building rapport between the participants and myself. The inclusion of participants from each quintile was crucial for understanding teacher leadership in the 4IR within diverse school contexts in South Africa. According to Archer (1995), key agents are instrumental in driving cultural and structural changes. Therefore, by purposefully and

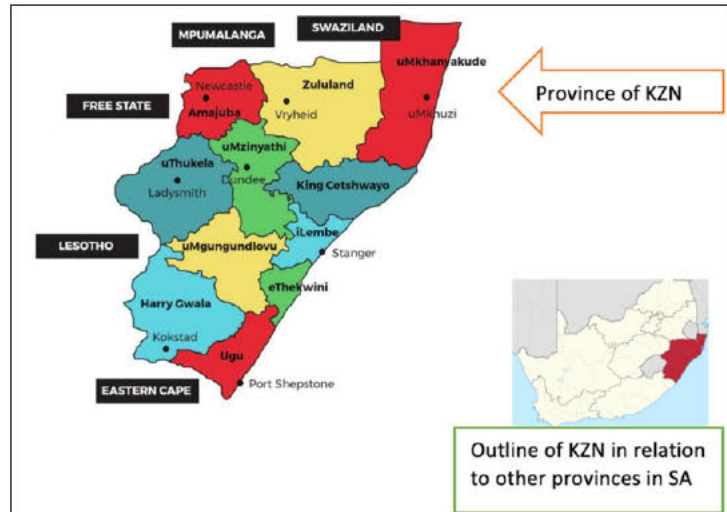


Figure 4.3- Map of KZN. Picture adapted from Christie & Monyokolo (2018)

conveniently selecting participants from each quintile, I believe that I obtained field texts enriched with valuable experiences from key agents operating in diverse contexts. Figure 4.3 depicts the 11 education districts in KZN. The participants in my study primarily taught in the iLembe, eThekweni, uMgungundlovu, and uGu districts. The inset map on the bottom-right-hand side of the figure, highlights the position of KZN in relation to other regions in South Africa. I adapted this image to clearly show the location of the schools where my study’s participants are employed.

4.5.1. Participant biographies

In the subsequent paragraphs, I provide a brief biography of each of the five participants selected for this inquiry:

Cindy: Quintile 1 school

Cindy lives in Stanger in KwaZulu-Natal. She is 59 years old and has been teaching for 37 years. She has been teaching at Esememe (sustainable) school for 32 years. Cindy’s rural school is located close to Stanger (see figure 4.3 for a precise location). Her school is part of the iLembe school district. This school is classified as a no-fee-paying school. She works in the foundation phase and currently teaches grade 3 learners.

Zama: Quintile 2 school

Zama is 47 years of age and lives in Scottsburg with her husband and 2 children. She teaches in a quintile 2 rural school in Port Shepstone called Ukuphikelela Ebuheni (Perseverance is virtue) Secondary School (see figure 4.3 for a precise location). Her school is in the uGu school district. She has been

teaching for 23 years. This school is classified as a no-fee-paying school. Zama predominately teaches English in the FET phase (grade 10-12).

Evalina: Quintile 3 school

Evalina, originally from Durban, Newlands, has spent 23 years living there and the past 8 years residing in the Phoenix area. She is a teacher at Hopeful primary (see figure 4.3 for a precise location), a no-fee-paying quintile 3 school in the Phoenix area. This school forms part of the eThekweni school district. With 9 years of teaching experience at this school, she works in both the foundation and intermediate phase, teaching a variety of subjects.

Kirstern: Quintile 4 school

Kirstern, who is 36 years old has lived in Verulam for all his life. He is currently employed at Westhill Secondary school, a quintile 4 school in the Durban-west area (see figure 4.3 for a precise location). Westhill secondary is a fee-paying school. This school is a part of the eThekweni school district. Kirstern teaches Natural Sciences and Mathematics. He has been working at his school for eight years and has a total of ten years teaching experience.

Simitha: Quintile 5 school

Simitha is 34 years old and has been teaching for 12 years. She was born in Port Shepstone and spent most of her life growing up there. After moving to a few schools during the earlier parts of her teaching career, she has now settled down in Pietermaritzburg with her husband and 2 children. She now works at Northville high in the Pietermaritzburg area, which is part of the uMgungundlovu school district. Northville High is a quintile 5, fee-paying school. She teaches Physics in the FET phase.

4.6 GENERATION OF FIELD TEXTS

By adopting the critical realist paradigm, I cannot accept at face value what is being said, observed or provided in interviews, observations or in documents as the ultimate truth (Sayer, 2000). Rather, the data I generate which is referred to as field text in narrative inquiry (Clandinin, 2013) must be used to probe deeper to unravel the best possible interpretation of the *real* that is being studied. Adopting a narrative view of experience within the narrative inquiry methodology underscores the generation of field text in narrative forms. According to Clandinin (2013) narrative denotes methods that employ the use of stories as field texts. Consequently, in this inquiry narrative interviews form the primary method for generating field text. Collage inquiry and photo-voice inquiry, both arts-based methods (de Jager et al., 2017) were used as secondary data generating tools. These methods serve as memory prompts encouraging

participants to 'see more' and 'tell more' in the narrative interview's lives (Jovchelovitch & Bauer, 2000). These methods of field text generation enabled me to produce thick descriptions of my participants' stories of experiences as teacher leaders in the 4IR in diverse contexts. In subsequent sections, I outline the use of each method.

4.6.1 Narrative Interviews

In alignment with Clandinin's (2006) recommendation to reconstruct social events from the perspective of the participants, narrative interviews were employed as my primary method of generating field texts. Narrative interview is defined as unstructured, in-depth interviews designed to create an environment conducive to storytelling, by encouraging participants through triggers to tell stories of vital events and occurrences within their social context (Jovchelovitch & Bauer, 2000). This method enables participants to express their experiences and perspectives through narratives, offering a natural mode of expression in their own informal dialect (Clandinin, 2006; Jovchelovitch & Bauer, 2000). Unlike pre-structured or structured interviews, which may constrain the natural flow of narratives (Cohen et al., 2007), narrative interviews utilise everyday communication styles like storytelling and listening, to surpass the confines of standardised questions (Jovchelovitch & Bauer, 2000). Narrative interviews are thus characterised by conversation, wherein the narrative accounts are collaboratively crafted by both the participant and the researcher. This method aligns with Clandinin and Connelly's (2006) perspective that people live storied lives and have a story to tell. Lia (2010) shares a similar view, expressing that narratives are not tightly structured but are collaborative and co-constructed by both participant and the inquirer. This indicates that both the inquirer and the participant are dynamically involved in the sense-making process.

To conduct narrative interviews, I follow the four-phase structure outlined by Jovchelovitch and Bauer (2000), involving initiation, main narration, questioning and concluding talk (refer to appendix B, pg. 285). For the *initiation phase*, I highlighted the nature, aims and objectives of my inquiry to the participants, along with the interview topics. In this stage I also informed the participants about the activities they will partake in, such as collage and photo-voice inquiry and outlined the proposed number of sessions. The main narration phase was focused on allowing participants to tell their stories based on the research sub-puzzles. During the first narrative interview session, I met with participants to hear their stories related to research sub-puzzle one. Subsequent sessions made use of collages and photos to drive the narrative interview towards addressing research sub-puzzle two and three. The questioning phase enabled me to probe deeper into the experiences of the participants to unearth the generative mechanisms.

In the concluding phase, I turned the recorder off to engage in informal discussion with the participants. I found this phase extremely pivotal for strengthening rapport with participants through casual talk about daily events. On several occasions, I recall engaging in conversation with my participants about parenting, general life challenges and other educational topics. For instance, Simitha and I spent several minutes talking about the challenges of parenting our kids while in other instances I recall chatting to Zama about finding purpose in religion. Throughout the narrative interview process, I remained cognisant of the three commonplaces of temporality, sociality, and place (see chapter 4.4.1, pg. 80) as I generated field texts.

4.6.1.2 Using Zoom Interview

To conduct each narrative interview, I used a video conferencing tool named Zoom. I decided to use this tool due to the COVID-19 pandemic creating uncertainty regarding face-to-face meetings. According to Archibald et al. (2019) Zoom is a collaborative, cloud-based videoconferencing service offering online meetings, messaging and secure recording of sessions. My choice for using Zoom aligned with the principles of the 4IR as it enabled me to engage with my participants in a blended physical-digital way. Zoom provided a host of digital tools that significantly simplified the data generation process (Horrell et al., 2015). A key advantage is its ability to store recordings internally without recourse to a third-party software (Archibald et al., 2019). This is particularly important for research where the protection of highly sensitive data is required, thereby taking ethical issues into consideration (Archibald et al., 2019). I found that this feature also facilitated easier transcription of the field texts, as Zoom built in recording and caption features enabled the conversion of spoken word into text.

Zoom provided a convenient, cost effective and flexible way to engage with my participants (Horrell et al., 2015). Travelling to rural schools across the province for each session would have been difficult and time consuming. During the interviews, the participants seemed comfortable in their homes. The screen-sharing function enabled the sharing of electronic materials, such as PowerPoints, digital photos and any other electronic material we needed during the interviews (Archibald et al., 2019). However, some of the challenges included load-shedding which caused internet disruptions resulting in lost meetings. To counter this challenge, I had to schedule meetings around the load-shedding schedule.

4.6.2 Photo-voice-inquiry and the need to consider photo-voice elicitation

In this inquiry, photo-voice serves as my secondary method for generating field text, serving as a tool to trigger memory recall and share stories (refer to appendix C, pg. 289). Photo-voice inquiry is defined as a method where participants capture photos that are related to a phenomenon that they wish to tell stories about (Wang, 1999). Participants are asked to capture photos depicting their practices of teacher

leadership for technological innovation in teaching and learning in the 4IR. The goal was for teachers to share stories of factors which enable or constrain their practice of teacher leadership in the context of the 4IR. Prior to entering the field to generate data, I experienced deep emotions of anxiety (refer to chapter 4.6.5, pg. 93 which outlines my reflection prior to entering the field), with concerns that relying primarily on interviews for the first research puzzle might leave many experiences untapped if participants were unable to recall specific details about their context, biographies and leadership/teaching practices over time. Realising the significance of the first session for attaining comprehensive insights into contexts, I sought to gather extensive details about their accounts. This prompted me to share my experiences with a critical friend (Samaras & Roberts, 2011); our conversation unfolded as such:

Tyran: I feel as if relying primarily on conversation through narrative interviews may not do justice to address the detail I feel I require to understand the participant in context. Context plays a huge role in my study. What if participants fail to recall important information, Ash?

Ash- I can relate to your emotion. Since you are already using photo-voice to address other questions, have you considered using photo-voice elicitation for your first session?

Tyran: Could you tell me more?

Ash- This will allow your participants to bring in photo's that they already have. They can also bring in metaphorical photos as well. I recommend you read my PhD. I used this method for my study.

Tyran- Thank you Ash. I will read around this.

Dialogue with critical friend

After reading around photo elicitation (Glaw et al., 2017) in research and its application in my critical friend's study (Govender, 2022), I found it fitting to adopt this method for addressing my first research sub-puzzle. Photo elicitation involves participants using photographs or visual mediums during interviews to facilitate discussion, evoke emotions, memories, and ideas (Glaw et al., 2017). A notable technique, termed *metaphorical photo elicitation* by Govender (2022) allows participants to use metaphorical images representing significant experiences when actual photos are unavailable. For instance, a participant might use a metaphorical image to represent their first day of work from 20 years ago, if the original photo is not available, but the event is significant to their narrative. Resultantly, using photo-elicitation (Glaw, et al, 2017) with metaphorical photo elicitation (Govender, 2022) enabled participants to share deep stories, as they are not confined to only using existing or newly captured photos.

For my study, I used photo-voice in conjunction with the Google Photo application. By using the Google Photo application, participants captured specific photos on their smartphones and upload them to the Google application. Participants were instructed to capture between 6 to 8 photos. I believe 6-8 photos would be sufficient for participants to relay their stories. In this application,



Figure 4.4 Zama's Google Photo album

participants then create an album to specifically upload photos they have taken to tell stories about. Once the album was created, participants shared this digital album with me via the Google Photo application. During the narrative interviews, participants used this album to tell stories. Figure 4.4 was an album created by Zama. She took 8 photographs over a period of 1 week and added them to her album. She shared this album with me prior to our third interview session. She then used her album to tell stories of why teacher leadership is an important practice to advance technological innovation for teaching and learning in the 4IR. Clandinin and Caine (2008) postulate that photographs can become a part of the field text. These photos assisted me as a narrative inquirer to help activate the telling of stories by participants (Clandinin & Caine, 2008).

4.6.3 Collage Inquiry

As a secondary method for generating field texts, collage inquiry was employed to facilitate deeper insights to better understand how the structure, culture and agency influence technological innovation in teaching and learning in the 4IR. Collage inquiry involves creating collages using fragments of found images or material which are glued on a surface to portray a phenomenon (Butler-Kisber & Poldma, 2010). My exploration of this arts-based technique led me to the *collage life story elicitation* technique (CLET) (Van Schalkwyk, 2010). CLET is a process of narrating life experiences using different modes of expression including both language and non-linguistic action, to narrate life experiences, thereby offering a deeper understanding of the symbolism informing the narratives (Van Schalkwyk, 2010). Collage making can overcome communication barriers to language, culture, expression, and memory (Van Schalkwyk, 2010). Collage inquiry served as a memory trigger, facilitating comprehensive storytelling. In alignment with Clandinin (2013), CLET enabled the integration of past experiences with present realities and anticipated futures, making it a significant tool for eliciting and exploring memories. Resultantly, these memories are used to attach meaning to the day-to-day realities (Van Schalkwyk, 2010), enabling an exploration beyond the empirical level of understanding to unearth generative mechanisms at the level of the real (refer to chapter 3. 4.3, pg. 64). Van Schalkwyk, (2010) concurs that collages enable one to

dig deeper into the lived experiences, perceptions about relationship with others and events that explain how their current reality unfolds.

For my study, I opted to use 'Pearltrees', a digital application, as a novel means for conducting collage inquiry. This application facilitates the creation of an online digital collection, encompassing pictures, words, and other snapshots to stimulate memory, dialogue and record a creative array of field texts. This application is different from other application as it permits users to gather visuals from a diverse range of sources, including social media platforms, internet sites, storage sites and personal smart devices. Pearltrees functions as a free, personalised media platform, offering a flexible and accessible medium for participants to compile digital collages. The concept '*pearl*' refers to the individualised content (pictures, words, sites, videos clips, etc.) the participants would like to add to a collection. Each collection is called a '*tree*'. For this research, participants were required to collect '*pearls*' to add to their unique '*tree*'. These trees then served as digital *collages* that were used by the participants to tell stories.

Refer to figure 4.5, which exhibits a section of Simitha's collage created using the Peartree application (Note: black highlights have been applied to the image to blur out Simitha's real name for confidentiality).The pictures, symbols and phrases collected by the participants on Pearltrees helped the participant explain how structure, culture and agency

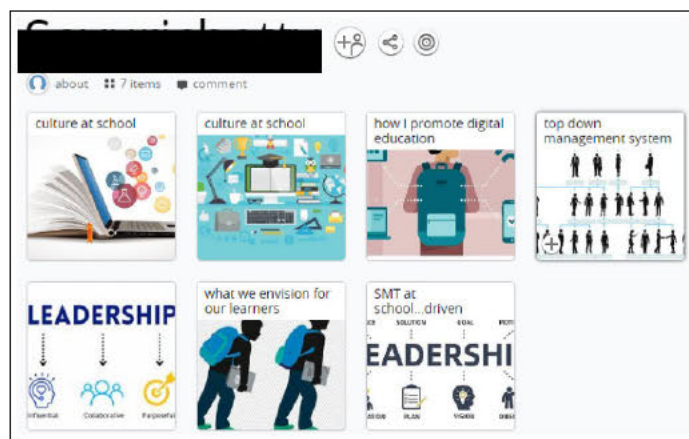


Figure 4.5 Simitha's Digital Collage

influence technological innovation in teaching and learning in the 4IR.

Collages enabled participants to reminisce about their life stories, capturing their perceived realities and interpretations of sociocultural practices, beliefs, relationships, and attitudes emanating from social encounters in different environments (Van Schalkwyk, 2010).

To effectively carry out the collage inquiry activity, I adopted Van Schalkwyk (2010) CLET process, including several interconnected steps. The initial step involved participants *creating their collages*, following a set of guidelines (refer to appendix D, pg. 290). This led to step two, the *storytelling phase*, where the participants shared stories about the significance of their selected images, discussing their choices and thoughts, feelings, and meanings associated with them. Subsequently, step three involved the *positioning phase* which enabled participants to locate themselves within the collage (at the time of

doing the collage), highlighting *silent voices* or absent images that would add depth to their story. Therefore, by positioning themselves in the collage, they actively dealt with conflicting voices/experiences of the past and present and try to make meaning of it.

Step four is called the *Juxtaposing phase*, which encouraged participants to contrast different narrative elements within their collage. This allowed the participant to reflect and explore the many positions on their collage. Van Schalkwyk (2010) points out that this juxtaposition reveals the interplay with negative events with positive outcomes and highly positive events with negatives outcomes. In a similar fashion, participants then selected three images on the collage that involve two pictures with similar meaning (positive or negative event) and one with an opposing meaning (positive or negative outcome). They then described the similarities and difference of the images and gave reasons why they considered them similar or different. According to Van Schalkwyk (2010), this step extends the self-reflective process as the participant engages in dynamic dialogue with relationships and functionalities embedded in the different images on his or her collage. The final step is called *reflection*. In step five, participants reflected on the entire collage and had the opportunity to tie loose ends by creating a sense of coherence from the collage.

4.6.4 Data Generation Plan

The data generation process in my inquiry spanned an extensive seven-month time frame. To manage this phase, I created a structured data generation plan, detailing the scheduling and content of both pre-session preparations and the actual interview sessions. The pre-session was crucial for preparing participants for their upcoming narrative interview. These involved sending detailed instructions via email, outline what participants should expect and prepare for in the main face-to-face interview session. The following is an outline of my data generation plan:

SESSIONS	TOPIC	ACTIVITY
Pre Session 1	Research participant permission/ meet and greet participants	Permission letters signed.
Pre Session 1	Explanation of research topic and negotiation of meeting dates	Explain my research topic to my participants. Set out meeting dates for the research journey.
Session 1	Narrative interview focusing on research sub-puzzle 1	Participants share biographical/contextual information. Participants share stories related to research puzzle one.
Pre Session 2	Photo-voice inquiry focusing on research sub-puzzle 2	Details and instructions of the task are shared with the participant via email/WhatsApp. Participants take a series of photos in the school, expressing why teacher leadership is vital in promoting technological innovation in teaching and learning in the 4IR.
Session 2	Narrative interview about the photos the participants have taken	Participants share stories about the photos they have taken.
Pre Session 3	Collage inquiry focusing on research puzzle 3	Details and instructions of the task are shared with the participant. Participants develop a digital collage. During the session, participants find pictures, words, symbols, phrases or quotes using the Pearltree application.
Session 3	Narrative interview about the collage developed by the participants	Participants share stories from their collages.
Session 4	Review of crafted story boards	Meet with participants to address any loop holes in the data or clear up any ambiguity.
Session 5	Review of crafted story	Participants read through the stories I have crafted to offer input about the degree of accuracy in capturing their stories.

Table 4.1: Data Generation Plan

4.6.5 Reflections: Pre and Post Experience of Working with The Participants

As a researcher, I eagerly anticipated entering the field, though the preparatory phase was overwhelming, leading to notable anxiety about initial interviews with participants. I was

concerned about my ability to establish rapport and feared

that the interviews might become too rigid. To understand and manage my emotions and document my

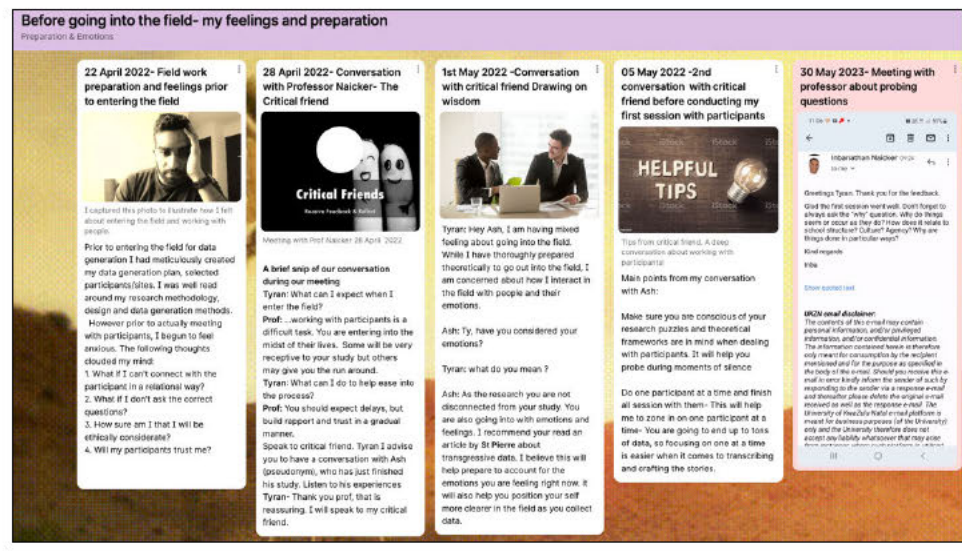


Figure 4.6: Diary entry prior to entering the field

thoughts, I utilised the Padlet application, which served as an emotional diary (refer to figure 4.6). On the 22nd of April 2022, the first entry on Padlet captured my hesitations and included a selfie that reflected my emotional state at the time. Subsequent entries included a discussion with my supervisor who advised me on fieldwork strategies and recommended that I consult a critical friend. It so happened, that a friend of mine had recently completed his PhD. The advice provided by my critical friend on his experiences in the field proved valuable. Our conversation on the 1st and 5th May 2022, discussed Connelly and Clandinin's (2006) advice of working alongside participants, emphasising relational work. Furthermore, at my critical friend's suggestion, I explored St. Pierre's (1997) concept of transgressive data, which is in alignment with my experiences in data generation. Transgressive data is described by St. Pierre (1997) as emotional, dream, sensual and response data. This data is often overlooked or deemed irrelevant in traditional qualitative studies (St. Pierre, 1997), yet when explored expands foundational knowledge of experiences. This theoretical perspective provided a frame for expressing my journey during the field text generation phase (St. Pierre, 1997).

Following each interview session, I documented key experiences on emotional data (St. Pierre, 1997) using Padlet. The emotional data often included deeply reflective moments, leading to periods of reflective silence between both the participant and myself. For instance, in my interviews with Simitha who is employed at a historically white school, governed by white leaders, she expressed gratitude for working at such a prestigious school. During the interviews I could sense in her tone that she was cautious when discussing the school's leadership. Overtime, as trust developed through gentle probing, she shared deep concerns about the masculine and racially homogenous state of leadership in her school, noting a significant lack of representation for women and people of colour. After sharing this emotionally charged moment, it led to a moment of reflective silence, underscoring the emotional weight of this challenge or experience. Figure 4.7 (a frame I documented during my second interview session with Simitha) notes how I reassured her of the experience she shared with me.

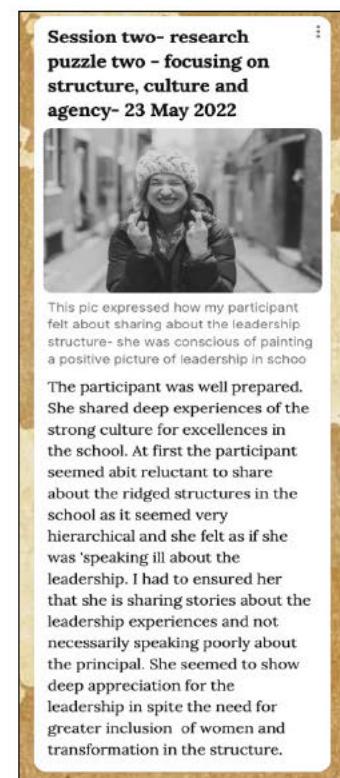


Figure 4.7: Reflection on my second session with Simitha

Another, participant, Zama in a quintile two school, shared her struggle as a black women overcoming the educational barriers imposed by apartheid laws, which limited her educational opportunities (refer to figure 4.8). Nevertheless, Zama completed her teaching degree in her late twenties and had to work in

other industries before finding her first job in a township school. These stories often left me highly emotional by profoundly shedding light on the personal and professional impacts of historical and systemic racial injustices. This engagement with my participants had me work through not only the participants emotional state but also my emotional responses influenced by my experiences as a non-white South African. The stories by Zama and Simitha illuminated the struggles endured by my parents during apartheid. These personal connections with the participants aligned with the education limitation I experienced as a person of colour, growing up in an economically poor household. The emotional data helped me approach the crafting of the stories with sensitivity. The interviews with participants often led to deeper conversations about overcoming such historical and systemic challenges, often serving as an informal therapy session in which we shared our role as change agents for the children we teach.

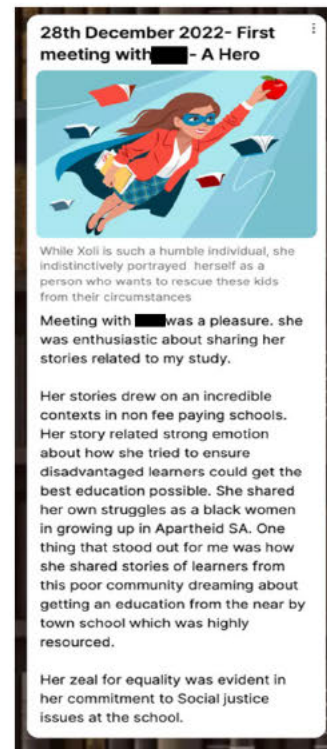


Figure 4.8 Reflection on my first session with Zama

During my study, I formed initial mental narratives about the participants' experiences based on prior literature about teachers in diverse contexts in South Africa. I had painted a metaphorical picture in my mind similar to St Pierre's (1997), envisioning where my study would go. I expected that teachers in lower quintiles might show limited engagement with technological innovation. This assumption was likened to engaging in a form of mental simulation or 'dreaming' about potential narratives (St. Pierre, 1997). However, the findings from the stories (in chapter 5 & 6) astonished me, unravelling a different reality, filled with potential for technological innovation in teaching and learning in the 4IR across all quintiles. While, this showed the gap between my dreamed anticipation and the lived reality of the participants, it led me to dream further. The stories they shared inspired me to dream of the South African educational landscape as one filled with opportunity to drive the 4IR. This dream is somewhat captured in my thesis image in chapter 9 (see figure 9.3.1, pg. 227). Overall, the engagement with my participants challenged and reshaped my perceptions, illustrating the significance of remaining open to emergent narratives that can alter information in literature or theoretical expectations.

The sensual data was about understanding the embodied experiences of my participants by drawing my attention to physical sensations, sounds, and visual details (St. Pierre, 1997). During the interviews, participants shared images of their schools' physical environments, which illustrated a stark difference between schools across the quintiles. For instance, I noted that teachers in lower quintile schools

managed classrooms with up to 80 learners, whereas schools in higher quintiles had as few as 20 learners in a class. The conditions of the classrooms, building and equipment created a sensual image about the participants' narratives. A striking example was shared by Zama, a teacher in a quintile two school, who shared a photo of her library in a cupboard project (refer to chapter 5, figure 5.14, pg. 123). The image was highly moving, underscoring the severe limitation in infrastructure and resources that teachers have to work with. In addition, Cindy in a quintile one school shared images of her school's farm and borehole project, which created a sensual understanding of the narratives of my participants. Conversely, Simitha in a quintile five school shared an arial photo of her school which included multiple sports fields, large buildings, swimming pools and parking areas, thereby showing the resources at this historically white school. Having never attended such a school myself, these pictures brought the narrative to life, showing the sensory aspects of their contexts. Overall, the sensory data enabled me to witness first-hand some of my participant's experiences in diverse quintiles. Apart from Kirstern's school, I found that the experiences and contexts of my participants varied widely from my own experience as a teacher and a learner.

Drawing on the concept of *responsive data* (St. Pierre, 1997), I was always careful not to view my participants as mere passive data sources. Inspired by Clandinin's (2013) notion of *coming along side* participants in the midst of their lives, I adopted a relational approach that enabled me to see them as active individuals in my inquiry and life. During data generation I built rapport through sincere conversation and being sensitive to their scheduling needs, showing respect for their time and contributions. The participants often prepared well for each session, sometimes voluntarily providing materials such as PowerPoint presentations and other documents. For instance, Evalina voluntarily shared her school's history document to enhance my understanding of her context, while Simitha's use of technology in a well-resourced school inspired me to explore various technological approaches to learning, such as blended and hybrid learning. Working with my participants in such a fashion, led to a fondness towards them, transforming and enriching the academic relationship in an empathetic way. This highlighted the significance of a supportive research-participant relationship in narrative inquiry, (Clandinin, 2013), aiding the investigation of sensitive and touching issues. As Clandinin (2013) mentions, '*entering in the midst*' of our participants lives creates meaningful engagement, that, though it must end, leaves a lasting impact on both the researcher and the participant. For this reason, when the data

generation stage drew to an end, It was a bittersweet moment. As I stepped back from data generation, I felt a sense of loss, similar to leaving in the midst of my participants lives, a notion that aligns with Clandinin (2013). This experience not only contributed to my academic journey, but also added to my personal narrative, highlighting the storied nature of human experience. At the end of my data generation stage, sometime in early 2023, I picked up my guitar and threw a few lyrics together to capture what I felt. See figure 4.9, describing my data generation experience.

Figure 4.9: Data reflection song:
Participant and Researcher We
Met One Day

Participant and researchers, we met one day
Uncertainty and nervousness, paved the way
Would the trust be there, would the story unfold?
Questions on my minds, I didn't know

Slowly but surely, we built a bond
From researcher and participant, to friendship fond
Your journey became my life lesson
Your experiences, my introspection

The challenges you faced, left me somber
The successes you shared, made my heart warmer
Your stories became a part of me
A reflection of your reality

As the sessions came to an end
A sense of loss, I couldn't pretend
Was it just a passing moment in my life?
Or a story that'll linger, beyond the final strife?

Participant and researchers, we may part
But the memories and lessons, will forever last
A brief journey we took together, with each other's aid
A bond we formed, but not made to last.

4.7 ANALYSIS OF FIELD TEXTS

Stories are fundamental to narrative inquiry, indicating that storied representation of the participants lived lives produce a credible account (Polkinghorne, 2002). Therefore, how I went about the restorying process impacts on the trustworthy re-telling of the story (Naicker, Pillay & Blose, 2020). Narrative inquiry as my chosen methodology facilitated a two-tiered analysis of the field texts: the first level, *narrative analysis*, and the second level, *analysis of narratives* (Polkinghorne, 2002). *Narrative analysis* is about how the stories are produced from synthesising field texts into coherent stories, while the analysis of narratives involves analysing the crafted stories (Polkinghorne, 2002). This two-tiered level of analysis is further explicated below

4.7.1 Narrative Analysis

After transcribing the data, I used *narrative analysis* to configure events into explanations and plots. Polkinghorne (2002) explicates that this analysis provides a retrospective explanation that links past events to demonstrate how an outcome might have surfaced. This level of analysis enables the field text to be transformed into research texts. To facilitate this process, I used storyboards. A storyboard is a visual outline made up of sketches, each representing one scene or camera shot in the video production industry (Mitchell et al., 2011). Unlike traditional narrative methods that focus on linking data elements to form a narrative, storyboarding offered me a visual and material approach to restorying, thereby providing a reflective and emancipator space for narrative inquiry (Mitchell et al., 2011). As Naicker, Pillay and Blose (2020) confirm, storyboards serve as a creative space for imaginative, tangible and reflexive space for narrative inquiry to work with the complexity of re-storying lived experiences. The story boards were

instrumental filtering out experiences that were unfortunately irrelevant to my study, thereby ensuring the chosen research texts aligned with the aims and objectives of my inquiry.

Instead of using the traditional method of creating storyboards, which involves sourcing different images and sticking them to a physical chart (Mitchell et al., 2011), I employed a digital approach using an online application known as Padlet. This application uses internet technology to provide a dynamic and creative space for constructing intriguing storyboards (refer to figure 4.10). Padlet interface allows for a flexible design choice, enabling the storyboards to be developed in a particular fashion. This application further supports the incorporation of various multi-media elements such as images, links and videos through an online search option, and also allows for the addition of captions or notes to each frame. I started by arranging the participant's life events into chronological order (Polkinghorne, 1995). Padlet's user-friendly interface enabled events to seamlessly be placed in chronological order. Throughout this process, I ensured that I carefully paid attention to *temporality*, *sociality* and *place* as I developed each storyboard (Clandinin, 2013). This three common places facilitated the process by ensuring I take note of disruptions, interruptions, silences and incoherences in my participant's experiences (Clandinin, 2013).

Once considering this, I developed plots to give the stories a structure and ensured coherence in the stories (Polkinghorne, 2002). Also referred to as emplotments (Naicker, Pillay & Blose 2020), I emphasised transforming field texts into coherent, emplotted, re-storied episodes of a person's life, featuring a clear beginning, middle and end (Polkinghorne, 2002). I conducted the narrative analysis in three stages: organised the events in chronological order, structuring these events into plots and synthesising the data events to develop a coherent story (Polkinghorne, 2002). Refer to figure 4.10, which illustrates the storyboard created for Kirstern, a teacher leader from a quintile four school. Each plot on the storyboard was represented with an image to harness the power of visual cognition in order to facilitate the process of data interpretation and meaning making (Naicker, Pillay & Blose, 2020). The digital storyboard as a visual, acknowledges the synergistic relationship between emotions and reason, thus creating a creative response to plots of voice, truth and representation (Naicker, Pillay & Blose, 2020). The act of selecting and annotating each plot on my digital storyboard, not only indulges my curiosity and imagination but also has the potential to evoke emotions of response during the interpretation of field texts. In addition to the aesthetic experience of creating a digital storyboard, my positionality is made available as I selected visuals for the storyboard and composed the emerging plots since value judgments are made visual (Naicker, Pillay & Blose, 2020). After selecting images to represent each plot, I annotated each plot directly on the storyboard (see figure 4.10). This aided in streaming the selections of field text from the transcriptions and preserved a record of my thought process

behind each plot, thereby ensuring coherence and linkage within the participants' narratives (Polkinghorne, 2002). For instance, in frame seven of figure 4.10, the combination of the image and its annotation ensured coverage of all relevant points impeding the adoption of technology in Kirstern's school.

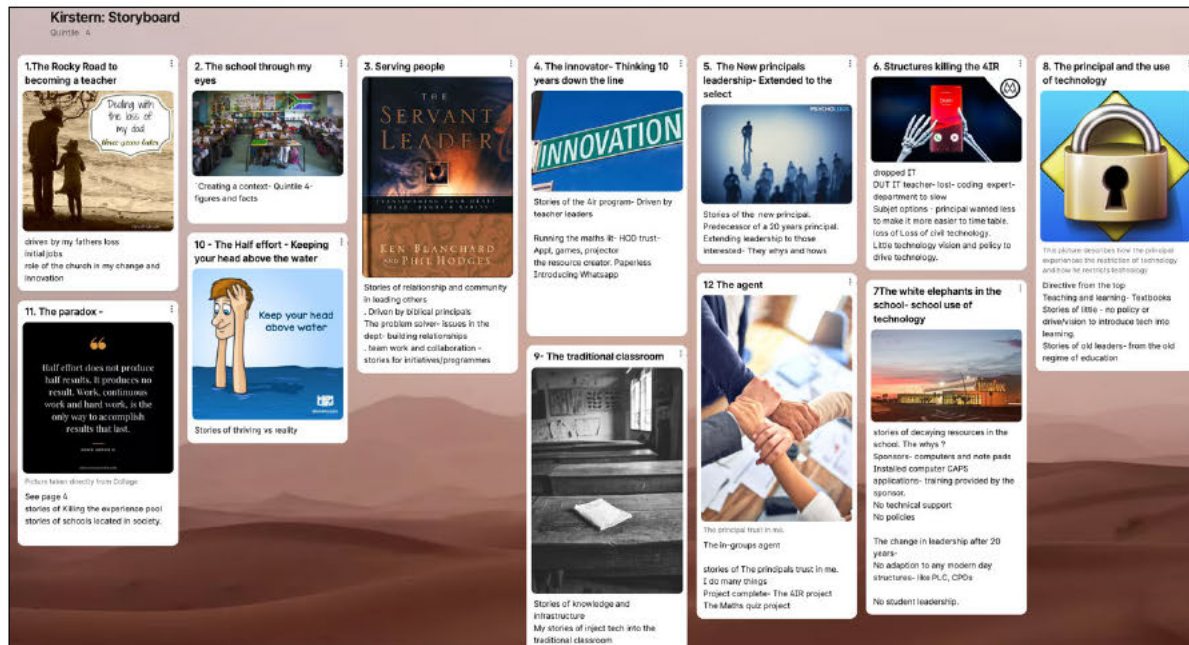


Figure 4.10- Kirstern's Storyboard

Creating the story boards was one of the aspects I enjoyed the most as it enabled me to acknowledge and make visual the intersubjectivity of interpretation as a creative process (Naicker et al., 2020). According to Cross and Warwick-Booth (2016) storyboard reflects the relationship of the researcher and the participant. Resultantly, to ensure the credibility of the narratives, I sent the completed storyboards to the participants, to inquire if these plots accurately represent a basis for their stories. In comparison to the participants reading their full stories, I found that the participants were responsive to this and eagerly gave feedback as it was a quick way to get their responses. Once the story boards were finalised, I co-constructed the narratives (Clandinin, 2013) and sent it to the participants to check and make amendments (refer to section 4.9.1, pg. 104 for a full account of the member checking process).

4.7.2 Analysis of Narratives

Analysis of narratives was used as a second level of analysis to analyse the re-storied narratives of each participant. This level of analysis included a close examination of the re-storied narratives to find concepts or themes appearing across the stories (Polkinghorne, 2002). To analyse the qualitative data, for both research sub-puzzle two and three, the constant comparative method (Glaser & Strauss, 1967) was utilised, employing a categorising, and connecting strategy. The constant comparative method (thereafter referred to as CCM) involves comparing and analysing data to identify patterns, similarities, differences,

and relationships (Glaser & Strauss, 1967). The CCM is a data analysis process and coding strategy that breaks data down into manageable pieces allowing them to be compared (Glaser & Strauss, 1965). According to Glaser and Strauss (1967) *coding* is a process of systematically categorising and labelling text to find patterns, themes and relationships. Codes that have a common theme or concept are grouped together to form a category. Glaser and Strauss (1967) informs us that these categories are more abstract than the codes and represent a higher level of data organisation. The formation of categories is described as a dynamic process since new text can potentially expand, refine or even challenge existing categories. The categories are continuously refined as more research text is analysed. This process culminates in a saturation point where no new research text/codes generate additional insights (Glaser & Strauss, 1967)

The method reflects characteristics attributed to its foundational origin- grounded theory (Glaser & Strauss, 1967). In this way I am not only interested in one category or pattern observed in data but how a category pattern may change dimensionally, which is found by invoking comparisons and seeing one pattern in relation to other patterns under various conditions (Glaser & Strauss, 1967). To illustrate, when examining the leadership practices of teacher leaders implementing new technological tools in their schools, I initially, identified categories such as innovation adoption and resistance management. As more data was compared and analysed across the different stories located in different quintiles- such as schools with different levels of technological resources, I observed how these practices changed. In schools with high-tech resources, innovation adaption, might involve advanced AI application strategies and enthusiastic engagement from staff, whereas, in schools with low tech-resources, the same category involved overcoming logistical and mindset barriers.

To facilitate this process, I used a coding software called Delve. This qualitative online software helps researchers organise, code and analyse data efficiently. I will now outline how I used CCM and the Delve software to analyse the data. On Delve, I first created a project to analyse research sub-puzzle two on the application. I then uploaded each participants story to the application. To ensure the analysis was inductive, my approach began with open coding, where I assigned descriptive labels to narratives segments without a predetermined framework, allowing themes and categories to emerge. I initially looked for incidence in which teacher leaders demonstrate leadership practices for driving technological innovation in teaching and learning. To do this, I read through each narrative to find *incidences* to make up categories (Glaser & Strauss, 1967). On the far right-hand-side of figure 4.11, it illustrates the various

categories that emerged across the data such as cultural intelligence in teacher leadership, empowerment and agency, professional development etc. I then looked for codes across all the narratives to add to those categories while also noting new categories that may emerge as data is compared. Each incident coded was then compared with previously coded

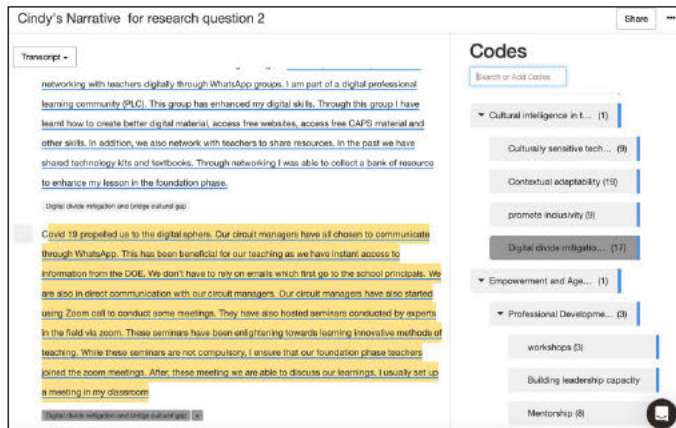


Figure 4.11- Using Delve software

incidents to refine and elaborate on these categories. For example, when an incident about the category 'cultural intelligence' was identified, it was compared with similar incidents and led to the understanding of underlying patterns across the contexts. Figure, 4.11 illustrates how the category cultural intelligence led to several subcategories with multiple codes assigned to them.

Throughout the process, memos were created after coding each category several times to capture emergent ideas and resolve analytical conflicts. (Glaser & Strauss, 1967). For example, I used memos to track changes across the quintiles- I recorded why certain decision were made to redefine certain categories, thus ensuring a clear audit trail of the analytical process (Glaser & Strauss, 1965). Memos also helped in linking codes across the different data sets, thus aiding in forming coherent theories and concepts from the data segments (Glaser & Strauss, 1967). It must be noted that as more data is coded, these categories are continuously compared and integrated, thereby deepening the analysis. This process continues until theoretical saturation is achieved (Glaser & Strauss, 1967), showing that no new research texts will add any new information to the category. Once the final categories were established, I was able to develop descriptors in chapter seven and eight that are distinctive to my inquiry.

For research sub-puzzle three, I followed the same process outlined above, however, I looked for research texts that outlined why teacher leadership is an important practice for technological innovation in teaching and learning in the 4IR. To illustrate figure 4. 12 shows how

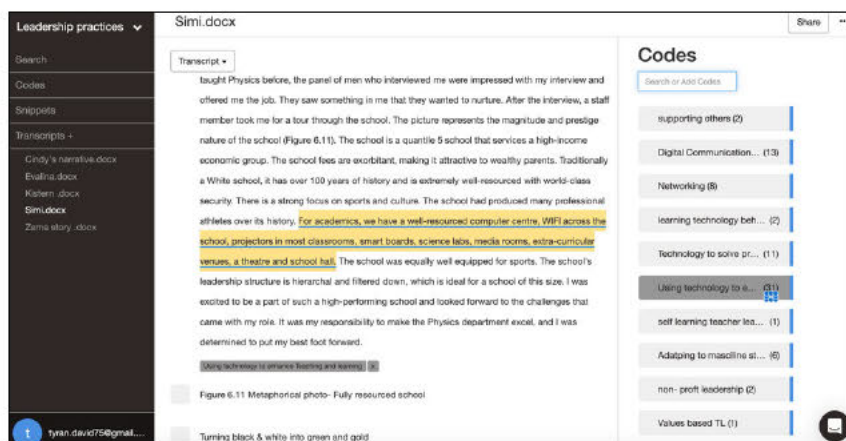


Figure 4.12 Coding for sub-puzzle 3

I open coded the narratives to find reasons as to why teacher leadership is important. This figure shows how multiple categories emerged with multiple codes being assigned to each category.

4.7.2.1 Reflections on using CCM and Delve software for my analysis

Using CCM enhanced my analysis by grounding it deeply in the research texts, leading to a rich and nuanced understanding of leadership practices for technological innovation. The CCM's depth is evident in the analysis chapters, where it connected grounding categories to broader theoretical concepts (Glaser & Strauss, 1967). Additionally, mapping the themes using CCM against my theoretical framework provided a structured yet flexible approach to understanding my findings and enabled new insights to emerge that were not part of my theoretical framework. For instance, cultural intelligence, data experts, prosocial teacher leadership etc. This shows how theoretical tenets manifest in practical cases, highlighting context which is a pivotal aspect of my study, particularly in relation to the educational technological dimensions of the 4IR. Comparing data across different contexts, helped to uncover how phenomena change under different condition (Glaser & Strauss, 1967), offering a holistic view of teacher leadership for technological innovation in teaching and learning.

During my inquiry, I came across an online tool called Delve, a software facilitating the CCM process. These tools proved highly effective due to its user-friendly interface, enabling for projects segregation for each sub-puzzle and streamlined data set comparisons. This tool enhanced my coding process by enabling easier categorisation, code tracking and cross narrative comparison on one interface, thereby supporting the nuanced application of CCM. Figure 4.13 shows some of the categories and bank of codes labelled for one of the research sub-puzzles. The bank of codes served as a centralised collection of research

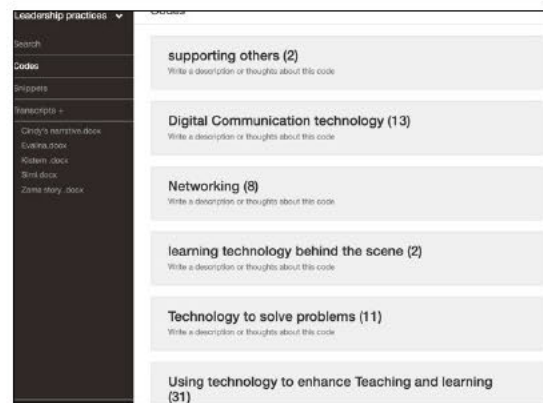


Figure 4.13 Bank of Codes

texts, enabling me to simply incorporate necessary excerpts into my analysis

chapters when discussing themes, rather than manually looking through each of the five narratives. Initially, I considered using concept mapping for thematic organisation (Butler-Kisber & Poldma, 2010), however, I found that Delve's tools together with CCM enabled for a closer engagement with the data by ensuring continuous comparison and integration of research text until thematic saturation (Glaser & Strauss, 1965), was achieved, thereby capturing the nuances in the narratives.

A minor limitation of this software is its reliance on a secure internet connection to access all its functions. It does not have an offline option, thereby making all work inaccessible during weak internet connection or electrical power outages like loadshedding. The subscription started from \$50 a month. Nevertheless, all projects are stored on the application even when one ends the subscription.

4.8 ETHICAL ISSUES

This study sought to understand the experiences of people in their daily lives. As a result, a sincere attempt was made to ensure that sensitivity through ethical considerations was adhered to. As a narrative inquirer, I have the ethical responsibility to protect the privacy and dignity of my participants (Clandinin, 2013). Therefore, I entered into the mist of my participants' lives in a polite manner ensuring mutual respect, dignity and connectedness between researcher and researched, and between researcher and the communities in which they live and work (Clandinin, 2013). For example, I respected all views shared by my participants, while being extra-cautious not to impose my own views on them. I approached each interaction with empathy, particularly when participants needed to cancel scheduled sessions. Illustrating empathy and interest in my participants' conversation became an ongoing habit throughout my study, thereby aligning with Ellis (2007) who noted the importance of empathy in research. Furthermore, I ensured that I was culturally, politically and socially sensitive to the stories they shared regarding their personal lives and work lives.

To further ensure ethics were meticulously followed, I rigidly followed procedural ethics as emphasised by Guillenmin and Gillam (2004). Procedural ethics include informed consent, confidentiality, rights of privacy, avoidance of deception and the commitment to do no harm (Guillenmin & Gillam (2004). For this inquiry, I obtained ethical clearance from the University of KwaZulu-Natal, confirming adherence to these essential ethical standards (refer to appendix E, pg. 192). In addition, permission was granted by the KwaZulu-Natal Department of Education to conduct research in schools within the province (refer to appendix F, pg. 293) and this was further validated by gatekeeper permissions from principals of the five selected school. I sent detailed letters describing the study's objectives and methods to each principal, who in turn provided access to their schools (refer to appendix G, pg. 194). Lastly, to ensure informed consent, all participants in this inquiry were given consent letters to sign (see appendix H, pg. 196 & I, pg.198). Their signatures indicated their voluntary participation in the inquiry.

I sent letters to each of the principals in which I outlined the nature of my study and my research intentions with the school and its teachers. In response to my letter, all principals granted me access to their schools. Lastly, I adhered to ethical procedures by giving the participants informed consent letters to sign if they

agreed to participate in my study. The consent process, which included a meeting with the participants, outlined the protection of their confidentiality by using pseudonyms. It is further made clear in the informed consent letters that they are free to withdraw from the study at any point with no consequences attached. Guillenmin and Gillam (2004) mention that *ethics in practice* must be adhered to throughout the study. This concept refers to the unpredictable and subtle ethically vital moments that happen while data is collected (Guillenmin & Gillam, 2004). In response to this, I adhered to a non-judgmental stance, accepting and listing all stories shared by participants with respect and appreciation. Additionally, as a narrative inquirer, the participants' are not simply seen as field text objects, but rather as people with whom I intend to come along side by establishing rapport and trust (Clandinin, 2013).

4.9. TRUSTWORTHINESS

In narrative inquiry, scholars direct researchers to address issues of trustworthiness in terms of verisimilitude and utility (Clandinin & Connelly, 2000; Loh, 2013). For this study, I ensured trustworthiness is observed by adhering to all aspects of verisimilitude and utility.

4.9.1 Verisimilitude

According to Connelly and Clandinin (2000) verisimilitude stands as a reliable criterion to attain and assess the value of narrative inquiry. This enabled my narratives to ring true and give the readers a vicarious experience of the participants' experiences and thereby enabling them to understand the decision made and the emotions left by the participants in the study. To that extent, verisimilitude was achieved by engaging in member checking. Member checking involves the activity of taking the crafted stories back to the participant to review and to offer an alternative interpretation (Loh, 2013). After

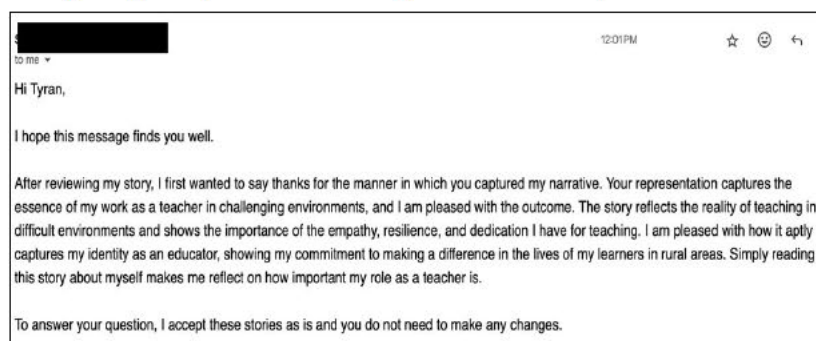


Figure 4.14 Example of member check by participant: Zama

each participant reviewed the re-storied narratives, they expressed deep appreciation for how accurately I captured and retold their stories. They acknowledged these narratives as a true reflection of their experience, as illustrated in figure 4.14 which includes an example of one of my participant's recognition for their satisfaction with the representation of their story. However, during member checking, one participant, Cindy, expressed concern about one of the images used from their photo-voice in the stories (see figure 4.15), noting that while the faces are unrecognisable, the background in the image was unique

to the school and could potentially identify the school. Resultantly, I assured the participant that I would blur the background completely, making its unrecognisable.

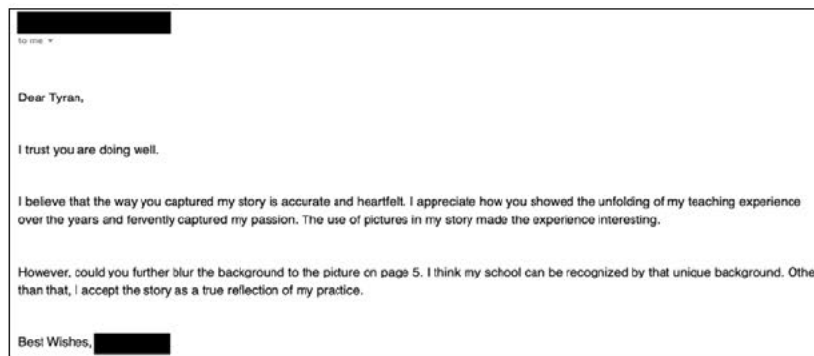


Figure 4.15 Example of member check by participant: Cindy

In addition, Loh (2013) proposes that peer validation and audience validation follow member checking to aid in the establishment of trustworthiness of interpretation. Peer validation is useful as it helped me seek validation from other researchers in a similar field of research. These peers are generally familiar with the related literature and would be able to provide some sort of corroboration concerning my interpretation of data. For this inquiry, I engaged critical friends at two key stages; firstly, to critique my storyboards during the narrative analysis process and secondly, after I analysed the data in chapter seven and eight. In alignment with the approach advocated by Naicker, Pillay and Blose (2020), these critical friends served as a sounding board to provoke my thought process and provide justifications for the choices I made on my storyboard and analysis chapters. My critical friends who provided feedback during this inquiry, are highly familiar with educational research and teaching. One of them holds a doctorate in education and the other possesses a master's degree in educational psychology, while currently pursuing her PhD. The last critical friend is a teacher who holds a degree in education. Not only do they have experience in research, but their educational backgrounds are also internationally diverse, with two having been educated in South Africa and the other in England. Table 4.2 illustrates who my critical friends were and the research sub-puzzles which they peer validated:

Name of critical friend	Educational background	Research sub-puzzle validated
Dr. A (Pseudonym)	PhD in Education Leadership	Sub-Puzzle 2 and 3 (Chapter 7 & 8)
Ms. Salma (Pseudonym)	Masters in Educational Psychology	Sub-Puzzle 1 and 3 (Chapter 6)
Ms. Aney (Pseudonym)	Bachelor of Education	Sub-puzzle 1 (Chapter 5)

Table 4.2: Peer Validation-List of critical friends

I have attached an example of an email that I sent to my critical friends requesting their assistance to peer validate

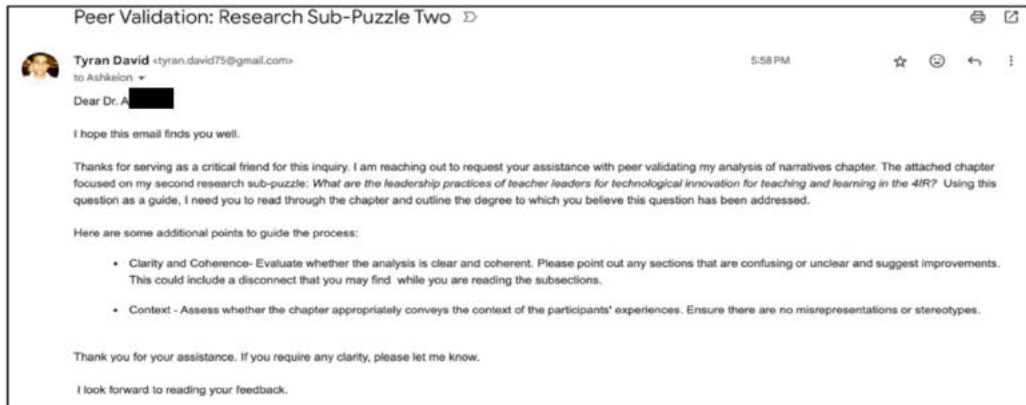


Figure 4.16 Request for peer validation

my analysis chapters. Figure 4.16 illustrates one of the Emails sent to request peer validation.

After sharing my work with my critical friends, they provided feedback that helped me improve my analysis. They confirmed the degree to which the stories represented the participants and ensured that the research sub-puzzles were being answered. They offered insights that I would have missed if I had not conferred with them. For instance, they pointed incoherences and minor reference issues. I have illustrated two examples of peer validation. Figure 4.17 is a response from Dr. A.

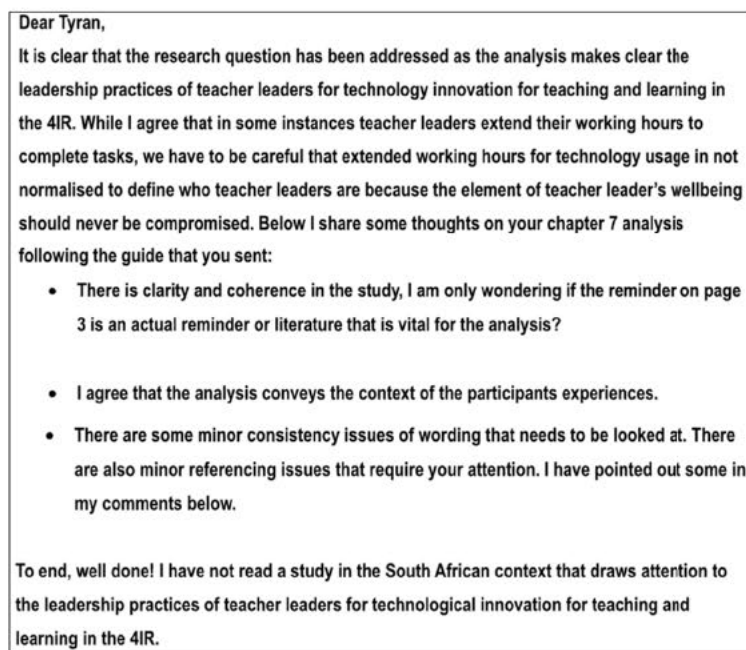


Figure 4.17 peer validation from Dr. A

Figure 4.18 is a response from Ms. Aney.

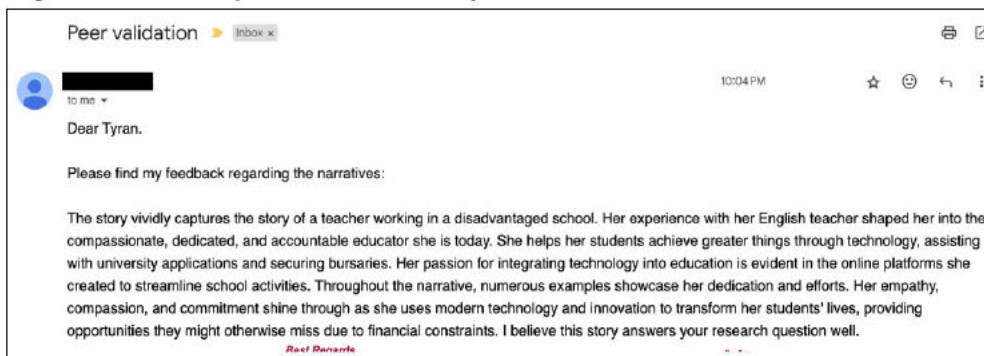


Figure 4.18 peer validation Aney

In addition, I sought audience validation from the primary intended users, readers and from whom the study is about (Loh, 2013). To facilitate this process, I arranged a brief presentation on my research analysis chapter for teachers and leaders at my school, where I serve as Head of Department in a high-

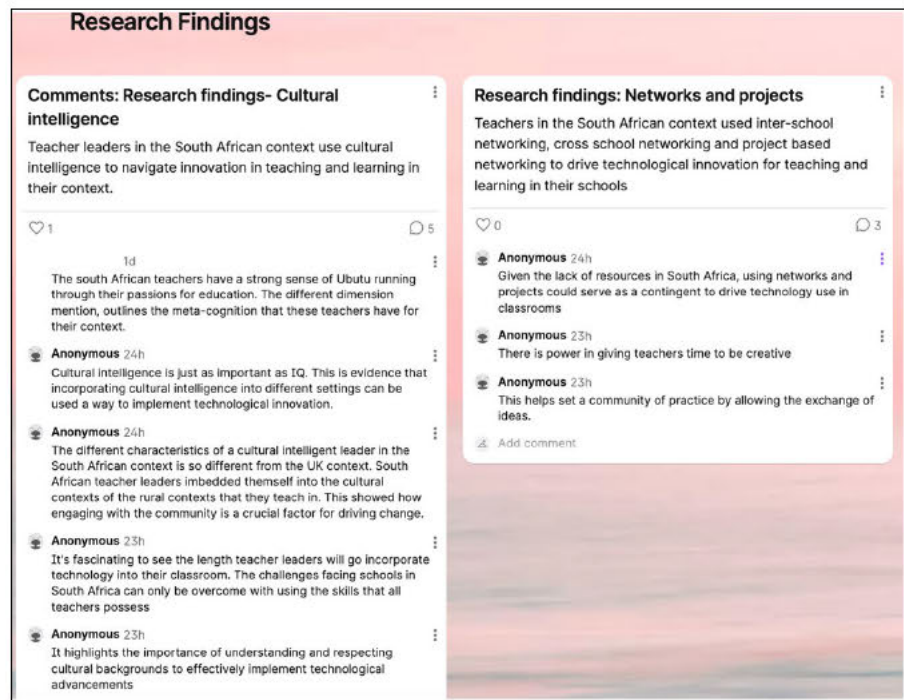


Figure 4.19 Audience validation

performing school. With the principal's permission, I used one of our CPD sessions to present my analysis chapter to my colleagues. Following my presentation, I encouraged them to provide feedback via Padlet. On Padlet I summarised the main findings and then asked my colleagues to comment anonymously. Some of their comments are captured in figure 4. 19.

4.10 CONCLUSION

This chapter delved into the methodological frameworks underpinning this inquiry. The chapter started by unpacking my paradigmatic position which aligns with critical realism. Subsequently, I expounded on the qualitative research design, outlining its suitability for the nature of this inquiry. The chapter then transitioned to a discussion on narrative inquiry as the core methodology guiding this inquiry. Thereafter, I outlined a comprehensive overview of the field text generation methods utilised and incorporated my reflective insights on the data generation process. Subsequently, the chapter explained the analytical approaches utilised to interrogate the field texts and included my reflections on the data analysis process. Finally, the chapter unpacked the ethical procedures and trustworthiness measures used in this inquiry. This chapter provided a significant methodological foundation for this inquiry offering a comprehensive lens through which to view and carry out this inquiry in a targeted manner. The forthcoming chapter focuses on the narrative analysis of my participants' field texts by presenting the co-constructed stories from participants in quintile, one, two and three schools.

CHAPTER FIVE

FROM QUINTILES TO QUANTUM LEAPS: UNVEILING THE NARRATIVES OF TECHNOLOGICALLY INNOVATIVE TEACHER LEADERS IN QUINTILE 1, 2 AND 3 SCHOOLS IN THE 4IR LANDSCAPE

5.1 INTRODUCTION

In chapter four I presented my research methodological 'toolbox' for my study. The purpose of the chapter was to discuss the methodological trajectory of this inquiry. Not only did the chapter document and describe my research methodology, but to a large extent, it vicariously captured my immersion in the study as I sought to generate field texts of teacher leaders in the 4IR for technological innovation for teaching and learning. Underpinned by narrative inquiry methodology, I generated data using narrative interviews, collage inquiry and photo-voice inquiry. This chapter marks the dawn of the analysis for my field texts. The purpose of this chapter is to unpack the findings to my first research question: *What are the stories of teacher leaders in diverse contexts for innovation in teaching and learning in the context of the 4IR?* To remind the reader, narrative inquiry employs a doubled pronged approach to analysis. Reflected in this chapter is the first level of analysis called *narrative analysis* (Polkinghorne, 2002). Chapter seven and eight delve into the second level of analysis known as *analysis of narratives*. Narrative analysis is the process of re-storying the field texts (Polkinghorne, 2002). Each narrative was carefully crafted around the three common places (See chapter 4.4.1, pg. 81) (Connelly & Clandinin, 2006).

The title 'from quintile to quantum leaps' is a metaphor to capture the lengths teacher leaders will go to ensure technological innovation in teaching and learning in spite of their contexts. This chapter focuses on the narratives of teachers in quintile 1, 2, and 3 schools, which are recognised as the poorest and categorised as "no-fee-paying" schools (Naicker, Myende, & Ncokwana, 2020). Given their poor contexts, these schools are not permitted to charge school fees and therefore receive funding from the government. Consequently, the challenging conditions they face significantly impact leadership, teaching and learning practices in these contexts. Scholars have identified that limited funding and contextual difficulties have compelled leaders in these schools to adopt a form of transgressive leadership, characterised by context-driven approaches (Naicker, Myende, & Ncokwana, 2020). Moreover, the inadequate financial resources provided by the government have resulted in minimal technological innovation in these schools, leaving teachers with limited access to technological resources (Maringe & Moletsana, 2015). Mestry (2018) provides evidence to substantiate the claim that teaching and learning in historically non-white schools, particularly in disadvantaged contexts, are primarily driven by less qualified professionals who struggle to provide high-quality, technologically innovative education. In stark contrast, formerly white schools

attract highly qualified teachers, possess abundant resources, and meet the technological requirements of the 4IR (Naicker, Myende, & Ncokwana, 2020). These disparities are further exacerbated by South Africa's classification on the GINI Index as one of the most economically unequal societies worldwide. The index reveals that 75% of the population reside in impoverished rural and township areas, characterised by weak socio-economic infrastructure, principally agrarian societies, and unreliable technological and internet services (Maringe & Moletsana, 2015). Considering the significant contextual differences that influence technological innovation in teaching and learning, it is pertinent to separate the narratives of teachers in quintile 1, 2, and 3 schools from those in quintile 4 and 5 schools. This approach allows readers to gain a comprehensive understanding of the diverse school context spectrum that shapes technological innovation. Hence, this chapter presents the stories of Cindy from a quintile 1 school, followed by Zama from a quintile 2 school, and finally with Evelina's story from a quintile 3 school. I then conclude the chapter by outlining key learnings relevant to each context.

5.2 Cindy's Story- Empowering minds from quintile 1: Unleashing teacher leadership

Rurality... holds a lasting place in my heart...

Born in the rustic village of Tugela in 1964, the charm of rurality has always captivated me. Settled along the scenic north coast of KwaZulu-Natal, Tugela was a village of wooden and iron structures, where a modest marketplace and a handful of shops formed the heart of the community. As a young child, I attended the local rural primary school. However, as I advanced in my educational journey, I had to venture beyond Tugela's boundaries and travel to KwaDukuza for secondary school education. The educational landscape during the 70s was a mix of tradition and strict discipline. Teachers imparted their wisdom, and we diligently transcribed their lessons into our notebooks. Academic excellence was paramount. Yet, beneath the surface, a political storm raged in our nation. Shielded from the turbulence of apartheid's strife by my parents and the close-knit community, I grew up unaware of the urban upheavals. There were always rumours of boycotts and attacks aimed at the rural area- this kept me in fear. My bond with Tugela deepened, and a passionate desire to liberate rural education blossomed within me. Driven by this passion, I embarked on a path to become an educator. In the early 80s, I pursued a diploma in teaching. Throughout my distinguished 37-year career, I dedicated myself to teaching in rural schools. Rurality became more than a mere backdrop; it became my purpose. I yearn to empower those who reside in the heartlands, to provide them with opportunities equal to those in urban areas. *Rurality*, with all its beauty and challenges, *holds a lasting place in my heart*—a driving force behind my quest for educational emancipation.

A self-sustaining school

My first teaching appointment was at a rural primary school in the North Coast in 1987. Thereafter, I transferred to my current school, called *Esememe (sustainable) school* in 1991. The school is in a deep rural serene area about 12km from KwaDukuza. The school is about 500m from the nearest transport/bus route. This is an old school which was opened in the 1950's. The school has 500 learners with 11 teachers, 2 HODs and 1 principal. Over the past year our school has opened its 1st grade 10 class. We therefore have both GET and FET phases in school. Our school services children from extreme poverty. Most people in the community are very elderly and uneducated. A vast majority of the children stay with their grandparents. The learners' parents usually live in the urban areas. In addition, our school has many orphaned learners and some cases of child headed homes. As a result, it is difficult to communicate with parents/guardians. Most printed letters are not understood by grannies or never reach the parents. Facilities in the community are very minimal. Our school has been a beacon of hope to the community.

Our principal together with the teaching team plays an active role in helping address social ills faced by the community. We believe that our learners basic needs must be met while we implement innovation and technology in the classroom. For instance, I have worked closely with the Department of Education (DOE) to get a borehole installed in our school. It is extremely sad to see the number of people in our community who come to the school daily to fill up water into buckets and barrels. These people still do not have running water in their homes. I am a key member of the school food nutrition program. The school nutrition program is the lifeline of the community. Every child in our school depends on the nutrition program for their lunch. While the policy from the DOE expresses that it will support quintile 1 schools, we have learnt that the DOE is unreliable when it comes to service delivery.

In February 2023, all funding from the DOE for the nutrition programme was suspended due to corruption allegations on the side of the DOE. Resultantly, as a school we had to turn to our contingency plan. Our school has started a farm. I have worked closely with the DOE to get the farm running. The DOE provides us with seeds. Over the past 3 years we have been using the yield for the school nutrition program and selling



Figure 5.1 Photo elicitation- Eco-school certificate

items to the staff members. Our school has even been given awards (see figure 5.1) for our level of sustainability and efforts to maintain an eco-conscious environment. As a teacher leader I am constantly raising money for the school to address social ills. In this regard I have influenced my school to work to become a *self-sustaining school*. We have members from the community to help with the school farm. By having this farm and employing community members, we have secured funding from the DOE to keep

this initiative alive. This project has also enabled us to secure donations from businesses in the town. This money is used to enhance our resources in the class. For instances, we used some of this funding to get our multi-media technology room going. The funding we get from the DOE is only enough to pay the bills. I have a deep connection with this school and its community. This school is my heart.

Introducing technology into our school

The use of technology in our school started to take off in 2020. Prior to this we only used worksheets, notebooks, and the chalk board to engage our learners. The change in our teaching took place when the DOE finally approved to sponsor us a projector and a white screen. Initially, if we wanted to use the projector, we had to use it in the media room because this was the only venue with a desktop computer. I was one of the first teachers to purchase my own laptop to make use of the projector in my classroom. I would carry the projector and screen from the school safe to connect it to my classroom at least once a week. I was persuading teachers in the foundation phase to make use of technology, but many teachers were still comfortable with their pervious way of teaching. I assumed that the younger teachers would automatically make use, but it was not the case. As a result, I decided that I would lead by example. This involved doing all my planning at home. I would use my WIFI at home to create PowerPoint, download videos/songs and create teaching material. The songs and videos on the PowerPoints captivated the learner's attention quickly. The colours and images encourage learners to stay focused. This not only encouraged the learners, but other teacher also purchased laptops and would make use of the project.

As an experienced teacher, I have learnt that you must use differentiation to teach our learners. I remember in the early 90's we had multigrade classroom. I would always notice how the mixing of the bigger grades with the small grades almost propelled the younger higher ability learners to learn from the bigger grades. Since I bought my laptop, I can differentiate activities for groups of learners. I would set high order tasks on my laptop for the higher ability learners to work on while I could spend one-on-one time with the lower ability group. I would sometimes allow the lower ability group to watch a



Figure 5.2 Collage inquiry- Crowded classrooms

video on my laptop while I work with the higher ability group. The only problem with this is that it only works with small class numbers. In classes with 30 learners and more, this becomes very difficult to do. A major problem in the school is the high number of students in our classrooms (*see figure 5.2*) and limited space available. In some classes we have three learners sharing a desk.

Using gaming apps to teach math...

In my pursuit to promote innovation in teaching at school, I sought the expertise of an individual that could lend a helping hand. That's when I partnered with Anthony, a qualified actuarial scientist, back in 2019. Anthony introduced a *mathematical gaming application* that would revolutionise the way learners approached algebra and geometry in our school. Together, we embarked on a journey of transforming education through technology. Initially, Anthony would visit the school, working closely with small groups of ten learners. Armed with around 20 devices, he guided the learners to solve challenging math problems through games (see figure 5.3). As time went on, we decided to take things further and organise competitions among the foundation phase learners within our school. The competitions became a highlight, with Anthony dedicating his time to our school annually to host his event. During this period, I had the opportunity to enhance my computer skills. Anthony generously shared his knowledge and introduced me to basic mathematical gaming applications that I could utilise on my own laptop. As a result, I started incorporating these games into my lessons, allowing learners to use my laptop in groups. However, due to limited resources, it was not always practical, as a large group of learners would crowd around a single device. To address this, I ensured that each learner had a chance to experience the games throughout the course of a week.



Figure 5.3: collage inquiry- Math's games

In addition to mathematics, I found another valuable use for my laptop in the classroom. I discovered the power of sing-along phonics tunes available on platforms like YouTube. Knowing that the children in our community had a deep love for song and dance, I harnessed this interest to enhance their English phonics skills. The students could now watch videos, sing along, and dance, resulting in improved proficiency in Isizulu learners' English phonics. Of course, integrating technology into my teaching journey came with its fair share of challenges. At the age of 59, I had not grown up in a technologically driven society. The efficient use of laptops and smartphones was unfamiliar to me. Decades had passed without a strong push for technology in schools, and our leaders had not made it a compulsory part of education. Yet, recognising the undeniable presence of technology in our lives, I was determined to adapt and learn. I immersed myself in technology and acquiring basic Microsoft skills. I sought guidance from fellow professionals, enrolled in courses, and even challenged myself to create electronic teaching materials. The hardest part, however, was letting go of the traditional methods of teaching. I had grown comfortable with relying solely on printed materials and handwritten notes. But through this journey, I learned that children also benefit from visual and interactive learning experiences—watching videos, playing games,

and engaging with electronic materials. Yet, it remains a bittersweet reality that we still depend on traditional methods due to the lack of equipment to fully embrace the potential of technology in education.

Mr Johnson

Our principal, Mr Johnson, has been leading our rural school for almost 20 years, bringing about gradual changes in terms of technological innovation and teacher empowerment. At 63 years old, he has always emphasised a culture of lifelong learning and teamwork among the staff. To foster these values, he created a plaque (see figure 5.4) outlining the core values of a team, focusing on instilling these principles in the teachers. Mr. Johnson believes in regular engagement with the staff and provides professional



Figure 5.4 Photo Voice- School Values

development (PD)opportunities tailored to their needs. Recognising the impact of the COVID-19 pandemic, he prioritised mental health and physical well-being as crucial aspects of teaching. To support the teachers through this challenging time, he organised information sessions, activity sessions, and social events as part of their PD. In addition, to fostering a sense of unity, Mr. Johnson has also distributed responsibilities among the teachers, promoting a strong culture of accountability. This approach has yielded positive results, as teachers have taken ownership of their duties and become more invested in the school. For instance, due to the need for fundraising, Mr Johnson allows teachers to create initiatives aligned with their passions. This has resulted in successful events such as dramatic art concerts in collaboration with the Durban Playhouse and market day programs.

Recognizing the importance of technology in education, Mr Johnson and I had been actively working with the Department of Education (DOE) since 2022 to establish a computer room in the school. Finally, in 2023, the department approved the development of a small computer room equipped with 10 laptops. Though it required using one of the limited classrooms, Mr Johnson took a proactive approach and developed an ICT policy in collaboration with staff members, the School Governing Body (SGB), and student leaders. While the policy is not yet finalized, it addresses crucial issues such as internet usage by teachers, privacy concerns, and curriculum integration. However, Mr. Johnson is concerned about the additional cost of security and the potential lack of technical support for maintaining the computer lab.

Furthermore, our principal makes serious efforts to strengthen ties with the community. In June 2022, the DOE launched the "Quality Learning and Teaching Education Community" program, aimed at involving all stakeholders in the school's interests. Mr Johnson embraced this initiative wholeheartedly and invited community



Figure 5.5: Photo elicitation- Strengthen ties with the community

leaders, parents/guardians, student leaders, SGB members, teachers, and DOE representatives to the launch event (see figure 5.5). During the event, he outlined the school's technological vision and emphasised the vital role the community would play in enhancing teaching and learning. All stakeholders present at the launch signed a pledge, fostering a positive atmosphere within the community and improving relationships. This increased support for the school, led community members to contribute to programs like the nutrition program. Additionally, and qualified unemployed teachers from the community volunteered their services free of charge, further strengthening the ties between the school and its community.

Nurturing teacher leadership

The principal has not restricted leadership to the SMT. He supports teachers in playing an active role in leadership at every aspect of the school. I too believe that leadership is not solely reserved for formal roles, but rather an opportunity for all educators to make a difference. Armed with this conviction, I set out on a mission to empower my fellow teachers to embrace technology and become agents of innovation in our rural school. I began by developing a culture of collaboration within the foundation phase. I have created spaces for dialogue and encourage teachers to share their insights and experiences during our meetings. Through open discussions and sharing of best practices, I have noticed a sense of rapport, camaraderie and collective responsibility start to form. We still share information, the traditional way, which includes printing it out. Our agendas are set by management, and we discuss information in our teams. We use WhatsApp to pass general school notices and share information from the DOE. As a result, I started pushing for professional development around the integration of technology for teaching and learning. In 2022 I found out that the DOE was hosting workshops for teachers interested in the 4IR. I signed up 2 teachers for this workshop. As a team of three we attended the workshop which focused primarily on the Internet of Things, coding, and robotics. When we got back to school, I worked with the two teachers to prepare a short workshop for the rest of the staff. We covered how technology can be used in class and in the school for teaching and learning. Building on this moment the DOE, informed this year (2023) that the Durban Institute of Technology was hosting a workshop on the 4IR. However, this course had to be paid for. The two teachers volunteered to pay for the course themselves as they wanted to learn more about the practical uses of the 4IR in school. The principal supported this by giving the teachers time off school to attend these courses and has given them time to complete their assignments. By fostering a culture of technology among my peers, more teachers are taking a vested interest and are making a slow move towards using technology in class.

However, the journey is not without its challenges. Within the school's culture, there exists a prevailing mindset of educational disadvantage, where limitations are seen as insurmountable barriers. Scepticism regarding the relevance of technology in the lives of the learners permeates the staffroom discussions. Some colleagues view the integration of technology as an unnecessary luxury, given the pressing basic needs that need to be addressed first. In addition, while the principal is positive about technology use, he has also been adamant about some traditional methods. For example, in 2022, our teachers proposed doing their weekly forecast and lesson plans electronically. In addition, teachers asked if they could use their phones as teaching aids to play songs or videos. They believed that it would save time and have a positive impact on teaching as they could access electronic material easier and faster. However, the principal refused this request. He explained that writing ensures there is a physical record. He was also afraid that many teachers would become distracted by their phones and not focus on teaching. I found this very counter directional to the move of technology.

Digital professional learning communities

Over my 37 years of teaching in a rural community, I found that networking with other schools is one of the most important things you can do to support your school. In my initial years, I would meet with our teachers to share recourses and teaching strategies. However, since 2020, I have been networking with teachers digitally through WhatsApp groups. I am part of a digital professional learning community (PLC). This group has enhanced my digital skills. Through this group I have learnt how to create better digital material, access free websites, access free CAPS material and other skills. In addition, we also network with teachers to share resources. In the past we have shared technology kits and textbooks. Through networking I was able to collect a bank of resource to enhance my lesson in the foundation phase.

Covid 19 propelled us to the digital sphere. Our circuit managers have all chosen to communicate through WhatsApp. This has been beneficial for our teaching as we have instant access to information from the DOE. We don't have to rely on emails which first go to the school principals. We are also in direct communication with our circuit managers. Our circuit managers have also started using Zoom call to conduct some meetings. They have also hosted seminars conducted by experts in the field via zoom. These seminars have been enlightening towards learning innovative methods of teaching. While these seminars are not compulsory, I ensure that our foundation phase teachers joined the zoom meetings. After these meeting we are able to discuss our learnings. I usually set up a meeting in my classroom. I believe our schoolteachers are currently at a stage where we are being enlightened about the 4IR.It's only a matter of time until we can embrace technology fully in school.

Tsotsi...

Our relentless pursuit of sponsors for technology and equipment is constantly threatened by the presence of cunning *Tsotsi's* (*South African slang for thieves*). In our community, the dire economic conditions have driven many individuals to resort to crime as a means of survival. Unfortunately, our school has not been spared from the clutches of these criminals. Over the past decade, we have endured countless break-ins, resulting in the loss of valuable resources such as equipment, stationery, and even money. In a devastating incident back in 2018, five computers that were generously donated to our school fell victim to the *Tsotsi's*. This theft dealt a severe blow to our educational endeavours, as replacing



Figure 5.6: Photo voice- Burglar bars

these computers seemed nearly impossible given our limited resources. Consequently, our progress towards embracing digital education was hindered. Moreover, to safeguard our school, we were compelled to invest a substantial amount of money in installing specialised burglar bars. You can see the photo (figure 5.6) depicting these bars, which were installed primarily in the administration block.

Furthermore, the logistical challenges we face in utilizing technology further compound our difficulties. Each day, we must transport the projector, laptop, and white screen from the administration block to the classrooms, and then back again at the end of the day. This arduous task discourages many teachers from incorporating technology into their lessons. Additionally, during our end-of-term holidays, we are unable to leave any equipment in the school premises, leading to the burden of teachers having to take items like the school TV and two computers home for safekeeping. To mitigate the security risks, our limited budget has been allocated to hiring daytime security personnel. Unfortunately, this means that we lack overnight security coverage, leaving our school vulnerable during the night. The constant threat posed by the *Tsotsis* not only hampers our progress in adopting technology but also strains our already limited resources.

...funding from the DOE...

Being a quintile 1 school means we are not permitted to charge school fees. We therefore receive *funding from the DOE*. The department has played an important role in supporting the school develop technologically. They helped fund our computer lab, nutrition programme, sustain our school farm and provide stationery for our learners. However, the budget from the DOE is insufficient to support technological growth and rarely on time. The money we get from the DOE is sufficient to pay off our monthly utility bills, security company and help with other general expenses. Now our school

infrastructure needs urgent upgrades. The classroom roofs have leaks, the walls need painting, and we require more classrooms. We require resources, such as devices, models and science and maths equipment for our classrooms. These conditions place serious constraints on our ability to produce quality innovative lessons. As a result, we constantly spend time raising funds to supplement the budget we get from the DOE. We do numerous fund raisers through the school year. These fund raisers are time consuming and results in loss of teaching time. We host market days, concerts, jumble sales and other events. On most occasions we must take these initiatives out of the community because the buying power of the community is weak. For our school concert we partnered with the Durban Playhouse to host a fund raiser in the nearby town.

...diverting our efforts...

Working in a rural area presents significant time constraints due to staff shortages and excessive workloads. Since 2022, our school has been understaffed. We lack three teachers and the (DOE) slow response exacerbates the situation. This results in teachers carrying the extra teaching load, leaving minimal time for lesson planning. The lack of time hinders the development of innovative lessons, leading to the recycling of old materials. Furthermore, with the introduction of the FET phase, primary school teachers are forced to cover grade 10 classes, creating a chaotic and scattered environment. I have been successful in getting volunteers from the community to help us teach in the primary. These are not qualified teachers, but we have no choice but to seek their help in teaching some lessons.

In addition to staffing issues, the school's culture perpetuates a mindset of limited possibilities. Many teachers struggle to embrace the potential of technology, considering it exclusive to more affluent schools. Moreover, our planning efforts are diverted towards addressing prevalent social issues. Since



Figure 5.8 Photo voice- Addressing female learners on teenage pregnancy & alcohol abuse



Figure 5.7 Collage inquiry- Tavern

2018, the opening of a nearby tavern (*see figure 5.7*) has negatively impacted learners, exposing them to alcohol abuse culture and resulting in incidents of alcohol possession. Teenage pregnancy is also a pressing concern, requiring extensive discussions and counselling sessions. As a qualified lay counsellor, I actively work towards breaking the cycle of poverty and changing attitudes in the rural area (*see figure 5.8*). Time limitations in our rural school impede various aspects of our work. Staff shortages and increased workloads affect lesson planning and creativity. The prevailing belief regarding technology further limits educational opportunities. Additionally, social issues demand significant attention, from addressing the impact of the

tavern to combating teenage pregnancy. Parent co-operation is very poor as most learners live with their grannies. Despite these challenges, we remain committed to finding solutions and leveraging community support to empower our students and provide quality education within the limitations of time.

...leaving us in the dark...

Over the last 5 years we have struggled with constant loadshedding. This has impacted our day-to-day administrative tasks by *leaving us in the dark*. For instance, we could not make electronic payments and we could not do printing. Since 2022, loadshedding has increased to 4 hours a day. This has had a negative impact on our desire to become more digital. On many



Figure 5 .9 collage inquiry
Loadshedding

occasions we had to revert to the traditional methods of teaching because we could not use our laptops and projectors. In addition, loadshedding drops the WIFI connection. Loadshedding has hindered the development of a technological culture in our school. We cannot rely on the internet to do research or play videos/songs since we constantly lose connection. These constant blackouts have delayed the uptake of developing more policies to drive technology. As a result, outdated policies and bureaucratic procedures impede the quick adoption of innovative practices. The limited access to technology resources, coupled with a loadshedding, further exacerbates the obstacles faced by the teachers.

Paving a better future

Advancing technological use in rural schools is a difficult task given the vast social ills we face. However, through taking a personal interest in our school, it gives you a drive to *pave a better future* for our learners. Going the extra mile is the norm in a rural school. You must be proactive and contingent in a rural school. You cannot only be dependent on the DOE solely. It's about the learners at the end of the day. We take great pleasure in seeing our learners attend university and getting good jobs.

5.3 ZAMA'S NARRATIVE: THE SOCIAL JUSTICE INSPIRED TEACHER LEADER

A Rural girl in a model C school

I was born in 1976, amidst the bustling township of Umlazi, burrowed in KwaZulu-Natal (KZN). Umlazi, like many townships, was laced with obstacles: a lack of adequate governmental services, insufficient infrastructure, and the suffocating grip of poverty. At age 10, my parents, driven by a desire for me to receive better education, made the decision to uproot our family to the South Coast region of KZN. I attended a Catholic boarding school reserved for blacks. Memories of that school still resonate within me. It was a place devoid of warmth, where we would rise with the dawn, only to take a bone-chilling icy bath.

Nonetheless, this school instilled in me the unwavering principles of Christianity. By the 90's schools were opening to all race groups. It was during this transformative era that my parents sent me to a model-C white school in Port Shepstone. I was not fluent in English, and the subpar education I experienced in black schools left me lagging behind. I was lonely at this school. Back then integration between race groups was uncommon. I understood that it was odd to have a *rural girl in a model C school*.

In 1992, my parents made the decision to relocate me to a different white school in Scottsburg. The quality of education in these previous white schools were exceptionally high. The teachers were highly qualified, classrooms were well resourced, and the school had multiple facilities. However, there was one teacher, Mrs Nel Van Niekerk who changed my life. She spent countless hours helping me improve my reading, writing, listening and comprehension skills in English. Mrs Nel would take me to the library daily. By the time I was in grade 12, I was passionately reading multiple books a month. She was the reason, I started studying teaching in 1996 at Ndumiso Training College in KZN. Majoring in English and Computer Literacy, my aim was clear - to bridge the gap in education by enhancing English proficiency and introducing the power of computer literacy within black schools.

Streetlights

In pursuit of educational empowerment and social justice, my journey as an educator took me from Telkom call Centre in 1997-1999 to my first teaching job in Umlazi in 2000-2001 and eventually leading me to Ukuphikelela Ebuhleni (Perseverance is virtue) Secondary School in Scottsburg. As a rural quintile 2 school, Scottsburg grappled with minimal municipal services, lacking refuse collection and streetlights. These restrictions enabled pressing challenges for schools in the area, where many children relied



Figure 5.10 Photo voice- School population

on government grants. In 2018 the statistics from my school showed that 50% of our learners do not live with their parents. Majority of these learners live with their Gogos (Granmas) while others are orphans. We further found out that these Gogos support these learners with their government grants of R1900 a month. In this community, parents and guardians often faced educational disadvantages. With approximately 1800 pupils to serve, our school faced a shortage of classrooms and teachers, despite recent assistance from the DOE in the form of mobile classrooms. Nonetheless, we still grappled with high learner-to-teacher ratios, with around 70-80 learners in each classroom. The sheer size of the school population is so large that capturing it in a single frame from the assembly stage view proved impossible (figure 5.10). These circumstances frequently left our learners feeling disheartened by the conditions they were compelled to endure.

One memorable afternoon in 2003, as the school bell signalled the end of the last period, a student approached me while I was on gate duty, sharing her appreciation for my English lesson. She expressed a sense of hope that my teaching had inspired within her. However, her gaze shifted across the field towards an urban area, where the presence of streetlights caught her attention. "At least they have *streetlights*," she murmured, wistfully wishing she had been born on that side. In that poignant moment, I realised the critical importance of my role as a social justice warrior within this community. I recognised the need to address social issues while also pushing for technological innovation. In addition to overseeing the school nutrition program and collaborating with an external organisation to identify learners living in extreme poverty, I embarked on a journey to bridge the technological gap.

My first mission was to guide grade 12 learners through the university application process. Since 2016, I opened the doors of my home to students, providing them with access to the internet. Together, we would search for bursaries and submit university applications. Furthermore, I invited my grade 12 learners to my house, where they could conduct online research for their assignments. However, the burden became too great for my laptop to bear, and the high cost of data often led me to exhaust my monthly limit. To adapt, I started downloading relevant materials and saving them as Word or PDF documents. Learners would then come to my house and utilise the information from these files. To further support our learners' research endeavours, I reached out to the local librarian in Port Shepstone. The librarian proved to be a valuable ally, assisting learners in researching the assigned topics. The only challenge we encountered was the library's distance from the school, approximately 12 Km away, which meant learners had to save up money for transportation. However, through effective networking with the library, I began to witness a gradual improvement in the quality of their work. My commitment as a social justice warrior became a guiding force, propelling me to address social issues while embracing technology and innovation.

...a pro-technological principal in a rural school...

I have been at Ukuphikelela Ebuhleni Secondary School for 20 years now, and during this time, I have witnessed significant changes in leadership. Before 2016, our school was plagued by staff division conflicts, political union issues, job promotion encounters, and even fraud cases involving mishandled funds. These problems had a detrimental impact on the school's stability, leading to issues with learner discipline, substance abuse, and hindrances to effective teaching and learning.

In 2017, a new principal arrived and swiftly assessed the numerous problems our school faced. He possessed a democratic nature coupled with a firm demeanour. As a master of policies, he ran the school by the book. I vividly remember him emphasising his commitment to unifying the school into one cohesive team. He began by nurturing trust among the staff. He engaged with teachers on a personal level, providing support during times of personal loss and visiting staff members in hospitals. Prior to his arrival, staff members were divided into two separate staff rooms due to ongoing conflicts. He promptly closed one staff room and encouraged staff to celebrate birthdays, graduations, and engage in social activities as a unified team (figure 5.11). Initially, there was resistance to these changes, but the principal organised events that facilitated collegial interaction among staff.



Figure 5.11: Collage inquiry-creating a culture of teamwork

Additionally, he convinced the School Governing Body (SGB) to provide lunch for teachers who gave up their time on Sundays to offer extra-matric classes. Furthermore, the principal initiated an annual Teachers Awards Day for matric teachers, where he hosted a lunch and presented thoughtful and expensive gifts to acknowledge their dedication. He wasn't simply a man who mandated weekend matric classes; he provided unwavering support to teachers throughout the process. These efforts have had a tremendous impact by fostering a culture of hard work and pride in our school.

The staff members genuinely appreciated the principal because he always followed through on his promises. From 2019 to 2021, he committed to providing the school with Wi-Fi access and installing cameras to enhance safety. Many teachers would describe him as *a pro-technological leader in a rural school*. Furthermore, in 2017, the principal initiated an effort to embrace paperless options. He decided that the school should use WhatsApp as the primary mode of communication and instructed each department to create a WhatsApp group. As the admin for the English department, I witnessed the benefits of this decision first-hand. WhatsApp proved to be a valuable tool as it facilitated the sharing of important documents, such as those received from the Department of Education (DOE). Additionally, each subject department could share electronic copies of annual teaching plans, assessment guides, CAPS policy documents, worksheets, PowerPoints, free CAPS textbooks, and even generic lesson plans. This streamlined our planning process, ensuring that teachers had these resources readily available. Not only did this save the school a significant amount of paper, but it also eliminated the need for teachers to print and store bulky documents.

In our English department, I would access these shared documents and create condensed PDF versions for our team. I would also compile resource packs for our learners using the shared textbooks, worksheets, and guides. When the COVID-19 pandemic hit, many textbook companies in South Africa

provided schools with free online access to teaching materials. Additionally, wealthier government and private schools shared a wealth of teaching materials online, including links to their own online lessons. Since our school already had active WhatsApp groups in place, it became effortless to share and adapt these resources to suit our teaching needs. Now that the pandemic is over, I have a substantial bank of resources at my disposal.

WhatsApp

Building on WhatsApp group as a communication tool, our principal embraced the idea of utilising WhatsApp conference calls to host some weekly staff meetings. It was a breakthrough, as teachers no longer had to worry about missing important discussions due to transportation constraints experienced in rural areas. Lunch breaks became opportunities for staff meeting and professional growth as teachers tuned in to the WhatsApp meetings eating their meals or fulfilling their other duties.

The WhatsApp platform extended its impact beyond meetings and into the department groups. The picture (figure 5.12) shows our languages department meeting agenda. The message was sent on a weekend in preparation for the upcoming week. In this way WhatsApp have helped us to be proactive with our planning and preparation. Teachers discovered a new realm of collaboration and idea-sharing. As part of the languages department, for example, I spearheaded a reading program called 'Drop Everything and Read.'

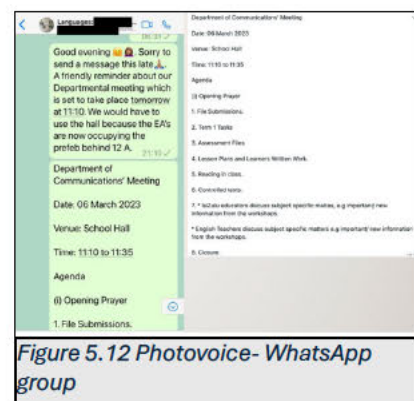


Figure 5.12 Photovoice- WhatsApp group

This involved learners dedicating 15 minutes a day to simply spend time to read. With over 60 teachers involved, the challenge lay in coordinating the program efficiently. WhatsApp came to the rescue, facilitating the seamless distribution of instructions, materials, and resources. Feedback flowed in real-time, enabling constant improvement and ensuring the program's resounding success. Since September 2022 we have seen a greater interest in reading across the school.

I collaborated closely with the HOD to push the boundaries of innovation even further. I spearheaded the implementation of electronic lesson plans, prioritising regular updates and encouraging creativity in teaching. If you look at the agenda (figure 5.12), we prioritise frequent lesson planning and discourage using previous year's lesson plans without updating it. By sharing lesson plans digitally, the teachers found themselves with ample time for reflection and improvement. Editing on word document is much better than handwriting new lesson plans which had to be stored in bulky files. Using their phones as teaching aids, they could easily access their lesson plans and make adjustments on the go, promoting

an active and engaging learning environment. This has also resulted in many teachers buying their own laptops and tablets since using electronic devices made it so much easier for planning.

However, not everyone embraced this digital transformation with open arms. Some teachers resisted the shift, citing a preference for traditional paper-based methods and expressing concerns about work-life balance. After closer inspection of the problems we found that many teachers were simply finding it difficult to adapt. I took it upon myself to train these teachers. I spend a lot of time teaching them how to edit and share documents. It was a slow process, but I found if you just stick to your goal and preserve others would eventually jump on board. There were some issues where a handful of teachers complained about data costs. However, the principal did not entertain this. He encouraged teachers to see how the positives outweigh the negative. However, working in a rural area can be unpredictable. Sometimes the thieves steal the phone tower cables which results in no connectivity. In addition, loadshedding is a constant threat to connectivity. This often leaves leaders/teachers with no internet for hours. Issues like these usually encourage teachers to turn to their traditional methods of paper usage.

Busy body - Library in a cupboard

Our school has a strong culture of hard work and strong track record of doing very well against all odds. We always get awards from the DOE. In the last Matric exam, the English department had a 100% pass rate. My class achieved the most A's. I received a certificate from the DOE to acknowledge the results I produced (Figure 5.13). However, it's not easy to produce excellent results in a rural school. It requires working beyond the given hours. I usually leave school at 5pm daily and work through the night to mark papers, create teaching/learning materials and complete other admin tasks. I have dark bags under my eyes. To be successful in a rural school, I must be a *busy body*. I must involve myself in many things which will give learners an opportunity to experience innovation.



Figure 5.13 photo elicitation Certificate

Our school does not have a library. In 2012, I started a small initiative called 'library in a cupboard'. I collected used books and sought after donated books from other schools and people in the areas. I would record the names of students on a manual book to keep a record of borrowed books (see figure 5.14).

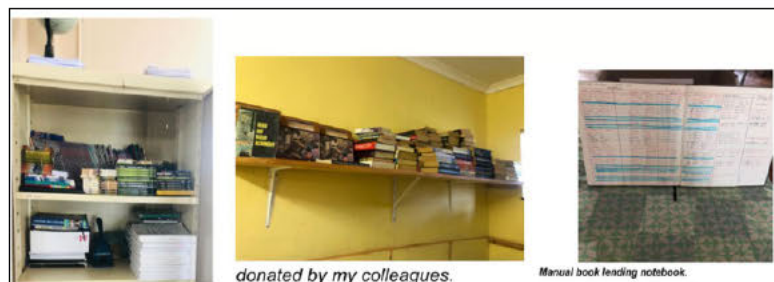


Figure 5.14 Photovoice -Library in a cupboard and record books

We didn't have many books, but learners would enthusiastically borrow books. This led to the development of a book club, in which I could get learners to do reviews on the books they borrowed. In 2020, after buying my own laptop, I would keep digital records of borrowed books and created book review templates for the learners. I then discovered I could download free E-books. This revolutionised our book club as I could subscribe to E-book sites and allow the learners to read offline books during the break or after school. I also subscribed to paid sites in order to get access to recent books. I don't mind paying for it as it benefits the learners. This has encouraged more learners to read in our school and have resulted in some learners downloading free E-book application on their phones or their parents' phones. However, a lot of the free sites are very limited and require a subscription which parents cannot afford. The problem I face, is that I have one laptop and therefore learners have limited access to reading time. In addition, some of the E-books are very expensive to continuously purchase and the school cannot afford any of these subscriptions now.

...a noble profession...

Despite the lack of technological resources within our school, I have made a personal commitment to seek out opportunities provided by external organisations to promote innovation for my learners. I have involved my students in innovative book review competitions since 2016. These competitions not only grant learners access to valuable resources but also encourage them to explore their creativity through research and writing. Through these competitions, learners learn the art of innovation. In 2018, we participated in the Funza literature competition, where we proudly



Figure 5.15 Photovoice-our students place 3rd in competition

secured the 3rd position (see figure 5.15). This achievement presented us with the incredible opportunity to attend the finals held in Pretoria. At the event, our learners immersed themselves in workshops that enlightened them about utilising digital platforms to enhance their writing and poetry skills. They also gained invaluable insights into networking with established authors and much more.

It is during moments like these that I realise that teaching is a *noble profession*. Teaching is not solely driven by financial gain. As an illustration, I willingly undertake the responsibility of transporting our students to various events, despite the district office being in Port Shepstone, a 70km distance from our school. I personally cover the fuel expenses to ensure their participation in spelling bees, debates, and moot court competitions. Our school has garnered remarkable success in moot court competitions, clinching the 1st position within the district. These competitions revolve around presenting compelling cases on a range of controversial issues. Leveraging the power of the internet on my laptop, our learners

delve into extensive research to construct articulate arguments and propose innovative solutions. It is imperative to seek opportunities beyond the school's boundaries that can expose our students to the realms of innovation and technology. By doing so, we witness a positive transformation within the school as more students develop a keen interest in academics.

The Big show

In 2018-2019, I was part of a dedicated team of educators who collaborated with an NGO to establish a computer room in our school. We were fortunate to receive 20 computers as a starting point, but we faced a major hurdle in setting up the room due to a lack of essential connectivity devices. Determined to overcome this obstacle, we started a fundraising campaign to acquire equipment. However, our school, located in a rural area, grappled with persistent issues of gangs, drug abuse, and alcohol addiction. Tragically, in 2019, we experienced a shocking incident when a group of thugs, informed by learners, broke into our school and stole the brand-new computers.

Shortly thereafter, a violent incident erupted within our school premises. Two learners, belonging to different gangs from the community, engaged in a violent physical confrontation in the classroom. The learners were taken to the principal's office. As tensions grew, one learner, Scelo, stormed out of the office, vowing to seek the intervention of "*the big show*" to resolve the issue. Moments later, Scelo reappeared, wielding a knife, which he referred to as "big show." He brutally stabbed the other learner and even inflicted harm upon the deputy principal, who tried to intervene. The arrest of Scelo by the police revealed a shocking revelation: Scelo's gang had orchestrated the break-in and theft of the computers. It was shocking, that the DOE did very little to support the school. The DOE indicated that due process must follow, and the Scelo must return to school. Prompt action was taken by the principal, who implemented weekly police checks at the school from 2020 to 2023. In 2022, one of the gang leaders was apprehended, leading to a noticeable transformation within the school environment.

Despite this progress, the constant challenges we face hinder the growth of technology in our school. Theft remains an ongoing issue and fortifying the security measures required significant financial resources. Replacing stolen equipment seemed nearly impossible, given the limited funds we received from the Department of Education (DOE), which were primarily designated for utility expenses. As a result, since 2021, computers have been confined to the administrative block, serving primarily administrative purposes. Limited Wi-Fi connectivity restricts access to these areas, allowing only a select number of Grade 12 students to conduct research using teachers' laptops. Our whole admin department

has come to rely on the use of computer/laptops for its daily functions. This includes emailing the DOE to receive subject resources and documents, the use of SA-SAMS, creating work sheets etc.

PowerPoint Revolution



*Figure 5.16 -Photovoice-
Using PowerPoints*

Since the covid pandemic in 2020, I was forced to rethink how teaching will take place. At the time classes were split into two to comply with covid capacity requirements. This resulted in doubling our teaching load. I bought a new laptop and projector. I used the smart board which was donated to the school and was fortunately left behind during a school break-in. As you can see in the picture the smart board is not fixed to the wall- which means it must be stored in a safe place daily. It's quite inconvenient. Nevertheless, I used my laptop to create engaging PowerPoints for the learners. In the photo (see figure 5.16), I was introducing the drama 'My Children, My Africa' as an English grade 12 lesson in January 2023. I used my PowerPoints to create a visual background of the drama which was set in Apartheid South Africa during a state of emergency. The visuals and audios created a vivid image in the learners' minds, and they were able to relate it to the text. As you can see the learners are high focused here. Ever since I started using PowerPoints, our lessons have become more conversational as learners tend to ask more questions about what they see on the slides. I noticed it helped students who are not fluent in reading to get a better understanding of the story. Using PowerPoints helped create an interest in the subject.

Making use of PowerPoints, meant that I had to redesign and create all my language resources. This included making all our resources digital. It was very time consuming and had to be done during my personal time. I had to type out texts, download images and insert video clips where needed. However, I managed to leverage a lot of digital resources from private schools which I networked with over the years to help create PowerPoints. While these PowerPoints were engaging, all the learner's work had to be done in books. Resultantly, learners were limited in terms of manipulating digital information. Since we cannot always print worksheets, learners must spend a lot of class time taking down notes from the PowerPoints or the chalkboard. On one hand, a notable constrain is that I share my projector with other grade 12 teachers who have purchased their own laptops. On the other hand, It is enjoyable that other teacher are buying into the *PowerPoint revolution* because they are witnessing how it makes our life easy in the long run. We don't have to rewrite lessons on the chalk board. In addition, we can infuse past paper exam questions into our lesson as opposed to only giving learners past papers at the end of the syllabus. We also share the cost of maintaining the projector.

I can only use the projector, for my grade 12 class, as other classes are too large-with up to 70 pupils packed to the front of the classroom. There is no space to even set up the projector, whiteboard and laptop. In these classes it is difficult to do innovative lessons as managing 70 learners is very difficult. We cannot cater for the individual needs of learners and therefore create very uniform lessons for these classes. These lessons are very paper based and textbook driven. Learners have to take down large text of notes, so they have material to learn from at home. Textbooks cannot be taken home as we don't have enough for every learner.

Sharing my knowledge

My school context has driven me to become a lifelong learner. I am driven to become an exceptional educator capable of effecting change. It is this driving force that led me to embark on my second year of a master's degree in social justice education, recognising social justice as a pivotal element in bridging the technological gap and fostering innovation in education. In line with my commitment to knowledge-sharing, I have taken on the responsibility of mentoring novice and assistant teachers. In Figure 5.17, captured in this photo,



Figure 5.17 Photovoice-workshopping new teachers

I am engaged in training new teachers on SA-SAMS, a tool for analysing students' academic results. Together, we leverage this data to develop targeted intervention strategies that are implemented in June 2023, once the syllabus content is covered. Over the years, this approach has proven successful in enhancing academic outcomes. Furthermore, I dedicate my time to assist teachers in embracing technology within the English department. By guiding them in creating effective PowerPoint presentations and exploring various applications, I have cultivated a culture of technological utilization. Emphasizing the value of lifelong learning, I have collaborated with the South African Council of Educators (SACE) to establish monthly professional development (PD) sessions for our teachers. By signing our school in the SACE PD program and diligently documenting our department's professional development activities on the platform, we earn valuable points as educators. Although this initiative is in its early stages, the positive response from teachers has ignited discussions about embracing digital and innovative approaches to learning.

Teaching in a rural school requires selflessness

Teaching in a rural school requires you to make a sincere commitment to hard work. It involves going beyond the call of duty to ensure we fight the bonds of poverty by exposing our learners to technology and innovation. It requires teachers to embrace digital forms of learning by digging into their own pockets

to affect change. In most cases, if we take small steps towards the technological revolution, it will leave a large impression on the life of our learners.

5.4 EVALINA'S STORY- THE TECH-SAVVY PIONEERING TEACHER LEADER

...a key to influence teaching and learning

As a child growing up in the late 1980s in Newlands West, Durban, I was very aware of the social and economic inequalities that plagued our community. Even though apartheid was coming to an end, the reality was that most people in my community were low to middle income earners and my parents were no exception. Similarly, majority of the adults in the community worked in textile factories while others occupied



Figure 5.18 Metaphorical photo-Keys of influence

government employment such as teachers, nurses, police officers and general municipal workers. At the time, many doors of opportunities were not available. It seemed like I did not have any keys to open doors of opportunity (Figure 5.18). The first democratic election in 1994 marked the genesis of my schooling career. Filled with hope, I laboured effortfully throughout my schooling career at Hillgrove to take advantage of the opportunities now available in South Africa. My high school did not have any fancy technology. In grade 11, in 2005, we once used a microscope in biology class to study the epidermis of an onion. The experiments we conducted in science created a deeper passion for science. In 2007, I started my Bachelor of Education at UNISA. In 2008 I transferred to UKZN to major in Science and Technology. Due to my excellent results in science, I was awarded a full bursary, and it quickly became my pledge to improve science through teaching and learning. In 2012 I graduated. It was an iconic moment. I saw my Bachelor of education degree as *a key to influence* teaching and learning (see figure 5.18).

...an iconic moment where technology came alive...

If I had not been exposed to technology in a first world classroom, I would have not known the importance of innovation for teaching. In 2010, I was funded by the university to partake in a student exchange program. I was placed at a university in the State of Pennsylvania, USA. The modules I studied incorporated the use of technology daily. One of the modules I studied already embraced the idea of online learning. My

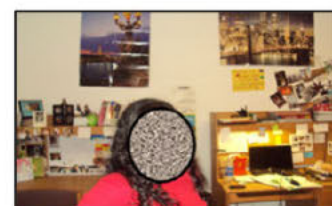


Figure 5.19 Photo elicitation-My Dorm room

photo (figure 5.19) reminded me of the hours I would spend working in my dorm room at my computer

station completing tasks. The internet speed was instant, live video quality was excellent and there were limited breakdowns in technology. For this module, on some occasions, we would meet in class and then we would have to access an online portal to complete tasks, participate in online broad-based discussions, engage in independent but guided study. I had the opportunity of doing my teaching practice in an America school. It was an iconic *moment where technology came live*. I was assigned to a grade two class in a public school in Mid-October 2010. I was at awe, as I walked through the school corridors. The school had fully functional science labs with world-class equipment. My grade 2 class had 20 students who occupied a well-resourced classroom. Students focused on problem solving. I watched as teachers used smart boards to help students solve problems. Students would learn in groups through building models of what they were being taught. During our math lesson, I recall accompanying students to the computer lab. Students accessed the computers, and the teacher used a math simulation to teach students geometry. This experience opened my eyes to what it truly means to use technology innovatively for teaching. There is a vast difference between a first-world classroom and the classroom we have in South Africa. I was eager to apply this knowledge to schools in the South African context.

I wanted to leave my mark regardless of the context...

June 2012, the bursary office requested that I immediately turn up to the Pietermaritzburg (PMB) education office to receive my appointment. I got a letter instructing me to start work at a school in Richmond which is about 1hour and 30 minutes from coastal Durban. I used google maps to find out that I had been appointed to a school in a rural area. As shocking as it seemed, I was excited to start my life as an independent woman. I



Figure 5.20 photo elicitation- Map of Rural Richmond

wanted to make my mark regardless of the context. A few days after receiving my appointment letter, my family and I punched in the GPS coordinates on google maps. All I remember seeing was green on the GPS screen (see figure 5.20). As we entered the Richmond area, we came across this beautiful school, with manicured lawns and immaculate buildings. However, the principal of this school reluctantly informed me that I was looking for the 'rural school' down the road. We finally get to the public school I had been appointed to. It looked like a regular government school from the outside. Most buildings were two stories high. It was very big. It had grades from grade R to 12. After finding a place to stay in Richmond, I started work immediately. Richmond was an emotionally warm place tucked in a countryside setting. The women's house that I boarded with helped me understand the culture of the area. The children the school served were extremely poor. Some even carried water from central water points to their home. I swiftly grew fond of the area and knew that this is an area *I want to leave my mark*.

I don't mind digging into my own pockets...

As a novice teacher in 2012, I admired how my Head of Department (HOD) mentored me as a novice. She taught me that planning was a number one priority. She regularly checked every lesson plan I created and ironed out any mistakes. She was serious about paperwork. I remember being submissive because I wanted to learn everything I could. We quickly developed a strong comfortable relationship because she trusted me. The school engaged in chalk and talk as a



Figure 5.20 collage inquiry- digging into my own pockets

teaching method as it fitted the school's context. I knew that changing the status quo would be achieved if other teachers saw what I was doing. I decided to use my own finance to inspire change. *I don't mind digging into my own pockets* (see figure 5.20) to help improve teaching. I purchased about 20 science kits and 20 textbooks. I then secured a sponsored projector from a church in Durban. When I would teach science, I would project on the ceiling of the class because we did not have a whiteboard. As uncomfortable as it was the learners appreciated the lesson. They enjoyed using the science kits and seeing the images in textbooks. This caught on like wildfire and other teachers started borrowing my projector. However, using the projector across the school was not a sustainable method as I had to invest more money into replacing bulbs and batteries. Coupled with the data struggle, was the poor internet reception in the rural areas. As a pioneer who introduced technology, I was often left with the task of solving these problems if I wanted to keep using this technology in the class.

One of the things that surprised me was that the school leaders still handwrote the 'year-end examination result schedules' on A3 paper in 2014. This was a schedule outlining the number and details of students who passed and failed at the end of the academic year. These schedules are sent to the circuit manager to approve. Seeing the challenge faced by managers, I then developed an Excel sheet for the school with the necessary formulas and hyperlinks. For the first time the school had an electronic copy of schedules which was editable. This led to all marks being recorded on excel sheets. While it was hard work at first, I knew this was not for me, it was for the betterment of the school. We were making so many mistakes doing it manually. I would teach staff how to use the computers. I would inspire them that change is hard but once you adapt to it and embrace it, it makes your life easy. This inevitably led to more digitalisation of worksheets, test and exams in our department. This impacted our quality of worksheets and tests as teachers slowly started using the internet to create relevant teaching material.

... etched in a strong culture of giving back...

By the end of 2014, I was in desperate need of a transfer back to Durban. I planned on getting married. In 2015 I finally got a one-way-transfer to a school in the Phoenix area which is northwest of Durban central. Coming from a rural school in Richmond, I felt anxious starting at a quintile 3 school in the suburbs. *Hopeful Primary* is a no-feeing school which serves 500 students predominantly from informal and township settlements. Parents choose our school because accessing it by public transport is easy given the proximity to the main road. Majority of the children come from homes where parents are unemployed and



Figure 5.21 Photo elicitation-school history booklet

depend solely on government grants. In 2015, the principal showed me around the school which housed about 20 classrooms over two blocks. The school has an admin block, car park, one playground and student toilets. Later in 2018, the school erected a computer lab. During my first meeting with the principal in May 2015, I sensed a feel of calm and peace. He reassured me of the life changing role I am playing in this school by serving children from extremely challenging economic and social background. I also got that sense of care from all teachers in the school. It was a gentle, warm, and peaceful care. The type of peace you feel at church. I then discovered that the school had a rich and lengthy history. The school is 55 years old and was established during the apartheid era through the contributions of the indentured labourers working in the sugarcane plantations. Our school cherishes and celebrates its history. For our 55th anniversary, the school pinned up the school history (Figure 5.21) in all classes and we had a whole-school celebration. The school is *etched in a strong culture of giving back* to its community. A strong sense of taking care of the community still plays a central role in the school.

Breaking your limits

'Breaking your limits' is our school motto. This motto drives our culture of learning and teaching in school. We use this motto to break the barrier of poverty which plagues our school. In 2016 I taught a grade 4 class. It was heart-breaking to see little kids come to school with no lunch, inadequate uniform, ill health, and the look of desperation on their face. I use every



Figure 5.22 Photo elicitation- awards day

occasion to share my success story with the children. I tell them stories of how I was awarded a bursary, my USA trip and the time I was placed 6th in a national singing competition. I teach them to dream. This photo (figure 5.22) illustrates our children proudly wearing their motto as they sing and dance to celebrate their 2016-awards day ceremony. It's a manifestation of breaking your limits. Since 2017, I became attached to the school culture of understanding our community. I believe that teaching and learning works both ways. Our culture as teachers is to learn where our students come from and then apply our

pedagogical skills to those situations. I find myself being parental. Carrying this serious yoke means ensuring you do everything to provide for the student's basic need. In addition to the school nutrition program, I work tirelessly to raise funds and secure donations for our underprivileged students. Equality, equity and justice drives my teaching at school. I don't focus on just bringing equality, but I am driven to ensure equity and justice in my classroom. If you look at the first box (Figure 5.23) it talks about the assumption that everyone benefits from the same support. Nevertheless, the support that I give learners is individualised because I need to consider every learner's background. Therefore, I see technology as

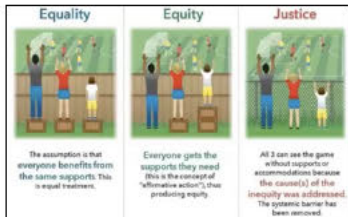


Figure 5.23 collage inquiry-Equality, Equity and Justice

closing the digital gap in my school. Using technology means exposing our learners to modern learning. It's about making learners independent thinkers by exploring the internet. I, therefore, work hard to transition the status quo of teaching and learning to include digital learning. However, the extent to which this is done is very minimal given the large number of learners we have and the limited resources at our disposal.

Changing the school by gradually changing the status quo through leadership

Upon joining Hopeful Primary in 2015, I was fortunate enough to be led by a longstanding principal who led the school for 18 years. The school has an aged staff. The principal, Mr Saul, knew his staff well. His approach to leadership was very passive and peaceful. He had an open-door policy and valued relationships. He would always check up on staff and form conversations. There was a sense of freedom. He was an exceptionally good speaker and could persuade staff to buy into the school vision. He maintained a culture embedded in addressing social issues faced by students. He maintained the traditional methods of teaching and learning as this best suited the school and its staff. We were not obligated to use technology, but he did ensure that teachers presented high quality lessons by being well prepared.

His successor, Mr Jay was appointed in 2016. The new principal did maintain the status quo of the school and introduced changes subtly. His style of leadership is vertical and shared (see figure 5.24). He leads by ensuring policy is followed and shared with his DP and HODs. For instance, when we had to introduce a new marking policy, he would ensure that HOD's discuss the policy with the teachers. This must then be followed up by developing strategies which will best suit the department. The principal focuses delegating tasks to the 'right people' who show initiative. He delegates tasks to teachers based on their strengths. He has provided more structure for the school in the sense that teachers and leaders know what their roles are and how they

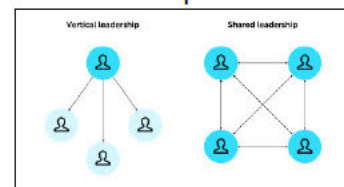


Figure 5.24 Collage Inquiry-leadership structure

should carry it out effectively. There has been a stronger culture for teaching and learning since his arrival. His vertical and shared leadership has enabled teachers to get involved in the policy because they know the expectations of the vision. It sometimes may seem very bossy and top-down from the outside but as an insider it's not so. I have also been invited in 2016 to contribute to the school admission policy and code of conduct policy. The principal has played a vital role in developing me as a leader. He took time to get to know me in 2016 and provided opportunities to develop me. For example, when he learnt that I was good at computers he would often divert all technology issues to me. In 2021, I was appointed as an acting HOD because the principal saw my value in working with people and getting the job done. If the principal did not see this potential in me I doubt I would have been so confident to lead people

Technology helps me cope with new challenges...

When I joined the school in 2015, I was tasked to teach Afrikaans as a second language. All I was given was a textbook, worksheets and the annual teaching plan. I had two options; I could have complained, or I could try and use this opportunity to inject technology into the school. I leveraged all the technology that I had. I brought in a tablet which I won from the national singing competition, I bought a keyboard for typing, some speakers and a dongle for the internet. I would then use google translate to translate the text into English for me. I would then use the tablet to create worksheets I could relate to. I would use the tablet to download videos. I would then get the kids to watch the video lessons while I acted as a facilitator. I would also use google translate to answer any questions that the learners had. Not only did this piece of technology save me time studying from a textbook, it made me confident to teach the children. However, this came with its challenges. One tablet meant over 30 children were trying to see a 20cm screen. It was not always practical on most occasions. I was also impacted by high data charges. For instance, I would have to pay roughly R350 a time to purchase additional data. Even when the school did get Wi-Fi in 2017, it did not extend to the classrooms. Therefore, I was left to solve this problem on my own. The biggest challenges with using one device is that learners don't have access to the material outside the lesson. For instance, learners still had to spend large amounts of time taking down notes in books so that they could have a source to study from. This meant allocating time to take down notes instead of engaging with learning.

A decade behind the technology curve

In 2018 I was finally allowed to get back into teaching Science. This opportunity allowed me to bring science to life and redevelop and restructure how it was taught. Previously, students primarily learnt from worksheets and 'chalk-and-talk'. Since then, I have taken small steps to include technology by making it more practical. The picture (see figure 5.25) represents how our school has transitioned to use some technology. However, I still



Figure 5.25 collage inquiry-Technology transition

believe that schools in my context are a *decade behind the technology curve*. With limited technological drive, teachers are left to implement technology and innovation at their discretion. I purchased my own laptop and projector to show learners videos of Natural Science experiments. With this tool, I aimed to make science lessons more engaging, interactive, and accessible to learners needs. As a level one teacher I knew I could not do this on my own. I therefore embraced collaboration and began networking with other educators. My husband was a computer science teacher and he helped me get in contact with teachers in other schools. These teachers added me to a WhatsApp group. On this group we shared teaching material and bounced off ideas. I remember one teacher introduced me to websites which had online sciences quizzes and games. As a result, I would create engaging slides and display online quizzes on the board for the learners. This sparked a newfound curiosity in the learners. However, for this to work, other classes which I did not teach had to have the same education experience. I therefore sought to inspire and guide fellow teachers in our phase by holding workshops and training during our department meetings. I focused primarily on training teachers how to create electronic material.

There was resistance from a few teachers who felt uncomfortable with adapting a new teaching approach. These teachers did not have the basic digital skills. However, I choose to preserve and believed that if I lead by example and demonstrated the benefits of technology, others would eventually follow. Even though others were reluctant to change, I was patient, and this fostered a spirit of collaboration. What further exacerbated this change were financial obstacles. Limited infrastructure, unreliable/expensive internet and a limited budget were constant hurdles. The school cannot afford to subscribe to sites or buy electronic computer applications which will bring science to life. However, I inspired some teachers to invest in buying their own devices. I aim at creating culture in which our laptops must be as familiar as using a writing pad/dairy. However, as a school we are making small strides to run a science curriculum for rapid innovation in learning.

The science and technology centre

In May 2018, Albaraka Bank equipped our school with a *science and technology centre*. Through the efforts of the principal and myself we were sponsored 25 computers. Our school even made the Newspaper (see figure 5.25). The principal boasted that it would be a gateway to study computers as students moved to high school. When the centre was



Figure 5.26 Science & Technology centre

opened, I was one of only a few teachers who made use of the computer room I would initially take my learners on a weekly basis to use the computers in 2018. It usually involved teaching the students basic computer literacy and watching science videos. The computers could not be used extensively as it did not have any science subject applications. The students could use google for research. However, many of the learners are not used to using technology. I spent a lot of time teaching learners rules and discipline. A concerning issue is that learners don't get enough time to use technology in school. Even though we have the technology, we don't have the time in the day to use it at length. It's not easy to fit technology into the curriculum on your own. Its 2022 and we don't have a designated computer teacher to help us maximize this technology.

Many teachers do not use the *science and technology centre*. Being one of few younger teachers in the school, I asked the principal if I could do a brief computer introduction to train teachers. I initially introduced teachers to computers, and I would show them how to use excel, power point and word document. I demonstrated how they could download videos, make worksheets, and project material. I also introduced a schedule that teachers could use to book the computer room. To further support teachers, I made myself available during my free period to re-teach any computer skills that they wanted me to reiterate. Some teachers appreciated this. I was trying to create a culture of technology use. However, I quickly realised that a serious strain was that we urgently needed full time tec-support for this centre. For instance, after a few months, the computers required a software update, connection would sometimes be interrupted, computers would experience shutdowns among a host of other issues. Such skills are beyond my level of computer literacy. It would take the school a long time to fix these issues. This resulted in some teachers sticking to their tried-and-tested methods of getting things done. While I have been successful in persuading several teachers to make use of technology in their teaching and learning, there still continues to be many teachers who are reluctant to make use of technology. The problem is we don't have a policy which mandates the compulsory use of technology in our teaching and learning.

In addition, the annual workshops by the `DOE do not support innovation and change. The workshop I attended at the beginning of 2022 focused on creating lesson plans. It highlighted traditional methods of teaching and learning with no emphasis on the use of technology to drive lessons. Furthermore, our school CPD's are based of the QMS report developed from teacher observation. The leadership focuses on issues around teacher content knowledge, learner engagement, learners' notebooks, classroom management and teaching strategies. In 2022, our QMS observation releveled that teachers must focus on group work. Our CPDs do not focus on how to use technology for teaching, rather it's to maintain a decent standard of education for our context.

The 4IR pilot program

The DOE is currently piloting a coding and robotics curriculum in select schools. In 2022, our school was selected to be a host school for the 4IR pilot curriculum. Our school is not a pilot school, but our computer lab was used to train teachers from the pilot school. I was fortunate enough to attend the workshops. The first session focused on passing information to teachers. We learnt about coding and concepts like the internet of things, big data, robotics, artificial intelligence, and web design. The other workshops were somewhat practical, where we learnt about programming and using applications like Scratch. We learnt how to use technology to solve problems and how to integrate it across subjects. For example, we learnt that if you are creating a robot, you would use Natural Science to wire the circuit and then use technology and math to program the robot. A lot of the programming is not easy. It was also difficult to take this knowledge back to our schools since we don't have the technology and required workstations to perform these trainings. However, when reporting back to our school by presenting the 4IR knowledge to teachers it created an awareness about the direction our teaching and learning needs to take. It is for such reasons, together with the principal we are driving the use of digital resources. Each department is expected to keep electronic copies of all policy documents, lesson resources and tests on a storage device. In our department we are saving science videos and PowerPoint presentation on our drives.

Improving communication

Despite minimal support from the DOE for driving technology, the school received a lifeline in 2021—a batch of 20 tablets to assist with teaching and learning during the COVID-19 pandemic. However, with a learner population of 500, it seemed unreasonable to distribute the tablets adequately. It was then that the principal made a strategic decision to leverage the tablets for improving communication between the school and parents. Class groups were created on WhatsApp, with each teacher being assigned a tablet to manage their respective classes. Tasked by the principal, I took on the responsibility of configuring the tablets, setting up SIM cards, and downloading the necessary applications.

During the pandemic, WhatsApp became a vital channel for updating parents and creating a channel for learning. It served as a platform for disseminating information about changes in timetables, classroom arrangements to adhere to capacity limits, and sharing learning materials with the students. The effectiveness and convenience of this communication method were evident, prompting the principal to decide to keep WhatsApp as an ongoing tool even after the pandemic subsided. To ensure responsible and consistent usage of WhatsApp, the school developed a WhatsApp policy. This policy aimed to guide teachers on appropriate posting practices, addressing the disparity in support provided to parents and learners by different teachers. Now teachers share electronic teaching material with parents. We also share videos and revision material. This has helped expose students to an array of digital learning material which is current and appealing.

...the problem solver

My colleagues often call me the *problem solver* and in 2022 I was tasked with the role of grade 3 coordinator. As a leader you must be willing to explore issues from multiple angles using the resources you have. I must find solutions that fit best. It's often trial and error. I received many concerns from teachers that learners were struggling to read and write. I then called a meeting with the grade 3 teachers. As a team I instructed my colleagues to make use of SA-SAMS to help us gain an in-depth understanding of the issues around reading and writing. SA-SAMS is an electronic software program provided by the DOE to record and track learner data. It helped us identify the different ability levels of our learners. We were able to note our learners' social backgrounds from this tool. We were able to gauge which learners were struggling in language and which part of language they were struggling in. Using data provided from SASAMS and teacher assessments data we found that many learning gaps were left during the COVID pandemic. Initially the principal decided that we must have extra-session in the morning starting from 7am to help these learners. However, learners frequently arrived late to school. The taxis only drop them off after 8am. This is an endemic problem. The principal has addressed it with parents but it's beyond our control. I then decided that we could use our break-time to help these learners. Coupled with this breaktime sessions, I created a WhatsApp group to send these children's parents practice material to work on at home. This plan worked well. Teachers were happy and learners liked the idea. A primary issue that commonly came up among parents was purchasing of data. Therefore, as teachers we had to be patient with parents as some of them could only access data by using WIFI at their workplaces. What makes matters worse, is that loadshedding often disturbed the internet connection. This often-left learners off-line for up to four hours.

The ageing challenge

When I lead, I am kind, clear, fair, and firm. One of the biggest challenges we face for advancing technology is having an aging staff. The principal acknowledges that the younger teachers are willing to get onto the bandwagon. However, we don't get the same buy in from the older staff. One of my roles as a grade 3 co-ordinator is to work with teachers and ensure that lessons are taught effectively. As a team we agreed that we will be designing worksheets on word document to give the learners on WhatsApp. This will help us save time from writing on the board. I also encouraged teachers to make use of the projector. However, one of the older staff, Mrs Fox continuously decides to write on the board and then later describes how there is not enough time to complete the topics. On many occasions, I have been accused of reinventing the wheel. It's also clear that she finds it difficult to take instructions from me as a younger leader. I then decided that I need to get to know why this teacher is defiant. After spending time with the teacher, I learnt that she is going through a lot of change in her life. She begun to share how using technology is not easy for her and yet the school expects her to adopt these methods. I also experienced that these teachers are afraid of the amount of work and effort it will take to redesign teaching material and upgrade their teaching styles. The older staff are accustomed to routine. Teachers like Mrs Fox also believe that this is just another passing gimmick from the DOE.

Innovation starts and ends with the teacher

Today I have I learnt that teaching for *innovation starts and ends with the teacher*. I must commit to being a lifelong learner. This involves making myself uncomfortable in the face of change and searching for solutions. I have come to realize that we will never get the support we need from the DOE, but we must step up and develop structures to push our school forward. My school may never get the technology it requires, but I can't just sit around, I must make the effort. Addressing social issues will bring us closer to strengthening our education at school.

5.5 CONCLUSION

This chapter provided the first level of analysis. The narratives of teacher leaders working in quintile 1, 2 and 3 schools. The narratives captured the implicit conditions in which teachers enact leadership to drive technological innovation for teaching and learning in the 4IR. The narratives highlighted the significant role contextual environments play on the implementation of technological innovation for teaching and learning. Cindy's narrative made clear the prevalent social ills faced in the quintile 1 schools. However, she emphasised the vital role networking and collaboration plays in advancing technological use in the school. Likewise, Zama's story also spoke of the awful limitations that social ills have on advancing technology. Zama however, acted as a catalyst of change in her school by purchasing her own technology

to get the technological revolution started. Finally, Evalina's narrative covered the important role she plays as a teacher leader in training teachers for the technological use and for driving technology in the school. The next chapter provides the level of analysis for teacher leaders working in quintile 4 and 5 schools.

CHAPTER SIX

EMERGING CATALYSTS: THE DIGITAL ODYSSEY OF QUINTILES 4 AND 5 TEACHER LEADERS IN THE TECHNOLOGICAL FRONTIER OF THE 4IR

6.1 INTRODUCTION

Chapter 5 presented the narratives of teacher leaders from quintile 1, 2 and 3 schools. In this chapter, I share the stories of teacher leaders from quintile 4 and 5. Schools in these quintiles are permitted to charge school fees in addition to the funding they receive from the government. The reason for dividing the stories into two chapters are discussed in chapter 5.1 (see, pg. 108). To further iterate, this chapter involved storying the field texts in order to display the first level of analysis known as *narrative analysis* (see chapter 4.7, pg. 97). The title of this chapter 'Emerging Catalysts' is a metaphor created to convey the idea of teachers who are driving change and sparking transformative actions. In this instance, catalysts signify the role as agents of change who are on a digital odyssey or voyage of challenge and personal growth in the 4IR context. The chapter unfolds by presenting Kirstern's story which is based in a quintile 4 school. It is then followed by Simitha's story, which is based in a quintile 5 school. Lastly, this chapter concludes by making visible the key points from each story

6.2 KIRSTERN'S STORY: OPTIMISING OPPORTUNITIES

...a sudden turn...

My mother always described my birth as the miracle of 1985. Being the long-awaited first-born son, I had the freedom to explore the green fields of Verulam, KwaZulu-Natal, the place where I was raised. Verulam in the 1980s was almost rural in nature, and many people worked in factories or on farms. My dad was a construction worker and took care of our family. He preached that the Lord Jesus was our source and hope for a brighter future. Due to my dad's minimum wage, I attended public school at Dianthus Primary in 1990 and finished school in 2002 at Mount View Secondary. Tertiary education was not a topic we discussed much in our family, so finding a job after school was important. I started working in the church's Youth Department as a musician and speaker. This role allowed me to influence countless youth by helping them redirect their lives away from drugs, alcohol, and other issues.

In 2009, my life took a *sudden turn* when my dad was murdered at a construction site in his mobile office. I still don't know what transpired, but the gang of criminals plundered the office and shot my dad. This threw my whole life into disarray. A few months later, the criminals were arrested, and facing them was the greatest challenge. My Christian values were put to the test. I had to see beyond human reason in order to make peace with what had happened. My dad's death was a launching pad for me to become

something greater. In 2010, I made the decision to study teaching part-time. I worked as a waiter at Spur, but I also decided to take a leap of faith and volunteered at a secondary school in my community. My skills were quickly noticed, and I was soon offered a position at the school. I am grateful for the challenges and triumphs that have shaped me into the person I am today. I found my purpose in life through serving others as a teacher.

I became an indispensable asset...



Figure 6.1 Collage
Inquiry- going beyond

In 2011, I initially started off as an admin worker at a secondary school in Verulam. That year, SA-SAMS was introduced as the compulsory admin server for public schools. I wanted to learn this complex system, so I approached the principal and asked if I could attend the workshops. At first, he was reluctant because I wasn't a state-employed worker. After the workshop, I was determined to become an integral part of the school's administrative team by going above and beyond my job responsibilities (Figure 6.1). I volunteered to set up all the admin computers in the office area with SA-SAMS and studied every function of the program during my break and after school. By being knowledgeable in the system, *I became an indispensable asset* to the team. Soon after, I even volunteered to workshop the teachers at the school, further demonstrating my commitment to my role. This had a positive impact as teachers were able to analyse learner results more easily. This enabled teachers to create tailored made support plans for grade 12 exam groups. The principal noticed my zeal and dedication, and this eventually led to even more opportunities for growth and development. Soon after, I was teaching Life Orientation. I would create captivating lesson for the students, and I would use my training from the church to provide life lessons. In addition, I started helping some of the Math's teachers since I was studying math's as my major. I volunteered to give Math additional classes to the grades 8 and 9. In August 2011, the principal who noticed the tremendous effort I was putting in and sent a motivational letter to the DOE to employ me as a substitute teacher. Since Math skills were rare, the DOE approved my appointment on the condition that I continue studying. With this new opportunity, I gave 110% effort. I would come into school at 6:30am to help the principal with any admin tasks. I did the relief roster, set up exam rooms, and helped with invigilation rosters. My principal saw my zeal and trusted me with many duties.

...merging different components...

My substitute position ended in Verulam, December 2015. In 2016, I was employed at a quintile 4 school in the Umlazi district, Durban west circuit. The former principal, Mr. Jacob, who led the Westhill secondary school for 20 years was well known for his level of excellence among public schools. He was talented at negotiating major deals and getting huge companies to buy into the school. During my short experience

with Mr. Jacob, he would secure thousands of rand in sponsorships and donations annually. I recall in 2015, he secured a sponsored to build 12 new classrooms, 4 in each of the three tutor buildings. In addition, he revamped the school toilets, computer rooms, media centre, library and school café. The school offered a host of subjects which were both academic and vocational. The school admin block, which was revamped, displayed pictures of several learners from the school who were placed in top positions in the country in their grade 12 examinations. My first impression of the school was embellished with awe as the school had achieved a multitude of success despite the low-to-middle income area it was located in.

Finding my feet in 2015, I watched how this principal led an aging staff. The staff trusted him greatly and would do anything he asked. The principal always got teachers to buy into his goals for the school. He would make different aspects of the staff come together for the betterment of the school (Figure 6.2). He knew how to merge different components in order to move



Figure 6.2 collage inquiry-bringing staff together

the school forward. The principal would do his best to provide his teachers with the resources and in turn the 60 teachers did their best in the class to serve the 1400 learners it catered for. The principal also supported teachers' strengths. For instance, teachers who were interested in social ills, he would support them to run lunch clubs and even host adult literacy classes for the community. In other cases, the school even had a sustainable farm (in 2010 to 2020) which employed three full time workers from the community. This resulted in NGO's that partnered with the school to support this initiative. In 2015, I walked into a thriving schooling which worked well to weave its way around social ills that the school faced. Mr. Jacob knew how to win the community over by allowing them to make free use of the school for cultural and religious reasons. In this way the community also looked after the school.

Reinventing the Wheel

In 2016, I began teaching Maths and Natural Science to grades 8 and 9. My Head of Department (HOD) had been in management for over 20 years and was close to retirement. He was a brilliant Maths teacher but strict and inflexible. He expected all plans to be followed as directed with little room for discussion. I found it challenging to extend myself in the Maths department as there was little room for change. However, with the arrival of the new principal in 2017, my HOD and about 10 other staff members retired within a year. Over the next three years, another 10 teachers retired, leaving the school with a staff of 60 teachers, of which 50% were new teachers. The new principal, Mr. Rick, had to manage new teachers coming into an established school while losing experienced managers and teachers. He implemented many changes in a short period, such as restructuring timetables and altering how internal exams took

place. He also terminated a few administrative workers and school governing body teacher contracts that he deemed unnecessary. However, many of the longstanding staff members were unhappy, and during a staff meeting in 2018, a longstanding HOD, Mr. Daniel, expressed his dissatisfaction with the changes. He argued that the current systems had been tried and tested and were successful given the school results. The other HODs echoed his sentiment and expressed concern that the principal was *reinventing the wheel*. A month later, Mr. Daniel resigned.

Despite this, I found the principal to be very welcoming and appreciated staff members who took initiative. He provided numerous opportunities for my growth as a teacher, such as assigning me to do the annual timetabling and supporting my initiative to start a school Youth Club and host a fun run. He even entrusted me to organise school events like the school debs' ball, school awards day, and grade 8 registration. I supported the principal's leadership, but other teachers became resentful and were reluctant to get involved in other activities. Fortunately, a small team of teachers stood with the principal and helped him get tasks done. As a teacher, the principal enabled me to participate in various management and leadership duties, and I respected him for that.

4IR Initiative

By 2017, a longstanding teacher, Mr. Govender, approached me to get involved in creating awareness about the Fourth Industrial Revolution (4IR). Schools in my community knew very little about STEM education and the 4IR. Together with this teacher we decided to create a yearlong *4IR initiative*. Mr Govender outlined how the 4IR was a key component for future education and he believed that this initiative would be well supported by the government. We decided that we would host a Math's Quiz at our school. However, it will only be open to grade 7 learners in the province. The principal of our school supported this initiative as he believed it would attract outstanding learners for grade 8. We marketed it across KZN schools, and we had about 120 learners from 60 different schools participate. We secured sponsors from countless businesses to help host the event. The aim of the event was to identify the 30 most innovative learners. These learners would then be given the opportunity to learn about the 4IR. We were able to secure robotics and coding classes for the winners. The winners also received training in 3D printing. Finally, the learners would receive a year's worth of advanced math tuition. Together as a team we put together a challenging and stimulating curriculum based on innovation. We used PowerPoints and computer apps to stimulate these learners. On many occasions we would invite other mathematicians to deliver lessons. These teachers often used smart boards and maths programs to teach these learners. As a teacher, I would network with these mathematicians to sharpen my own skills. I would then take these ideas to maths teachers in my school department. The atmosphere created in the

school and community was phenomenal. Leading an event of this size was a true growth experience for me. It was amazing to see what a small group of teachers could achieve. This event made our school popular in the community and we were able to network with many organisations who were willing to support our school. Our school received a R100 000 donation from a prominent Durban businessman.

You can't do the same on a chalk board

Our school has the resources to become tech-savvy. Our school has two computer rooms and a media centre. One of the computer rooms were used to teach computer science and CAT. After the 4IR initiative I networked with a computer scientist, named Carl, who works for an educational company who provides educational computer programs. Together with the principal he suggested that we make a request to his employer to help revamp our computer rooms. This worked well as his company sponsored the school 35 Notepads, a server and training. The company installed a server which would give teachers and learners access to an online portal of CAPS curriculum resources from Grade R-12. Carl's company even help set up the 35 Notepads. I was tasked with setting the training for the workshop. I was always curious about learning new technology. I remember when the guys came in to install the programs, I was one of the first people to get involved. I played an important role in helping set up the computer lab. Carl came in with his team and displayed how the program works. After creating an account each teacher could access worksheets, lesson PowerPoints, diagrams, maps, case studies and video lessons. This program gave us access to sites like Khan academy for Math's. The training went well, and many teachers understood how to access the material.

Once it was set up, I made frequent use of the computer room. There were not enough computers to host the 40 learners that I teach. I spent countless hours learning the system. I would take my learners there occasionally. I would use some of the application on the server. Once I learnt how to use the Geo-app, I would teach geometry on it (Figure 6.3). It was very time-

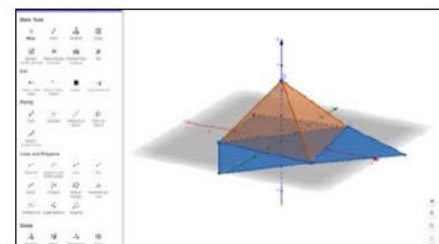


Figure 6.3 Photovoice- Computer app

consuming learning some of these apps on my own. I didn't utilise some apps as I could not figure them out. I usually searched YouTube tutorials to help learn how the applications work. Some application also needed additional plug-ins that you had to pay for or subscribe to. However, it was exciting for the learners. I would spend most of my time downloading the lesson resources to create worksheet and PowerPoints. I also downloaded countless videos from Khan Academy that I could project using the multi-media centre/library. These videos were useful as learners could watch other teachers teach how complex problems were solved using a variety of resources. For instance, my grade 8 classes would watch you can find the volume of a curved 3D shape. I had to learn what are the current trends in multi-

media that attract learners. It's important that you learn the lingo of the times. It's important to learn the lingo of the times because I teach children of different backgrounds and races. In my teaching of maths, I use these technologies to remain relevant and ensure I can communicate with learners. However, the multi-media centre was unreliable since no one maintained the projector and computer. As a result, the computer was often slow and replacing the projector bulb was a mammoth task. Overall, these videos allowed the objects to come to life and learners could relate to them. *You can't do the same on a chalkboard.*

...teachers will not immerse themselves into new learning if you don't lead the way...

In 2019, my journey as coordinator of the Mathematics Literacy (Math Lit) department was empowering. I was determined to change the way math's lessons was taught by embracing digitalisation. I would create worksheets for the team using computer applications. I redesigned a lot of the material from the DOE as it was too mundane. I believed that as a leader it was my



Figure 6.4 collage inquiry-Unlocking the innovation

job to unlock the innovation pool in the teachers I lead (Figure 6.4). As a leader I had the key to unlock potential if I could present the teachers with the foundation. At first, it was a challenge to get the teachers to access the electronic resource-hub I had created. This was a challenge as many of them were deep rooted in using files, textbooks, paper and the chalk board. While the novice teachers were keen, they lacked exposure to technological innovation in teaching. The challenge was that few understood what innovative and digital teaching looks like. I persevered by spending time teaching them how to access the USB drive, edit documents, print and taught some teachers how to use the computer lab. Sometimes I had to be firm and insist that they explore the drive to access the resources. *Many teachers will not immerse themselves into new learning if you don't lead the way* and make it compulsory. For instance, I attended the 'Introduction Math's Lit workshop' hosted by the DOE in February 2020. It primarily focused on sharing curriculum documents and dissecting the 2019 grade 12 Maths Lit exam.

I realised that to bring about change, it was important to improve communication within the department. I created a WhatsApp group where I shared curriculum documents, annual teaching plans, and other useful material. The teachers appreciated the convenience of using their phones to access the group. I also started weekly meetings where we discussed challenges. These meetings took place during school time as teachers were reluctant to stay in after school. This helped create a culture of continuous learning and teamwork, and I got to know the teachers personally, which helped me gain their buy-in into my vision. My HOD and principal trusted the decisions I made while I was coordinating Maths Lit.

...white elephants in the school...

Having all the technology in school will not guarantee innovation. The two computer rooms and media centres have become *white elephants in the school*. It's been four years since the 35 notepads have been installed in the school. Over the years very few teachers made use of it. There is no drive from the leadership to make use of technology. At the end of the day, it's all about the matric results. Technology use is not on the agenda at principals' meetings. When the principal reports back to staff after meetings, it's always about ensuring we are ready for school

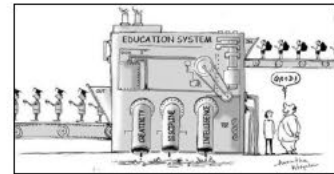


Figure 6. 5 Collage inquiry- Education system: no focus on innovation

evaluation and ensuring we achieve good results at the matric level. This picture (figure 6.5) shows how my school is only focused on getting learners through the system while not developing innovation, intelligence and creativity.

There is no room to be innovative as the curriculum is dense. We don't have any long-term vision in place to promote technology. Our current principal and HODs, are from the old regime of education, where *chalk and talk* methods were the way to teach. While many have moved away from this, I feel we have not moved very far because our leaders have not been exposed to what the 4IR means for education. Our school has failed to keep up with current trends. Our schools are facing problems that cannot be dealt with by old policies. For instance, our school policies, while they are democratic, they do not practically promote collaboration for teaching and learning. We are still very isolated in our approach to teaching and learning.

Over the past 6 years my school has moved in the opposite direction of the 4IR. We have dropped subjects like Computer Science and Computer Applications Technology. After our Computer Science teacher resigned in 2020, the DOE has failed to fill that position. Our computer science teacher was assaulted by a learner, and little was done by the DOE to support this teacher. The principal then made the decision to drop computer subjects as it was expensive to maintain and update the computers. Due to not having personnel to ensure that the computers, notepads and media centre is operational, it has resulted in these venues become major *white elephants*. This has put a restriction on subject selection and technological advancement in the school.

school's culture that has been clogging our progress

I have been concerned about the school's culture that has been clogging our progress in learning. Our schooling environment has changed but not much has been done to accommodate that change by 2020 (Figure 6.6). While we have many knowledgeable and experienced teachers, some with post-graduate qualifications, we still struggle with a lack of community and collaborative unity for tasks. Teachers are demotivated due to the behaviour exhibited by some students, which can sometimes escalate into physical

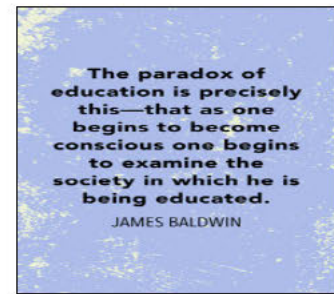


Figure 6.6 Collage inquiry-School change

confrontations. In 2021, our learners rioted through the school in opposition to a decision made by principal. Unfortunately, there are little effective policies in place to deal with these incidents, leaving teachers to handle them on their own. I have tried to address these issues in my classroom by being patient with learners and calling up parents when needed. However, this should not be solely the responsibility of teachers.

I have also noticed the lack of policies and structures to support learners who struggle with reading and writing. With 35-45 learners in a class, there is little room for innovation and technology, and it becomes difficult to cater to individual needs. I have had students in my class who cannot even write a sentence or identify letters. This is a serious problem, and we need to create strategies to support these learners. Additionally, there is a lack of collaboration and support from school leaders. While we have experienced teacher leaders who are underutilised, we have had instances where leadership did not want to support programs set up by teachers. This has led to unhealthy conflicts between teachers and leadership, and some decisions were made without the input of teachers. For example, in 2020 the principal once proposed that teachers stay 15 minutes after the exit time and 30 minutes later once a week to engage with learners and have meetings. However, this proposal was met with resentment and anger, leading to a lack of buy-in from teachers. The culture in our school has diminished to a point where several teachers do not care, and they have lost faith in the leadership. Without creating structures and policies to support struggling learners and providing opportunities for teacher collaboration and innovation, we will not progress.

...the traditional classroom...

As an educator in a school that lacks technological resources, my experience has been one of constant innovation and creativity. To provide my learners with the best possible education, I have had to rely on outdated equipment such as an old projector that I found in the school safe. While the colour-contrast on



Figure 6.7 collage inquiry- Tradition classroom



Figure 6.8 Collage inquiry- modern day class

the projector is not ideal, it allows me to show my learners important visuals for their math and science lessons. I have also been fortunate to have access to my personal laptop and internet, which I use to supplement my teaching and provide my learners with access to online resources. Despite these challenges, the biggest obstacle to providing a modern education in my school is *the traditional classroom* setup. Most of our classrooms are designed for individual learning, with rows of desks facing the front of the classroom (Figure 6.7). This setup does not allow for collaboration or exploration of the material, which are essential skills for the 4IR. We don't have WIFI and a computer for the teacher. Unfortunately, there are no policies or guidelines in place to transform our classrooms into more modern and innovative spaces where students can learn in groups and explore their own learning materials (Figure 6.8). The rigidity of our curriculum further hinders our ability to prepare students for the 4IR. Our focus is on content-based learning, with little room for innovation or the development of 21st century skills such as inquiry, problem-solving, and creating and evaluating. As educators, we have not been exposed to what the 4IR looks like in schools, and many of us were educated in a technologically deprived society. We are not equipped to model the skills that our students will need in the future. Over the past two years, I have been reading extensively about the 4IR in education and exploring ways to integrate technology and innovative teaching methods into my classroom. However, without support from school leadership and policies that encourage innovation, I am limited in what I can do.

...stretching myself above and beyond the expectations of the classroom

Our school has a strong culture of hard work. Despite facing numerous challenges, we always strive to be accountable for our actions. Personally, I make a conscious effort to put my best foot forward in everything I do, often *stretching myself above and beyond the expectations of the classroom*. In 2018, I had the privilege of hosting a high-school-wide science quiz. Our goal was to invite schools from across

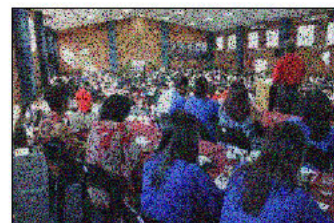


Figure 6.9 Photo elicitation- School quiz

the province to participate in this exciting event (as shown in figure 6.9). With the principal's approval, I took on the role of project leader. I remember coordinating with teachers to set up different categories of

questions, organizing the venue, sending out invitations, securing sponsorships for prizes, and arranging food. My team and I discussed who would be best suited for different tasks, and once teachers were assigned a role, they worked together with our team to form a cohesive unit. Our focus was on STEM education. As a result, participants were given resources packs/topics to explore. The science teacher Mr Pillay did a fantastic job preparing our learners. Resultantly, our school become more involved in science competitions. In 2019, Mr Pillay and I registered our science team for a science competition. Our school did well as learners progressed through multiple rounds. It had a positive impact on the science department as teachers were keen on preparing learners for these tasks. Learner were being exposed to innovative and technological information.

Over the years, I have also been successful in raising funds for our school. In 2021, I was able to network with a local business in our community to fund a R45,000 project to revamp our school corridors. I am passionate about working with children from underprivileged backgrounds, and as a result, I founded the Youth Group at our school to reach out to these kids. Currently, the Youth Group has grown to accommodate up to 200 learners every Friday. Through partnerships with local churches, we have been able to raise money to pay for learners' fees and uniforms, prepare food parcels, and assist learners who have lost their parents. As a teacher, I believe I have a duty to serve not only my learners but also the wider community.

...a great technological gap in this nation

As I call life a journey, so too my life as a teacher has been one. I worked through my teaching life with a lot of battles and mostly victories with an array of experiences I picked along the way. Optimising every opportunity has not only altered the course of my life but has altered the generation of learners I have encountered at school. Exposing learners to the 4IR is an initiative that teachers must drive. If I continue to wait on the DOE, we will have *a great technological gap in this nation*. As a teacher leader, I have to continue hosting provincial events, in hope that the DOE and other schools will catch the 4IR wave. The greatest concern is falling behind the technological curve.

6.3 SIMITHA'S NARRATIVE: INNOVATIVE TEACHER LEADER

The Teacher's Pet

I was born in a small town in Port Shepstone in 1990. Growing up in this town, I was enveloped by a strong sense of community, tradition and unity. By 1990, the town was shared among different race groups, fostering a sense of unity that I cherished. As a child, I was fascinated by learning, and my father was a great influence in nurturing my education. Though he hadn't had the opportunity to complete school during apartheid, he valued education and spent countless hours reinforcing my learning. I was the nerd of my family, and throughout my schooling, I was *the teacher's pet*. I attended Marburg Primary School and then moved on to Marburg Secondary School. In grade two, I was tasked with tutoring a classmate on phonics, which I loved. In high school, I found myself tutoring countless learners in Accounting, taking on a teacher's role before I even became one. My love for school drove me to become the Deputy Head Girl and dux awardee.

As early as primary school, I knew I wanted to be a teacher. This surprised many people who thought I should become a doctor given my excellent grades. But my love for education superseded everything else, and in 2008, I began my bachelor's degree in education with a major in Accounting and Biology at the University of KwaZulu-Natal. In 2012, I graduated with a Cum Laude pass. While working, I completed my Honours degree in Science Education in 2014. This too was with a Cum Laude pass. While working at my first school in Pinetown, I knew that I wanted to spend the rest of my career in the classroom. Although I was offered a bursary from UKZN to pursue a master's degree, I knew that a master's degree would typically drive people to work in a university, and that wasn't for me.

...you have to be cruel to be kind

In 2012 I started my first teaching Job at an all-boys' high school in the Pinetown area. This was a well-resourced quintile 5 school. I was employed as a Biology teacher. I have never experienced education in single-sex school. You can imagine teaching high energy level boys who love playing contact sport. It was baptism by fire. In your first year of teaching, you always end up with the most ill-disciplined class and academically low ability students. I had a lot of knocks in my first year, but it only made me stronger. You realise that as a leader in your classroom you don't look to the management to assist with issues of discipline. It shows weakness as a young teacher to call the headmaster into your class to reprimand a child. The leadership I learnt from my dad quickly surfaced as I needed to adapt. My dad taught me, '*you have to be cruel to be kind*' when you are leading. This meant you can't shun away the difficult things. Therefore, I would challenge the boy's poor behaviour by giving demerits, calling parents and

reprimanding them. I would challenge them with difficult class tasks, homework and additional work. At first this was seen as a punishment by the boys but later they began to experience the order it brought.

In 2013 I got married and had my first son. Having my own family, and inspired by my late father, I learnt that I had to lead my classroom and teachers the way I lead my household. The way I had led my boys in my classroom was very family orientated. This involved developing mutual respect with the learners. This allowed me to build relationships with the learners. Relationship building was the foundation of getting the boys to enjoy their learning. If you don't get to know the learners personally, their learning styles, their strengths and weaknesses, then your teaching style is not going to build them.

Leadership is about confronting uncomfortable situations

After 3 years in my teaching career, I was tasked as the subject coordinator for science. Due to my HOD having an extremely busy workload, the principal appointed me as subject coordinator. I was not paid for this role. I was selected for this role because of how people see me. This picture (figure 6.10) captures me as leader who is well put together, articulate, innovative and beats the deadline. I had the opportunity of leading three teachers. I saw leadership as having two roles.



Figure 6.10 Metaphorical Photo- the well-put-together teacher leader

First, as a teacher leader who leads other teachers and second, as a leader to learners. I would lead my teachers by example. I would set realistic expectations that I knew were achievable. This included meeting deadlines, developing innovative lessons and getting involved in extra-mural activities. Building relationships was my primary focus. You must get to know the people you lead by discovering their strengths and weaknesses. Relationships help you address uncomfortable situations. There were uncomfortable situations where I had to go and do peer reviews and teacher reviews. I had to address weaknesses with teachers that are older than me. However, I often did this by describing the issue, providing possible solutions to the problem and modelling the solution in my lesson.

In 2016 I got my team to see the need for innovation and technology in our subject. Leading by example, I started a robotics club in the school. I linked up with the Science Centre in Durban and enrolled our school in a robotics course and competition. Our robotics team was tasked by the Science Centre to build a Lego robot around natural disasters. The task involved building a robot to complete a host of tasks. I learnt about robotics and basic programming. We built and programmed the robot. The learners were absolutely vested in the task. The teachers that I led helped the team throughout. At first teachers were reluctant to give up their time because this meant giving up a few weekends and staying in after school. However, with much motivation and clear structure teachers bought into the project. Due to the

consistency of the project, teachers were more willing as time went on. At the competition our kids won best presentation and made it to regionals before being knocked out. In our second and third year we came back stronger and made it to nationals which was in Johannesburg. This created a huge buzz around the school. It also helped our robotics club grow. Leading and learning is very uncomfortable. However, if you can face those uncomfortable situations, it will take you to uncharted territory where you can learn new things.

They saw something in me that they wanted to nurture

In 2018, my husband's promotion resulted in us moving inland in KwaZulu-Natal, and I had to resign from my school in Pinetown. It was heart-breaking for me. I applied to many schools in the surrounding area. To my surprise, I received a call from an all-boys school in the area. The school was seeking someone to take the Physics achievement to an



Figure 6.11 Metaphorical photo- Fully resourced school

outstanding level. Although I had not taught Physics before, the panel of men who interviewed me were impressed with my interview and offered me the job. *They saw something in me that they wanted to nurture.* After the interview, a staff member took me for a tour through the school. The picture represents the magnitude and prestige nature of the school (Figure 6.11). The school is a quantile 5 school that services a high-income economic group. The school fees are exorbitant, making it attractive to wealthy parents. Traditionally a White school, it has over 100 years of history and is extremely well-resourced with world-class security. There is a strong focus on sports and culture. The school had produced many professional athletes over its history. For academics, we have a well-resourced computer centre, WIFI across the school, projectors in most classrooms, smart boards, science labs, media rooms, extra-curricular venues, a theatre and school hall. The school was equally well equipped for sports. The school's leadership structure is hierarchal and filtered down, which is ideal for a school of this size. I was excited to be a part of such a high-performing school and looked forward to the challenges that came with my role. It was my responsibility to make the Physics department excel, and I was determined to put my best foot forward.

Turning black & white into green and gold

As a new teacher at Northville High in 2018, I quickly learned that the school's culture was deeply ingrained in the blood of both the learners and teachers. The school's rich history was celebrated and promoted at every opportunity, with a particular focus on the memorial building (Figure 6.12) that serves as a monument to the school's culture and heritage. This building, which cannot be



Figure 6.12 Collage inquiry- Memorial building

renovated, is a tribute to the school's founders, its leaders [both past and present], and its most successful learners. It is where special events, such as the weekly assembly, take place. At these assemblies, the learners proudly sing the national/school anthem and say a prayer. They wear their school blazers, displaying the school emblem with pride. Whenever there is a success to celebrate, the boys give out a war cry, followed by a motivational masculine message from the principal.

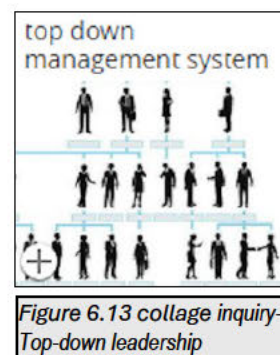
The building is a symbol of transformation and represents the school's commitment to turning black and white into green and gold. The motto is a call to unite the school's diverse student body into a single brotherhood. *Turning black and white into green and gold* means transforming every learner into a quality individual through academic, cultural, and sporting activities. The school recognises that it cannot present a bright future without addressing the issues of the past. The school's diverse demographic makeup prompted the establishment of a transformation committee in 2016. The committee, comprising academic staff, learners, and parents, focuses on transitioning the school from a previously white institution to an inclusively diverse school for both teachers and learners. Cultural and historical events are of tremendous importance at Northville High. In 2019; the school commemorated Youth Day by celebrating the life of Hector Peterson, the first teenager to be killed during the Soweto Uprising against apartheid education in 1976. Peterson's sister was invited to deliver a speech on racism and transformation. In 2020, I was part of a team who hosted conversations on white privilege. This conversation helped bring understanding and avoid misconceptions which were circulating in many other schools and were resulting in riots. Before, the COVID-19 lockdown, the school announced its support for the LGBTQ+ community. During one assembly, a learner spoke about the challenges he faced as a gay South African Indian. Walking into the memorial building one feels like a professional teacher, surrounded by a history of success, struggle, and transformation. The school's commitment to diversity, inclusivity, and transformation is truly inspiring, and I am proud to be a part of it. At our school we see the advancement of technology in our curriculum as a key tool to help us address past injustices and give our learners the start they need in life.

Everybody has a narrative

Our new principal joined the school 2016. His primary goal was to improve relationships. He promoted this by implementing the theme: *'Everybody has a Narrative'*. As teachers it becomes our task to get to know our learners' stories. Likewise, it was the task of our HOD to get to know their teacher's story. Firstly, the principal established this by introducing, Meal Fridays. As a department we would share a meal before having our department meeting. This helped us to get to know our teams better. However, there is more emphasis on getting to know the learners' stories in order to develop them into men. We treat our boys like gentlemen. We greet them, with a resounding "good morning gents". We do this to promote respect, knowing that these boys are one day going to be fathers and leaders in our society. As a form teacher we have planned activities to get to know our learners. For instance, this year [2022] I created topics on how you see yourself, how others see you and why is sport important to you. These topics help drive conversation. I sometimes think we overly communicate but the results are positive. The students have access to my number. Previously I would never give my number to learners. With WhatsApp being such a useful tool, you can't but help yourself to use it. I use it in line with the school social media policy.

Finding my place in the school

Joining the school in 2018 involved making major adjustment to how I involve myself in the school and how I lead others. I quickly learnt that this school was highly structured, with everyone having a specific role to play. Opportunities and roles were handed down by the leadership team and filtered down to HODs and teachers (Figure 6.13). In my early days at the school, I found myself supporting in extramural activities such as debating, public speaking, and squash. While I got involved, I realised that I had no



passion for these activities. What shocked me the most was that parents and the school seemed to prioritise these activities over academics. It took me two years to *find my place in the school*. I started a club to tutor physics, and it was highly engaging and stimulating. Taking the grade 12 classes in 2020, we achieved a 100% pass rate with the most A's. I went out of my way to make these lessons as engaging as possible because I had extra time to do so and I wanted to promote academics. I, therefore, would make use of the science labs to conduct experiments that were above and beyond the curriculum. I would create group projects for students to conduct experiment to test hypothesis. Given that the quality of results drastically improved, it was then that the school leadership recognised the value of academic clubs. However, I also learned that I didn't have to involve myself in everything in the school. If given an opportunity, I should do it well. Despite the school's highly effective leadership, there was little voice from

vital role in the training and support of the teachers during the lockdown period. The training sessions focused on various google software applications such as google docs, google classrooms, and google chrome books. The primary goal of these sessions was to create and sustain a digital form of the real-life classroom. The training sessions also included tests that helped to target strengths and weaknesses in the teachers' learning.

I found it daunting to record all lessons on google meet, knowing that the lessons would be seen by parents, and colleagues. This helped me become a more reflective teacher, and I was able to improve my practice. For instance, this year (2022) I started the topic on organic chemistry. This resulted in setting tests using google forms, which allowed me to create an answer scheme

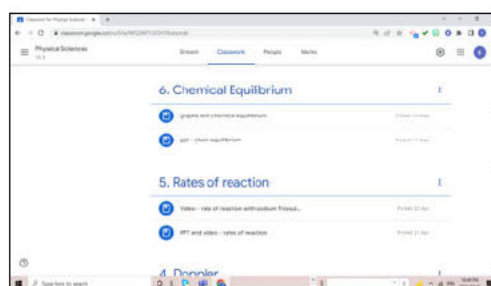


Figure 6.15 Photovoice-Google classroom

which would self-mark the learners' work. Google classroom also presented an incredible opportunity to upload work and communicate with the learners throughout the year (Figure 6.15). I could organise the learners' work into topics and monitor who had completed tasks. I would send out messages to learners and provide individualised feedback. The learners also had an opportunity to respond to my feedback. This allowed for efficient tracking of the learners' progress and ensured that they did not miss any important material. Digital learning also helped to solve the problem of learners who missed lessons due to their participation in sports. I had learners who were on the rugby, and cricket teams, and they often missed lessons. However, the recordings of the lessons enabled them to catch up on missed work and serve as a revision resource. This also kept the parents happy because they seem to value sport more than academics. The technological change in this school was a positive development that enabled the school to transition to digital forms of teaching and learning.

Imposter syndrome

Working in a thriving school requires you to make adaptations to the current context. The picture shows what I experienced when I joined this school and how I felt when we go through change. Change and new challenges tangle your mind (figure 6.16). As a teacher, it becomes my job to untangle these complex situations to present the boys with a quality education experience. In addition, given the high

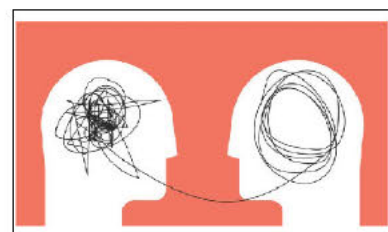


Figure 6.16 Collage inquiry-untangling complex situations

standards, you cannot come in and 'chalk and talk'. The school environment is such that you must put your best foot forward. To cope with this, I felt like I had *imposter syndrome*. Dealing with new technology

and digital learning can make you feel as if you will never catch on. Therefore, I found myself putting on a persona of excellence to cope while I was still frantically learning behind the scenes. I feel constantly anxious at times. Teaching a highly academic subject like physics to Grade 12 learners since 2018 involved putting a lot of pressure on myself to perform. My teaching preps cannot be recycled. I would adjust my lesson plans annually taking into consideration teaching methods and resources which will suit the current lot of learners. Every cohort of learners is different. As a teacher I must constantly find ways to teach better. This involves investing a lot of hours in self-learning. In 2021, I started using apps to teach circuits. There is a PHET simulation app developed by the University of Colorado. Using this simulation app brought life to the topic. Learners could clearly explore current changes and what happened to the voltage and resistance in a circuit. Learning one PHET simulation could take about 45-60 minutes to understand, and there are many. While, we do have free periods in school, I use them to immerse myself in new learning. You will barley find me in the staffroom during a break. You would think after 11 years of teaching, you would coast, but being effective means constantly adjusting.

...a culture of digital learning and technology in the school through communication

The school has put in place many strategies to help promote a culture of digital learning and technology in the school. The school prioritises communication. At the top, the leadership ensures that every learner has a student email account. The learner uses these accounts to log into school computers and google classroom. In addition, the administration team keeps in contact with parents via email, WhatsApp and google classroom. I ensure that I keep in contact with parents via email. Parents are paying a lot of money and want to know how their kids are doing. Within our departments, we are expected to have WhatsApp groups for the classes we teach. We have found that learners are more likely to check their WhatsApp messages than their email. The tool works well as it provides instant communication. I use this tool to send out exam information, revision, voice notes explaining content and motivational messages.

Prior to 2018, the school did not allow learners to bring in mobile phones. This resulted in learners sneaking in their phones. In 2016, our school had an incident were a child recorded one of our science teachers reprimanding a learner. The learner was obviously making the teacher angry. In a moment of anger, the teacher used her middle finger to point at the door, shouting "here's the door-get out!". However, the teacher did not use her finger to be vulgar. That was taken out of context by the learner, and the learner maliciously posted the video on YouTube. This resulted in an investigation by the DOE. This Incident led to the school developing a social media and mobile phone policy. The school leaders developed a comprehensive policy. This policy also allowed learners to carry their phones to school. The principal saw the benefit in allowing learners to bring in their phones by teaching them the social media

policy. Sometimes you don't have to fight every change, you must embrace it and make it work for you. During the grade 8 induction, the principal workshops learners and parents on the media and phone policy. In addition, the rules are re-enforced during assembly. I found that using WhatsApp had help me create a better relationship with the learners and it's in line with our motto, that everybody has a narrative. The school also encouraged teachers to have a bunter WhatsApp group with our form classes. This is a group in which learners and teachers can share memes, jokes and videos. This helps us to stay in touch with the current generations communication by becoming more relatable. Thus far the policies work well as learners are very respectable.

... policy needs a human affectionate touch ...

In 2020, my school made a significant shift towards digital learning, which resulted in the implementation of several policies that promoted the use of technology in the classroom. The policies provided guidelines on how to create and use Google Classroom, including posting and creating material, communication with parents, and privacy issues. During our term observations, we had to ensure that we incorporated technology in our class lessons, and HODs checked our learners' books and Google Classrooms. As the Grade 12 Physics coordinator, I started meeting with other Physics teachers in our department to plan lessons, create teaching materials, and share ideas. In 2021, I convinced our teachers to start using and working on 'live documents' for all planning. Following the policy guidance, I created planning folders on Google Drive and enabled teachers to make live contributions to documents. This has allowed us to collaborate more effectively, edit documents during meetings, and work remotely from different locations. It also saves us a lot of time, and we can create more effective materials since we can share ideas and edit them as we please. Additionally, our department meetings have also taken the same approach, and all curriculum documents and planning are now done on Google Drive. This has enabled us to work together as a team.

However, we encountered challenges when familiarizing ourselves with the system. Many teachers had to learn how to use Google Docs to create PowerPoints and Word docs, and learning how to edit live documents was new to us. Some teachers couldn't access the system, and organizing the folders was a challenge. Therefore, some teachers in our department were reluctant to use the tool and complained, especially the older ones. To address this, I suggested that we 'buddy up' with teachers to support each other. While the school had provided training and we do have tech support, I found that teachers sometimes need to be motivated in the initial steps because implementing *policy needs a human affectionate touch*. The adoption of digital learning has been a significant change for our department, and it has provided many benefits. However, it also came with some challenges. Nevertheless, we have

learned how to work with these challenges, and it has enabled us to create more effective materials and work together more effectively.

Sustaining a digital culture...

Sustaining a digital culture in school has been a journey of growth for me. I've learned that technology and digital learning aren't tools that dumb down education; instead, they enhance what we need to learn. When we shifted to online learning and started using more technology, it didn't instantly result in all students getting high marks. I found that students with a strong work ethic continued to thrive, while the lazy ones still had to be pushed. I realised that technology does not make one a critical thinker, and I still had to build up my learners through core



Figure 6.17 Photo voice- Smart boards

teaching. The CAPS curriculum is so content-driven and time-consuming that it doesn't always consider the use of technology. As a teacher, I had to be creative and find ways to fit technology to help enhance the curriculum, which was a significant barrier. In this dispensation of learning, the curriculum together with the annual teaching plans must integrate technology, as it's still too textbook-driven. In 2019, I became one of the first teachers to make frequent and consistent use of the Smartboard (figure 6.17). I taught myself how to use it since the school only had about four smartboards at the time. Using the board in my physics lessons helped bring concrete objects to life when teaching, and my Head of Department asked me to do short workshops with the science department. Resultantly, more teachers started using the whiteboards, and the school purchased more boards. Teachers in the department also started booking computer labs to do their lessons.

After the pandemic, I followed the school's instructions by ensuring that technology was being used in class. This is a photo (figure 6.18) I took of my learners using their Chromebook to complete work I had posted on their Google Classroom. The use of laptops and Chromebooks allowed me to teach my students to

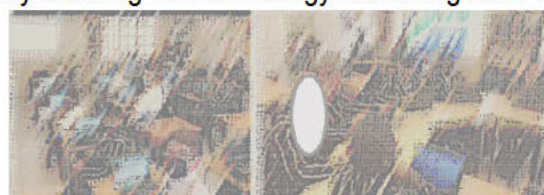


Figure 6.18 Photo voice- Chrome book use

become independent thinkers and use their devices for research. It's not just about getting Google to respond to questions; it's about teaching learners to research information that will help them assess, evaluate, and critique data. The level of insight that some of these learners have gained is incredible. The picture on the right shows learner in groups working through a topic (Figure 6.18). Therefore, it's important to keep the technological momentum built up during the pandemic going. But for this to work, I had to let go of certain teaching philosophies from the past. In the past, I believed that students needed

to be passive, seated, and inactive in their learning. However, this had to change. I had to create learning opportunities for the learners by using the resources available. With technology, this has caused learners to engage with each other.

Using technology outside the class



Figure 6.20 Gaming and editing clubs

For the 4IR to work, we must incorporate in all aspects of the school and not just to class learners. In 2021, I help solve a bullying problem that we have been experiencing in the school. The learners were not reporting the incidence because they were afraid. I suggested to my HOD that we



Figure 6.19- QR Codes

put up QR codes around the school and on google Classroom to allow learners to register a complaint. This strategy worked well. We had a few reports, and this helped us fix the problem. Currently, we still use this strategy to encourage learners to report any incidences. Thereafter, other departments started using the same idea to get learners to sign up for extra curriculums (figure 6.19). In addition to this, I have worked with my form class to help create clubs which are appealing to learners. In 2022 my form class started an online strategy gaming club and a video editing club. It's my duty to make these clubs appealing to the students even though I am not involved in them. This picture shows one of my boys editing one of our school football video footages (figure 6.20).

Learning Never Stops

Over the years I have discovered that learning never stops and that on some occasions change must be radical. The 4IR can only be realized in our schools if we prepare for it by adopting strategies that will be implemented across the school. You must be prepared to be uncomfortable through technological change. I for one, would have been reluctant to use technology if it was not compulsory. However, after using it, I can now say that I can never stop using it to enhance the education experience.

6.4 CONCLUSION

Chapter six captured the first level of analysis from teachers working in fee paying schools. Kirstern's story highlighted his experience of working in a quintile 4 school. The primary point taken from his narrative is that every opportunity must be utilised in order to enhance education in the 4IR. His narrative shared experiences of working in an environment that was counter-productive to the move of the 4IR. On the other hand, Simitha's story captured the incredible efforts put in place to digitalise education and prepare learners for the 4IR. Simitha's zeal to sustain a digital culture of learning by embracing technology is evident throughout her narrative in this quintile 5 school. The next chapter presents the second level

of analysis called analysis of narratives. Using my theoretical framework (see chapter 3, pg. 49), chapter seven aims at dissecting my second research puzzle.

CHAPTER SEVEN

LEADERSHIP PRACTICES OF TEACHER LEADERS FOR TECHNOLOGICAL INNOVATION IN TEACHING AND LEARNING IN THE 4IR

7.1 INTRODUCTION

Chapter five presented a narrative analysis focusing on teacher leaders in no-fee-paying schools, while chapter six delved into a similar analysis but centred on teacher leaders in fee-paying schools. By deconstructing these restored narratives, the current chapter commences the second layer of analysis, namely *analysis of narratives* (Polkinghorne, 2002) to address the second research sub-puzzle, which reads: *What are the leadership practices of teacher leaders for technological innovation for teaching and learning in the 4IR?* Guided by the *Teachers as Leaders Framework* (Crowther et al., 2009), which encompasses sets of principles and practices aimed at empowering teachers to assume leadership, this chapter endeavours to deconstruct the intricate facets of this sub-puzzle. In addition to this, I make sense of the *teacher leaders* leadership realities by employing a *social realist* framework to dissect the interplay between structural, cultural systems and teacher agency (Archer, 1995). To take this analysis deeper, I then utilised a *critical realist* lens to understand the stratified reality (Bhaskar, 1975) of the teacher leaders' leadership, based on the interplay between structure, culture, and agency (Archer, 1995). This framework enabled me to make sense of observable complexities (level of the *empirical*) of diverse education contexts, where teachers actions (*level of the actual*) are moulded by hidden underlying generative mechanism only found at the level of the *real* (Bhaskar, 1975). Employing the Constant Comparative Analysis (CCA) method (Glaser & Strauss, 1967), data was systematically coded, categorised and interpreted (see chapter 4.7.2, pg. 99 for a detailed description).

This chapter unfolds by presenting the leadership practices of teacher leaders for technological innovation for teaching and learning. The leadership practices are systematically discussed in themes and sub-themes that emerged throughout the analysis process of CCA. After analysing the teacher leader's leadership practice through the *teachers as leaders framework* (Crowther et al., 2009), a sub-theme is used to further discuss the interplay of structure, culture, and agency in their practices through the lens of *social realism* (Archer, 1995) and *critical realism* (Bhaskar, 1975). Presenting the discussion in this way enabled nuanced variations in leadership practices across different contexts to emerge, and thus, rich explanations could be inferred as contextual factors could be emphasised. The following major themes are discussed: leading student learning through educational technology, leading innovation in teaching and learning through networks and projects, innovation in communication networks and leading transformation by addressing social challenges.

7.2 LEADING STUDENT LEARNING THROUGH EDUCATIONAL TECHNOLOGY

A nationwide acceptance of technology to enhance teaching and learning in South African schools is not a common practice among all teachers (Torres & Giddie, 2020). This can be attributed to the challenges experienced in the form of insufficient resources, limited technological and digital training and ill-informed perceptions of the 4IR for education (Chisango & Marongwe, 2021). Drawing on such a statement to represent the technological landscape in education would be inaccurate as it paints all schools in South Africa with the same brush. Alternatively, context ominously or favourably influences the role of educational technology in schools. Although compulsory and unsegregated education was implemented with the demise of apartheid, vast disparities remain in resources and technological access across schools (du Plessis & Mestry 2019). With that said, influencing pedagogical excellence through changes in teaching and learning is a central practice of teacher leadership (Harris & Jones, 2019). The teacher leaders in my study prioritised the integration of *Educational Technology* as part of their practice to enhance teaching and learning. However, it was interesting to note the degree to which teacher leaders in my study integrated *Educational Technology* for innovation into their contexts. To elucidate the leadership nuances between quintiles, I have divided this theme into sub-themes, providing a specific examination of the teacher leader who leads in quintile four and five (fee-paying schools) and those teacher leaders who lead in quintile one to three schools (no-fee paying).

7.2.1 Leading Student Learning Through Educational Technology in a Quintile 4 and 5 Schools

Simitha works in a quintile five school which was a previously 'white' school. Prior to 1994, education under the apartheid government segregated education by race. This ensured that the white population received the highest quality education in well-resourced schools. The Black, Indian, and Coloured population received an inferior standard of education. After the abolishment of apartheid, the democratic government ranked schools into quintiles (1-5) based on the local area's economic factors (Mestry & Ndhlovu, 2014). This system ensured that government funding for education was equitably allocated to all schools across the quintile. However, most previously white schools and higher ranked quintile four and five schools remain well-resourced to support technological competencies, modern teaching methods, information communication technology and technological infrastructure to support education in the 4IR (Miranda et al., 2021; Torres & Giddie, 2020) (Chapter 6.3, pg. 152-153 for a detailed context). Simitha describes her use of educational technology for innovation in teaching and learning in the classroom as follows:

The use of laptops and Chromebooks allowed me to teach my students to become independent thinkers and use their devices for research. It's not just about getting Google to

respond to questions; it's about teaching learners to research information that will help them assess, evaluate, and critique data. The level of insight that some of these learners have gained is incredible. The picture on the right (Figure 6.18, pg. 159) shows learners in groups working through a topic.... But for this to work, I had to let go of certain teaching philosophies from the past...I had to create learning opportunities for the learners... (Chapter 6.3, pg. 159)

Simitha demonstrates the integration of technology into her practice by using technology to develop her learners critical thinking abilities, research skills and collaborative skills. Ramorola 's (2013) study found that while teachers may use technology, there is little evidence to demonstrate that teachers integrate technology into classroom activities that require students to think critically about curriculum content and collaborate effectively with peers. In contrast to Ramorola's (2013) findings, Simitha's practice in her classroom depicted the contrary. Her ability to practically enforce critical thinking through technology has been cited as significant skills for education in the 4IR (González-Pérez & Ramírez-Montoya, 2022). The 21st century frameworks on education skills for learners in the 4IR highlighted *learning skills* (creativity and innovation, problem solving, collaboration and communication), *literacy skills* (Information communication technology) and *life skills* (González-Pérez & Ramírez-Montoya, 2022). With an exception to the last skill, Simitha included both learning skills and literacy skills as a key driver in her practice.

Simitha used innovative technological methods to enhance teaching and learning through in-class digital tools, recorded lessons, assessments, and improved organisational skills. Simitha expounded:

...this year (2022) I started the topic on organic chemistry. This resulted in setting tests using google forms, which allowed me to create an answer scheme which would self-mark the learners' work. Google classroom also presented an incredible opportunity to upload work for the learners throughout the year (Figure 6.15, pg. 156). They could organise the learners' work into topics and monitor who had completed tasks. This allowed for efficient tracking of the learners' progress and ensured that they did not miss any important material... I started using apps to teach circuits. There is a PHET (technological education too which provides fun, free, interactive research-based science, and mathematics simulation) simulation app developed by the University of Colorado. Using this simulation app brought life to the topic. (Chapter 6.3, pg. 156-157)

The use of Google Chromebooks enhanced a blended approach to teaching and learning. This approach involved blending online or digital components with face to face instruction (Singh, 2021). Simitha was able to assign work on an online platform (known as Google Classroom) and learners were able to access and complete their tasks independently through digital avenues. Torres and Giddie (2020) described the 21st-century educator as one who guides learners in their development on how to search for information and function in ever-evolving digital society. This further aligns with current trends in educational technology where the focus has shifted from passive consumption of information to active engagement in the learning process (Mills et al., 2015) The integration of technology for research reflects the concepts of digital literacy which is a noteworthy skill in the 21st century (Schwab, 2016). Simitha's mention of creating learning opportunities suggests a shift from teacher-centred learning to student-centred learning, an approach that promotes self-directed learning (Mills et al., 2015). However, Simitha's practice reflects the teacher's adaptability, which is a characteristic highly valued in teacher leadership (Harris & Jones, 2019). The literature further purports that teacher leaders are flexible and willing to modify their teaching strategies to align with evolving educational technology (Frost, 2016) like the 4IR. Simitha integrates technology into multiple areas of her practice. This includes teaching, learning, assessments, and learner tracking. Technology has become an integral part of her regular practice as she utilises various digital tools to enhance teaching and learning in her classroom. She makes frequent use of a laptop, projector, and a smartboard to enhance technological innovation for teaching and learning. Simitha embraces core components of 4IR education. She makes use of the Internet of Things (smart board, laptops, chrome books, email), Artificial intelligence (PHET simulation applications), cloud-based storage (google drive, google classroom) (Miranda et al., 2021).

In contrast, Kirstern, who works in a quintile 4 school, was limited in his technological options as he had opted for mathematical technological applications and online video lessons to facilitate maths lessons. He describes:

Once I learnt how to use the Geo-app, I would teach geometry on it... I didn't utilise some apps as I could not figure them out... Some applications also needed additional plug-ins that you had to pay for or subscribe to... I would spend most of my time downloading the lesson resources to create worksheet and PowerPoints. I also downloaded countless videos from Khan Academy that I could project using the multi-media centre/library. These videos were useful as learners could watch other teachers teach how complex problems were solved using a variety of resources. For instance, my grade 8 classes would watch finding volume of a curved 3D shape. (Chapter 6.2, pg. 144)

Kirstern's story offers significant insight into the dynamic interplay of *educational technology* integration and teacher leadership. This corresponds with the idea that teachers who effectively integrate technology can enhance the learning experience. It also aligns with the concept of 'technological pedagogical content knowledge', which highlights the importance of teacher's understanding how to use technology in their specific subject areas (Koehler & Mishra, 2009). The participant's use of downloaded material for creating worksheets and PowerPoints is in line with the idea of teachers as curators and creators of digital content (Koehler & Mishra, 2009). This indicates the participants effort to adapt technology for their teaching context. Incorporating Khan Academy videos align with the idea of blended learning, where learners learn through a mix of online resources and traditional classroom instruction. However, the challenges they encountered, such as struggling with certain apps due to complexity or additional plug-in costs, shed light on the realities faced by educators in quintile 4 schools. The participant's reliance on downloading and creating resources independently underscores the need for self-reliance in such contexts. Moreover, the incorporation of Khan Academy videos to supplement teaching materials is noteworthy, as it reflects the participant's adaptability in navigating the challenges posed by their context.

This sub-theme highlights Simitha's and Kirstern's actions to implement *educational technology* into their practice. Their teacher practice aligns with construct two of the *Teacher as Leader's Framework* which highlights teacher leaders *striving for authenticity in their teaching, learning and assessment practices* (Crowther et al., 2009). The teacher leaders created learning experiences related to the learner's needs and aimed at improving the learner's education (Wenner & Cambell, 2017). The finding reveals that teacher leaders in quintile five (advantaged contexts) schools integrated technology through blended learning as a frequent practice in delivering the curriculum. In such a school, components associated with the 4IR were utilised (Internet of Things, artificial intelligence, cloud storage and online platforms). In these schools teachers were also able to enhance learning skills associated with the 4IR (González-Pérez & Ramírez-Montoya, 2022). On the other hand, Kirstern's context highlighted the lengths a teacher leader has to go to implement educational technology in previously non-white disadvantaged schools. While the school is a fee-paying school, the access to resources were limited. The teacher leader in this school had to be self-reliant, resourceful, and self-thought (about technology). Kirstern further demonstrated his teacher leadership by using innovation to suit his context and change the process of teaching and learning.

7.2.1.1 Unearthing the Generative Mechanism for Leading Student Learning Through Educational Technology in Quintile 4 and 5 Schools

As a critical realist (Bhaskar, 1975), it is crucial to examine the generative mechanisms at play in the realities experienced in both Simitha's and Kirstern's practice, as discussed above (section 7.2.1).

As a social realist, I use analytical dualism (Archer, 1995) (see chapter 3.4.4.4, pg. 68) to highlight the interplay between *structure (parts)* and *agency (people)* in Simitha's narrative. By de-linking the two, the *structures* such as access to digital tools and chrome books, coupled with online education platforms aligns with the trend of integrating technology in education (Koehler & Mishra, 2009), thus resonating with the ideas presented in the digital policies of the Department of Education in 2017 (Chisango & Marongwe, 2021). As the education sector pushes the 4IR agenda into curriculum, this policy framework is crucial for understanding the structural implications for individual teachers' actions. In addition to this, Simitha's school has developed policies to guide the implementation of technology for innovation in teaching and learning during the Covid pandemic. The school employed google experts to structure policy and set up resources for innovation in teaching and learning in the 4IR (see chapter 6, pg. 155-156 for a detailed account). Drawing on *agency*, Simitha's proactive approach and pedagogical shift reflects the concept of expansive learning (Engeström, 2001). This concept demonstrates how teachers reconstruct their professional practice in response to new challenges and opportunities. By doing so, Simitha portrays herself as a *cooperative agent*. Archer (1995) explains that cooperative agents emerge as a result of primary agents developing their agency by working with others and systems to transform themselves. The emergent property that surfaces are Simitha's *classroom environment*, where technology is used for her students independent learning.

With the emergence of these vital properties, I delve into Simitha's *stratified reality* (Bhaskar, 1975). At the level of the *empirical*, we observe the active use of digital technologies. This includes engaged learners in independent research and interactive learning. Shifting to the level of the *actual*, the events leading to this observation include the introduction of technology in the classroom. This further signifies Simitha's shift in teaching methodology, specifically her adoption of digital tools for teaching science. The events in this level represent Simitha's response to both internal motivation and external stimuli (Archer, 1995). As discussed earlier, Simitha's choice to integrate technology, aligns with Fullan's (2007) concept of education change, where teachers actively seek innovative practices. At the deepest level, the *level of the real*, the underlying structures include the *school's policies* and *easy access to technological resources*, thus encouraging technological integration. Such structures create a context in which Simitha's action occurs. The cultural mechanisms at play, such as the school's attitude and belief to drive

technological use (by employing google experts) and professional culture established within the school, influence Simitha's practice (Fullan, 2007). Furthermore, Simitha's agency, professional autonomy, and her pedagogical beliefs steer (see chapter 6, pg. 158 to further capture her beliefs) her to innovate within these structures and cultures. At this level we see the complexity of educational change as discussed by Westaway et al., (2019) where systemic factors interact with individual agency.

The application of analytical dualism in exploring Kirstern's practice (in a quintile 4 school) unravelled technological limitations as a *structural* constrain. This discovery aligns with the findings by Sehlako et al. (2023) who explored how structural disparities impact teaching and learning in South Africa. Additionally, this analytical approach elucidates his agency, characterised by his adaption and selective use of resources. His practice is in line with Bandura's (1977) concept of self-efficacy, suggesting that teachers' beliefs in their capabilities influence their engagement with technology for teaching and learning. The phenomenon surfacing from *analytical dualism* is the dynamic interplay of *innovation and constraint* in Kirstern's practice (Archer, 1995). His practice demonstrates how individuals' practices are shaped by both their personal dispositions and their social conditions (Bourdieu, 1986).

When examining this through the lens of *critical realism* (Bhaskar, 2008), one observes at the *level of the empirical* a weighty dependence on specific mathematical applications and resources. This indicates a more constrained use of technology in Kirstern's practice. The *events* (Bhaskar, 1975) in his practice include his adaption to available technology, the limitation posed by the need for paid plugins and his effort to supplement teaching and learning with external videos. His practice is influenced by his response to his environment, thus aligning with Molo and Mhlanga's (2021) study which outlined how external factors influence teacher's technological use. At the *level of the real* (Bhaskar, 1975), the resource constraints, and the broader educational disparities (Torres & Giddie, 2020; Yende, 2021) serve as a backdrop for Kirstern's practice. The cultural mechanism at play involves the school's attitude towards technology, influenced by the socio-economic factors. Kirsten's agency, decision-making and his professional self-efficacy as outlined by Bandura (1977), are central to comprehending his approach to technological integration.

7.2.2 Leading Student Learning Through Education Technology in Quintile 1-to-3 Schools

Cindy works in a quintile 1 school located in a rural area. Her school is not permitted by law to charge school fees. Given the low-income area that this school is in and its historical background (see chapter 5, pg. 110), the school does not have the buying power to purchase vast and current innovative technology. However, Cindy indicated the use of digital tools as a crucial component of her practice for leading student learning. Cindy mentioned that:

I was one of the first teachers to purchase my own laptop and to make use of the data projector in my classroom. I would carry the projector and screen from the school safe to connect it to my classroom at least once a week. I was persuading teachers in the foundation phase to make use of technology, but many teachers were still comfortable with their previous way of teaching... As a result, I decided that I would lead by example. This involved doing all my planning at home. I would use my home WIFI to create PowerPoint, download videos/songs and create teaching material. The songs and videos on the PowerPoints captivated the learners' attention quickly... Since I bought my laptop, I can differentiate activities for groups of learners. I would set high-order tasks on my laptop for the higher-ability learners to work on while I could spend one-on-one time with the lower ability group. I would sometimes allow the lower-ability group to watch a video on my laptop while I work with the higher-ability group. The only problem with this is that it only works with small class numbers. (Chapter 5.2, pg. 111)

Cindy's leadership in integrating educational technology was instigated by her high level of self-efficacy to implement technology within her classroom, as evidenced by her independent purchase of a laptop (Bandura, 1977). Self-efficacy can be described as one's belief in capabilities to execute a course of action (Bandura, 1977). Self-efficacy was identified as key role player for the implementation of technology in the South African context. Similarly, Zama and Evalina who are in quintile 2, and 3 schools, respectively adopted technological integration by acquiring their own laptops and projectors (see chapter 5.3, pg. 126 & 5.4, pg. 134). Cindy's approach is marked by her ability to inspire others to follow her lead rather than imposing it on them (Harris & Jones 2019). This aligns with the literature on teacher leadership that outlines the teacher leader's ability to lead by example (Frost, 2016).

Due to time constraints and limited internet access at school, much of her technology-oriented lesson planning occurs at home. Notably, teacher leaders in schools within quintiles one-to-three faced challenges regarding WIFI access. Zama from a quintile 2 school noted that integrating technology demanded considerable personal time investment for tasks like typing texts, downloading images, and

incorporating video clips (see Chapter 5.3, pg. 126). Despite these limitations, these teacher leaders (Cindy & Zama) voluntarily extended their work hours for lesson planning. Zama's dedication to technology, extended work hours, and weekend sessions yielded a remarkable 100% pass rate in the Grade 12 English NCS exams (see chapter 5. 3, pg. 123). Evelina also highlighted the efficacy of lunchtime lessons and sharing lesson activities via WhatsApp, which significantly enhanced Grade 4 learners' language skills (see chapter 5.4, pg. 137). This aligns with Chikoko et al's. (2015) assertion that maximizing time utilisation contributes to enhanced learner performance in resource-deprived contexts. In addition, literature on teacher leadership highlights the crucial role that effective time management plays in facilitating a positive educational outcome. Wenner and Campbell (2017) explained that teacher leaders often juggle multiple responsibilities, such as classroom teaching, curriculum development and collective leadership which requires them to use time efficiently. Resultantly, the teacher leaders noted improvements in learner engagement and improved academic outcomes through technology integration. Cindy's narrative description outlined her ability to differentiate by instruction by leveraging technology. Using her laptop provided high-order tasks and individualized attention to learners is consistent with effective practice using technology to support personalised learning. Relatedly, Evalina in a quintile 3 school described using WhatsApp groups to send out additional support for learners who required it. In addition, Cindy mentioned the use of songs and video to engage learners, aligns with idea that technology can enhance engagement (Schindler et al., 2017).

The practices of teacher leaders in quintile one-to-three schools aligns with construct two of the *Teacher as Leader's Framework* which highlights teacher leaders *striving for authenticity in their teaching, learning and assessment practices* (Crowther et al., 2009). These teachers strive to create learning experience that cater to the needs of their classes, challenging conventional teaching approaches by connecting, learning and assessment to the learners' future goal (Crowther et al., 2009). Despite facing resource constraint, similar to Simitha in a quintile five school, these teacher leaders utilise technology in a blended manner, leading the way in integrating into their classrooms. Their adoption of technology is driven by a recognition of its future significance, reflecting construct two as these teachers strive for a deeper understanding of tacit teaching and learning processes (Crowther et al., 2009).

7.2.2.1 Unearthing the Generative Mechanisms for Leading Student Learning Through Education Technology in a Quintile 1-to-3 Schools

From the above discussion (section 7.2.2), the experiences of the three teacher leaders in disadvantaged contexts schools lend itself to several similarities in their innovative approaches to teaching and learning. These similar practices (described above) among them include using personal devices and extending

work hours to develop technologically innovative lessons. Consequently, I will collectively analyse the underlying generative mechanism operating at the level of the *real* and in turn make sense of their observable practice at the level of the *empirical*.

The *structures* made visible through *analytical dualism*, demonstrate that all three teachers operate in lower quintile schools, thereby indicating low levels of resource availability and infrastructure support for innovation in teaching and learning in the context of the 4IR (Sikhakhane et al., 2021). The *structures* found in these schools provide both the opportunities and constraints for innovation, thus illustrating the interplay between education policy, resources, and each teacher's agency. Analysing the *agency* of the three teachers, I found each teacher exhibiting different levels of *agency* (Archer, 1995). As *primary agents*, all three teacher leaders show personal initiative and autonomy (Elder-Vass, 2008). Their actions of investing in personal devices and to work extra hours for lesson planning, are indicative of *primary agents* (Archer, 1995). This shows how they act within and upon structures (Elder-Vass, 2008). As *cooperative agents*, Cindy influences fellow teachers to adopt technology and Evalina shares lesson activities on WhatsApp. This indicates that they are not only changing their practice but are influencing their peers to adapt to technological methodologies to enhancing teaching and learning. However, given the access to some resources, skills development and support from their upper management, these teachers can transform themselves into *social actors* who advocate for technological change. However, given the access to limited resources, they are in a poor bargaining position to transform the whole organisation (Westaway et al., 2020).

Resultantly, the *emergent properties* (Archer, 1995) that have materialised from the practices of these teachers are innovative technological use. This property surpasses the individual actions of teachers, thus creating an environment where technology becomes a catalyst for educational enhancement. In other words, this innovation is only a direct outcome of the available resources (structures) or teacher agency, rather it arises from how teachers creatively traverse their environmental context. Such actions can be described in the concept of expansive learning (Engeström, 2001). This concept focuses on the process of learning through transformation and expansion of the learner's activity system.

Therefore, at the *empirical* level, varied technology used is observed to enhance learner engagement and help improve student outcomes (Bhaskar, 1975). At the level of the *actual*, actions such as acquiring personal devices, the creation of digital teaching material, the adaptation of instructional methods and extending planning time reflect the teacher's engagement with opportunities and constraints in their contexts. At the level of the *real*, the quintile system determines resource allocation and technological

infrastructure (Mestry & Ndhlovu, 2014; van Dyk & White, 2019). These *structures* shape the work of teachers. It's important to note that these *structures* reflect the broader educational policies in South Africa (Mestry & Ndhlovu, 2014). The literature outlines how resource allocation and funding for lower quintile schools from the DOE are often late and unreliable for enhancing education in the 4IR (Matlhale & Erasmus, 2015; Mestry, 2016). At this level we also find the personal beliefs, motivations, and professional autonomy of Cindy, Zama and Evalina to drive innovation in teaching and learning.

7.3 LEADING INNOVATION IN TEACHING AND LEARNING THROUGH NETWORKS AND PROJECTS

Networks are progressively emerging as the nerve centre of 21st-century educational systems, representing a critical conduit for transformative change (Van Dijk, 2016). The 4IR, as delineated by the Schwab (2016), necessitates a spectrum of skills—ranging from global citizenship to innovation, technological adeptness, and interpersonal acumen. Notably, these contemporary educational proficiencies find an effective conduit through networking practices (Azorín, 2020). Networking and projects appeared to emerge as a common thread in the narratives of participants. Below I present two sub-themes which emerged under this theme. These sub-themes are 'project-based networking beyond the borders of the school and interschool networking.

7.3.1 Project-Based Networking Beyond the Borders of the School

The concept of educational networks extends beyond a mere group or system; it signifies a dynamic community of interconnected individuals and organisations driven by shared interests, values, and concerns. This symbiotic interaction fosters knowledge exchange, mutual support, and enhanced learning opportunities (Hadfield et al., 2006; Kools & Stoll, 2016). This essence of networking aligns with Sliwka's (2003) assertion that networks serve as potent catalysts for educational change. Moreover, teacher leaders wield networks as agents of change, capitalising on the connectivity they offer to initiate solutions and foster innovation (Harris et al., 2017). A case in point is Cindy, who works in a quintile one school. She elevates mathematics learning through digital gaming applications. In her words:

...I partnered with Anthony, a qualified Actuarial scientist... Anthony introduced a mathematics gaming application that would revolutionise the way learners approached algebra and geometry in our school. Together, we embarked on a journey of transforming education through technology. Initially, Anthony would visit the school, working closely with small groups of ten learners. Armed with around 20 devices, he guided the learners to solve challenging math problems through games (see figure 5.3, pg. 112). As time went on, we decided

to...organise competitions among the foundation phase learners within our school... Anthony generously shared his knowledge and introduced me to basic mathematics gaming applications that I could utilise on my own laptop. (Chapter 5.2, pg. 112)

Due to limited access to technology for leveraging educational video games, Cindy proactively networked with an actuarial scientist. This strategic partnership facilitated the infusion of technological expertise, skills, and resources into mathematics teaching and learning. Expanding the project's scope, she orchestrated a competition to introduce more learners to this innovative learning approach. This collaboration with Anthony aligns with the literature on teacher leadership, emphasizing the importance of teachers taking the lead in innovation (Frost, 2016; Yusof et al., 2016). Networking also enabled Cindy to acquire new technological proficiencies, allowing her to implement them on a modest scale using her laptop (Diaz-Gibson et al., 2017). Kirsten, in a quintile four school, took networking a step forward by adopting projects and competitions to forge connections with multiple experts, thereby propelling 4IR education. He elucidates:

We were able to secure robotics and coding classes for the winners. The winners also received training in 3D printing. Finally, the learners would receive a year's worth of advanced math tuition. On many occasions we would invite other mathematicians to deliver lessons. These teachers often used smart boards and maths programs to teach these learners. As a teacher, I would network with these mathematicians to sharpen my own skills... In 2018, I had the privilege of hosting a high-school-wide science quiz. I took on the role of project leader. I remember coordinating with teachers to set up different categories of questions, organizing the venue, sending out invitations, securing sponsorships for prizes, and arranging food... Our focus was on STEM education... In 2019, Mr Pillay and I registered our science team for a science competition. (Chapter 6.2, pg. 143)

Kirsten employs projects and competitions to establish connections with technological experts in the field, bolstering student learning through 4IR-relevant skills like coding, robotics, and 3D printing. Within this networking realm, Kirsten embodies Spillane and Lowenhaupt's (2019) notion that educational leaders must adapt to societal demands, shaping instructional agendas and fostering cooperation. This aligns with the idea that the teacher leader' play a significant role in advancing education initiatives such as STEM, by engaging with various stakeholders, organising events and securing sponsors (Harris et al., 2017). He further cultivates collaboration by distributing tasks to fellow educators (Harris & Jones, 2019), thereby pooling expertise within the school for project success (Azorín et al., 2020).

These educators adopted a project-based methodology to foster innovation in teaching and learning within the context of the 4IR. Notably, they engaged in networking to facilitate organising, and participating in competitions, and crafting initiatives (as exemplified by Kirstern and Cindy) to infuse innovation into their respective subjects. This strategic approach is congruent with the fifth construct of the *teacher as a leader framework*, which delineates the teacher leader as a conduit for *translating ideas into sustainable courses of action* (Crowther et al., 2009). This concept resonates with Frost's (2016) investigation, which identified projects as a significant facet of teacher leadership. My study revealed that teacher leaders' engagement in development projects is propelled by a profound personal drive, fuelling intense enthusiasm and a deep sense of moral purpose (Wenner & Cambell, 2017). In contrast, Frost (2016) found a comparatively diminished level of enthusiasm and moral purpose among formal leaders obligated to spearhead projects. Evidently, teacher-led projects often emanate from their intrinsic perceptions of challenges (Frost, 2016). The teacher leaders under study exhibited a robust moral impetus to drive innovation, particularly within challenging contexts. Through these projects, they tapped into technological expertise that extended beyond their immediate community confines.

Leveraging projects as a means of networking to propagate technological innovation within disadvantaged educational settings (as Cindy did) has demonstrated efficacy as a short-term remedy for these educators. In resource-scarce schools, such initiatives serve to inculcate a novel culture of teaching and learning (Berry & Ginsberg, 1990). Importantly, these projects facilitate a gradual integration of technological innovation into the school environment. Rather than taking a rapid approach to the technological revolution, networking provides the opportunity to meet context-sensitive needs. In other words, the teacher leaders sought after skills that they could implement based on the available technology.

7.3.1.1 Unearthing the Generative Mechanisms of Project-Based Networking Beyond the Borders of the School

The *structures* made visible through analytical dualism (Archer, 1995) in Cindy's and Kirstern's practice (as discussed in section 7.3.1) display variations. The structural environment in Cindy's school included severe limitation in resources but demonstrates an openness for innovation through collaboration. Kirstern's school appears to have greater access to resources and opportunities for external partnerships. Their levels of *agency* further show variation. In this instance Cindy primarily operates as a *cooperative agent* as she partners with a scientist to introduce learning through gaming. Her project outlines attempts to enhance learning through technology (Ng' ambi et al., 2016). In Kirstern's case, he operates as a *social*

actor by networking with mathematicians, organising school wide competitions and leading projects that integrate STEM education. In other instances, he uses these projects to network with companies to help install computers in the school, thus introducing approaches to transform how education is delivered in the classroom. In essence he has altered the preceding structures and cultures (Archer, 1995) that initially shaped the approach to teaching and learning in his school.

The interplay of structure and agency reveal two *emergent properties* (Archer, 1995). Firstly, an enhanced educational ecosystem emerges. Both teacher leaders' initiatives have contributed to an ecosystem where technology and outside expertise enrich the learning experience (Katzenmeyer & Moller, 2009). The literature show that such ecosystems propel traditional learning environments, therefore introducing students to advanced concepts (Moloi & Mhlanga, 2021). The second *emergent property* is a culture of collaboration for innovation. Through these teachers' efforts, a culture of collaborations with experts from specialised disciplines emerges. The specialised knowledge and initiatives from these experts help create a new normal (de Klerk, 2022), reflecting a shift in the educational culture to embrace the 4IR.

Resultantly, at the *empirical level* (Bhaskar, 1975) we observe in Cindy's practice the use of digital games to enhance mathematics with an expert from outside the school. In Kirstern's school we observe interschool-school competitions, collaboration with professionals and integrations of advanced technologies. At the level of the *actual* (Bhaskar, 1975), both teachers' collaboration and networking helps enhance the education practice and help secure resources for advanced learning opportunities (Fullan, 2007). The underlying structural mechanism are evident through the quintile system that governs funding and resources (Mestry, 2016). While funding policies may allow Cindy's school to receive more government funding, the funding is often insufficient or unreliable to enhance education (Matlhale & Erasmus, 2015). This explains the limited access to resources in Cindy's rural school. However, Kirstern's, educational policy allows quintile four school to leverage school fees (Mestry, 2016). Given the higher economic area of the school, schools help supplement government funding, thus allowing such school to have more resources. However, the underlying cultural mechanism at the school show attitudes and beliefs that are open to modern innovative teaching practices. The schools also demonstrate a sincere appreciation for collaboration with outside professions which are located outside the education sector. Therefore, coupled with professional autonomy (Wenner & Campbell, 2017) of both Cindy and Kirstern, their decisions to embrace technology, invest in personal development and collaborate with outside individuals/organisations demonstrate a high degree of agency thus, influencing what is seen at the level of the empirical.

7.3.2 Interschool Networking to Enhance Teaching and Learning

Interschool networking refers to the collaborative relationships and interactions that take place among teachers from different schools (Frost, 2016; Díaz-Gibson et al., 2017). It usually involves sharing resources, expertise, best practices, and knowledge to improve the quality of education for teaching and learning (Torres & Giddie, 2020). In a quintile 3 school, Evalina utilised interschool networking when she expressed:

As a level one teacher I knew I could not do this on my own. I therefore embraced collaboration and began networking with educators from other schools ...These teachers added me to a WhatsApp group. In this group, we shared teaching material and bounced off ideas. I remember one teacher introduced me to websites which had online science quizzes and games. As a result, I would create engaging slides and display online quizzes on the board for the learners. This sparked a newfound curiosity in the learners. (Chapter 5.4, pg. 134).

Through WhatsApp, Evalina adeptly acquired and implemented innovative assessment strategies. Networking manifests as a conduit for enriching pedagogy through the adaptation of novel methodologies from peers (Azorín, 2020). Moreover, WhatsApp serves as an instant and efficient networking platform.

According to Torres and Giddie (2020), 60% of South African schools are no-fee paying and only 28% of public schools use technology. They described a wide technological gap between rich and poor schools. Given the enormity of this gap, Torres and Giddie (2020) highlighted networking with universities, public structures and other NGO's as crucial components in advancing technology use in schools. Specific to my study, Evalina developed interschool networks to drive technological development for teaching and learning. In this way, she was able to acquire electronic material to enhance teaching and learning. While there is a dearth of literature to capture the engagements of leadership for networking (Azorín, 2020), Harris and Jones (2019) found that through networking, teacher leaders collaborate across schools, share insights, innovative practice, and experience. In this instance, Zama and Evalina used WhatsApp to network (see chapter 5.3, pg. 121-122 & chapter 5.4, pg. 134) with other schools to improve their practice and adopt innovative strategies. These teacher leaders were able to obtain technological skills beyond basic computer literacy skills. In addition, Makgoti (2014) emphasised that teachers need to see and learn from the practices of others.

The practices outlined by Evalina have assisted her in acquiring digital material from other well-equipped institutions which they would have not otherwise accessed from their immediate environment. Her

practice aligns with construct five of the Teachers as Leader's Framework which highlights *translating ideas into sustainable systems of action* (Crowther et al., 2009). These teachers nurtured networks of support to lead technological innovation. In essence, networking aided this teacher leader to achieve educational goals through collaboration with multiple agencies (Diaz-Gibson et al., 2016). Snell and Swanson (2000) propagated collaborative proficiencies as a skill domain of a teacher leader as they are proactive in the search for and creation of opportunities to be collaborative. Evalina modelled collegiality as a mode of work (Lambert, 2003; Snell & Swanson, 2000). This teacher leader's practice was in line with what Crowther (1997) would describe as employing *interactive skills* to develop network support in which they establish a critical mass of support to influence change.

Taking it a step further, Nguyen et al. (2019) noted *human capital* and *social capital* as two prime sources of influence demonstrated by teacher leaders. The former describes the teacher leader's expertise while the later emphasises professional relationships through social networks (Nguyen et al., 2019). Evidently, the mentioned teacher leaders under study, strategically harnessed their social capital to impact teaching and learning within their respective contexts. This indicates a purposeful alignment with the principles of social capital, wherein networks foster knowledge dissemination and pedagogical innovation to some degree in their contexts.

7.3.2.1 Unearthing the Generative Mechanisms for Interschool Networking to Enhance Teaching and Learning

Analytical dualism aided in outlining two key structures (Archer, 1995, Archer, 1999) in Evalina's practice: *Interschool networking* and the *quintile three school ranking system*. The creation of WhatsApp groups as a tool for sharing resources and ideas represents structural innovation, thereby creating collaborative opportunities beyond the school's direct resource base. In addition, Evalina's quintile three school faces resource constraints, as indicated by Torres and Giddie (2020) concerning the technological divide in South African schools. Moreover, through the process of *analytical dualism*, Evalina's practice is showcased as that of a *cooperate agent* (Archer, 1995). Her practice shows her seeking collaboration and networking with educators from other schools. Her engagement with WhatsApp groups and the adoption of digital resources for her classroom show her dedication to enhance teaching and learning. She works with others to develop her agency to transform herself (Archer, 1995). However, one must note that while her networking involves interactions with other professionals, her interaction within her own classroom is mostly independent. In other words, the decision-making, implementation, and adaption of novel teaching methods are made independently and transform her own practice first. Such characteristics align closely with that of a *cooperative agent* (Archer, 1995).

The interplay of *structure* and *agency* from Evalina's practice revealed two *emergent properties* (Archer, 1995). This included improved *pedagogical practice* and a *culture of interschool collaboration*. Drawing on the former, new teaching strategies and digital material are used by Evalina due to collaboration and resources shared by teachers from other schools on WhatsApp (Nguyen et al., 2020). The latter property demonstrates how Evalina's involvement in interschool networking creates a culture where sharing digital resources and innovative teaching methods become a norm in her practice (Joe-Atodo, 2022). Therefore, this starts to influence the broader educational practice within her context.

The observation at the *empirical level* (Bhaskar, 1975) shows the integration of digital tool to enhance teaching and learning. This becomes apparent by her use of online quizzes and games, along with the creation of engaging PowerPoints. At the level of the *actual*, Evalina's choice to become a part of interschool WhatsApp groups, actively communicate with other educators and take initiative to find and exchange teaching materials, characterise *actual* events (Bhaskar, 1975). These actions are seen as a proactive step by the teacher leader to address her teaching challenges and seek improvement (Day & Harris, 2002). The generative mechanism at the level of the *real* (Bhaskar, 1975) are firstly influenced by Evalina's context in a quintile three school (as discussed in previous subthemes). As highlighted by Keyember and Nel (2019) the technological divide between fee paying and no fee paying school set the platform for Evalina's actions. Secondly, the cultural mechanism at play are a culture of collaboration and resources sharing among teachers, enhanced by WhatsApp, mirrors a larger educational culture which values peer support (Harris & Jones, 2019). This cultural shift towards technology usage for innovation in teaching and learning is in response to the challenges posed by technological disparities in such contexts (Lubinga et al., 2023). Lastly, the agential mechanisms, are represented in Evalina's drive to forge professional networks. Her actions represent a commitment to professional growth, thus demonstrating her individual response to the structural and cultural conditions embedded in her school contexts.

7.4 INNOVATION THROUGH IMPROVEMENTS IN COMMUNICATION NETWORKS FOR ENHANCING TEACHING AND LEARNING

Leaders are utilising digital technology to influence members through E-leadership (Dasgupta, 2011). According to Avolio and Kahai (2003) this form of leadership refers to the application of leadership principles and practices in electronic or virtual environments, enabled by digital technology. E-Leadership has extended itself to the education leadership arena and has reshaped how leaders *communicate* and engage with stakeholders. E-leadership revolutionises communication by transcending physical

boundaries and enabling real-time interaction irrespective of geographic boundaries (Van Wart et al., 2019). School leaders leverage many digital platforms, such as video conferencing, email, social media and learning management systems, to engage with teachers, staff, parents, and students (Koh & Kim, 2004). Crucially, interpersonal skills are at the core of teacher leadership (Snell & Swanson, 2000). This includes the ability of the teacher leader to work with colleagues, learners, and parents by clearly and effectively communicating with them (Snell & Swanson, 2000). Under this theme, three sub-themes arose to illustrate how teacher leaders utilise forms of E-leadership for innovative communication to enhance teaching and learning across the school contexts.

7.4.1 Innovative Communication: A Relationship Between the Teacher and Learner

Effective communication between learners and teachers varies widely in the South African context. This variation is owed to the diverse educational landscapes ranging from well-resourced private institutions to under resourced public schools (van Dyk & White, 2019). Establishing and leading effective communication between the teacher and learners in the South African context is fraught with multiple challenges including language diversity, resource disparities, class size and socio-economic factors (van Dyk & White, 2019). However, the literature points out that South African teachers are known for going the extra-mile (Makoelle & Makhalemele, 2020) to establish communication with their students. Different scholars have found that teachers are beginning to integrate technology such as e-learning platforms to enhance positive teacher interpersonal communication with their learners (Torres & Giddie, 2020; Xie & Derakhshan, 2021; González-Pérez & Ramírez-Montoya, 2022). Effective interpersonal communication with students impact engagement, learning achievement, well-being, motivation, success and other social and emotional factors (Xie & Derakhshan, 2021). In my study, Simitha was the only teacher who led communication with learners using technology. Simitha describes:

...We have found that learners are more likely to check their WhatsApp messages than their email. The tool works well as it provides instant communication. I use this tool to send out exam information, revision, voice notes explaining content and motivational messages. Google classroom also presented an incredible opportunity to upload work and communicate with the learners throughout the year (Figure 6.15, pg. 156). I could organise the learners' work into topics and monitor who had completed tasks. I would send out messages to learners and provide individualised feedback. The learners also had an opportunity to respond to my feedback. (Chapter 6.3, pg. 157)

Simitha's practices embraces digital communication tools to enhance both in-class and beyond the class learning. Both WhatsApp groups and Google classroom serve as an effective means for disseminating electronic resources, delivering personalised feedback, and elucidating complex concepts through voice notes. Her practice is consistent with the principles of blended learning as defined by Singh (2021). This pedagogical approach involves the integration of traditional face-to-face communication with online components (Singh, 2021), a practice she adeptly employs. Utilising online platforms such as google classroom, enables her to personalise feedback, demonstrating an alignment with the core tenets of blended learning. Blended learning does not only facilitate individualised learning, but also enables flexibility in scheduling, therefore creating an environment conducive for the incorporation of technology to enhance teaching and learning.

Her practice inherently embodies the essence of E-leadership, surpassing spatial boundaries and fostering real-time interaction (DasGupta, 2011). Construct one of the *teachers as leaders framework* (Crowther et al., 2009) is evident when Simitha used WhatsApp for not only sending academic information but also motivational message, demonstrating an understanding of the importance of socio-emotional support alongside academic guidance (Harris & Muijs, 2005). This further indicates her positive interpersonal communication behaviour towards learners. She cares about how her learners feel about their learning (Xie & Derakhshan, 2021). Providing individualised feedback and allowing students to respond on these digital platforms fosters a sense of care and support, which are tenets of effective teacher leaders (York-Barr & Duke, 2004). This highlights a commitment to students' success and growth (Harris & Muijs, 2005).

Her approach resonates with the establishment of digital platforms to facilitate seamless information exchange and serve as hub where the teacher can share resources, announcements, and innovative ideas. Moreover, it fosters reciprocal communication, enabling learners to actively engage and respond digitally, thus embodying the tenets of effective two-way communication (Kramer & Crespy, 2011). In line with scholarly discourse, her adept establishment of open communication channels cultivates constructive dialogue among students, mirroring the principles highlighted by Deal and Peterson (2009). To a certain degree Simitha's practice aligns with the first and second construct of the *Teachers as Leaders Framework* (Crowther et.al., 2009). This includes '*conveying convictions for a better world*' and '*strive for authenticity in teaching, learning and assessment practice*' respectively. Embedding two-way communication between her students and herself resonates with the ideas of showing a genuine interest in her students' lives (construct one) and connecting teaching, learning and assessment to student futures (construct two). However, the framework fails to encompass the role of communication between the

teacher and learners for socio-emotional support. It can be argued that learning involves more than just mere exposure to information; rather it includes social, psychological, and emotional interactions as was aptly evident during the Covid-19 pandemic. Simitha's E-leadership to engage communication fostered a balance between academic, motivation and student relationships.

7.4.1.1 Unearthing the Generative Mechanisms for Innovative Communication: A Relationship Between the Teacher and Learner

By delinking structure and agency by *analytical dualism* (Archer, 1995), we can discern how a quintile *five school setting* and *digital platforms* inform Simitha's practice. Given the wealthy status of Simitha's school, she benefits from greater resource availability than lower quintile schools (van Dyk & White, 2019). In this instance, the use of WhatsApp and Google classroom serve as structural elements that enable Simitha to embed innovative communication practices. Evidently, these platforms provide the infrastructure for digital interaction and personalised feedback. Simitha demonstrates *primary agency* (Archer, 1995), using digital tools to enhance communication with her learners. Her *primary agency* includes distributing exam information, voice notes, motivational messages and using google classroom to personalise feedback. Her agency is umbrellaed under *primary* since her actions are tailored to the specific needs of her learners. In addition, her practice incorporates E-leadership (Dasgupta, 2011), thus exceeding traditional classroom boundaries, indicating a higher level of leadership and innovation. In this case, her practice goes beyond participating in existing structures; she attempts to shape her educational environment by using technology for both socio-emotional support and academics. This shows a creative approach to teaching. Now, one may argue that she possesses a degree of *cooperative agency*, given her engagement in some forms of collaboration. However, her actions are largely independent (Elder-Vass, 2008). A closer look at her narrative reveals that her actions are constrained by the rigid leadership *structures* at play in her school. She comments:

Despite the school's highly effective leadership, there was little voice from the ground up. From the picture (figure 6.13, pg. 154) presented, the school has a top-down approach. The headmaster is at the top, with deputies in charge of specific areas such as sport, discipline, and academics... I find my voice is restricted. The teacher's autonomy is mainly in the classroom (see chapter 6.3, pg. 154-155).

Due to the sheer size of her school, leaders enforce a ridged use of the leadership organogram, where leadership is filtered down for more efficient staff management (Bush, 2003). Furthermore, she mentions that her school encourages her to exercise her agency within her classroom and supports initiatives

undertaken there. Resultantly, teacher leadership is restricted within the classroom (Grant, 2010). Such a structure informs her *primary agency* discussed above and leads to the emergent properties outlined below.

By employing analytical dualism, the interplay between the structures, cultures and agents, clearly highlight the following *emergent properties* (Archer, 1995): *enhanced learner engagement and a culture of reciprocal communication*. Through the lens of critical realism (Bhaskar, 1975), we observe at the level of the *empirical* the implementation of blended learning and active learner engagement. Simitha's practice combines traditional face-to-face teaching with digital components to enhance communication with her learners (Singh, 2021). At the level of the *actual*, Simitha's decision to integrate digital tools in her classroom, tailored her communication to meet the needs of her learners, both academically and socio-emotionally. The generative mechanisms at play are three-fold. Firstly, the availability of resources in a quintile five school and the wealthy status of the community in which the school is located enabled the use of such technology (van Dyk & White, 2019). Secondly, the culture of innovation in the school is widespread by the action of leaders to invest in creating a culture of technology use (see chapter 6.3, pg. 155- explaining the hiring of google experts). Such an approach aligns with research that outlines the need for socio-emotional support alongside academic instruction (Xie & Derakhshan, 2021). Lastly, the agential factor shows her individual expertise and pedagogical approach. Her use of e-leadership shows her ability to move beyond the traditional classroom (Dasgupta, 2011) and her interest to provide emotional support (Harris & Muijis, 2005).

7.4.2 Innovative Communication: A Relationship Between the Teacher and Parents

Communication with parents and support from parents is one of the cornerstones for supporting students (Xi & Derakhshan, 2021). The literature indicates that active communication with parents consistently shows positive impacts on learner outcomes. These includes better attainment, higher attendance, and improved behaviour (Modisaotsile, 2012; Okeke, 2014). Additionally, scholars advise that having open lines of communication with parents increase parental involvement, enhanced school-home connections, improved parent satisfaction and aided the support for academic at-risk students (Modisaotsile, 2012; Okeke, 2014). While communication between teachers and parents are evident in most quintiles, the use of technology to enhance teacher-parent communication was evident in my study. Here again, the nuances in communication prominently emerge. For instance, Evalina in a quintile 3 school shares:

...the school received a lifeline in 2021—a batch of 20 tablets to assist with teaching and learning during the COVID-19 pandemic...the tablets [were used] for improving communication

between the school and parents. Class groups were created on WhatsApp, with each teacher being assigned a tablet to manage their respective classes. Tasked by the principal, I took on the responsibility of configuring the tablets, setting up SIM cards, and downloading the necessary applications...WhatsApp became a vital channel for updating parents and creating a channel for learning. It served as a platform for disseminating information about changes in timetables, classroom arrangements to adhere to capacity limits, and sharing learning materials with the students (see chapter 5.4, pg. 136-137).

Evalina played a pivotal role in establishing WhatsApp as a tool for class teachers to disseminate information to parents during the COVID-19 pandemic. The proactive drive to set up and configure devices, as well as manage the communication, demonstrates Evalina's willingness to assume leadership. The responsibility undertaken by Evalina, reflects the role a teacher leader plays in promoting effective communication between the school and parents (Leithwood, Harris & Hopkins, 2020). This initiative can also be viewed as an example of leadership in promoting positive teacher-parent relationships (Newman et al., 2019). Overall, the teacher's drive to set communication channels on WhatsApp and manage dissemination of information represents a form of E-leadership.

This teacher leader models a significant aspect of e-leadership called asynchronous communication. They employ this approach by disseminating information, sharing updates, and initiating discussion through digital platforms, allowing parents to engage at their convenience (Dasgupta, 2011). This sub-theme is in line with the fifth construct of the *teachers as leaders framework* (Crowther et al., 2009) as it aims to nurture networks of support. The use of WhatsApp and email for communication is a community leadership dimension. It serves as platform for to engage with the parent community, update them and create channels of learning beyond the classroom.

7.4.2.1 Unearthing the Generative Mechanisms for Innovative Communication: A Relationship Between the Teacher and Parents

In studying the interplay of Evalina's practice through the lens of social realism, I notice the nuanced interplay between structural context, agency, and the emergent properties. *Analytical dualism* in Evalina's contexts revealed two structures at play. This includes *technological provision* and her *principal's support*. Being a quintile three school, the government provided tablets during the covid-19 pandemic, thus representing a structural change to enhance the school's technological capacity (Okeke, 2014). However, crucial to this was the principal's supportive stance for such change (also see chapter 5.4, pg., 132). The principal's support (Joe-Atodo, 2022; Harris & Jones, 2019) is crucial as it empowers Evalina to explore

and implement new approaches in communication and pedagogy. The principal's support and motivation acts as a catalyst for Evalina to enact change and assume leadership roles in digital communication (Cheng & Szeto, 2016). The research on teacher leadership outlines the role of the principal as one of the most significant factors in developing and empowering the agency of teacher leadership. (Cheng & Szeto, 2016; Jacobs, Beck & Crowell, 2014). As a result, Evalina's pre-emptive desire to develop digital communication channels is influenced by her principal's support. This increases her capacity to effect change and operate as a *cooperative agent* (Harris & Jones, 2019).

The initiatives taken by Evalina leads to the following emergent properties: *Improved teacher parent interaction* and *extended educational support*. The establishment of WhatsApp for communication leads to more effective information sharing, thus improving the relationship between the school and parents/caregivers (Modisaotsile, 2012; Okeke, 2014). In addition, this initiative, enables the classroom to be extended onto a digital platform. This change is not simply about introducing technology but rises from the interplay between Evalina's innovation and the *structures* and *culture* at the school. Resultantly, through the lens of critical realism, one observes at the *empirical level* (Bhaskar, 1975), the use of WhatsApp as a platform for communication. The events that occur in the *actual* is Evalina's actions for setting up WhatsApp groups for each class, configuring tablets and ensuring it is used well. The generative mechanisms at play at the *level of the real* are the allocation of tablets to quintile three schools, principals support and the school's policy to use digital technology for communication. This level also accounts for the broader educational policies and socio-economic factors which influence the receipt of digital resources (van Dyk & White, 2019; Lubinga et al., 2023). The cultural mechanism shows a shift in embracing digital communication as influenced by the pandemic. This lends itself to evolving social norms in this context (Harris, 2003). The agential factor in this level is Evalina's innovative mindset and leadership character (Wenner & Campbell, 2017).

7.4.3. Innovative Collaborative Communication Between Teachers and their Colleagues

A major use of E-leadership is to improve collaborative learning through communication. According to Harris, et al. (2017) collaborative learning enables teachers to work in collaboration and engage in an on-going series of questions that encourage learning among themselves. Collaborative learning through digital platforms was demonstrated in Simitha's and Kirstern's practice. Simitha in a quintile five school describes:

I started meeting with other Physics teachers in our department to plan lessons, create teaching materials, and share ideas. In 2021, I convinced our teachers to start using and

working on 'live documents' for all planning... I created planning folders on Google Drive and enabled teachers to make live contributions to documents. This has allowed us to collaborate more effectively, edit documents during meetings, and work remotely from different locations. It also saves us a lot of time, and we can create more effective materials since we can share ideas and edit them as we please. Additionally, our department meetings have also taken the same approach, and all curriculum documents and planning are now done on Google Drive. This has enabled us to work together as a team (see chapter 6.3, pg. 158).

Simitha's collaboration with her team through 'live documents' and Google Drive for planning is an example of E-leadership. In Simitha's case she utilises technology to enable efficient collaboration and sharing of ideas (Katzenmeyer & Moller, 2009) through editing and remote learning (Avolio et al., 2009; González-Pérez & Ramírez-Montoya, 2022). The use of this technology allows for real-time collaboration. This aligns with the concept of e-leadership, where technology is used to enhance leadership (Avolio et al., 2009), in this instance teacher leadership. Collaborative networks are essential for sharing best practices and fostering a sense of community among educators (Hargreaves & O'Connor, 2018). Simitha's level of influence to convince the team to use these methods draws on effective communication as vital for creating a shared work vision and sense of purpose (Muijs & Harris, 2006). Simitha's use of technology to work with her team was highly collaborative as it enabled all members to actively utilise technology in the process. In other quintile schools, teacher leaders utilised cost effective technology to enable collaboration. In quintile three and four schools Zama and Kirsten created WhatsApp groups to communicate and share teaching materials with their department members. Zama practice displays how she made maximum use of WhatsApp groups for her languages department when she expresses the following narrative:

The picture (figure 5.12, pg. 122) shows our languages department meeting agenda. The message was sent on a weekend in preparation for the upcoming week. In this way WhatsApp have helped us to be proactive with our planning and preparation. Teachers discovered a new realm of collaboration and idea-sharing. As part of the languages department, for example, I spearheaded a reading program called 'Drop Everything and Read.' With over 60 teachers involved, the challenge lay in coordinating the program efficiently. WhatsApp came to the rescue, facilitating the seamless distribution of instructions, materials, and resources. Feedback flowed in real-time, enabling constant improvement (see chapter 5.3, pg. 122).

Similarly, Kirstern outlined:

I created a WhatsApp group where I shared curriculum documents, annual teaching plans, and other useful material. The teachers appreciated the convenience of using their phones to access the group (see chapter 6.2, pg. 145).

Both participants use WhatsApp as a tool to foster in collaboration and communication between staff members. Collaboration building is a central aspect of teacher leadership. Zama's use of WhatsApp for sharing the agenda highlights how technology can enhance communication and planning in a quintile 2 school. This proactive approach demonstrates Zama's initiative in promoting efficient collaboration and idea-sharing. Using WhatsApp to spearhead and coordinate her reading program by distributing material, giving instructions and resources, reveals effective e-leadership.

Overall, the three teacher leaders in this inquiry utilised technology to enhance communication among their peers. Their actions align with the *Teachers as Leaders* framework (Crowther et. al., 2009), which emphasised the teachers taking initiative to lead in their school contexts. Their use of E-leadership aligns with the idea of using technology to facilitate educational processes and improving teaching and learning. However, in a quintile 5 school there is more systemic and advanced use of technology for collaboration. The teachers are using Google drive for real time collaborative planning. This also enabled remote work which helps to save time and fostered a culture of sharing ideas as they edited material. This same approach then extended into the department meetings, thus fostering a cohesive and collaborative environment. In comparison, Zama and Kirstern, primarily relied on WhatsApp for communication and collaboration. While Zama and Kirstern experienced benefits in terms of proactive planning, communication and sharing resources, Simitha's narrative illustrated an advanced level of complexity in technology adoption.

7.4.3.1 Unearthing the Generative Mechanisms for Innovative Collaborative Communication Between Teachers and their Colleagues

The above analysis shed light on how these teacher leaders used innovative communication methods to enhance collaboration between teachers. Taking this analysis further, I studied the interplay of Simitha's, Zama's, and Kirsten's practice through the lens of *social realism* (Archer, 1995) to reveal the nuanced interplay between *structural context*, *agency*, and the *emergent properties*. Using *analytical dualism*, two primary structures emerge, infrastructure for technology and school policies. From the above discussion (section 7.4.3.), I noticed that each school's technological resources shaped the possibility of

collaboration. In Simitha's quintile five school, advanced tools like google drive are used, while Kirstern and Zama in quintiles four and two school's make use of WhatsApp as a more accessible platform. In addition, Simitha's school drives the use of advanced technology by implementing in the school policy. In Kirstern's and Zama's instance, no policy has been developed to drive the use of technology for communication. Resultantly, Simitha's *cooperative agency* is demonstrated in her efforts to lead the integration technology for improved planning in teaching and learning. She creates google drive folders for collaborative planning, thus demonstrating her E-leadership (Avolio et al., 2009) and signifying a high level of autonomy and decision-making capacity. In addition, her ability to convince her peers to adopt 'live documents' for planning reflects her influence (Katzenmeyer & Moller, 2009) within her department. Kirstern and Zama's agency is also *cooperative* as they use WhatsApp for agenda setting, resource sharing and creating a culture of communication within their departments. Their choice to integrate technology shows their adaptability considering their limited resources. In addition, their efforts highlight *cooperative agency* as they create a collaborative community in their departments.

This analysis reveals two *emergent properties*, a *collaborative culture* within departments and *innovation in planning*. Understanding this through lens of critical realism (Bhaskar, 1975), one observes the use of use digital platforms (google drive and WhatsApp) by these teacher leaders for collaborative communication and planning at the level of the *empirical*. At the level of the *actual*, Simitha's influence on the team to digitise the planning process for teaching and learning and the creation of digital folders for collaborations are *events*. Likewise, Kirstern's and Zama's establishment of WhatsApp groups for effective departmental communication are strategic choices to utilise accessible technology to enhance collaboration. Their actions demonstrate their leadership in adopting and promoting technology for collaborative purposes, thus aligning with the concept of E-leadership (Avolio et al., 2009). The underlying factors influence the events at the *actual* and observations at the *empirical* are three-fold. Firstly, the structural mechanism through the availability and accessibility of technology influenced the use of technology for collaboration. In addition, the policies to drive technology use led to the adoption of technology for communication, particularly in Simitha's school. Secondly, the cultural mechanism at play includes the cultural shifts in education. In this instance, the schools are experiencing a shift in cultural norms regarding the use of technology to enhance digital communication and collaborative work. Lastly, the agential mechanism at play are personal competencies, beliefs, and motivations of the teacher leaders in adopting digital tools for communications and collaboration.

7.5 LEADING TRANSFORMATION OF TEACHING AND LEARNING BY ADDRESSING SOCIAL CHALLENGES IN THE CONTEXT OF THE 4IR

In the complex South African education landscape, educators have emerged as pivotal agents of change (Grant, 2017), particularly within deprived school settings (Blose & Naicker, 2018, Chickoko, 2018; Grant, Naicker, Pillay, 2018), embodying the fundamental principles of transformative leadership practices. This leadership paradigm emphasises an unwavering focus on social justice, equity, sustainability, and quality of life (Sheilds, 2010). Transformative leaders in education enact change through displaying a core value base and spirituality that promotes interconnectedness to something greater than the self (Sheilds, 2010). Within the South African educational context, teachers recognise that addressing social challenges isn't just a noble endeavour; it's an imperative for the advancement of teaching and learning (Grant 2017). The literature describes a concept known as *prosociality* (Yada & Jäppinen, 2018). Borrowing from Naicker and Govender (2020), they summed-up *prosociality* in education under three actions: prosocial motives, prosocial behaviours, and prosocial impacts. Prosocial motives involve teachers demonstrating care, altruism, and empathy (Naicker & Govender, 2020). In this instance, teachers seek out assistance to help vulnerable learners. Prosocial behaviour takes it further by referring to the act by teachers that promotes the welfare of learners by going the extra mile. Lastly, Prosocial impacts involve making a positive impact on the lives of the learner. Most of the teacher leaders in my study shared vivid stories encapsulating their desires to address social challenges in the context of the 4IR. After analysing the data, one sub-themes emerged.

7.5.1 Thuma Mina: Teachers Going the Extra-Mile

Blose and Naicker (2018) alluded that many schools in South Africa, especially those in deprived context, continue to suffer from the wounds of apartheid, where neglect and a lack of humanness still prevail. As a result, many teachers in South Africa engage in activities that tend to benefit others. Naicker and Govender (2020) aptly captured this notion in the Isizulu phrase, '*thuma mina*'. This phrase originates from an IsiZulu song that translates- 'send me'. This song captures the actions of people engaging in services for the advancement of fellow beings and their communities (Naicker & Govender, 2020). These scholars elucidate how South African teachers actively engage in community services for the advancement of fellow beings (Naicker & Govender, 2020). The values implicit in the phrase include a sense of care and empathy embedded in the leadership of teachers. Scholars argue that in instances where care and empathy (*prosociality*) are lacking, there are diminished levels of school effectiveness, lower levels of teacher commitment and learners' performance tend to decline (Blose & Naicker, 2018; Van der Westhuizen & Meyer, 2014). Located in a rural quintile one school, where poverty is widespread,

Cindy exhibits a leadership that demonstrates care for the well-being of her learners and community. She describes:

I yearn to empower those who reside in the heartlands, to provide them with opportunities equal to those in urban areas. We believe that our learner's basic needs must be met while we implement innovation and technology in the classroom. For instance, I have worked closely with the Department of Education (DOE) to get a borehole installed in our school... The school nutrition program is the lifeline of the community. ...Our school has started a farm. I have worked closely with the DOE to get the farm running... This money [from selling produce from the farm] is used to enhance our resources in the class. For instances, we used some of this funding to get our multimedia technology room going. (see chapter 5.2, pg. 109-110).

Cindy demonstrates care for the well-being of the learners in her school by ensuring the basic needs of her learners are met through establishing long-term projects. She displays the importance of meeting basic needs as a precursor to implementing technological innovation in the classroom. Cindy's approach highlights creating an enabling environment for learning. The borehole project and the school nutrition program are foundational blocks for creating a conducive learning environment. The link to teaching and learning is made by how these initiatives create conditions that allow students to engage more effectively with technology-enhanced learning. In addition, the farm project which contributes to funding multi-media technology, shows how leadership can innovatively support both social needs and technological advancements in education. Cindy come from a deprived background and could therefore identify with some of the challenges her learners faced (Yada & Jäppinen (2018)). As a result, she demonstrates her prosocial behaviour by displaying strong commitment to the rural community. Cindy's collaboration with the DOE to install a borehole and initiate a school farm highlights her proactive approach to meeting essential needs. In turn the funding gained is strategically invested in enhancing resources at her school.

Evalina who is in a quintile 3 school further displays her prosocial leadership for social justice. Evalina's narrative description highlights the following:

I find myself being parental. Carrying this serious yoke means ensuring you do everything to provide for the student's basic needs. Equality, equity, and justice drives my teaching at school. I don't focus on just bringing equality, but I am driven to ensure equity and justice in my classroom. If you look at the first box... (Figure 5.23, pg. 132) it talks about the assumption that everyone benefits from the same support...I give learners is individualised because I need

to consider every learner's background. Therefore, I see technology as closing the digital gap in my school. Using technology means exposing our learners to modern learning. (See chapter 5.4, pg. 132)

Evalina's practice focuses on equality, equity and justice in her teaching. Her emphasis on individualised support centered on each student's background is an example of how teaching and learning can be enhanced through a personalised approach. This is specifically relevant in the context of technology, as Evalina views technology as a tool to close the digital gap and expose learners to modern learning methods. Her emphasis on individual support and using technology to close the digital gaps aligns with Hargreaves and Fink's (2006) notion of teacher leaders who personalise learning experiences through innovative practices. In this way Evalina, displays a key aspect of prosocial behaviour, which is empathy (Yada & Jäppinen, 2018). By focusing on an individualised learning approach, she acknowledges the diverse backgrounds and challenges faced by learners, thus aiming to provide individual or tailored support that maximises their potential to learning. In addition, Evalina uses technology to mitigate the digital gap and expose her students to modern learning methods. This aligns with prosocial leadership as it uses innovation to bring about positive social change (Yada & Jäppinen, 2018). In this instance, it enhances the educational experience and opportunities for learners who might otherwise be left behind in the rapidly evolving technological landscape.

The phrase *thuma mina* is aptly captured in the practice of these leaders as they all respond to the call of the learning needs of their students. Overall, teacher leaders demonstrate how prosocial forms of teacher leadership, encompassing transformative aspects can drive technology innovation in rural/poor schools. Their engagement in prosocial behaviours were practical and impactful on the community and individual learners. In addition, the teacher leaders make genuine efforts of employing *prosociality*. Their efforts to function as teacher leaders further supports these roles. Both teacher leaders practice aligns with construct 3 of the teachers as leader's framework which emphasises providing *equal opportunity for diverse learners* (Crowther et al., 2009). Through making resources available, the teacher leaders try to close the digital gap between schools in rural and wealthier areas. On one hand, Cindy's efforts to provide for the basic need the community aligns with *teachers as leaders framework*, which underscores the broader responsibilities of teachers in fostering positive change within their community. On the other hand, Evalina's practice of providing individualised support aligns closely with construct two as she aims at addressing *learners' unique needs* (Crowther et al., 2009). I found that these teacher leaders' narratives not only align with Crowther et al's. (2009) framework but draws on a broader understanding of teachers as encompassing roles such as change agents and moral agents. In essence, it seems that

there is a strong interconnection with teacher leadership, *prosociality* and social justice in education. It is evident that teachers play a significant role in advocating for equality, challenging disparities and fostering inclusive educational environments.

7.5.1.1 Unearthing the Generative Mechanisms for Thuma Mina: Teachers Going the Extra-Mile

Understanding the practices of these teacher leaders through social realism (Archer, 1995) reveals peculiarly *structural* and *agential* factors at play. The educational context (structure) of both teachers is deeply affected by historical and current socio-economic inequalities. Archer (1995) describes that structures and cultures of any context precede the individual. Cindy in a rural quintile one school and Evalina's quintile three school encounter distinct obstacles, which include resources constraints and immense digital divides. In addition to this *structure*, Cindy seeks institutional support from the DOE for infrastructure projects to enable her initiatives. The agency of these teachers is seen through their commitment to address basic needs as foundational tenets for technological innovation. Cindy's borehole and farm project, shows her leadership for a transformative approach to education, while Evalina's focus on individual support, demonstrates her personalised approach to education to drive equity, equality, and justice (Hargreaves & Fink, 2006). As a result, the following *emergent properties* are noted: *Enhanced learning environments* and the *creation of more equitable and inclusive learning environments*. The actions of both teacher leaders contribute to establishing learning environments where basic needs are met and technology is integrated for effective learning to bridge the digital divide. These teachers' actions lead to more equitable and inclusive classrooms which acknowledge the diverse economic backgrounds of their learners and provide access to modern learning gadgets.

The stratified layers (Bhaskar, 1975) of these teacher leaders' reality initially reveal their practical application at the level of the *empirical*. Cindy efforts to develop school infrastructure and Evalina's personalised approach to teaching using technology are observable consequences of their leadership. At the level of the *actual* we find Cindy's engagement with the DOE and Evalina implementation of technology to drive individualised learning experiences for her learners. The generative mechanism which enabled the set events and observations in these schools are found in the availability of resources and broader socio-economic conditions that shape the operational environment (van Dyk & White, 2019). The cultural mechanisms at play are the prevailing culture that values prosocial behaviour such as empathy and equality (Yada & Jäppinen, 2018). These factors influence how teachers approach their roles and responsibilities in the classroom and broader community (Bhaskar, 1975). As a result, the agential mechanisms in these teachers practice are found in their professional beliefs and commitment to social justice that enable them to innovate and mitigate the digital divide (Harris, 2003).

7.6 CONCLUSION

In this chapter, I have undertaken a comprehensive analysis of narratives to address my first research sub-puzzle. Through this analysis, I have successfully identified the distinct leadership practices of teacher leaders concerning technological innovation in the context of the 4IR. Using a social realist framework, I was able to explore the generative mechanism which have influenced the leadership styles we see at the level of the empirical. The learnings in this chapter underscores the critical role of teacher leaders in the implementation of educational technology, thereby enhancing pedagogy and introducing novel methods in both teaching and learning. This chapter further elucidated the significance of networking as a powerful tool to propel teaching and learning. The data indicates the efficacy of various forms of networking, such as project-based networking and interschool networking, all contributing to the advancement of innovation in education. A further learning highlighted in this chapter sheds light on the increasing importance of innovative communication channels in creating effective interactions among all stakeholders in the school, thereby enhancing the overall teaching and learning for innovation. Lastly, the chapter revealed the crucial role of prosocial teacher leadership in paving the way towards innovation in teaching and learning. Lastly, utilising a social realist and critical realist framework (*Archer, 1995; Archer, 1996; Bhaskar, 1975; Bhaskar, 2008*), this chapter presented a nuanced analyse into the generative mechanisms influencing the realities represented in each sub-theme. The subsequent chapter will pivot towards addressing the second research sub-puzzle: *Why is teacher leadership a significant practice to advance technological innovation in teaching and learning in the 4IR?*

CHAPTER EIGHT

TEACHER LEADERSHIP AS A SIGNIFICANT PRACTICE TO ADVANCE TECHNOLOGICAL INNOVATION IN TEACHING AND LEARNING IN THE 4IR

8.1 INTRODUCTION

The previous chapter systematically unpacked the findings to the first research sub-puzzle: *What are the leadership practices of teacher leaders for technological innovation for teaching and learning in the 4IR?* The current chapter delves into the second research sub-puzzle: *Why is teacher leadership a significant practice to advance technological innovation in teaching and learning in the 4IR?* This chapter is anchored on the restoried narratives presented in chapters five and six and analysed through the lens of *adaptive leadership* (Heifetz et al., 2009). This theory was employed to explore how adaptive leadership principles are applied in an evolving education system. Specifically, this chapter examines how teacher leaders make adaptations in diverse contexts, tackle challenges and endeavour to 'thrive' in promoting innovation in teaching and learning in the context of the 4IR. In a similar fashion to chapter seven, I make sense of the *teacher leaders'* realities by employing a *social realist* framework to dissect the interplay between structural, cultural systems and teacher agency (Archer, 1995). Taking this analysis deeper, I then utilised a *critical realist* lens to understand the stratified realities (Bhaskar, 1975) of the teacher leaders practice, based on the interplay between structure, culture, and agency (Archer, 1995). This framework enabled the generative mechanisms to be unravelled at the *level of the real* and aided in explaining the actions in the *actual level* and observations at the *empirical level* (Bhaskar, 1975). Using the *constant comparative method* together with *Delve software*, the data was systematically coded, categorised, and interpreted (Glaser & Strauss, 1967). Four themes are discussed to outline *Why teacher leadership is an important practice to advance technological innovation in teaching and learning in the 4IR?* These themes are cultural intelligence in teacher leadership, ethical technological teacher leadership, teacher leadership for empowerment and data-driven schools.

8.2 CULTURAL INTELLIGENCE IN TEACHER LEADERSHIP: A BRIDGING FACTOR

Teacher leadership does not only harness technological advancements, but it is also useful in navigating diverse *cultural* educational landscapes (Bush & Glover, 2016). Resultantly, culture, as distinctively described, varies from community-to-community (Hofstede, 1980), instilling life with collective meanings, symbols, beliefs, and norms (Yusof et al., 2016) that are deep-seated in all societal intuitions, including schools. Since culture is created by the community, it can be insinuated that individuals and organisations who aim to transform these landscapes must do so with caution and sensitivity. Against this backdrop, cultural intelligence emerges as an approach to navigating diverse educational contexts to effectively

implement changes, particularly in South African education (Carrim, 2022) amidst the integration of the 4IR (Schwab, 2016). Cultural intelligence is an individual's desire to learn about other cultures, approaching other cultures with tolerance and the ability to adapt swiftly when entering a new cultural environment (Cobanoglu, 2021; Earley & Ang, 2003). In the South African context, where schools vary on a wide spectrum in terms of resources, background, and community cultures (Spull & Taylor, 2015), contextual adaptability is a crucial component of cultural intelligence (Thomas & Inkson, 2004). Contextual adaptability involves adjusting one's behaviours, actions, and attitudes in response to different cultural contexts and intercultural interactions (Heifetz et al., 2009). Cultural intelligence is built upon *metacognitive, cognitive, motivational, and behavioural* dimensions (Earley & Ang, 2003). Each dimension contributes to the ability to understand and operate within different cultural settings. In addition, cultural intelligence resonates well with the principles of adaptive leadership, which highlights the need to understand an organisation's *culture* and *structure* (Heifetz et al., 2009). Under this broad theme of cultural intelligence, three subthemes emerged to demonstrate the teacher leader's cultural intelligence.

8.2.1 Motivational Dimension of Cultural Intelligence by Teacher Leaders in the 4IR

The motivational dimension involves teachers paying attention and energy to learn a different culture, motivating oneself for the purpose, managing his/her emotions and behaviours accordingly (Earley & Ang, 2003). Livermore (2011) suggested that teachers who adapt their practices to align with cultural backgrounds and contexts of their learners have a higher cultural intelligence. Cindy, in a quintile one school, embodies this through her innovative use of technology in teaching and learning in culturally sensitive ways. Cindy demonstrated this in her narrative when she described:

I discovered the power of sing-along phonics tunes available on platforms like YouTube. Knowing that the children in our community had a deep love for song and dance, I harnessed this interest to enhance their English phonics skills. The students could now watch videos, sing along, and dance, resulting in improved proficiency in Isizulu learners' English phonics. (see chapter 5.2, pg. 112).

Cindy utilises cultural relevant methods (music and dance available on YouTube) to teach English lesson skills among her IsiZulu learners. This demonstrates implementing and using technology in culturally sensitive ways as it taps into the local culture. By considering the cultural background of her learners, she exhibits cultural responsiveness as she aims to understand and respect the cultural norms and preferences of her learners (Aldhaferi, 2017). She also demonstrated the *motivational dimension* of cultural intelligence and cultural technological sensitivity of her learners and community when she

mentioned that she had been “actively working with the DOE since 2022 to establish a computer room in the school (see chapter 5.2, pg. 113).” This indicates her understanding of the educational needs of her learners and the community. Her attempt to establish a computer room shows her zeal to enhance teaching and learning using computers. The literature firmly describes teacher leaders as those who enhance teaching and learning by introducing novel tools to propel the learners educational experience (Joe-Atodo, 2022). Similarly, Evalina in a quintile three school demonstrated her cultural intelligence when working with parents in the community. She mentions:

I created a WhatsApp group to send these children’s parents practice material to work on at home. This plan worked well... A primary issue that commonly came up among parents was purchasing of data. Therefore, as teachers we had to be patient with parents as some of them could only access data by using WIFI at their workplaces. What makes matters worse, is that loadshedding often disturbed the internet connection (see chapter 5.4, pg. 137).

Evalina demonstrates her cultural intelligence by adapting a cost-effective and accessible mode of communication (WhatsApp) to send practice material to the children’s parents. In this way, she demonstrates a culturally sensitive approach to technology as it considers the socio-economic constraints of the community (Earley & Ang, 2003). The motivational dimension of her cultural intelligence is further made clear when she is able to control her emotions and behaviours to suit the context.

Both Cindy’s and Evalina’s practice are embedded in the *motivational dimension* of cultural intelligence (Earley & Ang, 2003) as they demonstrate a strong intrinsic motivation to embrace and integrate technology in ways that resonate with their learners and communities’ culture and backgrounds. These teachers’ efforts go beyond compliance with educational requirements, as they demonstrate interest and dedication to incorporate technology in ways that are meaningful and accessible. However, to do so, these leaders demonstrated adaptive leadership principles in their practice. As adaptive leaders they diagnosed complex problems (Heifetz et al., 2009). In Cindy’s case it involved implementing technology in a culturally sensitive manner and establishing a computer room. Evalina had to find a communication mechanism which considers the socio-economic constraints in the community (data/WIFI & loadshedding limitation). According to Heifetz et al., (2009) adaptive leaders distinguish between *technical* and *adaptive* challenges. The issues they were facing were an adaptive one as it was a systemic issue which required the implementation of something new into an existing culture (Heifetz et al., (2009). Introducing new approaches to teaching or ways of communicating study material requires adaptive solutions. Both teacher leaders revealed that the problem they were facing required an *adaptive solution*. Cindy’s role in

establishing a computer room and Evalina's use of WhatsApp for education purposes are responses to adaptive challenges. In addition, they both demonstrated the adaptive leadership principles of *experimentation and learning* (Heifetz et al., 2009) by experimenting with new innovative methods of learning and communication. Experimenting with solutions, enabled the adaptive leader to put him/herself in a position to generate DNA to thrive in a changing context Heifetz et al., (2009). In other words, the teachers can develop strategies that suit a changing environment while discarding redundant traditional strategies/methodologies.

In essence, the way in which these teachers approached challenges and adopted solutions had a positive influence beyond the walls of the classroom. This aligns to teacher leadership as they exerted influence beyond traditional teaching roles by influencing educational practice (Wenner & Campbell, 2017). Both teachers revealed that the *motivational dimension* of cultural intelligence is crucial for teacher leadership in the context of the 4IR, particularly where adapting and integrating new technology requires not only skill and knowledge but also motivation to engage with rapid change.

8.2.1.1 Unravelling the Generative Mechanism for the Motivational Dimension of Cultural Intelligence by Teacher Leaders in the 4IR

Utilising social realism (Archer, 1995) as a theoretical lens, I unearth the generative mechanism at play by delinking the *structures* (parts) and *agency* (people) in both Evalina's and Cindy's narrative (as discussed above, section, 8.2.1) using analytical dualism. The structures at play are the *school quintile system* and the *cultural dynamics* of the community context. The discussion presented in section 8.2.1 highlighted how Evalina's and Cindy's school were significantly influenced by historical and socio-economic elements (Blose & Naicker, 2018). The structural elements are evident in the schools' limited access to technology and the predominant socio-economic challenges which inevitably shape teaching and learning in lower quintiles. Coupled with this structure is the cultural background prevalent in this school. Resultantly, these teachers' cultural responsiveness was key in their practice (Aldaheri, 2017). The agency demonstrated by both teachers were evident on different levels. On one hand, Cindy evidently shows characteristics of a *social actor* (Archer, 1995) through her innovative use of culturally relevant teaching strategies. Her initiatives show a pertinent commitment to community service (Naicker & Govender, 2020). As a *social actor*, Cindy influences the wider school community by integrating cultural factors into the learning experience, thus enhancing the aptness of her teaching methods.

Evalina, on the other hand acts as both *cooperative agent* and a *social agent* (Archer, 1995). As a cooperative agent, she setup WhatsApp groups to collaboratively link with parents to enhance their

children's engagement through electronic learning material. In addition, she also presents herself as a *social actor* by immersing herself and adapting to the socio-economic realities found within her school's community. Her practice aligns with the tenants of the motivational dimension of cultural intelligence (Earley & Ang, 2003) and how its role influences the adaption of technology into education. These teachers have transformed into *social actors* by developing an identity (Archer, 1995) that pursues the integration of technology into teaching and learning. They have taken a vested interest (Archer, 1995) in transforming how teaching and learning takes place by drawing on cultural intelligence as a catalyst.

The resultant *emergent properties* (Archer, 1995) in this instance are an *educational practice for cultural inclusivity and community engagement*. The agency demonstrated by these teacher leaders have led to the establishment of inclusive classroom environments, in which technology is integrated in culturally sensitive ways. The communities' identities are included in their practice and thus used to address the digital divide in lower quintile schools. In addition, the teacher leadership demonstrated actions that extended beyond the walls of the school and into the community (Katzenmeyer & Moller, 2009).

Drawing on critical realism, a stratified reality of these teacher leaders' practice is made visible (Bhaskar, 1975). At the level of the *empirical*, one observes the motivational dimension of cultural intelligence through the implementation of song and dance in Cindy's practice. Similarly, in Evalina's practice the use of WhatsApp can be seen as a culturally intelligent practice (Earley & Ang, 2003). At the level of the actual, Cindy's actions are evident in her initiatives to integrate learning content and resources that is culturally sensitive to context, dance, song, and language of the community. Evalina's actions included adopting communication networks to suit the socio-economic realities of stakeholders in the school community. This leads us to the deepest level of reality, where *generative mechanisms* potentially explicate the actions at the level of the *actual* and the observation made at the level of the *empirical* (Bhaskar, 1975). The structural generative mechanisms at the *level of the real* shaping the practices in lower quintile schools are *resource limitations* and the *wider socio-economic conditions* of learners who attend such schools (van Dyk & White, 2019). The cultural generative mechanisms at play include *cultural values and norms of the community*. These factors have shaped how teacher leaders integrate innovation for teaching and learning into their practice (Angelle & DeHart, 2011; York-Barr & Duke, 2004). The agential generative mechanisms are characterised by Cindy's and Evalina's cultural intelligence (Earley & Ang, 2003) and adaptive leadership (Heifetz et al., 2009) in their endeavours to respond to structural and cultural issues- a detailed discussion of these challenges is reinforced in section 8.2.1.

8.2.2 Metacognition and Cognitive Dimension of Cultural Intelligence by Teacher Leaders

Metacognition and *cognition* are different from the *motivational dimension* of cultural intelligence as it requires the teacher leader to demonstrate an awareness of other cultural environments and use knowledge from experience to relate to culture (Earley & Ang, 2003). Zama's and Simitha's practice reveal insights into the application of *metacognitive* and *cognitive dimensions* of cultural intelligence. To be specific, the *metacognitive dimension* is an individual's awareness of other culture's existence and recognising the difference between his/her culture and others (Earley & Ang, 2003). This dimension is clear in Zama's practice in a quintile two school as she works with teachers. She mentions:

WhatsApp proved to be a valuable tool [among teachers] as it facilitated the sharing of important documents, such as those received from the Department of Education (DOE). Additionally, each subject department could share electronic copies of annual teaching plans, assessment guides, CAPS policy documents, worksheets, PowerPoints, free CAPS textbooks, and even generic lesson plans...I spearheaded the implementation of electronic lesson plans, prioritising regular updates and encouraging creativity in teaching. If you look at the agenda (figure 5.12, pg. 122), we prioritise frequent lesson planning and discourage using previous year's lesson plans without updating it. By sharing lesson plans digitally, the teachers found themselves with ample time for reflection and improvement. Editing on word document is much better than handwriting new lesson plans which had to be stored in bulky files. Using their phones as teaching aids, they could easily access their lesson plans... promoting an active and engaging learning environment (see chapter 5.3, pg. 121-122).

Zama's metacognitive approaches are on display as she capitalises on mobile technology's prevalence in South African culture (Moloi & Mhlanga, 2021). By using WhatsApp, she is not just providing a new tool, but also proactively connecting teaching practices with community digital behaviours (such as WhatsApp). By encouraging her peers to move to digital resources, Zama shows a strategic approach to enhancing the school's education delivery. In addition, it demonstrates a higher level of self-awareness and strategic foresight (Petrović, 2011). Her practice aligns with the finding by Lui et al. (2018) who proved that *metacognition* facilitates closeness and collaboration, intercultural dyads, and creativity in multicultural teams. In the South African context, Sikhakhane et al. (2021) discovered that due to the unequal availability of technology among teachers and learners, many teachers resort back to traditional approaches. However, Zama's' practice exemplifies her reflection on the cultural norms and her strategic planning to integrate technology in a way that is both innovative and culturally harmonic. This initiative demonstrates her capacity to reflect on current processes and envisage more efficient, adaptive

techniques that are in line with the growing digital landscape. Zama's approach demonstrates how her highly developed *metacognition* enables her to be aware of others cultural preferences and adjust their mental modes during and after interactions (Earley & Ang, 2003).

While Zama displayed elements of the *metacognitive dimension* in her practice, Simitha demonstrated the *cognitive dimension* in her practice. The *cognitive dimension* of cultural intelligence accumulates general knowledge about cultural contexts and cultural differences through education and experience (Rajasekar et al., 2021; Ziyatdinova, 2017). Simitha, who is in a quintile five school comments:

Google classroom also presented an incredible opportunity... (Figure 6.15, pg. 156). I could organise the learners' work into topics and monitor who had completed tasks. I would send out messages to learners and provide individualised feedback. The learners also had an opportunity to respond to my feedback. This allowed for efficient tracking of the learners' progress and ensured that they did not miss any important material. Digital learning also helped to solve the problem of learners who missed lessons due to their participation in sports. I had learners who were on the rugby, and cricket teams, and they often missed lessons. However, the recordings of the lessons enabled them to catch up on missed work and serve as a revision resource. This also kept the parents happy because they seem to value sport more than academics (see chapter 6.3, pg. 156).

Her practice unravels the *cognitive dimension* of cultural intelligence through her integration of digital platforms (google classroom) into her teaching. Research conducted by Moloï and Mhlanga (2021) observed that the adoption of such platforms in public schools is minimal due to the extensive training required for utilisation. Furthermore, several studies conducted in South Africa corroborate that a significant number of teachers lack educational technology training, self-efficacy and adaptive capacity required to integrate technology for the 4IR into their lessons (Nkambule & Amsterdam, 2018; Torres & Giddie, 2020). Contrastingly, Simitha's practice presents the contrary as it reflects her knowledge and understanding of digital platforms, along with her adeptness in employing these tools effectively. Simitha's ability to apply these tools in her practice suggests a high level of cognitive development as it shows cultural intelligent *awareness* and *learning* (Thomas & Inkson, 2004). Cultural intelligence in the cognitive dimensions of *awareness* includes being aware of one's cultural biases and assumptions (in this case about education), while *cultural learning* suggests that cognitive cultural intelligence is not a static set of facts but a dynamic process of learning about cultural contexts (Thomas & Inkson, 2004). Simitha demonstrates the cognitive dimension of cultural *awareness* and *learning* by integrating technology into

her classroom that goes beyond digital literacy; it involves a deeper understanding of how technological tools can enhance learning and teaching processes (Mishra & Koehler, 2006) shaped by the 4IR.

Zama's and Simitha's approach to advance the use of digital tools (WhatsApp & mobile phones) and digital platforms (google classroom) represent adaptive and technical challenges respectively (Heifetz et al., 2009). Zama's approach in advocating for digital tools is an adaptive challenge as it required a change from the traditional mindset and practices of her colleagues. In this instance, Zama is confronting the deeper systemic issues of how teachers plan, collaborate, and engage with educational content. Simitha's adaptive leadership practice displays how she guides her peers through a process of *unlearning* old habits and adopting new practices (Heifetz et al., 2009). Her practice also demonstrates what Heifetz et al. (2009) labels '*creating a holding environment*'. This is evident in her practice as she created a space where teachers can experiment with new teaching methods, reflect on their practice, and adjust. The importance of updating and refining lessons digitally, cultivates an environment of continuous learning (Heifetz et al., 2009).

Simitha on the other hand faces technical challenges as she needed to effectively learn how to use digital platforms. Such challenges can be solved by acquiring relevant new skills which are crucial to the context (Heifetz et al., 2009). Simitha's willingness to embrace new technologies and adjust her teaching methods exemplifies the adaptive principles of *navigating uncertainly*, which is an important part of adaptive leadership. Her activities reflect a willingness to *experiment and learn*, which is vital in the context of South Africa's fast expanding educational technologies. Overall, both teacher leaders, Zama and Simitha exemplified cultural intelligence, particularly in the *metacognitive* and *cognitive dimension*. Such skills have proven pivotal to navigate the diverse cultural aspects involved in implementing change for innovative teaching and learning.

8.2.2.1 Unearthing the Generative Mechanism of Metacognition and Cognitive Dimension of Cultural Intelligence by Teacher Leaders

Analytical dualism emphasises that structure/culture and agency operate on different time scales. Therefore, delinking structure/culture and agency in Zama's and Simitha's practice (as discussed in section 8.2.2) enables one to analyse how agents respond to and interact with these conditions (Archer, 1995). The resultant structures at play are *digital infrastructure* and *the socio-cultural conditions*. These structures are impacted by the quintile system and the socio-economic context of the community, thus shaping the teacher leader's technological approaches for innovation in teaching and learning (Moloi & Mhlanga, 2021). These factors lead to varying levels of agency enacted by the teacher leaders. Zama

demonstrates her role as a *social actor* by effectively implementing WhatsApp for collaborative planning (Archer, 1995). Her metacognitive awareness demonstrates how she aligns teaching practices with digital behaviours in the community, thus showing her role as a *social actor* as she encourages her colleagues to adopt innovative methodologies (Petrović, 2011). Simitha's cognitive agency can be described as *primary* (Archer, 1996). She demonstrates this *cognitive primary* agency by her effective use of Google Classroom, showing in-depth practical knowledge of how to infuse digital tools into the learning process for innovation in teaching and learning (Thomas & Inkson, 2004; Earley & Ang, 2003). Her *primary agency* is particularly visible in how her actions are focused within the classroom (Harris & Jones, 2019).

The resultant *emergent properties* (Archer, 1995) include *enhanced teacher collaboration* and *culturally responsive teaching practices for innovation*. The former emergent property alludes to the use of digital tools to improve collaboration, thus enhancing creative and methodical lesson planning and nurturing professional development among peers (Wenner & Campbell, 2017). The latter emergent property shows how the *agency* of both teacher leaders led to the establishment of teaching methods that integrate technology for innovation while also ensuring cultural sensitivity. This approach adopted by the teacher leaders ensures engaging and contextually relevant learning experiences for their learners.

To identify the generative mechanisms behind these emergent properties, *critical realism* is utilised to unearth the stratified realities for Zama and Simitha (Bhaskar, 1975). At the *empirical level*, observations like Zama's use of WhatsApp for collaborative lesson planning and Simitha's integration of google classroom for interactive learning and learner progress tracking show their cultural intelligence (Earley & Ang, 2003). The events at the *actual level* include Zama's decisions to transition lesson planning to a digital platform and Simitha's implementation of google classroom for individualised learning experiences. Their actions are characterised by strategic planning and adaptability in response to their cultural and technological context. The generative mechanism at the *level of the real* include structural mechanisms such as the availability of technology, the school's policies regarding technological use and the wider socio-economic factors shaping the implementation of digitised learning (Mestry & Ndhlovu, 2014; Moloji & Mhlanga, 2021). The cultural mechanisms are clearly perceived in the cultural norms and preferences within the school community and their attitudes towards the use of technology (Mishra & Koehler, 2006). Finally, the agential factors found in both teacher leaders practices include reflective and strategic thinking and their adaptability to culturally diverse contexts (Heifetz et al., 2009). Zama's agency, fuelled by leadership autonomy lends itself to that of a *social actor* as she extends her impact on teaching and learning beyond her classroom. Simitha's agency is restricted within her classroom by her school's

hierarchical management (refer to chapter 6.3, pg. 152 & 154 for a detailed description of her school's management structure), leading her to apply her cultural intelligence primarily within her classroom.

8.2.3 Behavioural Dimension of Cultural Intelligence in Teacher Leadership

Behavioural cultural intelligence is exhibited verbally or behaving in accordance with people from other cultures in one's relations (Rajasekar et al., 2021; Shokef & Erez, 2008). In the context of the 4IR, it relates to adapting behaviour through verbal and non-verbal actions to harness technology that fits a particular diverse context. Kirstern, in a quintile four school, demonstrated aspects of the *behavioural dimension*. He expounded:

I spent countless hours learning the system... I would use some of the application on the server. Once I learnt how to use the Geo-app, I would teach geometry on it (Figure 6.3, pg. 144). It was very time-consuming learning some of these apps on my own. I didn't utilise some apps as I could not figure them out. I usually searched YouTube tutorials to help learn how the applications work... However, it was exciting for the learners... I also downloaded countless videos from Khan Academy that I could project using the multi-media centre/library. These videos were useful as learners could watch other teachers teach how complex problems were solved using a variety of resources. For instance, my grade 8 classes would watch how you can find volume of a curved 3D shape. I had to learn what are the current trends in multi-media that attract learners. It's important to learn the lingo of the times because I teach children of different backgrounds and races. In my teaching of maths, I use these technologies to remain relevant and ensure I can communicate with learners. (see chapter 6.2 pg. 144)

Kirstern adapts his behaviour to effectively engage with his students by using multi-media resources. His adaption is an indication of the *behavioural dimension* of cultural intelligence as it involves changing one's behaviour to accommodate different cultural contexts (Ang et al., 2007). This is seen in Kirstern's practice as he demonstrates and responds to the learning preferences of his learners in his classroom by attempting to remain relevant and approachable. By Kirstern investing several hours into learning new teaching application shows his behavioural adeptness in aligning his teaching methods with the cultural and educational needs of the learners. By attempting to use verbally relevant communication, displays his sensitivity when working with learners from diverse cultures (Rajasekar, 2021). His actions seemly align with the study by Petrović (2011) who found that people with highly developed behavioural cultural intelligence exhibit contextually appropriate behaviours based on their broad range of verbal and nonverbal capabilities such as using culturally appropriate words, facial expression, and idioms.

Kirstern portrays his *adaptive leadership* through cultural intelligence by attempting to address both *technical* and *adaptive challenges*. He faces technical challenges such as learning new digital tools (Heifetz et al., 2009). These challenges are generally solved by acquiring new skills for the effective use of technology in education. Kirstern demonstrates his teacher leadership to remain a lifelong learner as he attempts to learn new digital tools to enhance his teaching methods (Harris & Jones, 2019). His willingness to experiment with different teaching methods and technologies shows a key principle of adaptive leadership, which is *learning through experimentation*. Kirstern exhibited a learning-orientated approach to handling complex challenges in his context.

8.2.3.1 Unearthing the Generative Mechanism of the Behavioural Dimension of Cultural Intelligence in Teacher Leadership

Through the process of analytical dualism, I can study the structural, cultural, and agential elements (Archer, 1995; Archer, 1999) from Kirstern's analysis on the behavioural dimension discussed in section 8.2.3. The structures at play include the *technological environment* in which Kirstern operates. His environment provides certain technological tools and resources that require him to engage in self-learning for adaption. In addition, his *diverse classroom dynamic* supplemented by diverse cultural backgrounds and mixed learning preferences, provide a structural context for teaching and learning. This dynamic lends itself to the adoption of culturally sensitive teaching methods to efficiently address the broad range of learning needs. Resultantly, Kirsten showcases primary agency through his behavioural (Rajasekar et al., 2021; Shokef & Erez, 2008) adaptability in committing to learning and using different multimedia applications for teaching and learning. *Primary agents* generally involve themselves in individual actions and initiatives, which are inspired by personal motives and beliefs (Westaway et al., 2020). It is also characterised by the individual's initiative to lead innovation within their context (Archer, 1995). In a similar manner, Kirsten's decision to invest time in learning novel applications is seen as a self-directed effort (York-Barr & Duke, 2004). In other words, he independently seeks out solutions to problems in his classroom. His endeavour of self-learning reflects a high degree of personal responsibility for his professional enhancement as a teacher in the 4IR. Through his self-learning, his efforts align his teaching methods with the cultural and individual preferences of his learners, thus demonstrating his cultural intelligence in the *behavioural dimension*.

Through the process of *analytical dualism*, the interplay between the *parts (structure/culture)* and *people (agents)* highlighted the following *emergent properties* (Archer, 1995): *culturally receptive teaching practices* and *improved learner engagement* in class. Through the lens of critical realism, as theorised by

Bhaskar (1978), the underlying generative mechanisms of these emergent properties become clear. This clarity is made visible by exploring these teachers' realities in stratified layers (Archer, 1995; Danermark et al., 2002). At the *empirical level*, one observes this teacher leaders using various multimedia tools and digital applications in his classroom to teach difficult mathematical problems. At the *actual level* his actions are characterised by *investing more time to learn new technologies* (Muijs & Harris, 2003). His self-directed learning is supported through YouTube tutorials at this level. This reveals his approach to learning skills which are inevitable for modern day teaching and learning, thus reflecting his desire to stay a lifelong learner (Hairon & Goh, 2015; Wenner & Campbell, 2017).

The underlying mechanisms impacting Kirstern's cultural intelligence in the behavioural dimension located at the *level of the real* are threefold. Firstly, the availability to digital resources in his quintile four school is impacted by governmental policies and the ability to leverage school fees (Mestry & Ndhlovu, 2014). Secondly, the cultural mechanisms at play are found in the diverse learner backgrounds at the school. The various backgrounds of the learners and the societal shifts towards digital learning are vital cultural elements. These aspects shaped how Kirstern approaches teaching and required adaptability and cultural intelligence (Ang, 2007). The *agential mechanisms* at play is Kirstern's lifelong learning and adaptability (Hairon & Goh, 2015; Heifetz et al., 2009; Wenner & Campbell, 2017). His desire to continuously learn independently and adapt his teaching styles reveal his agency. His response to technological and cultural intricacies located in his educational setting shows an elevated degree of adaptability for innovation in teaching and learning (Heifetz et al., 2009; Mishra & Koehler, 2006)

8.3 ETHICAL TECHNOLOGICAL TEACHER LEADERSHIP FOR DIGITAL GAP MITIGATION

Leadership for the ethical consideration of technology is emerging as a crucial component in educational leadership, particularly in the context of technology into learning environments (Chomunorwa & Mugobo, 2023). For this discussion, I will refer to this form of leadership as *ethical tech leadership*. Ethical tech leadership is not only about incorporating technology into educational environments, but doing so in a way that consciously addresses digital divides (Selwyn, 2016). It entails an inclusive approach in which teacher leaders seek to ensure that every learner and educator, regardless of socioeconomic background, has equitable access to technology and the skills to properly use it (Gorski, 2005). The digital divide, described as a social inequality between individuals regarding access to ICT, frequency or use of technology, and ability to use ICT for different purposes (Ercikan et al., 2018), becomes increasingly visible as the usage of ICT increases. In the educational context of South Africa, the divide is beyond a matter of connectivity, it further involves disparities in digital literacy and access to resources (Van Dijik, 2020). There are three levels of the digital divide in schools: ICT infrastructure; ICT usage by teachers

and learners in the classroom; and empowerment of individual learners (Hohlfeld et al., 2008). Factors such as teachers' attitudes towards technologies and their resistance to new ICT hinder the use of technologies in the classroom (Chisango & Marongwe, 2021; du Plessis & Webb, 2012). These factors highlight both a systemically entrenched challenge and technical challenges- which lend itself to adaptive leadership. The research on teacher leadership has empirically demonstrated how teacher leaders have played a pivot role in mitigating educational ethical disparities through inclusion, resource allocation, sharing best practices and collaboration (Wenner & Campbell, 2017). Through ethical tech leadership, the teacher leader in my study attempted to mitigate the digital gap. The following subthemes emerged:

8.3.1 Digital Gap Mitigation Through Resource Accessibility and Usage

The teacher leaders in this study played a pivotal role to attain and make digital resources accessible and appealing for their learners. Zama in a quintile two school purports:

I bought a new laptop and projector. I used the smart board which was donated to the school that was fortunately left behind during a school break-in. As you can see in the picture (see figure 5.16, pg. 126) the smart board is not fixed to the wall- which means it must be stored in a safe place daily... I used my laptop to create engaging PowerPoints for the learners. In the photo (see figure 5.16, pg. 126), I was introducing the drama 'My Children, My Africa' as an English grade 12 lesson in January 2023. I used my PowerPoints to create a visual background of the drama ... The visuals and audios created a vivid image in the learners' minds, and they were able to relate it to the text. As you can see the learners are high focused here (see figure 5.16, pg. 126) (see chapter 5.3 pg. 126).

Zama's usage of a smart board and PowerPoint presentations for her English classes shows a proactive approach to integrating technology into teaching. Despite the inconvenience with the smart board not being fixed to the wall and the threat of theft, Zama's resourcefulness shines through. This method not only increases learners' engagement but also caters to various learning styles by incorporating visual and audio aspects (Katzenmeyer & Moller, 2009). Similarly, Cindy, who is in a quintile one school with extreme limits in accessibility to technology, enhanced accessibility to her primary school learners in several ways. She made the following comment:

That's when I partnered with Anthony, a qualified actuarial scientist... [He] introduced a mathematical gaming application that would revolutionise the way learners approached algebra and geometry in our school... Anthony would visit the school, working closely with

small groups of ten learners. Armed with around 20 devices, he guided the learners to solve challenging math problems through games (see figure 5.3, pg. 112). (see chapter 5.2 pg. 112)

Cindy also made her personal device a common part of the learning experience. She describes how:

I found another valuable use for my laptop in the classroom. I discovered the power of sing-along phonics tunes available on platforms like YouTube... I harnessed this interest to enhance their English phonics skills. The students could now watch videos, sing along, and dance. (see chapter 5.2 pg. 112).

Given limited access to resources in her quintile one school, Cindy's partnership with outside agents, represents innovative approaches to teaching maths and making it accessible to her learners in novel fashions. Cindy's collaborative innovation with external experts is supported by Fullan (2007) and Joe-Atodo (2022) who argue that such partnerships can bring fresh perspectives and innovative solutions to education problems. In addition, she makes technology accessible by making use of her own technological devices.

The digital divide made apparent in these teacher leaders' schools aligns with the first level of the digital divide as outlined by Hohlfeld et al. (2008). This level constitutes the lack of ICT infrastructure, which is perceived as a rudimentary aspect of the digital gap in educational settings. Both Zama and Cindy ensure that their limited digital resources are utilised in their practice. These teachers have taken heed of the DOE's goal to digitalise education (Sehlako et al., 2023) by going the extra-mile despite their contexts (Naicker & Govender, 2020). The educational context of both Zama and Cindy epitomise the digital divide in lower quintile/rural schools, characterised by limited internet access and scarce digital technologies (Chisango & Marongwe, 2021). A study by Chomunorwa and Mugobo (2023) found that the digital divide in quintiles one and two schools is particularly severe, where the use of technology is minimal or non-existent. In contrast to this trend, Zama and Cindy's practice addressed the digital divide by ethically navigating resource disparities and ensuring equitable access of technological tools. Their practice resonates with Selwyn (2016) who emphasised the potential of digital technologies to transform educational practices. The incorporation of multimedia material (as in the case of Zama and Cindy), such as PowerPoints, gaming, and video applications can dramatically improve learners' engagement and comprehension (Mayer, 2014).

These teacher leaders seemly demonstrated *adaptive leadership* by navigating resource limitations to mitigate the digital divide. Heifetz et al. (2009) outlined adaptive leaders as those who thrive in challenging environments. Zama and Cindy's adaptive leadership utilised available resources creatively to mitigate the digital divide and to ensure they thrive. Zama's relentless use of a non-fixed smart board and Cindy's engagement with external experts exemplifies problem solving (Heifetz et al., 2009) in resource-limited-schools. By making technology accessible in their lessons, they demonstrated their ability to address *technical challenges* (Heifetz et al., 2009). While Zama and Cindy demonstrate adaptability, their solutions to the problems are based on technical solutions. In essence their solutions might not address systemic issues experienced because of the digital divide. The reliance on personal or external resources, while effective in the short term, might not ensure a long-term sustainable solution.

Zama and Cindy's use of personal devices as a tool to mitigate the digital divide in their contexts challenges traditional interpretations of the adaptive leadership theory, specifically, the principle of *protecting voices from below*. This could be seen as a divergence from the adaptive leadership theory, since their initiatives raise concerns about reinforcing the top-down approach, as changes are driven by the individual rather than collective efforts (Heifetz & Laurie, 1997). Adaptive leadership broadly recognises the role of the formal leader in instigating change through addressing challenges. In other words, the formal leader is responsible for rallying followers together and creating *holding environments* (Heifetz et al., 2009) in which all stakeholders can share ideas and alleviate stresses. In this way *the voices from below* are protected and allows marginalised followers to have their voices heard (Heifetz & Laurie, 1997).

However, in the inquiry of Zama and Cindy, who are not formal leaders, adaptive leadership lacks a strand on change and problem solving started by informal leaders. Their practice/actions, which is characterised by experimenting with solutions in their immediate environments (classrooms), is consistent with the adaptive leadership principle of *experimentation*. Significantly, their actions do not fortify the top-down-approach demonstrating the effective impact of the informal leadership (Day & Harris, 2002). The teacher leaders' initiatives mitigating the digital gap by using their agency to make technology accessible in their classrooms first and later inspire others through their actions. Their practice aligns with the first *dimension of teacher leadership* claimed by Day and Harris (2002) who described the central responsibility of the teacher leader as initiating school improvements into their individual classrooms. In essence, they are the epitome of the *voices from below*. Their practice further aligns with the literature on teacher leadership which portrays teachers as action orientated leaders. Such teachers are known for their part in role modelling, demonstrating best practices and actively participating in instigating school

improvement initiatives (Hairon & Goh, 2015; Katzenmeyer & Moller, 2009). Zama and Cindy's teacher leadership challenge the adaptive leadership theory to extend its perspective to include the contributions of informal leaders. It calls for a rethinking of leadership dynamics, implying that adaptive leadership can come from a variety of levels within an educational organisation rather than only formal positions.

8.3.1.1 Unearthing the Generative Mechanism of the Digital Gap Mitigation Through Resource Accessibility and Usage

By utilising *analytical dualism* within the framework of social realism, allows one to recognise the emergent properties in Cindy's and Evalina's practice based on the analysis in section 8.3.1 (Archer, 1995). *Resource disparity* and *limited technological infrastructure* are prime structures found in Cindy's and Zama's context. These structures shape the teacher leader's ability to implement technology efficiently into classrooms (Chomunorwa & Mugobo (2023; Hohlfeld et al., 2008). Drawing on these prevailing structures, both Zama's and Cindy's ethical-tech leadership show characteristics of *primary agency* (Archer, 1995, Quinn, 2016). Zama's choice to buy a laptop and use a donated smartboard shows her pre-emptive approach to tackle resource limitations in her school. In addition, by creating attractive PowerPoints using a smartboard despite the inconvenience caused logistically, shows her innovation to improve learning. However, these actions are driven by Zama's personal commitment and determination to enhance learning in her classroom. Similarly, Cindy's partnership with external experts and the use of her personal device as a teaching tool is an example of an individualised approach, driven by her comprehension of her learners needs. Both Zama's and Cindy's actions demonstrate that of a *primary agent* (Archer, 1995).

The interplay of these *parts* with the *people* reveals the following emergent properties (Archer, 1995, Archer, 2003): *Increased access to technology* and the *enhanced learning experiences* of the learners. Through the lens of *critical realism*, a stratified reality emerges to aid in unearthing the generative mechanism for the digital gap mitigation through resource accessibility and usage in these teachers' practices. (Bhaskar, 2008). At the *empirical level*, one observes the use of laptops by teachers, smartboards to enhance learning and partnership with external experts. These observations were influenced by the actions at the *actual level*, evident by the proactive decision to use personal laptops and form partnerships to enhance technology use. These tactical actions are insinuated to help overcome the limitation present in their school contexts, thus showcasing elements of teacher leadership (Crowther et al., 2009; Katzenmeyer & Moller, 2009).

At the *level of the real*, we find multiple generative mechanism at play impacting the actions at the actual level and the observations at the empirical level (Bhaskar, 2008). Firstly, structural mechanisms are demonstrated in the lack of ICT infrastructure and little access to digital tools as made evident in lower quintile schools (Hohlfeld et al., 2008; Van Dijk, 2020). These barriers are systemic challenges that Zama and Cindy must work through in the South African educational technological landscape. The cultural mechanism at play includes Zama's and Cindy's positive attitude towards the use of technology to enhance teaching and learning (Du Plessis & Webb, 2012). In addition, the positive response from the learners' experience with technology further highlights their optimistic attitude towards innovative learning (Du Plessis & Webb, 2012). The agential mechanisms are found in Zama's and Cindy's adaptability and ethical commitment to ensure equitable access to digital learning for innovation. (Heifetz et al., 2009; Selwyn, 2016).

8.3.2 Digital Gap Mitigation by Teacher Skills Development and Attitude Towards Technology

A key character in the 21st centenary workplace, is to remain relevant by ensuring the continuous acquisition of skills geared towards innovation (Schwab, 2016). However, coupled with skill acquisition is the perceptions and attitudes people hold regarding technology for innovation in schools. Chomunorwa and Mugobo (2023) pointed out that the success or failure of any innovation is based on the users' adoption and acceptance which depends on perceptions or attitudes. Some of the teacher leaders in my study exemplified this character of lifelong learning by acquiring skills and influencing the perceptions of others. For instance, Cindy, who is close to 60 years old and in a quintile two school expressed her lifelong learning in the following narrative description:

...I was determined to adapt and learn. I immersed myself in technology and acquiring basic Microsoft skills. I sought guidance from fellow professionals, enrolled in courses, and even challenged myself to create electronic teaching materials. (see chapter 5.2, pg. 112)

In another instance, Cindy described how she benefited from up-skilling herself through video-conferencing platforms and the influence she has on her peers: She makes the following comment:

They [the DOE] have also hosted seminars conducted by experts in the field via zoom. These seminars have been enlightening towards learning innovative methods of teaching. While these seminars are not compulsory, I ensure that our foundation phase teachers joined the zoom meetings. After these meeting we were able to discuss our learnings...By fostering a

culture of technology among my peers, more teachers are taking a vested interest and are making a slow move towards using technology in class (see chapter 5, pg. 115).

Despite Cindy's long career in traditional modes of education and pedagogy, she demonstrates her ability to acquire new skills that are necessary for the 4IR. Acquiring Microsoft skills and participating in Zoom conferences reflects a proactive approach to professional development (Hairon & Goh, 2015). Cindy demonstrates her rigor for lifelong learning by seeking guidance from professionals and enrolling in educational courses to help her cope with the technological revolution. Her practice aligns with studies by Leithwood (2021) who mentions that lifelong learning enables teachers to develop expertise and confidence which are crucial for influencing educational practices and keeping up with the pace of rapid change in educational methods. Cindy's willingness to embrace learnings and adapt teaching methods is a significant step in addressing the digital divide experienced by teachers. In a recent study conducted in poor socio-economic educational context in South Africa, Chomunorowa and Mugobo (2023) found that majority of the teachers demonstrated no interest for the use of educational technology for innovation. Cindy's teacher leadership demonstrates the contrary. In addition, she also reveals how she uses her new learnings to capitalise on and change the poor attitudes of her peers about technology. Similarly, Evalina influence played a significant role in mitigating the digital gap by influencing the attitudes of her peers. Evalina in a quintile three school purports:

One of the biggest challenges we face for advancing technology is having an aging staff. One of my roles as a grade 3 co-ordinator is to work with teachers... As a team we agreed that we will be designing worksheets on word document to give the learners on WhatsApp. This will help us save time from writing on the board. I also encouraged teachers to make use of the projector. However, one of the older staff, Mrs Fox continuously decides to write on the board and then later describes how there is not enough time to complete the topics. On many occasions, I have been accused of reinventing the wheel... I then decided that I need to get to know why this teacher is defiant. After spending time with the teacher, I learnt that she is going through a lot of change in her life. She begun to share how using technology is not easy for her and yet the school expects her to adopt these methods. Teachers like Mrs Fox also believe that this is just another passing gimmick from the DOE (see chapter 5.4, pg. 138).

Evalina's encounters with older staff members who are hostile to using technology demonstrate the diversity of teacher views toward technology use. It also points out the reservations teachers may have about the effectiveness technology will have on the learning experience (Chomunorowa & Mugobo, 2023;

Kayember & Nel, 2019). According to the literature there are two sorts of barriers to technology integration in education: first-order (external) constraints such as a lack of access to technology and second-order (internal) barriers such as attitudes and beliefs (Christensen & Knezek, 2017; Ertmer, 1999). Evalina's difficulties with older staff members demonstrate second-order obstacles, in which resistance is rooted in personal values and familiarity with traditional ways. Evalina's efforts to identify and resolve these objections show a nuanced approach toward leading change and mitigating the digital divide. Comparably, Kirstern in a quintile four school experiences challenges from teachers who are staunch in the traditional methods of teaching. He outlines his leadership practice as follows:

As a leader I had the key to unlock potential if I can present the teachers with the foundation. At first, it was a challenge to get the teachers to access the electronic resource-hub I had created. This was a challenge as many of them were deep rooted in using files, textbooks, paper and the chalk board. While the novice teachers were keen, they lacked exposure to technological innovation in teaching. The challenge was that few understood what innovative and digital teaching looks like. I persevered by spending time teaching them how to access the USB drive, edit documents, print, and taught some teacher how to use the computer lab. (see chapter 6.2, pg. 145).

Kirsten's devotion to equip his peers, particularly in the use of electronic resources, reveals leadership that encourages digital literacy. Fullan (2007) highlights the importance of leaders in modelling continuous learning and support for staff through change. His efforts to overcome resistance from teachers steeped in traditional methods, exemplifies the realities associated with transforming educational practices (Grant, 2017). However, Kirstern's role in assisting teachers represents the role outlined by Fullan (2007), where he not only leads by example but also provides support for his teachers.

The realities of the teacher leaders uncover a prevalent digital divide among teachers. The divide depicts a problem extending beyond access to digital technological resources (Chomunorwa & Mugobo, 2023; Mhlanga & Moloji, 2020). Central to the issue are teachers' reluctance to acquire digital skills and align attitudes for technology for innovative application. This issue is apparent in the literature, where many teachers demonstrate a lack of interest for technology use (Chomunorwa & Mugobo, 2023). In addition, where technology is used, teachers doubt the effectiveness of technology for innovative lessons (Chomunorwa & Mugobo, 2023; Moloji & Mhlanga, 2021). Likewise, the teachers in my study reported resistances from colleagues regarding the use of technology for innovation in lessons. The resistance stemmed from teachers having a negative attitude towards technology because they do not have the

skills to function in a new era of education. However, the teacher leaders in my inquiry attempted to solve these problems adaptatively (Heifetz et al., 2009).

The teacher leaders in my study perceived the necessity of upskilling to mitigate the digital divide in their own utilisation of technology for innovation in teaching and learning. Mishra and Koehler (2006) state that the effective integration of technology requires teachers to develop technological pedagogical content knowledge. This includes an understanding of the interaction between technology, pedagogy, and content (Mishra & Koehler, 2006). The teacher leaders self-driven learning fits with this approach because they not only learn technical skills but also how to use them pedagogically. Therefore, the teacher leaders' narratives in this inquiry represented the adaptive principle of *regulating distress* by slowly introducing technology and supporting peers through the transition. These teachers' efforts to sustain attention on the significance of digital literacy amidst resistance are crucial aspects of leading. In this regard, the teacher leaders play a key role in influencing teachers' perceptions on the use of technology by supporting them through the process.

In creating an environment where teachers are encouraged to develop new skills (Heifetz et al., 2009), these teacher leaders are initiating an adaptive culture in the school (Nelson & Squires, 2017). Resultantly, these teachers' efforts to teach other teachers about technology use suggest keen awareness of the digital divide among educators. This entails not only meeting the current need for technology skills, but also changing fundamental attitudes and beliefs about teaching and learning in the digital age. This depicts both a *technical* and *adaptive challenge* simultaneously. In this instance, the teacher leaders are reregulating DNA as adaptive leaders (Heifetz et al., 2009). They are doing this by shedding off tradition DNA (old traditional methods of teaching) and creating new DNA (digital skills) to help older and less trained teachers thrive in a new environment (Owens & Valesky, 2007). Simultaneously, through reregulating DNA, they are changing beliefs about how learners should learn the 4IR.

Overall, these teacher leaders demonstrate a commitment to ethical tech leadership. Notably, the teacher leaders do not marginalise older and less trained staff members. Instead, they commit to bridging divides experienced in the South African context. This highlights adaptive leadership, as the teacher leaders preserve valuable traits among staff members needed to facilitate change. In other words, the teacher leaders recognise the significance of existing knowledge of the older/less trained staff. They then focus on teaching them new skills which will enable them to apply their knowledge to teaching and learning in the 4IR.

8.3.2.1 Unearthing the Generative Mechanism for Digital Gap Mitigation by Teacher Skills Development and Attitude Towards Technology

To propel the analysis in section 8.3.2 further, I study the interplay of the *parts (structures/cultures)* and *people (agents)* in Cindy's, Evalina's and Kirstern's practice through the lens of *social realism* (Archer, 1995). By employing *analytical dualism*, two structures are noted. The first structure is the *educational quintile system and resources*, as these present significant challenges in lower quintile schools (Chomunorwa & Mugobo, 2023). Secondly, the *digital literacy norms* present itself as another structure impacting teacher skills and attitudes towards technology. As outlined above, the teacher leaders faced significant resistance to embedded technology use for innovation in teaching and learning. The predominant norms and attitudes towards digital and technological use in schools, influence the uptake of technology (Moloi & Mhlanga, 2021). The teacher leaders demonstrated a high degree of *agency* in their practice. Their actions align with that of a *social actor* (Archer, 1995). These teacher leaders influenced their colleagues' perceptions regarding technological use for innovation in teaching and learning. The teacher leaders invested time to informally train their peers to utilise technology (Day & Harris, 2002). In this way they were able to introduce a new culture of technology use and help address second-order barriers to technological integration regarding attitudes and beliefs, as outlined in discussion 8.3.1 (Christensen & Knezek, 2017; Ertmer, 1999).

As a result of *analytical dualism*, the following *emergent properties* are made visible: *Enriched digital literacy* and a *change in attitudes for embracing technology*. Employing critical realism, a stratified reality emerges to unearth the generative mechanisms (Bhaskar, 2008). At the *empirical level*, one observes the use of technology in the classroom for innovation in teaching and learning and the efforts by teachers to develop and influence their peers to utilise technology for innovation in teaching and learning. At the *actual level*, teachers such as Cindy engage in professional development activities. Such activities demonstrate her actions to upskill herself by attending seminars and courses aimed at encouraging technological use in the classroom (Fullan, 2007). An additional event evident at the *level of the actual* is *peer support and influence* by teacher leaders. All three teacher leaders demonstrated relentless efforts to transform the attitudes and beliefs regarding technological use for innovation in teaching and learning. These efforts were made visible in the strategies to address both *technical and adaptive challenges* faced in their contexts (refer to section 8.3.2, pg. 209) (Heifetz et al., 2009). At the level of the real, the agential mechanisms driving all three teachers practice is their *adaptability and ethical tech leadership practice*. Some teacher leaders showed their adaptability by upskilling themselves, while others dedicated themselves to equipping their peers with digital skills and knowledge to help change their perceptions and attitudes about technology use for innovation in teaching and learning. In addition, their commitment

to influencing their colleagues despite the digital gap and the socio-economic conditions of the school, shows their ethical tech leadership.

8.4 TEACHER LEADERSHIP FOR EMPOWERMENT THROUGH MENTORING

Empowerment is a process that is perceived to enable teachers to have greater control and decision making over their practice (Sergionanni, 2001). York-Barr and Duke (2004) discussed the importance of professional autonomy in teacher leadership, suggesting that when teachers are empowered, they are likely to innovate and integrate new initiatives into their teaching and learning. The concept of empowerment is also linked to capacity building as it involves the capacity of teachers to enact change (Hargreaves & Fullan et al., 2021; Lieberman & Miller, 2011; Muijs & Harris, 2003). To empower peers, teacher leaders take on roles of mentoring by providing guidance, sharing expertise, and offering emotional support to less experienced teachers (Katzenmeyer & Moller, 2009). Mentoring can also be done with peers, where teacher leaders work collaboratively with less experienced teachers to build a supportive and reciprocal learning environment. Various studies have indicated that mentoring significantly impacts the professional growth of teachers (Gul et al., 2019; Hobson et al., 2009; Sawalhi & Chaaban, 2021). The research by Muijs and Harris (2003) proved that well-developed mentoring led to improved teaching pedagogies and increased self-efficacy.

The teacher leaders in my study demonstrated mentoring as a strategy to empower and assist colleagues to adapt to the use of technology for innovation in teaching and learning. Simitha in a quintile five school made the following comment:

Many teachers had to learn how to use Google Docs to create PowerPoints and Word docs, and learning how to edit live documents was new to us. Some teachers couldn't access the system, and organizing the folders was a challenge. Therefore, some teachers in our department were reluctant to use the tool and complained, especially the older ones. To address this, I suggested that we 'buddy up' with teachers to support each other. While the school had provided training and we do have tech support, I found that teachers sometimes need to be motivated in the initial steps because implementing policy needs a human affectionate touch. The adoption of digital learning has been a significant change for our department, and it has provided many benefits. (see chapter 6.3, pg. 158)

Simitha's practice highlights a significant challenge in the adoption of digital tools among teachers. The challenge is especially felt among older teachers. Simitha's mentoring approach demonstrates

practicality and a sense of empathy. Through peer-mentoring, she recognises the importance of collaborative learning and the sense of comfort it establishes during periods of new/challenging learnings. Her 'buddy up' approach runs parallel with the idea of collaborative mentoring in educational contexts. Mullen (2009) explained that peer mentoring which involves teachers supporting each other's professional development is extremely effective in instilling a collaborative learning culture. Furthermore, the role of peer mentoring is pivot for technology integration because it enables teachers to learn from colleagues who possess first-hand experience with such classroom dynamics (Giles et al., 2020; Hargreaves & Fullan, 2012). Taking it further, Evalina in a quintile three school demonstrates her mentoring in the following ways:

Many teachers do not use the science and technology centre. Being one of few younger teachers in the school, I asked the principal if I could do a brief computer introduction to train teachers. I initially introduced teachers to computers, and I would show them how to use excel, power point and word document. I demonstrated how they could download videos, make worksheets, and project material. I also introduced a schedule that teachers could use to book the computer room. To further support teachers, I made myself available during my free period to reteach any computer skills that they wanted me to reiterate (see chapter 5.4, pg. 135).

Evalina tackles challenges by offering practical training on how to use computers. In addition, she creates a schedule to make herself available for further support. Evalina takes on mentoring in addition to her teaching load (Nguyen et al., 2020). A personalised approach to mentoring is displayed by her willingness to reteach her colleagues aspects of technology that they may struggle with. This shows her patience in transforming the practice of older staff who struggle with learning technology. Her approach involves direct intervention. Her direct contact with colleagues aligns with Hudson (2013) who purported that joining instructional practice with modelling will enhance the mentee's skills and self-assurance. Similarly, Kirstern in a quintile four school outlined his mentorship in the following fashion:

At first, it was a challenge to get the teachers to access the electronic resource-hub I had created. This was a challenge as many of them were deep rooted in using files, textbooks, paper and the chalk board. The challenge was that few understood what innovative and digital teaching looks like. I persevered by spending time teaching them how to access the USB drive, edit documents, print and taught some teacher how to use the computer lab (see chapter 6.2, pg. 145).

Kirstern spends time addressing the reluctant use of technology by focusing on foundational training to aid teachers in understanding and using technology. He also demonstrates patience as a key character in the mentoring process. Kirstern's practice demonstrates the importance of developing basic skills before introducing more complex technologies (Collins & Halverson, 2009). This approach tackles the issue highlighted in the literature, where concerns have been raised regarding South Africa's education capacity to integrate coding, robotics, and other digital technologies. These concerns are rooted in observed limitation in foundational computer literacy and mathematical ability.

The practice outlined by these teacher leaders demonstrated how they used mentoring to solve *adaptive challenges* (Heifetz et al., 2009). The literature often speaks about formal forms of mentoring that are assigned to expert teachers to facilitate less expertise/novice teachers (Katzenmeyer & Moller, 2009). In addition, the literature draws on the effectiveness of mentoring programs developed by educational authorities to be implemented in schools (Hobson et al., 2009). However, the teacher leaders in this inquiry proactively took on the task of informal mentoring. These teachers recognised the challenges hindering the practice of teaching and learning for innovation and willingly mentored peers to help build their skills in technological use and pedagogy. The challenges experienced in this instance was both adaptive and technical (Heifetz et al., 2009). As an adaptive challenge, it required teachers to change their mind sets and habits about the use of technology in their teaching practice. As a technical challenge, it included reskilling teachers to help them become more innovative in their teaching and learning practice.

The teacher leaders adapted a method consistent with the adaptive leadership principle of '*creating holding environments*' and *regulating distress* to tackle both adaptive and technical challenges (Heifetz et al., 2009). Drawing on the former principle, they create a supportive environment where teachers can experiment, learn, and adapt at their own paces. Through mentoring, teacher leaders were able to assist their colleagues in unlearning traditional/redundant practices and learning new skills (Heifetz et al., 2009) necessary for innovation in the 4IR. Informal mentoring allowed teachers to make gradual challenges in their practice while feeling supported, thereby lending itself to the later principle of *regulating distress* (Heifetz et al., 2009). As the older teachers experienced stress resulting from new technology, mentoring proved valuable as it helped teachers feel supported. Notable, all the teacher leaders demonstrated patience in their mentoring process, reflecting empathy toward older teachers as they made adaptations and learnt new skills. Patience and empathy are prime characteristics of the adaptive process since change requires graduality.

Overall, mentoring serves as a manifestation of the adaptive leadership attribute known as *mobilising people for change* (Heifetz et al., 2009). By building the foundational skills of their peers, teacher leaders are encouraging their peers to move towards more digital and technological forms of innovative teaching and learning. The teacher leaders are effectively mobilising their peers for change by preparing them to tackle challenges that come with innovation.

8.4.1 Unearthing the Generative Mechanism of Teacher Leadership for Empowerment Through Mentoring

By utilising a *social realist framework*, pertinent structural/cultural (parts) and agential (people) elements were delinked using analytical dualism and then explored (Archer, 1995). *Professional development/mentoring resource disparities* and the *prevailing school culture* present themselves as crucial structural elements at play. The former structural element highlights disparities in resources across the quintiles and how this will significantly impact the effectiveness of professional development through mentoring. Such constraining elements shape the opportunities and challenges encountered by teacher leaders as they attempt to empower their peers. This disparity was clearly noted in the differences between Simitha's and Kirsten's practice when compared to lower quintiles (Chomunorwa & Mugobo, 2023). The latter structural elements highlight how longstanding educational cultures within the school either enable or hinder the adaption of mentoring as a development tool (Nguyen et al., 2019). The teacher leaders expressed encountering resistance from older peers who were more inclined to traditional approaches of teaching and learning.

All three teacher leaders demonstrate actions that align with that of a *social actor* (Archer, 1995). These agential elements include *proactive mentoring to influence school culture and attitudes*. These teacher leaders' mentor their peers by not only instilling skills but by further impacting the overall culture of the school. These teachers demonstrate their teacher leadership by using mentoring to create supportive and reciprocal learning contexts (Katzenmeyer & Moller, 2009). Notably, these environments are sensitive to the learning processes of older teachers who struggle to adapt to teaching and learning in the 4IR (Heifetz et al., 2009). This shows how teacher leaders used mentoring to transition beyond mere compliance with education standards by echoing an in-depth understanding of their peers' needs (Heifetz et al., 2009).

The *emergent properties* made visible through delinking the parts and people include a *collaborative learning culture* and *enhanced teacher empowerment in the school through mentoring* (Archer, 1996). Using a *critical realist framework*, one can unearth the generative mechanisms giving rise to these

emergent properties by understanding its reality in a stratified manner (Bhaskar, 2008). At the *empirical level*, one observes peer mentoring, training, and the establishment of support mechanisms by the teacher leaders. At the *actual level*, we find teacher leaders taking actions to implement and initiate mentoring opportunities for their peers. Other actions also included practical training and emotional support by the teacher leaders to help older peers unlearn certain traditional approaches to teaching and learning and in turn learn how to utilise technology to drive innovation in teaching and learning.

The underlying generative mechanisms at the *level of real* are manifold. The structural generative mechanisms are located in the access to technological resources to help aid mentoring for innovation in teaching and learning. Additionally, there are cultural and attitudinal barriers present. The predominant culture in the schools shaped attitudes towards technology use and change, specifically between the older teachers. The agential mechanism at play includes the *teacher leader's adaptiveness*. The teacher leaders demonstrated their ability to empathise with their peers who were experiencing a radical shift in teaching and learning. These teacher leaders identified the needs of their peers and adaptively responded to it with efficient mentoring tactics (Heifetz et al., 2009). The teacher leaders' approach to mentoring empowered their peers by enhancing their skills, self-efficacy and attitudes (Muijs & Harris, 2003).

8.5 DATA DRIVEN SCHOOLS: TEACHER LEADERS DRIVE DATA USE IN SCHOOLS

Internationally, more teachers are committing their professional development to data expertise, and schools are employing data analysts for school planning based on multiple data sets available at the school (Bambrick-Santoyo, 2010). Such schools are being described as data driven schools since they rely on data to inform teaching and learning. Data can come from many sources such as performance data, demographical data, attendance data, transportation data, surveys, and academic and behaviour data (Kanjee & Molio, 2014). Data enables teachers to understand their learners by identifying the knowledge, skills, needs, interests, and levels of understanding of their learners. Using data available at the school enables teachers to understand challenges of learning in areas that were taught and addressed (Wohlstetter et al., 2008). In the South African context, the use of data remains an exclusive practice to inform policy at a provincial and national level. Data from EMIS (Education Management Information Systems), SNAP (data recorded on the 10th day of every school year data, Annual School Survey and performance data (ANA- Annual National Assessment, NSC- National Senior Certificate, TIMSS- Trends in International Mathematics and Sciences, PIRLS- Progress in International Reading and Literacy) are utilised to inform provincial and national policy (Van Wyk, 2015). However, the literature remains largely silent on how South African teachers use available data to inform their teaching and

learning in the classroom. To encourage data use at the ground level, the DoE introduced the *South African Schools Administration Management System (SASAMS)*. This is a free administrative and management software solution which gives general school information, learner and parent information, human resource information, learner listing, governance, financial, curriculum, timetabling, physical resources, and attendance. Some teacher leaders in my study utilised data as a vital part of their practice to inform their teaching and learning for innovation.

Evalina in a quintile three school describes her use of data in the following narrative description:

I received many concerns from teachers that learners were struggling to read and write. I then called a meeting with the grade 3 teachers. As a team I instructed my colleagues to make use of SASAMS to help us gain an in-depth understanding of the issues around reading and writing... It helped us identify the different ability levels of our learners. We were able to note our learners' social backgrounds from this tool. We were able to gauge which learners were struggling in language and which part of language they were straggling in. Using data provided from SASAMS and teacher assessments data we found that many learning gaps were left during the COVID pandemic (see chapter 5.4, pg. 137).

Evalina makes use of data from SASAMS to understand complex problems (reading and writing) from multiple dimensions. In her analysis of the data, she not only looks at academic performance but also considers social background factors to solve problems associated with reading and writing. Evalina identified learning gaps that were widened by the COVID-19 pandemic which revealed a vital part of data use in education. It showcased the ability to track longitudinal progress and learning disruptions. Such data will be crucial in post-pandemic recovery efforts. In a similar fashion, Zama in a quintile two school institutionalises data practises in her school. Zama shares the following in her narrative:

I am engaged in training new teachers on SASAMS, a tool for analysing students' academic results. Together, we leverage this data to develop targeted intervention strategies that are implemented in June 2023, once the syllabus content is covered. Over the years, this approach has proven successful in enhancing academic outcomes (see chapter 5.3, pg. 127).

Zama's approach to train new teachers is indicative of her effort to embed data driven practices in school culture. Her attempted practice resonates the study by Wohlstetter et al. (2008) who focus on the systemic integration of data use in institutions. Furthermore, Zama uses the data to make strategic

timeous intervention plans for her grade 12 learners. Volante and Cherublin (2010) described using data to make timely and informed decisions in education. Taking it further Kirstern played a crucial role in facilitating data literacy at his school. He described his role in the following narrative description:

I even volunteered to workshop the teachers at the school, further demonstrating my commitment to my role. This had a positive impact as teachers were able to analyse learner results more easily. This enabled teachers to create tailored made support plans for grade 12 exam groups (see chapter 6.2, pg. 141).

Like Zama, Kirstern attempts to promote and build data literacy in school. In addition, the data was used to support learners' individual needs. Bambrick-Santoyo (2010). pointed out in their study that data can be used to develop tailed support plans for learners.

While the teacher leaders at the whole school level may have not completely realised comprehensive data use, their leadership serves as a catalyst in the facilitation of data use at a micro level- within their departments. Their practice aligns with the literature which indicates that teacher leaders possess the influence to introduce innovative initiatives and enable fellow teachers to embrace them (Wenner & Campbell, 2017). Their use of digital tools (such as SA-SAMS) by these teacher leaders are emerging as a significant enabler in leveraging data for innovation problem solving in teaching and learning. This indicates that the competence of teacher leaders in effectively using data for pedagogical insight (Katzenmeyer & Moller, 2009). The teacher leaders in this study show both optimisation and practicality for use of data, which is in contrast with to the finding by Kanjee and Molio (2014). The data indicates that the teacher leaders demonstrated their ability to distinguish between technical and adaptive challenges (Heifetz et al., 2009). Technical problems in education like lack of data literacy, can be solved with simple procedures such as training session on data analysis tools like SASAMS. Adaptive challenges in this instance, include altering learning gaps widened by the COVID-19 pandemic and changing teachers' mindsets towards data driven decision making. The teacher leaders in the study seemly demonstrated an understanding of the nuanced difference. The teacher leaders imparted the skills necessary for data literacy while also nurturing a culture of data use in the school.

In addition, the teacher leaders demonstrated the adaptive leadership principal of leading to *regulate distress*. Both Kirsten's and Zama's initiatives to workshop teachers and training novice teachers showcases empathy by acknowledging that teachers require support in data literacy. Evalina on the other hand demonstrates problem solving through collaboration, which mitigates the anxiety associated with

addressing complex issues like literacy challenges experienced by the learners. These actions help regulate distress as it relates to the emotional and professional needs of their colleagues. According to Nelson & Squires (2017) this is a critical aspect of guiding teams through challenging transitions of change.

8.5.1 Unearthing the Generative Mechanisms for Data Driven Schools: Teacher Leaders Drive

Data Use in Schools

To thrust the analysis in section 8.5 further, I study the interplay of the *parts (structures/cultures)* and *people (agents)* in Zama's, Evalina's and Kirstern's practice through the lens of *social realism* (Archer, 1995). By employing *analytical dualism*, *data infrastructure* and *national policies* are two notable structures at play. The structures within the South African education systems, include the South African Schools Management System (SASAMS) that provide a data framework for teachers to function in. Since the availability and accessibility of digital infrastructure differ across schools, this will impact the degree to which it is utilised in schools (Kanjee & Molio, 2014). In addition, the drive from national and provincial policies and the school culture will influence the degree to which data is used to inform teaching and learning. Given these structures, the teacher leaders demonstrate their *primary agency* (Archer, 1995) as they *proactively use data structures* to inform their teaching strategies. Their commitment to data use, showcases their understanding of driving data use to influence educational outcomes. However, these teachers further act as *social actors* in they endeavour to *facilitate data literacy* (Archer, 1995). In their efforts to train their peers to use SASAMS, these teachers present themselves as *social actors*. In this way the teacher leaders are creating a culture of decision-making using data.

As a result of the interplay between the parts and people, the following *emergent properties* are made clear: *Teaching and learning strategies informed by data* and *data literacy culture* (Archer, 1995). Utilising *critical realism*, a stratified reality emerges to unravel the generative mechanism (Bhaskar, 2008). At the level of the empirical, we observe Zama, Evalina and Kirstern using data from SASAMS to find learning gaps and develop intervention strategies to support their students learning. At the *actual level*, the teacher leaders' actions include using SASAMS as a data source and training their peers. This shows their efforts to lead data driven schools. At the *level of the real*, we find the generative mechanisms influencing the actions at the level of the actual and observations at the empirical level (Bhaskar, 1975). The structural mechanisms include the accessibility to data and technological infrastructure. This indicates that the level of accessibility to data infrastructure and the availability of training in different quintile contexts create different opportunities and constrains. In addition, there are crucial systemic challenges within the educational system evident by literacy gaps that teacher leaders address through data use. The agential

generative mechanism is made clear in the teacher leaders' adaptive leadership for problem solving (Heifetz et al., 2009). By the teacher leaders identifying gaps and responding adaptively with tactical plans, this showcases their leadership qualities. In addition, these teachers used their agency to create a culture of data use. They did this by shaping their peers' attitudes and building learning environments around data usage.

8.6 CONCLUSION

In this chapter the findings to my second research sub-puzzle were presented and discussed under four key themes: cultural intelligence in teacher leadership, ethical technological teacher leadership, teacher leadership for empowerment and data driven schools. These themes collectively underscored *why teacher leadership is a significant practice for innovation in teaching and learning in the 4IR*. Through the lens of adaptive leadership, the teacher leaders showcased how they addressed both adaptive and technical challenges in their schools. The key learnings from this chapter highlights the teacher leaders use of cultural intelligence across various dimensions to influence innovation in teaching and learning. The chapter further elucidates the role of ethical technological teacher leadership to mitigate the digital gap evident in schools. A subsequent learning underscored the role teacher leaders play to mentoring peers in adapting their attitudes and beliefs regards the uptake of technology for innovation in teaching and learning. The chapter further explicated the emergence of data driven schools which are being initiated by teacher leaders. Lastly, by employing a social realist and critical realist framework, this chapter presented a nuanced analysis into the generative mechanisms influencing the realities represented in each sub-theme. By exploring the interplay between the *parts* and *people* using analytical dualism, I was able to study the stratified reality of the *emergent properties* (Archer, 1995; Archer, 1996; Bhaskar, 1975; Bhaskar, 2008). As this inquiry progresses, the forthcoming final chapter delves into the conclusions and contribution that this study has made to academia.

CHAPTER NINE

FORESEEING TEACHER LEADERS IN SOUTH AFRICA'S 4IR TERRAIN: CONCLUSIONS AND CONTRIBUTIONS OF THIS INQUIRY

9.1 INTRODUCTION

The preceding chapter comprehensively unpacked the findings pertaining to the third research sub-puzzle: *Why is teacher leadership a significant practice to advance technological innovation in teaching and learning in the 4IR?* In this concluding chapter, I begin by encapsulating the essence of the entire study. This is achieved by presenting a concise summary of each preceding chapter, thus serving as a reminder to the reader about the central facets explored in this inquiry. Subsequently, I draw on the findings to formulate the conclusions of the study. Following the conclusions, the chapter transitions towards a self-reflexive examination of the research journey. This reflection outlines the researcher's personal and professional insights in conceptualising, operationalising, and concluding this study. Following along this path, attention is given to the contribution that this study has made to the field of education leadership, particularly in terms of educational leadership scholarship, educational leadership theory and educational research methodology. Thereafter, the chapter explores the implications that have risen from the study's findings, thereby illuminating the path for potential future research within this field.

9.2 A SYNOPSIS OF THE INQUIRY

Chapter one introduced the inquiry's cutting-edge exploration of teacher leadership as a catalyst for innovation in teaching and learning in the context of the 4IR within diverse school settings in South Africa. Critically exploring the necessity of this focus, the chapter unravelled the prevailing research gaps that I aimed to fill, given the pertinent global and local emphasis placed on the integration of 4IR technologies into education (Sehlako et al., 2013; Schwab, 2016). Employing a narrative inquiry methodology (Clandinin, 2013), this chapter delved into a deep background outlining the dynamics of this integration, shedding light on unique challenges, and providing nuanced empirical insights on the need for this study. The justification for my study were threefold. The *personal* and *practical* justifications give an insight into my initial interest in the study, while the theoretical justification fortified these motivations, providing a theoretical foundation for my research (Clandinin & Caine, 2013). Key to this chapter was the articulation of the primary research puzzle: *What are the lived experiences of teacher leaders from diverse school settings of technological innovation in teaching and learning in the 4IR?* The main research puzzle was dissected into three sub-puzzles, which are:

- What are the stories of teacher leaders in diverse contexts for innovation in teaching and learning in the context of the 4IR?

- What are the leadership practices of teacher leaders of technological innovation in teaching and learning in the 4IR?
- Why is teacher leadership a significant practice to advance technological innovation in teaching and learning in the 4IR?

Chapter two embarked on a comprehensive review of literature to explore the current debates around the studied phenomenon. The literature review unfolds over three sections, with the aim of addressing key aspects of the studied phenomenon. The initial section examines the diverse educational context in South Africa with the purpose of outlining how this diversity influences and impacts teacher leadership and technological innovation for teaching and learning. Providing a contextual overview was pertinent for exploring the unique enablements and constrains that impact structure, culture, and agency for technological innovation in teaching and learning. The second section examined the current debates around teacher leadership. The purpose of this examination was to analyse various perspectives, practices, and theories of teacher leadership to shed light on its implications for education in diverse settings and as a driver of innovation in education. The final section discusses elements of the 4IR and its impact on education. Specifically, I examined the reality of the 4IR in South Africa by discussing the preparedness of the education system for the 4IR in different contexts.

In Chapter three, the theoretical underpinning for this inquiry was presented. The chapter expounded on three key theories, namely, the *Teachers as Leaders Framework* (Crowther et al., 2009), Adaptive Leadership (Heifetz et al., 2009) and Social Realism (Archer, 1995). The *Teachers as Leaders Framework* (Crowther et al., 2009) aided in grasping the multifaced roles of teacher leaders in their daily practices. The *Adaptive Leadership Framework* (Crowther et al., 2009) was examined to highlight its role in navigating technical and adaptive challenges faced by teacher leaders in the context of the 4IR. *Critical realism* (Bhaskar, 1975) as a meta-theory was discussed to explore the stratified reality of the participants experiences, while *Social Realism* (Archer, 1995) provided the tools to unearth the generative mechanism. This framework was utilised to explore the generative mechanisms influencing the practice of teacher leaders in diverse contexts at the level of the *empirical, actual, and real* (Bhaskar, 1975). The purpose of this theory's utilisation was to explore the interplay between *structure, culture, and agency* (Archer, 1995) operating in diverse contexts in which teacher leaders' function. The three theories provide a framework for exploring how teacher leaders navigate and transform educational settings for innovation in teaching and learning within the 4IR. This assemblage of theories enabled the exploration of the practical actions, adaptative processes and underlying generative mechanism that shape the experiences of teacher leaders for innovation in teaching and learning in diverse school contexts.

Chapter four provided a compelling display of the methodological tools utilised in this inquiry, starting with a discussion on my paradigmatic position in critical realism (Bhaskar, 1975). The purpose for this paradigm was to demonstrate that there exists a reality beyond human observable measure, into which one must delve to unravel generative mechanism. This paradigm offered a lens to study the stratified reality of my participants by exploring the level of the *empirical*, *actual*, and *real*. Through this exploration I was able to unearth generative mechanisms influencing the practices of teacher leaders for innovation in diverse contexts. Subsequently, the research design was elaborated upon, with emphasis on embracing a qualitative approach to research. The key purpose for using this methodology was to capture rich experiences of the teacher leadership through narrative inquiry (Clandinin, 2013). Narrative inquiry methodology was significantly vital for its ontological and epistemological commitments, which aligns with my inquiry's aim to understand the nuanced experiences of teacher leaders. The chapter then gives a detailed explanation of the methodological procedures to provide direction into the process of participant and site selection, data generation methods and analysis of field text. I generated much of the data using digital technology to elicit field texts. Subsequently, ethical considerations and the assurances of trustworthiness was discussed. This involved outlining verisimilitude and utility as inherent prerequisites for sustaining trustworthiness. Lastly, the limitations to the study are presented.

In Chapter five I undertook the first level of analysis, focusing on narrative analysis (Polkinghorne, 1995). The overall purpose of this chapter was to answer the 'what' research sub-puzzle: *What are the stories of teacher leaders in diverse contexts for innovation in teaching and learning in the context of the 4IR?* This chapter captured the riveting stories of teacher leaders from quintile one, two and three schools, commonly known as no-fee-paying schools. These schools are generally located in underprivileged areas and represent the poorest segments of the education spectrum. The chapter outlined the enthralling experiences of teacher leaders who spearhead teaching and learning for innovation in the context of the 4IR. It is through these teachers' narratives that we gain insight into their leadership practices for innovation in teaching and learning observed at the *level of the empirical*. Their stories poignantly captured the strategies used to navigate and adapt to challenges experienced (Heifetz et al., 2009) in their unique contexts.

In a similar fashion to chapter five, **chapter six** presented the narrative analysis of teacher leaders from quintile four and five schools. This draws our attention to the other end of the quintile spectrum. These schools are permitted to levy school fees and are generally located in well-developed urban areas. Like chapter 5, this chapter's purpose was to answer the 'what' research sub-puzzle. The chapter captured the experiences of teacher leaders who lead teaching and learning for innovation. Their stories

demonstrated context specific leadership strategies used to imbed innovation into teaching and learning in the context of the 4IR. Their stories reveal the cultural, structural, and agential factors shaping the reality of their teaching and learning at the level of *the empirical, actual, and real*.

Chapter seven's key purpose was to answer the second research sub-puzzle: *What are the leadership practices of teacher leaders for technological innovation for teaching and learning in the 4IR?* The chapter used the *teachers as leader's framework* (Crowther et al., 2009) and social realism (Archer, 1995) to offer a second level of analysis, known as *analysis of narratives* (Polkinghorne, 1988). Utilising the *constant comparative method* (Glaser & Strauss, 1967) together with Delve software, the chapter identified four key themes across the narratives. Using the teachers as leaders framework, social realism and critical realism, I dissected their leadership practice for technological innovation in teaching and learning. One significant finding showed how teacher leaders are initiating learning through the integration of *educational technology*. These teacher leaders leverage technology to integrate it into their lessons for innovation and to develop 21st century learning skills. Through the lens of social realism, I was able to make sense of how varying/prevaling structures and cultures influenced the degree of implementation of educational technology across quintiles. Another key finding demonstrated how leaders influence innovation in teaching and learning through projects and networks. I learnt that teacher agency played a significant role in driving innovation in teaching and learning. Agency in turn was shaped by structures and cultures at play. Teacher leaders who demonstrated high levels of agency positioned themselves to affect change and lead innovation.

The prime purpose of **chapter eight** was to answer the third research puzzle: *Why is teacher leadership an important practice to advance technological innovation in teaching and learning in the 4IR?* Utilising the constant comparative method together with Delve software, the chapter uncovers four key themes, with a focus on how teacher leaders navigate complex challenges using adaptive leadership theory. I then used the social realism theory to unearth the generative mechanism influencing their practice on the *level of the real*. One pertinent finding is the utilisation of cultural intelligence to navigate complex changes in diverse educational contexts. This finding highlights the significance of culturally responsive leadership made visible through the different dimension of cultural intelligence for technological innovation in teaching and learning. Another key finding outlined teacher leaders as pivot instruments for mitigating the digital divide evident across quintiles. The concept of ethical tech leadership emerged as crucial practice among teacher leaders. This concept demonstrates a deep commitment to address inequality, socio-economic challenges, and wellbeing of educational settings for driving innovation. Overall, I learnt

that teacher leaders are simultaneously addressing adaptive and technical challenges. They reveal that they are not only challenging adversity but are also pioneering practices.

9.3 CONCLUSIONS AND THESES OF THE INQUIRY

This inquiry's primary research puzzle was: *What are the lived experiences of teacher leaders from diverse school settings for technological innovation in teaching and learning in the 4IR.* To effectively answer this question, three sub puzzles were utilised. After presenting the findings to these sub-puzzles (in chapter 5-8), I now present the conclusions and theses for each sub-puzzle:

9.3.1 What are the stories of Teacher Leaders in Diverse Contexts for Innovation in Teaching and Learning in the Context of the 4IR?

The stories of each teacher leader served as a powerful vehicle enabling me to transport and immerse myself in their lived experiences (Caine et al., 2013; Connelly & Clandinin, 2006). Through their stories, I not only felt their emotions but further understood the nuances in their contexts, and noted the subtleties of their teacher leadership experiences (Clandinin, 2013). Each teacher leader's story opened a portal revealing specific quintile realities and offered me a glimpse into the cultural, institutional, and personal *commonplaces* in which these stories unfold (Connelly & Clandinin, 2006). Using *analysis of narratives* (Polkinghorne, 1988), I crafted each story in chapter five and six. I now present the theses gauged from the five narratives to share key conclusions for this research sub-puzzle. However, I first begin by presenting the thesis through an image I created using AI technology. This approach was informed by narrative inquiry's idea of '*silences, gaps and white spaces* that are often not captured in text, even though there exist a text to know and tell (Clandinin, 2013; Neumann, 1997). The words of Neumann (1997) aptly captured my attention when she described telling stories of her mother, she speaks:

'... of silences that emerge inevitably in every text, that grow in every effort to imagine another's life, that accompany every gesture of empathic imagination. It taught me that the stories I hear of others' lives are composed only partly of text, they are also composed of silences for which no text can exist' (Neumann, 1997, p92).

While I believe I captured the *white spaces* (Clandinin, 2013) of the teacher leaders by using art-based methods (de Jager et al., 2017) to elicit their stories and gain a vivid image of their context in practice, I too became concerned that I may have not captured the interplay of text and white spaces in presenting the thesis for this research sub puzzle. Therefore, to demonstrate to the reader the mental image of the

thesis I had in my head, I used artificial intelligence to create an image by feeding it descriptor words, outlining context, tone, location, and other facts. *Figure 9.1* captures my thesis statement: *'In the diverse and everchanging South African educational landscape, the teacher leaders are pivotal catalysts for innovation in teaching and learning, revealing that, despite erratic levels of resource availability and government support, personal resilience, proactive professional development, and a sincere*



Figure 9.1-Thesis Image

commitment to addressing socio-economic challenges are key in the effective integration of technology for innovation in teaching and learning'. The image portrays the stories of teacher leaders as pivotal agents (Archer, 1995; Harris & Jones, 2019) for the integration of technology for innovation in teaching and learning. The image illustrates teacher leaders on pedestals (see figure 9.1), symbolising their position as adaptive leaders who orchestrate flourishing ecosystems (Frost, 2016; Heifetz et al., 2009) across different quintiles and environments, inclusive of both rural and urban settings (refer to figure 9.1). Moreover, the image represents schools that are thriving (see figure 9.1) (Heifetz et al., 2009) in distinct fashions, capturing environments that are actively busy with teaching and learning. Overall, the image captures the central role of teacher leaders in not only adapting to but also thriving amidst challenges and opportunities presented in the South African context.

To augment this thesis, it is pertinent to consider the Human Development Index (HDI) by the United Nations, which scored South African development as 0.71 in 2021 (Cowling, 2024), classifying it under the category of 'high human development'. HDI evaluates countries based on literacy rates, life expectancy and gross domestic product (Nagle & Guinness, 2018). Despite South Africa achieving a literacy rate of 95.33% in 2021, which may be construed as an equitable and advanced education system, however the literature depicts a contrasting picture. It describes the South African education system as one of the world's most polarised, with disparities outlining some schools as globally competitive and others as severely dysfunctional (Faloye & Ajayi, 2021; Naicker et al., 2013). In my study, the stories capture the polarised reality of the digital divide (Adeleke, 2020; Faloye & Ajayi, 2021) impacting the integration of technology for innovation in the 4IR. The stories of each teacher leader offered the reader a nuanced experience of the extremities dominating the education system and lengths teacher leaders

go to ensure innovation in teaching and learning. Resultantly four conclusions are drawn to highlight key learnings.

The first conclusion highlights the learning derived from how the stories vividly record the divided nature of schools from quintile one to five. This division can be aptly captured in resource availability across the five quintiles. For instance, the teachers in lower quintiles lacked digital material, internet connection and digital devices, while schools in the upper quintiles provided their learners with chrome books, online learning platforms, blended learning opportunities and access to world leading technology. This division aligns with the literature on South Africa's educational preparedness for the 4IR (Motala, 2018; Sikhakhana, et al., 2021). Resultantly the teacher leaders' stories centre on navigating resource constrains in innovative ways. The stories reveal how Cindy, Zama, Evalina and Kirstern make use of limited resources, employ community engagement, and used simple yet effective technology to ensure innovation in teaching and learning. The literature indicates that a limiting factor for technology use in the 4IR in South Africa is the scarcity of digital resources, unreliable internet connection and the deep socio-economic challenges facing schooling communities in rural communities (Bornman, 2016; Faloye & Ajayi, 2022). These factors were pertinent features in quintile one to quintile four schools. However, these teacher leaders demonstrated resilience (Southwick et., 2017) and innovation to navigate resource constrains (Wenner & Campbell, 2017) to ensure innovation in teaching and learning. The stories outlined the broader social and systemic challenges faced in South African basic education, from economic disparities to infrastructural limitation. The stories teach us how teacher leaders are vital role players in addressing system challenges through innovation in education.

A second key learning derived from the stories elucidate professional development (PD) as a driving force for innovation in teaching and learning. Continuous PD is constantly found across all the narratives, in which the teacher leaders displayed a profound dedication for ongoing PD, a character strongly resonant in teacher leadership literature (Frost, 2016; York-Barr & Duke, 2004). Notably, these teacher leaders did not only seek after conventional PD from authorised organisations but proactively supplement their competences, particularly in technology and digital skills, through self-directed learning (Boyer et al., 2014), such as video learning and connecting with experts. This approach aligns with the literature that describes teacher leaders as lifelong learners (Katzenmeyer & Moller, 2008; Wenner & Campbell, 2017). This character underscores a desire for self-driven learning, thus surpassing the limited training opportunities offered by the school or the DOE. This pursuit of PD, as illustrated in the narratives, presents a crucial factor for equipping teachers with new skills. As a result, this facilitates their adaption (Heifetz et al., 2009) to change and drives them to introduce novel teaching and learning methods. Resultantly,

the teacher leaders' stories demonstrate the effective role that self-directed professional development played in influencing their practice.

The third key learning elicited from the stories of teacher leaders concerns their ability to establish collaborative networks. The teacher leaders demonstrated the significance of developing networks both intra-school and outside their schools. The stories illustrated collaboration with teachers across schools, community members and external experts to positively impact technological innovation within their school. This notion aligns with the literature which identifies collaboration as an essential part of teacher leadership (Lieberman & Miller 2011; Harris & Jones, 2019). The research confirms that teacher collaboration can fundamentally support student academic outcomes, improve lesson planning, introduces novel ideas, and encourages the sharing of best practices (Goddard et al., 2015; Muijs & Harris, 2006). In addition, the literature underscores the significance of teachers' social networks as a crucial factor for influencing teaching, learning and organisational change (Coburn et al., 2013). Further to this, the teacher leaders networking in this inquiry enabled them to reflect on their practice (Coburn et al., 2013), improve their practice and enabled them to stay self-motivated (Hofman & Dijkstra, 2010) despite their context. Moreover, the teacher leaders demonstrated that for technological innovation in teaching and learning to be successfully implemented, interpersonal networking and sharing of knowledge is a crucial component to ensure its success (Riel & Becker, 2008).

The fourth conclusion drawn from the teacher leaders' stories highlights; the imperative for teacher leaders to adapt the curriculum and teaching practices. This is vividly illustrated through the stories of Simitha and Kirstern, revealing their efforts to integrate and embed 4IR technologies into their practice. While the literature indicates that South Africa may not be thoroughly prepared for the integration of 4IR into education across different quintiles, there exist immense opportunity to leverage its advantages (Oke & Fernandes, 2020; Moloji & Marwala, 2020; Moloji & Mhlanga, 2021). Resultantly, these teacher leaders' stories highlight productive curriculum adaption, ensuring that they meet the needs of their specific contexts while continually aligning with the broader curriculum design (Debarger et al., 2013). In addition, their stories reflect a pragmatic method to assess their technological/digital knowledge and readiness, an important step in integrating 4IR into educational practices (Avelino & Ismail, 2021). For instance, the extended commitment by Simitha and Kirstern to master the effective use of scientific simulation tools and mathematical computer applications, exemplifies this. The literature supports the notions that teacher preparation for technology-enabled pedagogy is key to imbedding 4IR technology (Mokgatla and Moseley, 2022). Therefore, the teacher leaders have employed innovative methods to incorporate 4IR technology into the curriculum and their teaching and learning methods.

9.3.2 What are the Leadership Practices of Teacher Leaders for Technological Innovation for Teaching and Learning in the 4IR

Employing the *teachers as leader's framework* (Crowther et al., 2009) and integrating social realism (Archer, 1995), I rigorously interrogated the data to find nuanced underlining mechanisms contributing to teacher leadership practices. This led to the following thesis pertaining to this research sub-puzzle: *Teacher leadership for technological innovation in the 4IR within the context of South Africa is underlined by adaptive innovation, collaboration, and a sincerer commitment to equity. Based on this thesis, I outline three conclusions for this sub-puzzle.*

Firstly, we learn that the leadership practices of the teachers are strongly devised *around adaptive technological integration*. The teacher leaders in contrasting school quintiles have paralleled their practice with the concept of 'technological pedagogical content knowledge' (Mishra & Koehler, 2006). The teachers in my study demonstrated the significance of teachers understanding how to use and implement technology in both their subjects and contexts. The teacher leaders demonstrated resourcefulness, by utilising available technology that would fit their context. For instance, teachers in wealthier schools made use of digital tools provided by their schools, while other teachers in lower quintiles used technological resources that were free or had to be created. This included accessing free websites to download videos and worksheets. The participant's use of downloaded material for creating worksheets and PowerPoints is in line with the idea of teachers as curators and creators of digital content (Koehler & Mishra, 2009). The teacher leaders practice emphasises the concept of 'technological pedagogical content knowledge' as a vital factor for adapting technology to specific contexts. Adaptive technological integration is a mechanism for enhancing teaching and learning in an innovative way.

Secondly, *strategic forms of collaboration* formed a central part of the teacher leader's education practice to enhance teaching and learning for innovation. The key learnings from *project-based networking* beyond the limits of the school highlighted a form of strategic collaboration for technological empowerment, particularly in schools facing resource and skills constraints. For example, Cindy's initiative to partner with an external expert demonstrates an innovative approach to introducing and integrating technology in education. This form of collaboration emphasises a strategic move beyond traditional school boundaries to improve technological innovation in education delivery, thus affiliating with the notion of educational change being driven by external collaboration as teachers position themselves as key role players within the broader educational system (Fullan, 2020). The teacher leaders demonstrated that to be an effective leader at the school level, they had to engage with external entities to enhance their internal practice (Fullan, 2020). In other words, schools that participate in networks with other

schools tend to do better, thereby reflecting the vital role of such collaboration. In this way, teacher leaders saw themselves as part of a larger system (Fullan, 2020). This strategic form of collaboration shows how technology is being used to transform the learning experience. For instance, Cindy's use of the gaming application transformed how mathematics was being learnt. This approach is supported by the idea of STEM education, thus involving blending the curriculum with modern technological methods to create a culture of innovation (Christopher & Lawton, 2018; Harris et al., 2017). Additionally, the teacher leaders used project networking to mobilise not only technological resources but integrate human technological expertise to enhance teaching and learning. For instances teacher leaders like Kirstern, used novel projects to elicit funding, resources and expertise from the government and other NGOs interested in improving schools. This conclusion highlights the emergence of teacher leadership as a catalyst for cross-sector collaboration. This notion expands the scope of the Teachers as Leaders Framework (Crowther et al., 2009) (see section 9.5.2.1 for a further discussion).

Under the umbrella of *strategic collaboration*, interschool networking for teaching and learning emerged as a leadership practice by the teacher leaders. The key learning outlined that teacher leaders establish professional networks with other schools for digital resource sharing. WhatsApp was used as a platform to leverage digital resources and share best practices. This strategic form of collaboration aids in overcoming resource limitations and enhance teaching practices. Overall, this use of digital platforms for collaboration, reflects the emerging concept of E- leadership (Avolio et al., 2009). Using technology to form interschool networks underscores the role of digital tools in empowering teacher leaders, thus affirming the view of the importance of social capital in education leadership (Nguyen et al., 2019) and creating communities of practice (Calvert, 2016; Riveros, 2012). This form of collaboration offers new insights on technology as a medium for democratizing educational resources. WhatsApp and other digital platforms emerged as tools to democratise access to educational resources. This suggested an extension of teacher leadership into the digital realm, beyond face-to-face interaction. Additionally, the studies showed through the *emergent properties* (Archer, 1995), the concept enhanced educational ecosystems embedded in cultures of collaboration, which surface from the interplay of structure culture and agency.

Thirdly, a key learning derived from this research sub puzzle emphasises the priority teacher leaders place on *equity* (Sehlako et al., 2023), a principle that they drive through technological innovation. The teacher leaders demonstrate a commitment to social justice (particularly in lower quintiles) and efforts to parallel technological advancements found in advantaged schools (Naicker et al., 2016), thus aligning with the principle of transformative leadership (Shields, 2010). This framework aligns teacher leaders as agents who tackle both academic challenges and strive for broader socio-economic reforms. The

utilisation of technology by teacher leaders for innovation in teaching and learning is fuelled by their efforts to minimize the digital gap. This aligns with literature that underscores striving for social change as a key element in the progression of education in the 4IR (Yada & Jäppinen, 2018; Crowther et al, 2009; Wenner & Campbell, 2017). Adding to this perspective is the notion of *prosociality* (Yada & Jäppinen, 2018), which has become increasingly connected to teacher leadership (Naicker & Govender, 2020). This perspective contributes to the development of self-actualisation in educators and positively influences learners' self-concept, thus aiding in addressing societal challenges (Grant, 2019; Naicker & Govender, 2020). Both Cindy and Evalina's actions illustrate prosocial teacher leadership, where their actions go beyond traditional pedagogical roles to address wider social challenges (Naicker & Govender, 2020). Yada's and Jäppinen's (2018) notion of *prosociality* aligns effectively as it shows how empathy, care and altruism in leadership are significant in driving technological innovation in teaching and learning. Significantly, the findings reveal how technological advancements in different quintile schools are effectively intertwined with a deeper understanding of and response to socio-economic realities in South Africa. This mirrors a nuanced application of the 4IR in education in different contexts, where technology is not just a tool for learning but also a means to bridge social and economic divides.

9.3.3 Why is Teacher Leadership a Significant Practice to Advance Technological Innovation in Teaching and Learning in the 4IR?

To answer this research sub puzzle, I drew on *adaptive leadership* as a theoretical lens (Heifetz et al., 2009). In addition, I used a *social realist* (Archer, 1995) lens to unearth the emergent properties and generative mechanisms. This approach enabled an exploration into the interplay between structure, culture, and agency, thus providing a nuanced understanding of the stratified realities of each teacher leader within their specific context (Archer, 1995 & Bhaskar, 1975). This led to the following thesis pertaining to this research sub-puzzle: *Teacher leaders play a multifaceted role as agent of change who manoeuvre and bridge the complex interplay of cultural intelligence, ethical technological integration, mentoring and data-driven schools*. This thesis led to three conclusions.

Firstly, cultural intelligence emerged as a significant finding among teacher leaders. The teacher leaders demonstrated various dimensions of cultural intelligence (Earley & Ang, 2003), enabling them to effectively adapt within their context. In this case, the deployment of cultural intelligence by teacher leaders aided in narrowing the chasm between technological innovation and the diverse educational contexts, thereby improving the relevance and effectiveness of technology use in lessons. For instance, Cindy and Evalina's experience epitomise an in-depth understanding of cultural context. Their teacher leadership practice illustrated the pivotal role of cultural intelligence in facilitating the integration of

technological innovation into different contexts. The research underscores the critical notion that cultural understandings within an organisational structure play for enhancing progressive change (Early & Mosakowski, 2004). The teacher leaders who used cultural intelligence were better able to implement technology for innovation and gain the acceptance of technological use as a favourable practice from both learners and teachers. Therefore, a key learning from this finding shows that effective integration of technology in diverse contexts requires not just advanced technological skills (Koehler & Mishra, 2009), but to a large degree an understanding of the cultural dynamics of the organisation and its community.

Secondly, the study outlines the emergence of *ethical tech leadership* as a crucial key learning element in mitigating the digital divide, thereby signifying a novel approach to innovation in teaching and learning. This key learning highlights the role played by teacher leaders in addressing not only the digital divide experienced by learners, but also teachers. The literature describes South African schools as experiencing all three digital divides, which include: *digital access divide*, *digital capability divides* and the *digital outcome divide* (Faloye & Ajayi, 2021). However, Zama and Cindy's initiatives demonstrate innovative approaches to these challenges. By utilising personal resources and establishing external collaboration links, they enhance *digital access*, *digital capability*, and *digital outcomes* (Faloye & Ajayi, 2021), thereby personifying innovative solutions to the digital divide (Mishra & Koehler, 2006). These initiatives highlight the evolving nature of teacher leadership within South Africa, as it extends itself into areas of resource management and educational technology integration (Katzenmeyer & Moller, 2009). This indicates the moving of teacher leaders beyond the traditional roles of an educator, to now intertwine teaching expertise with technological expertise and ethical considerations in leadership (Harris & Jones, 2019).

In line with *ethical tech leadership*, the teacher leaders are vital in promoting digital skills and attitudes required for driving innovation in teaching and learning. Cindy exemplifies this by focusing on attaining technological skills and influencing her peers' views towards technological use. This underscores the importance of continuous professional learning and adaptive learning in the present educational landscape (Chomunorwa & Mugobo, 2023). Through ethical tech leadership, the teacher leaders focused on empowerment through skills attainment and attitude transformation through context sensitive mentorship (Chomunorwa & Mugobo, 2023). For instance, the teacher leaders played a significant role in equipping older peers, who lacked exposure to technology, with the necessary digital skills by employing context sensitive methods to modify attitudes of those struggling with implementation for innovation lessons. The literature confirms that age is considered a crucial factor contributing to the digital divide (Lavery et al., 2018). Individuals aged 50 and over are less inclined to use modern technology

because they believe that their traditional devices are sufficient (Faloye & Ajayi, 2021). Instead of marginalising elderly members who were resistant to change, the teacher leaders valued their experience and focused on facilitating skills development to ensure adaption to the 4IR (Heifetz et al, 2009). The role of mentoring and professional development demonstrated by Simitha, Evalina, Cindy and Kirstern is rigorously supported by research (Wenner & Campbell, 2017; York-Barr & Duke, 2004), thus emphasising the value of such practices. Overall, the teacher leaders enhanced mentoring by engaging in peer mentoring, a more sensitive approach to working with peers who are adapting to change, thereby aligning with Mullen's (2009) research on the effectiveness of collaborative learning cultures. This also leads to a unique form of informal technological mentorship from the teacher leaders themselves. As opposed to formal technological training which requires ICT professionals, the teacher leaders focused on peer-led, empathetic direction and support for teachers, therefore focusing on a practical way to learning and collaboration.

A third conclusion drawn from this study is the notion of data driven schools, as a transformation of teacher leadership through data utilisation. My inquiry unpacked a transformation in the teacher leader practices, moving from primary agents to more collaborative and systemic roles within the school. This is demonstrated in the practices of Evalina, Zama and Kirstern, who utilised data from SASAMS to inform instructional practices and school intervention programs. This change in agency, underscores a move in teacher leadership from individual classroom-based actions to broader school-wide data driven initiatives, therefore expanding the scope of teacher leadership in education in diverse contexts (Datnow et al., 2007; Fiofanova, 2021). The teacher leaders in my study become crucial players for interpreting and employing data for school improvement, as opposed to simply being receipts of policy. By using SASAMS they revealed an in-depth capacity to work through systemic challenges, such as literacy gaps expanded by the COVID-19 pandemic, thus turning these issues into opportunities for targeted instructional improvements (Kanjee & Moloji, 2014). Their agency shows the significance of teacher leadership in closing the gap between policy-level data and ground-level educational practice.

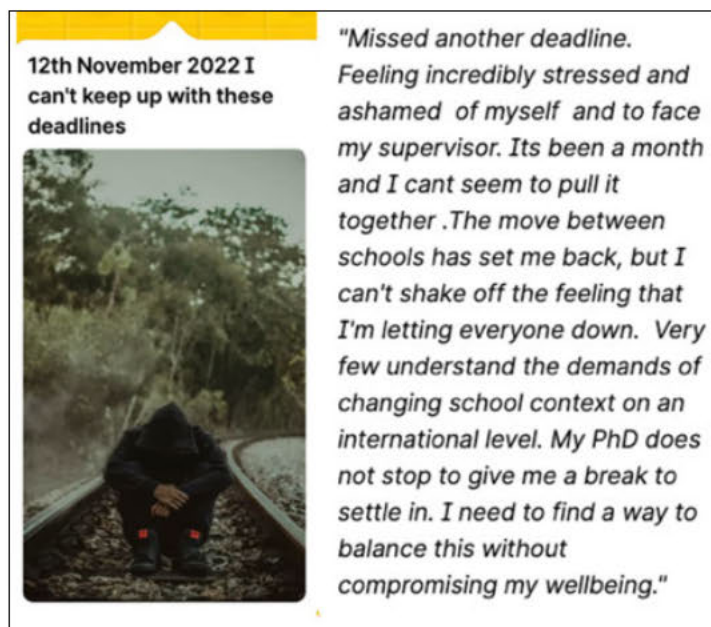
9.4 INSIDE THE JOURNEY: MY REFLECTIVE ACCOUNT OF THIS INQUIRY

In this section, I have chosen to complete my reflection adopting a unique blend of *dialogical reflection* and *journal excerpts*. The literature illustrates that keeping a journal has been effective for encouraging reflective thought as it promotes cognitive awareness and critical thought (Lindroth, 2015). Using dialogical reflections, I engage in a conversation between *my past* and *present self*, paralleling the narrative inquiry's emphasis on how we interpret our past and present selves through the stories we live, tell, and retell (Clandinin & Rosiek, 2007). The notion of dialogism posits that the self is composed of a

dynamic multiplicity of voices, each with its own perspective, and these voices engage in dialogue within itself (Herman et al., 1993). The idea of *dialogical reflection* is a process where different parts of the self (in my case, I refer to the past and present self) interact with each other, leading to deeper self-awareness and understanding (Hermans et al., 1993). Coupled with dialogical reflection, I use *journal excerpts* to offer a vivid glimpse into my immediate thoughts and emotions at different seasons in my research journey. I used Padlet as a creative way to record and express my thoughts and emotions through pictures and text over a four-year timeframe (see below figure 9.2). In my reflective discussion, I highlight how my interaction with the academic world, my supervisor, participants, and the challenges of balancing my professional and academic life have shaped me as an individual and academic over time (Dewey, 1958; Clandinin, 2013).

9.4.1 Contending with Expectations and Self-Doubt in My Academic Journey

Past self: Every missed deadline made me feel like a failure. I was concerned that my supervisor would see me as an unsuitable PhD candidate or even worse, as someone wasting his academic time. The pressure to send work or give an update on my progress every fortnight was overwhelming. It was overwhelming because my new work context demanded exorbitant amounts of time. Not being able to seem productive in my PhD journey created self-doubt in my



academic abilities. *Figure 9.2* captures one of my Padlet journal entries

Figure 9.2 Journal Excerpt

expressing how I felt knowing I could not keep up with the demands of my PhD and the expectations set out by my professor. As demonstrated in the image in *figure 9.2*, It felt like I was on a railway line, waiting for a train to hit me. The train was symbolic of the emails I would receive from my professor inquiring into my progress.

In addition to this I captured some of my emotions I felt starting a new job and balancing my PhD studies (refer to figure 9.3). The following excerpt details a significant moment when I planned on pausing my PhD. It records a personal encounter with adaptive leadership, a transforming experience that ultimately led to my perseverance. Reflecting on the journal excerpts brings tears to my eyes, as this reminds me of how close I came to *hanging up my academic gloves*.


<p>THE BIG HIC UP: Hanging up my gloves but Living adaptive leadership</p>  <p>Hanging up my gloves</p> <p>I started a new job as an HOD in an international school. This was my first role as a formal leader. This school was an incredible school that led with excellence. With that came a high demand on me as a teacher and leader. Starting a new job in such an environment meant me working tremendously long hours- up to 14 hours a day. I had no time to spend on my studies. I was highly stressed at this point. Acclimatising to a new job, a new country and a new role was tremendously demanding. Working in SA did not come close to the amount of work I had to do as a HOD in an international school.</p>	<p>To survive I had to adapt- I applied the principals of adaptive leadership. However, this involved me neglecting my studies. This burdened me. I was losing something I loved (my dream of becoming a doctor in Ed). I go to bed in tears. I felt as if I was letting down my supervisor who expected a-lot more from me. I also felt as if I was not there for my family who needed me.</p> <p>I truly, made the decision around November to hang up my gloves and take a break from studying. My job was too demanding and I had a department to run with countless students depending on my leadership. However, wife encouraged me to just hold on. She said don't take a break, just wait until December- See if you can pull it together then.</p> <p>This experience brought me close to what change for leadership and adaptive leadership involves- Its one painful process.</p>
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Figure 9.3 Journal Excerpt

Present Self: I now understand that this challenge was part of my growth journey. It wasn't about being flawless but about learning to communicate and manage expectations. It taught me to express my shortfalls because my worth as a researcher should not be defined by moments of delay.

Reflective Commentary

Looking back on these moments, I know now that I tied my self-worth too closely with productivity and deadlines. This journey taught me the significance of open communication and self-compassion. I viewed my supervisor as an academic giant in the field of education leadership and management. I often wanted to ensure that I could keep up with his standards. I put undue pressure on myself that he himself did not put on me. In every instance, my supervisor always navigated me through tough academic challenges. Overall, this academic expedition, aligns with Clandinin's (2013) notion of meeting in the midst of intersecting paths with individuals, particularly my supervisor, whose mentorship has been influential. The literature underscores the effective role played by supervisors in developing students for academic excellence (Kiley & Halliday, 2019). Additionally, it's an expedition in which this mammoth task of a PhD unfolds amidst the complexities of my family and work life, educating me on balancing academic endeavours with self-care and understanding the impact of mentorship.

9.4.2 Developing A Notion of Teacher Leadership in Diverse Contexts

Past Self: My personal and professional experience with the school quintile systems was embedded in quintile four and five schools. My view of teacher leadership was strongly influenced by more affluent schools and teacher leadership literature from the global north. I pondered on how the concept of teacher leadership would translate effectively in lower quintiles. Figure 9.4 captures a journal reflection entry after meeting with Cindy from a quintile two school (the participant's real name was omitted using black highlights in the figure). On two separate occasions, I noted with wonder her teacher leadership activities at her school.

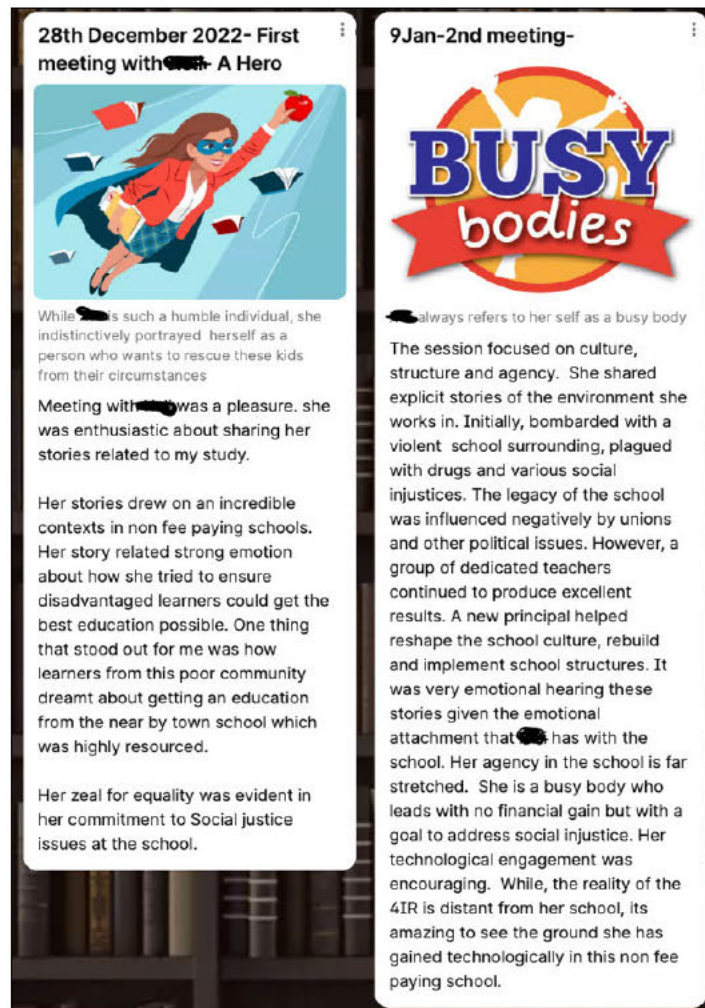


Figure 9.4 Journal Excerpt

Present Self: This academic journey

enlightened my literal encounter with teacher leadership in lower quintile schools. The innovation, self-efficacy, self-motivation, resilience, and dedication showed by teacher leaders, has significantly altered my understanding and respect for teacher leaders. The practical experience and knowledge demonstrated by such teachers are often overlooked and their stories not heard. I now believe that there are 'gems' hidden in lower quintile schools who work to make their contexts thrive.

Reflective commentary

My understanding of teacher leadership for innovation has transformed my thinking, particularly in lower quintile schools. A vast majority of teacher leadership literature is written from developed countries perspectives (York-Barr & Duke, 2004; Wenner & Campbell, 2017). Resultantly, conversing with teacher leaders from lower quintile schools added context to my understanding and removed any preconceived perspectives I unconsciously held before analysing the data. For me, it was an enlightening experience.

The findings of my inquiry unravelled a peculiar reality in lower quintile schools. Their adaptability to manoeuvring limited resources and attaining technology, underscores their depth of knowledge and strategic use of technology for enhancing lessons (Koehler & Mishra, 2009). My encounters with these teachers and their depth of teacher leadership expanded my understanding. These teachers demonstrated a solid commitment to equity and dedication to providing quality education in the face of socioeconomic barriers (Carrim, 2022). Their commitment to *prosociality* illustrated a unique dimension to teacher leadership that expanded my understanding of teacher leadership for innovation. This research transformed my perspective of teacher leadership to a more grounded understanding of the realities of teachers working in lower quintiles. Their leadership actions in adverse conditions have not only added to the academic field but to my personal journey as an academic.

9.5 NEW INSIGHTS AND ORIGINAL CONTRIBUTIONS OF THE STUDY

In this section, I outline the contributions that my study has made to education leadership scholarship, educational leadership theory and educational research methodology.

9.5.1 Educational Leadership Scholarship

Firstly, this inquiry contributes to the discourse on *teacher agency* in the *realm of technological innovation in diverse educational contexts*, particularly within the 4IR. Moving beyond the base framework by Crowther et al's., (2009) work, which primarily positions teacher leaders as change agents within their schools, this study emphasises their roles in transcending conventional pedagogical confines. By adapting technology, teacher leaders become a pivot in driving innovation, thus aligning with Harris and Jones's (2019) notion of expansive agentive roles in education. Adapting technology proficiency in schools is vital for the 4IR era (Moloi & Mhlanga, 2021). This inquiry's exploration across each quintile demonstrates context-sensitive strategies utilised by these teacher leaders, thus contributing to a nuanced understanding of teacher agency for technological innovation in the context of the 4IR in South Africa.

The above insight further lends itself to the second novel learning: the importance of diversifying leadership practises across different contexts. While the Teachers as Leaders Framework (Crowther et al., 2009) advocates for diverse leadership practices, it expresses these practices in a rather uniform school context. My inquiry presents first-hand evidence of how teachers leadership practices are shaped and differ widely across different quintile contexts. The *emergent properties* and *generative mechanisms outlined in the different schools* empirically demonstrated how structure and culture influence the agency of the teacher leader's leadership practice (Archer, 1995; Bhaskar, 1978). Therefore, this inquiry adds to

the *Teacher as Leader's framework* by accentuating the recognition of diverse contexts, particularly in developing countries such as South Africa which face extremities (Naicker et al., 2016) in its education system.

The third new sight gauged is strategic collaboration and network building. The Teacher as Leaders Framework centres collaborative leadership as an important factor (Crowther et al., 2009), however this is limited to within the school boundaries. My study extended this by demonstrating how teacher leaders establish *networks beyond their schools*. The teacher leaders employed E-leadership, project-based networking, and interschool networking through digital platforms to develop a culture of collaboration (Azorín, 2020; Dasgupta, 2011; Ertmer, 1999; Muijs & Harris, 2003; Sliwka, 2003). These networks with external experts and other educational specialists provided an avenue to innovate for teaching and learning (Postholm, 2016; Vangrieken et al., 2015). This demonstrates that teacher leadership extends beyond the school yard and now encompasses broader *educational communities and digital spaces*.

Fourthly this inquiry highlighted the interplay of structure, culture, and agency (Archer 1995 & Bhaskar, 1975) in teacher leadership for innovation in teaching and learning. Using the theory by Archer (1995), the inquiry demonstrated how teacher leadership circumnavigate the complex interplay between structural constraints, such as those influenced by the quintile system and resource limitation (Ahmed & Sayed, 2009; Mestry 2018; Mestry, 2016), cultural factors evident in community norms and socio-economic backgrounds (Carrim, 2022; Yende, 2021) and individual agency (Harris & Jones, 2019). The emergent properties and the stratified reality of this interplay (Archer, 1995) highlight how teachers work within and beyond systemic constrains to turn challenges into opportunities for innovation and growth. This study explicates how teacher leadership is not merely an individual desire but is inevitably influenced by structures and cultures within which they exist. Adding to this nuanced understanding, critical realism sheds light on the generative mechanisms influencing teacher leadership in diverse contexts, thereby offering a stratified analysis of reality to underscore the challenges and opportunities for integrating technology for innovation in teaching and learning in the 4IR. In the diverse landscape of South Africa, this involves creative problem-solving and strategic use of resources to enhance teaching and learning for innovation in the 4IR. Such insights epitomise the dynamic and multifaceted nature of educational leadership challenges in the 4IR dispensation.

Lastly, my study uncovered how adaptive leadership can be applied to *complex and diverse environments*. The teacher leaders demonstrated adaptive skills by contextually diagnosing and addressing not only *technical challenges* but also *adaptive challenges* (Heifetz et al., 2009). Teacher

leaders from diverse contexts showed how they skilfully played a role in changing traditional educational perceptions of technological use, altering teaching practices, developed innovative teaching initiatives and integrated technology for innovation in context sensitive and empathetic manners. The literature characterises adaptive challenges as innately complex since it addresses deeply entrenched systemic issues (Heifetz et al., 2009). Taking this further, this inquiry extends the existing knowledge by demonstrating how teacher leaders detect and respond to dynamic challenges which blend both *technical challenges* with deeply embedded *adaptive challenges*. While much of the literature tends to separate technical and adaptive challenges, this inquiry pragmatically gives insights into how teacher leaders, particularly in diverse contexts found across school quintiles, concurrently address adaptive and technical challenges (Nelson & Squires, 2017). For instance, the teachers encountered technical challenges in the form of technology integration and adaptive challenges made visible in the form of cultural responsiveness, equity, and education perceptions. This rounded approach to facing challenges enriches this theory's application and educational change (Sunderman et al., 2020; Fullan, 2007), by offering a nuanced understanding of real-world situation found in developing countries which face extremities in its levels of development. Moreover, this key learning is supported by the literature's notion on adaptive leadership in education (Nelson & Squires, 2017; Sunderman et al., 2020) and the role it plays in mitigating the gap between traditional practices and innovative approaches in teacher leadership (Wenner & Campbell, 2017; Bush and Glover, 2016).

9.5.2 Educational Leadership Theory

In the following subsection, I present the contributions my study made to the Teachers as Leaders Framework (Crowther et al., 2009) and the Adaptive Leadership Theory (Heifetz et al., 2009).

9.5.2.1 Contribution to the Teachers as Leader Framework

My study contributes to the teachers as leader's framework (Crowther et al., 2009) by adding a dimension of *prosociality* (Naicker & Govender, 2020; Yada & Jäppinen, 2018) underscored by ideologies of social justice and community engagement. This inquiry advocates the importance of teacher leadership in the 21st century, particularly in disadvantaged contexts to involve both pedagogical innovation and a dedication to addressing broader societal issues. These challenges are interconnected with educational advancements in the 4IR in the South African context (Ng'ambi et al., 2016; Lubinga et al., 2023). The findings indicate that *prosociality* typified by care, altruism, and a drive for equity (Eisenberg et al., 2013) is needed as an integral part of the framework, specifically in contexts characterised by socio-economic issues. This further aligns with literature on educational leadership, stressing the role of empathy and ethics in leadership practices (Fullan, 2020), thereby underpinning a shift in teacher leadership towards

a more holistic community-centric approach. The idea of prosocial teacher leadership to the teacher as leader's framework is illustrated below:

I created this model (figure 9.5) to show the enhancement of the teachers as leaders' framework (Crowther et al., 2009) by incorporating a new layer of *prosociality*. The model illustrates the teacher leadership model at the centre. The inclusion of the *prosociality* dimension, characterised by prosocial motives, behaviours, and impacts makeup a

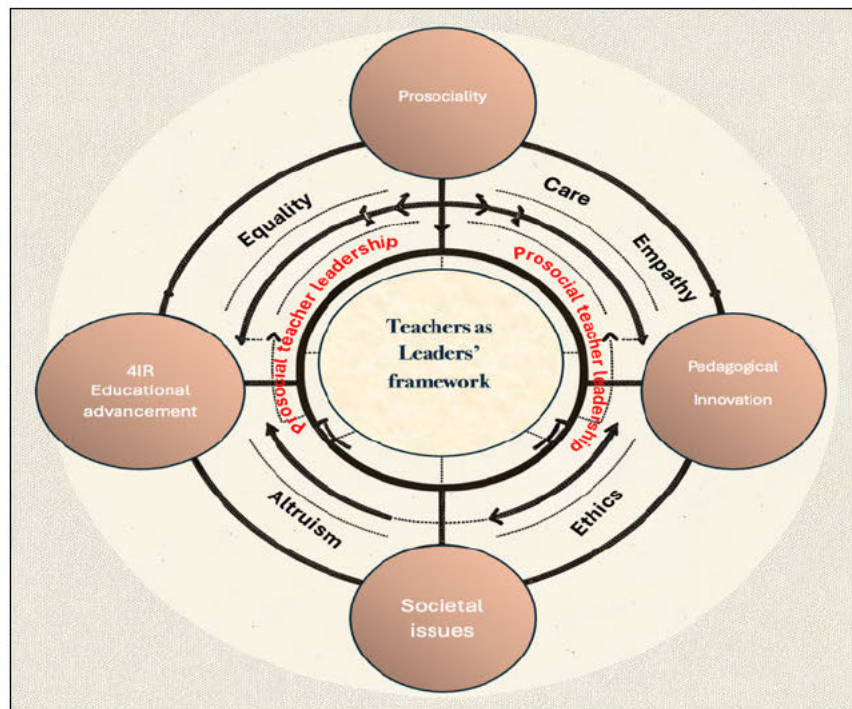


Figure 9.5- Adaption of Crowther et al's., (2009) Teacher as Leaders Framework

significant component of the framework (Yada & Jäppinen, 2018). In my model, prosocial actions, such as care, altruism and a drive for equity underscored by social justice and community engagement form an integral part of the framework. Prosociality as an addition, enriches the teacher leadership model by emphasising pedagogical innovation and a commitment for addressing broader societal challenges. This model recognises the specific challenges and needs of the 4IR in the diverse South African context, thus advocating for a shift towards more community-involved approaches. This involves the community playing an active role with leaders in implementing educational technological advancements in school. The model also shows an alignment with the boarder literature on empathy and ethics in educational leadership, thereby revising the framework to culminate into the 'prosocial teacher leadership model'. This model is needed to address the interconnected challenges of educational innovation and societal well-being in the 21st century, especially in disadvantaged contexts.

9.5.2.2 Contributions to the Adaptive Leadership Theory

My study expands the adaptive leadership theory by emphasising the role of informal leaders (Muijs & Harris, 2006) in adapting to change. The traditional adaptive leadership framework places emphasis on formal leaders driving change (Nelson & Squires, 2017). While these formal leaders do consult with the 'voices from below' by creating holding environments (Heifetz et al., 2009), the change is often not

initiated from such voices below. My study challenges this by revealing the vital impact informal leadership roles play in driving adaptive change education in the context of the 4IR, particularly in diverse educational settings. Teacher leadership adds a unique element to adaptive leadership, showing how it is relevant in the field of education, particularly in the evolution of the context of the 4IR. This shows how the theory can be used to solve modern problems facing education.

Lastly, my study uncovers the integration of *cultural intelligence* (Earley & Ang, 2003) into adaptive leadership (Heifetz et al., 2009). While the notion of culture forms a significant part of the adaptive leadership theory, this inquiry explicitly integrates *cultural intelligence* into the adaptive leadership framework. This concept shows teacher leaders using cultural intelligence to strategically manoeuvre and shape the cultural dynamics within educational contexts, thus highlighting a critical aspect in the diverse and globalised context of the 4IR (Schwab, 2016). Current research in leadership is increasingly interrogating the effectiveness of leadership motivation, particularly as traditional forms of motivation are often short-lived (Astuti et al., 2020; Yalçınkaya et al., 2021) in an organisation. This drew my attention to a key component in the adaptive leadership framework, which highlights the 'mobilisation of people' towards change (Heifetz et al., 2009). Central to this component is the principle of *regulating distress*, in which leaders are encouraged to place enough stress to motivate change, while discerning that excessive stress can be counterproductive (Heifetz et al., 2009). Notably, this theory tends to bypass the dynamic emotional and psychological dimensions of adaptation, as made inherent in cultural intelligence. Although the literature on leadership for change acknowledges that change often results in stress, anxiety, uncertainty, fear, and confusion (Christie, 2010; Heystek, 2016), there is a gap in understanding how leaders need to manage these real-life emotional challenges faced by members. Through cultural intelligence, this inquiry bridges the gap by having explored the four dimensions (Earley & Ang, 2003) affecting the emotional and psychological aspects of mobilising people for change. Particularly, this study shed light on how teacher leaders manage anxiety and resistance that accompany change, therefore advocating for a layer of emotional intelligence into the adaptive leadership framework.

I created the model below (using the Whimsical diagram app) to capture the additions I have made to the adaptive leadership model:

The model (figure 9.6) begins by showing the traditional formal role of the adaptive leader in solving technical and adaptive challenges. From the *traditional model*, *formal leaders* are responsible for consulting with the 'voices from below'. The formal leaders then make final decisions. However, incorporating, the new role of the informal leader (teacher

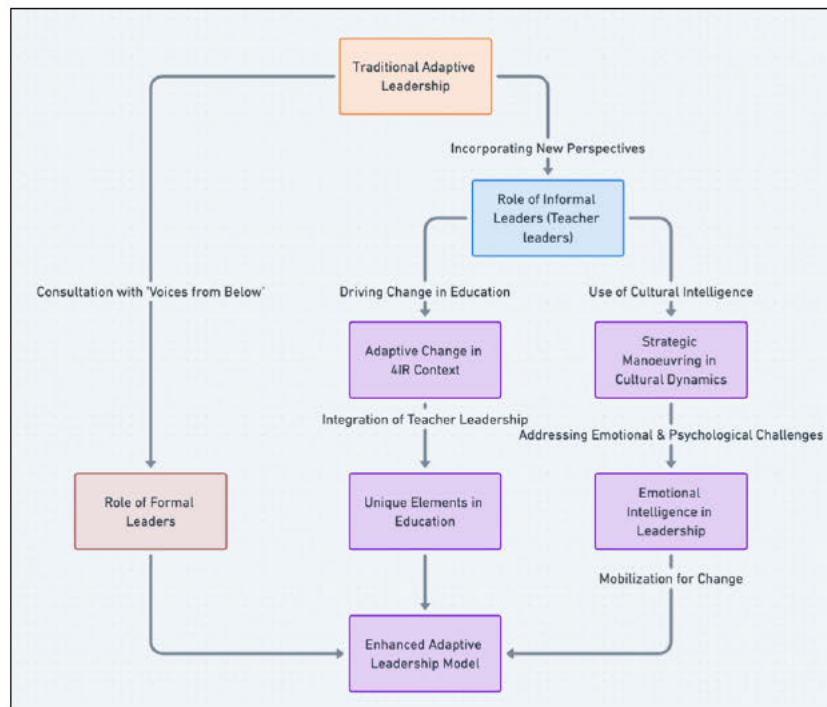


Figure 9.6- Adaption of Heifetz et al's., (2009) adaptive leadership theory

leaders), change can be initiated from new paths. The model demonstrates that informal leaders influence adaptive change in the 4IR. The 'adaptive change in 4IR context' node represents the specific challenges and adaptations required in the evolving terrain of education in the 4IR. The *integration of teacher leadership stage* emphasises the unique character of teacher leadership in the field of education, thereby introducing a crucial layer to the adaptive leadership theory.

Drawing our attention back to the *informal leaders (teacher leaders)*' node, the use of cultural intelligence emerges. This aids in strategically manoeuvring and shaping cultural dynamics with diverse educational contexts. This shows the role of cultural intelligence in addressing the emotional and psychological challenges of change experienced by members of the school. At this stage, leaders demonstrate the importance of managing emotions like anxiety and resistance that accompany change. Resultantly, the model adds a layer of emotional intelligence as a crucial element in the 21st century-world of leadership. The addition of these elements leads to an enhanced model of adaptive leadership that is more effective in mobilising people towards change, particularly in diverse educational contexts. Overall, the addition of informal leadership and cultural intelligence enriches this adaptive leadership model, making it more appealing for modern educational contexts.

9.5.3 Research Methodology in Education Leadership

Based on the perspective that people live storied lives, this inquiry explored the experiences of teacher leaders through story, (Clandinin & Caine, 2008). I sought to understand the experiences of the teachers through a form of digital storytelling (Lambert, 2009), an approach that is relatively new in narrative inquiry as it aims to enhance traditional methods (de Jager et al., 2017). Some of the traditional collage inquiry methods seemed limited in the range of images offered in magazines and newspapers (de Jager et al., 2017). I incorporated digital technologies to generate accurate and diverse field texts that could capture contextual images. This methodological innovation used the *Pearl Trees* application and *Google Photo Album* application to enable participants to create digital collages accessing multiple sites to describe their thoughts. Google Photo albums enabled the participants to digitally store captured photos and to access photos from their private albums to aid their storytelling. Thereafter participants would electronically share these digital albums with me. Using this method helped me efficiently articulate the *whitespace* and *silences* in the teacher leaders' narratives (Clandinin, 2013).

To facilitate the narrative analysis process, I employed a storyboard approach as introduced by Naicker, Pillay and Blose (2020), however, I extended it by using *Padlet* for digital storyboarding. This modification from paper to digital storyboards enabled rigorous and interactive plot and sub-plot development, through real-time rearrangement, annotations, access to search engines and editing options. In addition, this tool was invaluable as it enabled access to the storyboard on multiple devices. In my inquiry, the digital storyboard helped in two ways: It created a contextually accurate visual image of the plots and aided in validating the research plots created. By sharing these digital storyboards with the participants, I could attain feedback on the accuracy of the subplots used for the creation of their final narratives. I found that participants were keener to engage with the storyboards than to actually read through their final narratives. I found that I received quicker and more detailed responses from the participants regarding their storyboards. This method helped confirm the final narratives accurately and enabled misinterpretations to be addressed. For example, one of the teacher leader's feedback items enabled me to understand her nuanced interpretation of her school's leadership, as it balances a hierarchical yet effective approach to running the school. Initially, her stories primarily portrayed the school's leadership as solely rigid and hierarchical. However, by viewing her digital storyboard, she was able to recognise the limitations in her verbal depiction, thus acknowledging the absence of a comprehensive overview of the school leadership style. I believe this gave the participant the opportunity to see the visual image that I held of her school through her story. I believe this might have been overlooked if I did not use these methods to capture the participants' subplots. These methodological contributions play a significant role in advancing qualitative research using arts-based approaches (de Jager et al., 2017).

9.6 IMPLICATIONS FOR FURTHER STUDIES

In this section I present the implications of this inquiry for further research endeavours. While this study has revealed significant findings for the prospect of teacher leadership for innovation in teaching and learning in the diverse context of the novel 4IR, I propose further research projects to propel this phenomenon forward. I propose these further projects into three specific yet interconnected classifications: geographic expansion, theoretical enrichment and policy development.

9.6.1 Geographic Expansion

While my inquiry provided an insightful exploration of the teacher leaders experiences across all five quintiles, there is a geographical limitation inherent in its design. Further research projects should move beyond the provincial boundaries of KwaZulu-Natal to spatially include diverse sets of provincial settings such as Gauteng or the Eastern Cape. Extending the study in this way and increasing its sample size lends itself to a greater depth for understanding of the phenomenon being studied, thereby increasing the scope for additional findings pertinent to the 4IR and teacher leadership. In addition, incorporating a wider provincial range will deepen our knowledge of cultural and regional differences impacting innovation in teaching and learning.

9.6.2 Theoretical Enrichment

Utilising social realism as a theory and critical realism as my research paradigm in my study is a significant milestone in my academic journey. The dynamic examination of how reality is stratified and shaped by underlying generative mechanism was utterly enlightening on both academic and personal levels (Archer, 1995 & Bhaskar, 1975). Through the process of analytical dualism my study effectively examined the interplay of structure, culture, and agency in diverse contexts. The depth of literature on these theories was intellectually thought-provoking and at times I wanted to integrate all aspects of these theories into my study. However, practical constraints related to the study's timeframe, focus and purpose, directed me to a more central approach. Therefore, I propose that future studies employ Archer's (1995) *morphogenetic approach* to dig deep into the complexities of social change in diverse contexts of education. Specifically, this approach focuses on two key characters. Firstly, a *temporal element* highlighting how structures and agency influence each other *over time* within specific periods (Archer, 1995). Secondly, it delves into cycles of morphogenesis, describing cycles that start with pre-existing structures which influence and constrain current agency (Archer, 1995). This approach could potentially give further insights into how educational structures found in different contexts and different levels of teacher agency change in response to the challenges and opportunities made possible by the 4IR.

9.6.3 Policy Development

The timeliness of this study cannot be overlooked given the current 4IR curriculum that is being piloted across South Africa. While this ambition to revolutionise South Africa's education is admirable, this study highlights the complexities of its diverse educational terrain for a developing country. This inquiry's findings cautioned one on adopting a '*one size fits all approach*' given its diverse educational terrain (Sehlako et al., 2023). This inquiry draws our attention to the need for nuanced strategies that consider the complex diverse educational context of South Africa. Resultantly, I propose that future research projects should explore the implications of this study's findings to inform educational policymaking. This would include a nuanced explorations of how technological innovation for teaching and learning can be effectively imbedded into diverse quintiles, taking into consideration the specific challenges and opportunities presented by each (van Dyk & White, 2019; Faloye & Ajayi, 2021; Schwab, 2016). This could provide practical insights for the implementation of 4IR programs into mainstream education.

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APPENDIX A

Teachers as Leaders Framework (Crowther et al., 2009, p.3)

Teacher leaders . . .

Convey convictions about a better world by

- articulating a positive future for all students
- contributing to an image of teaching as a profession that makes a difference

Facilitate communities of learning by

- encouraging a shared, schoolwide approach to core pedagogical processes
- approaching professional learning as consciousness-raising about complex issues
- synthesising new ideas out of colleagues' professional discourse and reflective activities

Strive for pedagogical excellence by

- showing genuine interest in students' needs and well-being
- continuously developing and refining personal teaching gifts and talents
- seeking deep understanding of significant pedagogical practices

Confront barriers in the school's culture and structures by

- standing up for children, especially disadvantaged and marginalised individuals and groups
- working with administrators to find solutions to issues of equity, fairness, and justice
- encouraging student 'voice' in ways that are sensitive to students' developmental stages and circumstances

Translate ideas into sustainable systems of action by

- working with the principal, administrators, and other teachers to manage projects that heighten alignment between the school's vision, values, pedagogical practices, and professional learning activities
- building alliances and nurturing external networks of support

Nurture a culture of success by

- acting on opportunities to emphasise accomplishments and high expectations
- encouraging collective responsibility in addressing schoolwide challenges
- encouraging self-respect and confidence in students' communities

APPENDIX B

NARRATIVE INTERVIEW PLAN

For this study I will be using narrative interviews as my primary data generating method. Photo-voice and collage inquiry will be my secondary data generation methods to aid the interviews. The four phases of narrative interviews, which are the initiation phase, the main narration phase, the questioning phase and the concluding talk phase would be observed (Jovchelovitch & Bauer, 2000).

Initiation phase – This will last for about 5 minutes.

Here I will explain the aims and objectives of my study to my participants. I will explain to my participants what narrative interviews are. I will then talk them through the activities that we are going to do (for example, collage inquiry and photo-voice inquiry).

The main narration: This will last about 60 minutes long for each of the three sessions. This will be where I give my participants the chance to tell their stories.

Session one

In the first session I will:

- Seek to gain some biographic information about the participant in both their personal and professional life. While this is not the primary focus of my study, it is important to note that narrative inquires seek to build a relationship and rapport with participants in relational ways (Clandinin, 2013). This will also help me understand who my participants are and how this informs their teacher leadership.
- Pose the main question, which is, what are the leadership practices of teacher leaders of technological innovation in teaching and learning in the 4IR? I will simplify this question by asking: what are some of the leadership practices that you engage in to use technological innovation for teaching and learning in the 4IR? I will allow my participants to respond.

Session two

For this session, my participants would be expected to bring about six-to-eight photos that relate to the next research puzzle, which is: why is teacher leadership an important practice to advance technological innovation in teaching and learning in the context of the 4IR?

The participant will be required to take photos that express why teacher leadership is vital in promoting technological innovation in teaching and learning in the 4IR. The participants will use their phone camera

to take photos. These photos will be uploaded to the google photo application as an album before the session starts. These photos can also be metaphorical. I use the Wang and Burris (1997) guide to navigate this section. In their study on health promotion, they describe detailed procedures, methodology and analysis of the photo-voice inquiry. I have however fine-tuned the questions to fit my study.

Instruction: Can you explain and describe the significance of your photos as to why teacher leadership is an important practice to advance technological innovation for teaching and learning?

Session three

I use the work of Butler-Kisber and Poldma (2010) on collage inquiry as a guide for this session. The collage inquiry is going to be completed on the PearlTrees application which participants will have to download on their mobile phones. Before the session, I will give the participants detailed information on how to use the application. I will also encourage them to get familiar with the application weeks before this session. During the session, I will ask my participants to find pictures, words, symbols, phrases or quotes using the PearlTree application that describe how school structure, school culture and teacher agency influence technological innovation in teaching and learning in the 4IR. I will do this in four parts during the session:

- I will ask the participant to find images describing how they experience school structure (I will explain structure to the participant) playing a role in influencing technological innovation for teaching and learning in the 4IR in their schools.
- I will then ask the participant to find images describing how they experience school culture (I will explain culture to the participant) playing a role in influencing technological innovation for teaching and learning in the 4IR in their schools.
- Thereafter I will ask the participant to find images describing how their agency (I will explain agency to the participant) plays a role in influencing technological innovation for teaching and learning in the 4IR in their schools.
- Finally, I will ask the participant to describe the collage that they have arranged. I will ask the participant to describe the significance of the chosen images to school structure, school cultures and teacher agency. They will then relate their stories to me.

Instructions – Could you describe the images that you have selected to make up your collage? Where necessary, describe events that have influenced your selection of these particular images.

Questioning phase – This works with the main narration stage and would be about 15 minutes.

If their story perhaps reaches a deadlock, the questioning phase would allow for me to ask questions.

Session one

- Tell me about who you are as a teacher?
- Why do you get involved in leading initiatives?
- Tell me about leading in the 4IR
- Can you tell me about events that have influenced this situation?
- Tell me about how your leadership has influenced teaching and learning by using technology and being innovative.
- Share with me how your leadership practise influences people in the classroom and beyond the classroom.
- What happened next?
- Tell me why this leadership styles/practise is appropriate/inappropriate?
- How did these experiences influence your leadership?

Session two – Photo-voice Inquiry

- Can you explain what is happening in this photo?
- What do you see here?
- What is really happening here?
- How does this photo relate to your leadership in promoting technological innovation in the 4IR?
- Why did you choose these photos? What would you like people to know about the importance of technological innovation for teaching and learning?
- How does this photo speak about the importance of teacher leadership in advancing technological innovation in the 4IR?
- Express what emotion that these photos bring. Describe where that emotion generates from. Be descriptive.
- How does this photo capture the advancement of the 4IR in schools as a teacher leader?

Session three – Collage inquiry

- Explain why you chose this image.

- Share what the image represents in terms of structure, culture and agency.
- What role peers/senior management play in influencing structure, culture and agency? How did this influence your thinking and shape your experience?
- Express what emotion that these images bring. Describe where that emotion generates from. Be descriptive.
-

Concluding talk

I would also need to thank my participants at each session and make them know that their story is valuable.

APPENDIX C

SESSION THREE: PHOTOVOICE INQUIRY

instructions:

Take photos using your smart phone (between 6-8 only) which:

- Captures you teaching for innovation. The use of technology/science to promote teaching and learning
- Captures your leadership in class/or beyond the class
- Captures the important role that teachers play in promoting innovation in the school for teaching and learning.
- Captures the importance that your leadership plays in the school.

You will then use the google photo application to create an album in which you store your selected photos

APPENDIX D

COLLAGE INQUIRY DIRECTIONS

Instructions: Using the Pearl Trees application, search for pictures which describe your school culture, school structure and agency. All selected pictures should be added to your pearl tree. The pictures you search for can be images or quotes. The purpose of this activity is to capture the culture, structures and agency in your school which influence teaching and learning for innovation (4IR).

PROMPT: **WHAT PICTURES SHOULD YOU CONSIDER LOOKING FOR?**

1. Culture

- Pictures which describe the past, present and future culture for teaching and learning in your school through your eyes. This could include the norms, ethos, 'the way we do things around here', values, attitudes, prejudices, symbols etc.
- Pictures which describe the leadership culture in your school- For example, is leadership rigid or distributed etc.
- Pictures which talk about the culture you try to create for your teaching and learning in order to be innovative.
- Cultures which promotes the Fourth industrial revolution at your school
- Any cultures which promote/hinder teaching and learning for innovation.

2. Structure

- Pictures which describe the policies (school policies, department policies, rules etc) which promote or hinder your teaching and learning in the classroom and beyond the classroom.
- Pictures of leadership structures- describes how leadership takes places in your school. How do you experience leadership from upper management?
- Structures which promote the 4IR in your school- comp labs.

3. Your Agency- Your autonomy/freedom as a teacher

- Pictures which describe your agency as a teacher. This could include pictures which describe how you take initiative to be innovative in your classroom and to go beyond your classroom (into the school and community).
- Pictures which describe your involvement in decision making, change processes, tackling problems etc.

- Pictures of programs you initiated to bring about change.
- Your autonomy as a teacher in the school
- Your personality as a leader.
- How do you promote the 4ir in your school - what enables or constrains you from doing this?

APPENDIX E



04 April 2022

Tyran Reiley David (208506289)
School Of Education
Edgewood Campus

Dear TR David,

Protocol reference number: HSSREC/00003863/2022

Project title: Teacher leadership and the fourth industrial revolution: Stories of teachers working in diverse school contexts

Degree: PhD

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 14 February 2022 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

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 through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 04 April 2023.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,



Professor Dipane Hlalele (Chair)

/dd

Humanities and Social Sciences Research Ethics Committee

Postal Address: Private Bag X54001, Durban, 4000, South Africa

Telephone: +27 (0)31 260 8350/4557/3587 Email: hssrec@ukzn.ac.za Website: <http://research.ukzn.ac.za/Research-Ethics>

Founding Campuses: ■ Edgewood ■ Howard College ■ Medical School ■ Pietermaritzburg ■ Westville

INSPIRING GREATNESS

APPENDIX F



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

OFFICE OF THE HEAD OF DEPARTMENT

Private Bag X9137, PIETERMARITZBURG, 3200
Anton Lembede Building, 247 Burger Street, Pietermaritzburg, 3201
Tel: 033 392 1051

Email: Phindile.duma@kzndoe.gov.za

Enquiries: Mrs B.T. Ntuli

Ref.:2/4/8/7273

Mr Tyran Reiley David

██████████
Newlands West
DURBAN
4037

Dear Mr David

PERMISSION TO CONDUCT RESEARCH IN THE KZN DoE INSTITUTIONS

Your application to conduct research entitled: **“TEACHER LEADERSHIP AND THE FOURTH INDUSTRIAL REVOLUTION: STORIES OF TEACHERS WORKING IN DIVERSE SCHOOL CONTEXTS.”**, in the KwaZulu-Natal Department of Education Institutions has been approved. The conditions of the approval are as follows:

1. The researcher will make all the arrangements concerning the research and interviews.
2. The researcher must ensure that Educator and learning programmes are not interrupted.
3. Interviews are not conducted during the time of writing examinations in schools.
4. Learners, Educators, Schools and Institutions are not identifiable in any way from the results of the research.
5. A copy of this letter is submitted to District Managers, Principals and Heads of Institutions where the Intended research and interviews are to be conducted.
6. The period of investigation is limited to the period from **06 April 2022 to 31 March 2025**.
7. Your research and interviews will be limited to the schools you have proposed and approved by the Head of Department. Please note that Principals, Educators, Departmental Officials and Learners are under no obligation to participate or assist you in your investigation.
8. Should you wish to extend the period of your survey at the school(s), please contact Miss Phindile Duma at the contact numbers above.
9. Upon completion of the research, a brief summary of the findings, recommendations or a full report/dissertation/thesis must be submitted to the research office of the Department. Please address it to The Office of the HOD, Private Bag X9137, Pietermaritzburg, 3200.
10. Please note that your research and interviews will be limited to schools and institutions in KwaZulu-Natal Department of Education.

██████████
Mr GN Ngcobo
Head of Department: Education
Date: 06 April 2022

GROWING KWAZULU-NATAL TOGETHER

APPENDIX G

GATE KEEPER PERMISSION


Newlands West
Durban
4037

**Attention: The principal
Dear, Sir Madam**

REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT YOUR SCHOOL

My name is Tyran David. I am a Ph.D. student at the University of KwaZulu-Natal School of Education (Edgewood Campus). As part of the requirements to complete my Ph.D. in Educational Leadership, Management and Policy at the University of KwaZulu-Natal, I am required to conduct research. My study focuses on teacher leadership and the fourth industrial revolution. This study aims to explore the lived experiences of teacher leaders in diverse contexts of the fourth industrial revolution. I wish to request your permission to conduct research at your school. I would like to interview one teacher leader from your school. Should permission be granted, I will use narrative interviews together with photo voice inquiry and collage inquiry to generate data from the participant. The interviews will be scheduled at the convenience of the participant and will in no way hinder the day-to-day running of your school.

Please note that participation in this study is voluntary and the participant has the right to withdraw from the study at any time without any negative consequences. There will be no financial benefits that the participant and the school may accrue as a result of their participation in this research project. In addition, you are assured that the details of the school and the participant will be kept confidential, and their identity will not be disclosed to anyone.

Should you choose to accept my request for consent to conduct research at your school, you are required to grant me permission in the form of a **signed** letter with your school's **letterhead** and school **stamp**.

For more information and questions about the study, you may contact the researcher, the research supervisor or the university research office on:

RESEARCH DETAILS	SUPERVISOR'S DETAILS:	RESEARCH OFFICE DETAILS:
<p>Mr. TR David</p> <p>██████</p> <p>Email: ██████████</p>	<p>Professor I. Naicker</p> <p>School of Education</p> <p>University of KwaZulu-Natal</p> <p>Edgewood Campus</p> <p>Tel no: 031-260 3461</p> <p>Email: naicker1@ukzn.ac.za</p>	<p>HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION</p> <p>Research Office, Westville Campus</p> <p>Govan Mbeki Building</p> <p>Private Bag X 54001</p> <p>Durban 4000</p> <p>KwaZulu-Natal, SOUTH AFRICA</p> <p>Tel: 27 31 2604557 - Fax: 27 31 2604609</p> <p>Email: HSSREC@ukzn.ac.za</p>

Thanking you in advance.

Sincerely yours in Education,

████████████████████

Mr TR. David

APPENDIX H

INFORMED CONSENT TO PARTICIPATE IN RESEARCH

[REDACTED]
Newlands West
Durban
4037

INFORMED CONSENT LETTER

Dear Participant,

My Name is Tyran Reiley David a Ph.D. student from the University of KwaZulu-Natal, Edgewood Campus. I am currently completing my Ph.D. in Education leadership, management and policy. As part of the degree requirements, I am tasked to conduct research.

You are invited to consider participating in my research study. The title of my study is, *Teacher leadership and the fourth industrial revolution: Stories of teachers working in diverse school contexts*. This study aims to explore the lived experiences of teacher leaders in diverse contexts in the fourth industrial revolution (4IR). The study plans to involve five teacher leaders from five different schools. I plan to use narrative interviews together with collage inquiry and photo-voice inquiry to generate data. My primary research puzzle is: *'What are the lived experiences of teacher leaders of technological innovation in teaching and learning in the context of the 4IR?'* Data will be generated to investigate this question. I intend to have 3 session of interviews with each participant. During these sessions, participants will be narratively interviewed. The sessions are estimated to last approximately one hour each, over a 6 month period.

The study will not involve any risk or discomfort to you as the participant. It is important to note that the study provides no direct benefit to you as the participant. However, I hope that this study will be one of the first to contribute to the understanding of teacher leadership in the context of the 4IR in South African schools.

This study has been ethically reviewed by the UKZN Humanities and Social Sciences Research Ethics Committee (**approval number HSSREC/00003863/2022**). Please note that your participation in this research is voluntary and that you may withdraw from the study at any point with no penalty or harm caused to you. If you accept to participate in the study, there will be no costs incurred by you. In addition, your identity will not be disclosed to anyone during and after the study is completed. Instead, I will use

pseudonyms when referring to you and the school in which you work. I will not give the precise location of your home or school in the study. Instead, where necessary, I will refer to your location in a broader context. All data that is generated, will be handled with extreme sensitivity throughout the study and after the study. All generated will be stored in a cloud. After five years the documents, transcripts and audio/video will be deleted.

In the event of any problems or concerns/questions you may contact the researcher, research supervisor or the UKZN Humanities & Social Sciences Research Ethics Committee using the following contact details:

RESEARCH DETAILS	SUPERVISOR'S DETAILS:	RESEARCH OFFICE DETAILS:
Mr. TR David [REDACTED] [REDACTED] Email: [REDACTED]	Professor I. Naicker School of Education University of KwaZulu-Natal Edgewood Campus Tel no: 031-260 3461 Email: naicker1@ukzn.ac.za	HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION Research Office, Westville Campus Govan Mbeki Building Private Bag X 54001 Durban 4000 KwaZulu-Natal, SOUTH AFRICA Tel: 27 31 2604557 - Fax: 27 31 2604609 Email: HSSREC@ukzn.ac.za

Thank you for your contribution to this research.

[REDACTED]

Your Sincerely
 Tyrn David

APPENDIX I

CONSENT BY THE PARTICIPANT DECLARATION

CONSENT:

I _____ (Name) have been informed about the study titled Teacher leadership and the fourth industrial revolution: Stories of teachers working in diverse school contexts by Tyran David.

- I understand the purpose and procedures of the study.
- I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.
- I declare that my participation in this study is entirely voluntary and that I may withdraw at any time.
- If I have any further questions/concerns or queries related to the study, I understand that I may contact the researcher.
- If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact the research office.
-

Additional consent, where applicable

I hereby provide consent to:

Audio and video record my interview

YES / NO

Use of my photographs for research purposes

YES / NO

Signature of Participant

Date

APPENDIX J

LANGUAGE CLEARANCE CERTIFICATE

25 Maple Crescent
Circle Park
KLOOF
3610

Phone 031 – 7075912
[REDACTED]
Fax 031 - 7110458
E-mail:
dr1govender@telkomsa.net
sathsgovender4@gmail.com

Dr Saths Govender

2 JULY 2024

TO WHOM IT MAY CONCERN

LANGUAGE CLEARANCE CERTIFICATE

This serves to inform that I have read the final version of the thesis titled:

Teacher Leadership and the Fourth Industrial Revolution: Stories of Teachers Working in Diverse School Contexts by Tyran Reiley David, student Number, 208506289.

To the best of my knowledge, all the proposed amendments have been effected and the work is free of spelling and grammatical errors. I am of the view that the quality of language used meets generally accepted academic standards.


Yours faithfully



DR S. GOVENDER
B Paed. (Arts), B.A. (Hons), B Ed.
Cambridge Certificate for English Medium Teachers
MPA, D. Admin.(2003)

APPENDIX K

TURNITIN REPORT

 Turnitin Originality Report <u>Chap 1-9 - TR David.docx</u> by Tyran David From Thesis Dissertation (MEd and PhD Thesis) Processed on 05-Jun-2024 9:53 AM CAT ID: 2396010796 Word Count: 103803	<table border="1"><tr><td>Similarity Index</td><td colspan="2">8%</td></tr><tr><td>Similarity by Source</td><td>Internet Sources:</td><td>6%</td></tr><tr><td></td><td>Publications:</td><td>3%</td></tr><tr><td></td><td>Student Papers:</td><td>3%</td></tr></table>	Similarity Index	8%		Similarity by Source	Internet Sources:	6%		Publications:	3%		Student Papers:	3%
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[Govender, Ashkelon. "Transnational experiences of teacher leadership: narratives of South African expatriate teachers. Izelileko zolhisha abangabaholi emazweni ngamazwe. Okuxoxwa wothisha baseNingizimu Afrika abasebenza kwamanye amazwe." 2022](#)

- 2 < 1% match (student papers from 16-May-2018)
Class: PhD Thesis
Assignment: Thesis
Paper ID: [964527609](#)

- 3 < 1% match (student papers from 18-Nov-2015)
Class: PhD
Assignment: Thesis
Paper ID: [602253522](#)

- 4 < 1% match (student papers from 16-Nov-2021)
Class: MEd 2021
Assignment: MEd
Paper ID: [1704302952](#)

- 5 < 1% match (student papers from 03-Feb-2020)
Class: PhD Thesis
Assignment: Thesis
Paper ID: [1250720902](#)

- 6 < 1% match (student papers from 02-Dec-2023)
[Submitted to University of KwaZulu-Natal on 2023-12-02](#)
