



**Opportunities and Challenges of Digitalisation in High School Learning in the
Free State**

by

NKGAPANE CATHRINE LEBONE

Dissertation submitted in fulfilment of the requirements for the degree

Master of Technology: Business Administration in Project Management

in the

FACULTY OF BUSINESS & MANAGEMENT SCIENCES

at the

CAPE PENINSULA UNIVERSITY OF TECHNOLOGY

Supervisor: Mr S Fore

CPUT Copyright information

The dissertation/thesis may not be published either in part (in scholarly, scientific or technical journals), or as a whole (as a monograph), unless permission has been obtained from the University

DECLARATION

I, Nkgapane Cathrine Lebone, declare that the contents of this dissertation/thesis represent my unaided work and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



Signed

07 December 2022

Date

ABSTRACT

Recent years have seen a rise in the prominence of digitalisation in education. To take advantage of the benefits that these technologies provide, adaptation is necessary. This is particularly true when you consider the global advancements in teaching methods and technology brought about by the fourth industrial revolution (4IR). However, schools in rural areas are frequently at a disadvantage because they lack the necessary infrastructure, such as electricity and internet connectivity, which hinders their adoption of digitalisation in education.

This study identifies the challenges that users of digital platforms in high schools experience when they are implemented and used. It also seeks to identify the resources available to high school students that will enable them to use digital platforms efficiently. The data is gathered quantitatively and the relevant literature is reviewed. To collect data, structured questionnaires were given to the respondents. Subsequently, these were examined using SPSS version 27.0, a statistical program for social science research. The findings are discussed using descriptive statistics to infer the data and the information represented using tables.

Various stakeholders, including the government, private sector and donors, should work together to ensure the effective adoption of 4IR technologies that will facilitate their adoption in the rural schools. With its extensive resources, South Africa could lead the way in high school digitalisation. 4IR and the Covid-19 pandemic have transformed the learning environment and it should not be limited to the conventional classroom with chalk and board.

Keywords: digitalisation, information and communication technology, high school learners, the fourth industrial revolution.

ACKNOWLEDGEMENTS

I would like to acknowledge and give my warmest thanks to my supervisor, Mr Stanley Fore, who made this work possible. His guidance and advice carried me through the stages of conducting my research.

I would like to give thanks to my sister Ms Mmabali Moloji, my two sons Messrs. Kealeboha Lebone and Thabang Lebone for their moral support and always being my pillars of strength.

I would also like to give thanks to my friends, Mr S Jwili, Messrs. N Litlhakanyane, Z Magagula, A Seseane, M Nkhobo and S Ngezi for always reminding me that God gives his hardest battles to his strongest soldiers.

Special thanks go to my late parents, Mrs Limakatso Moloji and Mr Boy Moloji, for always believing in me. Your prayers have sustained me so far.

Finally, I would like to thank God, the Almighty, for letting me through all difficulties. I have experienced your guidance and grace day by day. I will keep on trusting you for the future.

DEDICATION

This work is dedicated to:

God, my Creator.

My late parents, who never failed to give me support in every area of my life and for always teaching me to be humble and kind.

TABLE OF CONTENTS

DECLARATION.....	II
ABSTRACT	III
ACKNOWLEDGEMENTS.....	IV
TABLE OF CONTENTS	VI
LIST OF FIGURES	XI
LIST OF TABLES.....	XII
GLOSSARY	XIII
CHAPTER 1	1
INTRODUCTION	1
1.1 INTRODUCTION TO THE STUDY.....	1
1.2 BACKGROUND	2
1.3 PROBLEM STATEMENT	3
1.4 RATIONALE AND SIGNIFICANCE OF THE STUDY	4
1.5 AIM AND OBJECTIVES OF THE STUDY	5
1.6 RESEARCH QUESTIONS.....	5
1.7 RESEARCH OR CONCEPTUAL FRAMEWORK	6
1.8 RESEARCH DESIGN	6
1.8.1 Research approach.....	7
1.9 RESEARCH METHODOLOGIES AND PROCESSES	7
1.9.1 Population.....	7
1.9.2 Data collection instruments.....	7
1.9.3 Sampling method.....	7
1.9.4 Sample size	8
1.10 DATA COLLECTION/FIELDWORK	8
1.11 DATA CODING AND ANALYSIS	8
1.12 ETHICAL CONSIDERATIONS	8
1.13 OUTLINE OF THE DISSERTATION	8
1.14 DEMARCATION/DELIMITATION OF STUDY	9
1.15 CONCLUSION.....	10
CHAPTER 2.....	11
LITERATURE REVIEW	11
2.1 INTRODUCTION.....	11

2.2 DIGITAL TECHNOLOGIES IN THE INFORMATION AGE AND THE FOURTH INDUSTRIAL REVOLUTION	12
2.2.1 Policy challenges with digitalisation in schools.....	13
2.3 ICT PLANS, POLICIES AND PRACTISE IN SOUTH AFRICA.....	13
2.4 INTERACTIVE WHITEBOARDS.....	15
2.4.1 South African case study of the use of digital technology	16
2.4.2 Educational strategic management	19
2.4.3 Management and leadership	20
2.4.4 The function of school governing bodies	20
2.5 SOUTH AFRICA'S URBAN-RURAL DIGITAL DIVIDE	20
2.6 TAPPING INTO THE GENERATION Z IN DIGITALISATION OF EDUCATION.....	23
2.6.1 Empowering students with mobile technology.....	25
2.6.2 Visual communication and Web 2.0	27
2.6.3 Digital divide effects on Web 2.0 learning	29
2.6.4 Classrooms in the poorer areas	29
2.7 ICT INTEGRATION IN SCHOOLS IN SOUTH AFRICA	30
2.7.1 Electronic textbooks (e-books).....	31
2.7.2 Obstacles to using electronic textbooks (e-books).....	32
2.8 LIMITATIONS OF THE STUDY	34
2.9 CONCLUSION	34
CHAPTER 3.....	36
RESEARCH METHODOLOGY	36
3.1 INTRODUCTION	36
3.2 RESEARCH QUESTIONS AND RESEARCH OBJECTIVES	36
3.2.1 Problem statement, aim and objectives	36
3.2.1.1 Problem statement.....	36
3.2.1.3 Study's research questions	37
3.2.1.4 Research aim and objectives	37
3.3 RESEARCH DESIGN AND METHODOLOGY	37
3.3.1 Research philosophy.....	38
3.3.2 Research approach	39
3.3.3 Research instrument.....	40

3.4 POPULATION	41
3.5 SAMPLING.....	41
3.5.1 Sample method.....	41
3.5.2 Sampling frame.....	42
3.5.3 Sample size	42
3.6 DATA COLLECTION INSTRUMENT	43
3.7 DATA CODING AND ANALYSIS	43
3.8 VALIDITY AND RELIABILITY.....	44
3.8.1 Validity	44
3.8.2 Reliability.....	45
3.9 ETHICAL CONSIDERATIONS	45
3.9.1 Participants' rights	46
3.9.2 Informed consent.....	46
3.9.3 Confidentiality and anonymity.....	47
3.10 CONCLUSION	47
CHAPTER 4.....	48
RESULTS AND FINDINGS.....	48
4.1 INTRODUCTION	48
4.2 SIGNIFICANT FINDINGS ON EMPLOYEE DEMOGRAPHICS.....	48
4.2.1 Gender.....	48
4.2.2 Age 48	
4.2.3 Level of education	49
4.2.4 Current position.....	50
4.2.5 Work experience in the current position	50
4.3 OTHER FINDINGS	51
4.3.1 Digitalisation replaces traditional workflow with digital processes.....	51
4.3.2 Instead of clinging to successes, the digital revolution makes it more time-consuming to research new development strategies	52
4.3.3 Findings on digitalisation changing the modern and professional working models	
52	
4.3.4 Findings on digitalisation constantly improving the work life of employees	53
4.3.5 Findings on digitalisation increases the workflow efficiency.....	53
4.3.6 Findings on digitalisation minimise technical errors.....	54

4.3.7 Findings on digitalisation apply new services and technologies quickly and flexibly	55
4.3.8 Findings on digitalisation improve work quality and performance	55
4.3.9 Findings on digitalisation constantly increasing learners' productivity	56
4.3.10 Findings on schools having trained personnel in the workforce to work in the digital environment	57
4.3.11 Findings on the perception that the school lacks a strong information technology foundation to successfully conduct digitalisation	57
4.3.12 Findings on the perception that the school leaders lack digital thinking and knowledge	58
4.3.13 Findings on the perception that the school staff lack digital thinking, knowledge and skills	59
4.3.14 Findings on the perception that the most prominent challenge for school digitalisation is access to finance and limited skills in entrepreneurship	59
4.3.15 Findings on the perception that the school management is facing cultural changes as they have to adapt to adopt unfamiliar technologies	60
4.3.16 Findings on the perception that the school's staff is facing cultural changes as they have to adapt to adopt unfamiliar technologies	61
4.3.17 Findings on the idea that the introduction of digital technologies is causing a fundamental change in the way that the entire school is perceived	61
4.3.18 Findings on the perception that the school is facing increased competition exacerbated by globalisation	62
4.3.19 Findings on the perception that the school's management is facing the stress of moving digitally before others to survive and gain competitive benefits	63
4.4 DESCRIPTIVE STATISTICS	63
4.5 CONCLUSION	66
CHAPTER 5	68
CONCLUSION AND RECOMMENDATIONS	68
5.1 INTRODUCTION	68
5.2 AIM AND OBJECTIVES OF THE STUDY	68
5.3 CONTRIBUTION OF THE STUDY	69
5.4 SUGGESTED FUTURE RESEARCH	70
5.5 RECOMMENDATIONS	70
5.6 CONCLUSION	71
REFERENCES	73

APPENDICES	97
ANNEXURE A: ETHICAL CLEARANCE.....	97
ANNEXURE B: PERMISSION-GRANTING LETTER.....	98
ANNEXURE C: LANGUAGE EDITING LETTER	100
ANNEXURE D: QUESTIONNAIRE	101
ANNEXURE E: TURNITIN SIMILARITY REPORT	104

LIST OF FIGURES

FIGURE 1: A BALANCED MATRIX STRUCTURE.....	19
--	----

LIST OF TABLES

TABLE 1: CHALLENGES FACED IN THE IMPLEMENTATION OF DIGITAL TECHNOLOGIES IN SOUTH AFRICAN SCHOOLS.....	13
TABLE 2: GENDER.....	48
TABLE 3: AGE GROUP.....	49
TABLE 4: LEVEL OF EDUCATION.....	49
TABLE 5: CURRENT POSITION.....	50
TABLE 6: WORK EXPERIENCE IN THE CURRENT POSITION.....	51
TABLE 7: DIGITALISATION REPLACES TRADITIONAL WORKFLOW WITH DIGITAL PROCESSES.....	51
TABLE 8: DIGITALISATION INCREASES THE TIME SPENT ON RESEARCHING A NEW DEVELOPMENT STRATEGY INSTEAD OF HOLDING ON TO ACHIEVEMENTS.....	52
TABLE 9: DIGITALISATION IS CHANGING THE MODERN AND PROFESSIONAL WORKING MODELS.....	53
TABLE 10: DIGITALISATION IS CONSTANTLY IMPROVING THE WORK LIFE OF EMPLOYEES.....	53
TABLE 11: DIGITALISATION INCREASES THE WORKFLOW EFFICIENCY.....	54
TABLE 12: DIGITALISATION MINIMISE TECHNICAL ERRORS.....	54
TABLE 13: DIGITALISATION APPLY NEW SERVICES AND TECHNOLOGIES QUICKLY AND FLEXIBLY.....	55
TABLE 14: DIGITALISATION IMPROVE WORK QUALITY AND PERFORMANCE.....	55
TABLE 15: DIGITALISATION CONSTANTLY INCREASES LEARNERS' PRODUCTIVITY.....	56
TABLE 16: THE SCHOOL IS FACING A LACK OF SKILLS IN THE WORKFORCE TO WORK IN A DIGITAL ENVIRONMENT.....	57
TABLE 17: THE SCHOOL LACKS A STRONG INFORMATION TECHNOLOGY FOUNDATION TO SUCCESSFULLY CONDUCT DIGITALISATION.....	58
TABLE 18: THE SCHOOL LEADERS LACK DIGITAL THINKING AND KNOWLEDGE.....	58
TABLE 19: THE SCHOOL STAFF LACKS DIGITAL THINKING, KNOWLEDGE AND SKILLS.....	59
TABLE 20: THE MOST PROMINENT CHALLENGE FOR SCHOOL DIGITALISATION IS ACCESS TO FINANCE AND LIMITED SKILLS IN ENTREPRENEURSHIP.....	60
TABLE 21: THE SCHOOL MANAGEMENT IS FACING CULTURAL CHANGES AS THEY HAVE TO ADAPT TO ADOPT UNFAMILIAR TECHNOLOGIES.....	60
TABLE 22: THE SCHOOL'S STAFF IS FACING CULTURAL CHANGES AS THEY HAVE TO ADAPT TO ADOPT UNFAMILIAR TECHNOLOGIES.....	61
TABLE 23: THE ENTIRE SCHOOL IS UNDERGOING A RADICAL CHANGE DUE TO THE ADVANCEMENT OF DIGITAL TECHNOLOGIES.....	62
TABLE 24: THE SCHOOL IS FACING INCREASED COMPETITION EXACERBATED BY GLOBALISATION.....	62
TABLE 25: TO SURVIVE AND BENEFIT FROM COMPETITION, THE SCHOOL'S ADMINISTRATION IS UNDER PRESSURE TO GO DIGITAL BEFORE OTHERS.....	63
TABLE 26: DESCRIPTIVE STATISTICS ON DIGITALISATION.....	64
TABLE 27: DESCRIPTIVE STATISTICS ON DIGITALISATION.....	66

GLOSSARY

Academic teaching staff: Refers to any staff members of the university, university college, and its subsidiary colleges who hold the academic ranks of professor, associate professor, assistant professor, full-time lecturer, or part-time lecturer (unless the part-time lecturer is enrolled as a student), or who hold any other rank created by the governing council and designated by it as an academic rank (Andersson & Pears, 2017:2).

A rural school: Is a school outside of cities and most of its students are typically young adults from agriculturally active rural or small towns (Higgins & Abowitz, 2017:367).

Digital competence: Is the use of information technology and digital media necessary to perform tasks, address issues, communicate, manage information, act morally and responsibly, collaborate, produce, and share knowledge for employment, leisure, learning, socialising, empowerment and consumerism (Ferrari, Punie & Redecker, 2019:84).

Digital platforms: Components that give a technological system its essential functionality and serve as the foundation for developing supplemental products, technologies, or services (Pettersson, 2021:188).

Digitalisation: A transformation process involving various organisational levels and processes (Pettersson, 2021:188).

Private school: Is a school that parents pay tuition to send their children to because the government does not fund it (Wamalwa & Burns, 2017:2).

Public school: A school (or other establishment) is considered public if it is run or owned by the public or duly elected representatives of the people (Higgins & Abowitz, 2017:367).

Stakeholder: An individual or group that can affect or is impacted by an organisation's goals being met (Benna, Abratta & O'Leary, 2016:1).

CHAPTER 1

INTRODUCTION

1.1 Introduction to the study

There is a profusion of technologies that may be used for pedagogy. However, Msiza, Malatji and Mphahlele (2020:300) argue that the educational system is underperforming because of various factors, including perceived high cost and a fundamental lack of experience and skills. The concern that needs to be raised is how sustainable these initiatives are after Covid-19, despite the sad reality that some students from low-income backgrounds continued to be excluded from them due to lack of access or prohibitive costs (Msiza, Malatji & Mphahlele, 2020:300). This question is pertinent in the sense that, although some students remained observers of the unfolding digitalisation, at least some who could have been non-participants became immediate beneficiaries. A follow-up question but of equal significance is: does it need a closure of schools for whatever reasons for the governing authorities to see the reason for digital inclusiveness in high schools? This commitment by the government has been visible, particularly on paper. Late in the last decade, Dzansi and Amedzo (2014:341) highlighted that the South African government on its part realised and acknowledged the importance of information and communication technology (ICT) in education.

People's lives have been transformed by technology, which has revolutionised the way they work, travel, manage their health and learn (Duffy, 2022:1). The giant steps that society and the world are taking in terms of digitalisation are leading us to a new panorama in all sectors, including education (Iberactiv, 2021:1). Digitalisation is considered a multi-step transition that occurs at multiple organisational levels (Pettersson, 2021:188). In terms of reforming and upgrading the worldwide educational environment, digitalisation of education has now become a major trend (Yehya, 2021:2). The foundation for all economic development and the accomplishment of strategic goals is education (Ordov, 2019:1320). Therefore, the digitalisation of the educational system is particularly crucial (to ensure inclusive quality education, meet the learning needs of

youth and adults through equitable access to suitable learning, eradicate gender inequalities in primary and high school education and improve the quality of education).

Jahnke, Bergström, Mårell-Olsson, Häll and Swapna (2017:2) argue that the recent rise and increased access to technology open up new teaching and learning possibilities. The remarkable capabilities provided by technology to record the digital footprints of today's students, who are active participants in cutting-edge educational experiences and digital natives, have piqued the interest of the research community globally in the topic of digitalisation of the educational system (Viberg & Mavroudi, 2019:1). Similarly, according to Pettersson (2021:188), the creation and use of digital technologies has expanded as waves throughout education systems and society. Therefore, schools have no choice but to prepare themselves to get ahead of the change by identifying the opportunities and challenges that are appearing in today's education environment.

1.2 Background

A significant global revolution has occurred over the past two decades and this revolution calls for a new model of education that is appropriate for the twenty-first century (DBE, 2021:1). According to Mrs Angie Motshekga, the Minister of Basic Education, "as we reflect on teaching and learning and where some of our challenges have been, a way forward is to not only ensure that we expose our students to the fourth industrial revolution, but also to use technology to enhance teaching and learning in the classroom" (DBE, 2021:1). The awareness of the governing authority of the prominence of digitalisation can be deduced from the aforementioned statement. Fudin (2012:1) reported that by 2013, every learner in South Africa should be technology proficient, according to the goals set in the country's White Paper on e-Education.

The results of a study conducted in Limpopo by Msiza, Malatji and Mphahlele (2020:300) showed that, besides television sets, photocopiers and desktop computers, there was lack of ICT resources at schools for ICT integration, which had a damaging effect on teachers' ability to advance curricula. The current study is distinct from this one in that it examines both the integration of digitalisation as well as the use of digitalisation

technologies and factors that enable a more effective digitalisation environment in South Africa through the use of cutting-edge technologies such as IWBs, cell phones and tablets by not only learners but also their instructors. Regrettably, these negative effects have huge consequences on the future development of students, both academically and vocationally. As the Council of Education Ministers (CEM) (CEM, 2019:1) comments, these latest technologies are expected to influence people's daily lives, particularly if they are to equip the new generation and re-educate and re-skill the existing generation.

The fourth industrial revolution (4IR) current market will be impacted by 4IR and the current generation should ensure that the youth is appropriately prepared for future skills and employment markets (CEM, 2019:1). However, the ripple effects transcend the individuals and can be felt even at the national level regarding muted development and economic growth. Thus, this study is relevant as it serves as a reminder to the South African governing authorities and as an awareness to the society of the importance of schools' digitalisation in the 21st century.

1.3 Problem statement

Despite enormous efforts to advance the use of digitalisation in South African schools, regrettably many rural schools continue to be excluded (Dzansi & Amedzo, 2014:341). Moreover, Yehya (2021:2) notes that it solves several new technical concerns, such as computer viruses, software and data protection. Infrastructure and technology systems investments are necessary because of the digitalisation of education. Some schools in particular regions of the country have not yet started the process of converting traditional schools to digital schools to profit from digitalisation because doing so is quite expensive (Dzansi & Amedzo, 2014:341). Similarly, Isah and Ojetunde (2019:3) posit that traditional teaching equipment has mostly become archaic in most institutions, particularly when comparing private (fee-paying) and public (government tuition-free) institutions. Private schools can buy cutting-edge modern teaching tools to train their staff and meet modern market requirements that are sometimes lacking in public institutions (Isah & Ojetunde, 2019:3). This translates into educational exclusion.

Studies have looked at the effects of digitalisation on the South African environment. Dlamini (2020:40–60) focused on digital equity in schools. Between 2017 and 2021, this study examined the technological literacy of in-service teachers in one of South Africa's rural provinces. The programme included training in digital skills, technological pedagogical knowledge and computing skills for 2 493 primary and secondary education teachers. The study's findings supported the low ICT proficiency of teachers, demonstrated the existence of an unequal society and showed how serious the issue of digital inequality is even today. However, there was improvement in teachers' acquisition of technological knowledge. According to the study, on-site digital technology support, opportunities for all teachers to grow professionally and investments in digital infrastructure should be made proportionately. Therefore, by concentrating on the opportunities and difficulties of digitalisation in high school learning in the Free State, the current study contributes to this expanding field of research.

Furthermore, Ilomäki and Lakkala (2018:6) argued that there is an intensive body of research on digitalisation in the corporate world, but research on digitalisation in school contexts is scarce, or completely lacking. Ilomäki and Lakkala (2018:6) concluded that although some positive outcomes reveal a link between innovative instructional methods (less teacher-centred) and the use of digitalisation, predictions about rapid adoption and deployment of digitalisation into classroom systems have not been reached.

1.4 Rationale and significance of the study

The foundation for learners to acquire or improve their digital capabilities and skills is teachers' technological proficiency, which is linked to their pedagogical knowledge of using technology in education (Ilomäki & Lakkala, 2018:6). This study therefore argues that despite the drawbacks of using digital tools in the classroom, the value of doing so in education should not be undervalued. Furthermore, research on school digitalisation adds significant value to the understanding of how to improve teaching methods (Siljebo, 2020:29). Thus, the study will improve the socio-economic status of high school students in South Africa by revealing the gaps in the digital transformation at the

high school level and by advancing educational inclusion through digital transformation (Siljebo, 2020:29).

Digital transformation at the high school level can pave the way for faster adaptation at tertiary institutions globally, which are already embracing technology to achieve online activities and other educational outcomes. This quicker adaptation can result in improved academic performance. Improved academic performance will open the way for better career paths. At a national level, the skills attained by students at an early level of their high school journeys can be used to increase productivity levels and by so doing help with economic growth. At a global level, those skills can help with the interconnectivity of the global village and spawn global growth.

1.5 Aim and objectives of the study

This study determines the benefits and drawbacks of using digital technology in high school instruction. Thus, it seeks:

1. To identify the issues that stakeholders encounter in the implementation and use of digital platforms in high schools.
2. To discover the opportunities available for high school children that allow them to effectively use digital platforms.

1.6 Research questions

The following research questions are generated based on the aim and objectives of this study:

1. What are the issues that stakeholders encounter in the implementation and use of digital platforms in high schools?
2. What opportunities exist for high school children to effectively use digital platforms?

1.7 Research or conceptual framework

Over the past few decades, digitalisation, and in particular the usage of technologies such as the internet, has proliferated and developed into a crucial aspect of society, altering economic systems, means of obtaining information, family dynamics, and, educational institutions (Altuna & Lareki, 2015:206). The world has entered a new period, the information revolution (Altuna & Lareki, 2015:206), and institutions are adjusting in many ways to this new environment. This study is grounded in the postpositivist philosophy. McGlinchey (2022:1) states that postpositivism seeks objective conclusions by striving to understand and deal with limitations and biases in ideas and knowledge developed by researchers. It is related to quantitative approaches that allow for the identification of causal associations based on the premise of a cause-effect relationship between two variables and its common methods include statistical analysis and experimentation (Bonache & Festing, 2020:105). Herlo (2017:330) explains that schools should develop ways to learn more transparent and flexible paths towards open source content and student-centred learning experiences in an era of nearly complete connectedness and opportunistic social media platforms.

Furthermore, this study uses the postpositivism philosophy because the acquired knowledge using a postpositivist perspective is based on meticulous observation and numerical assessment of external truth when analysing individuals' behaviour (Creswell & Creswell, 2017:7). For instance, this study seeks to explore the opportunities and challenges of digitalisation in high school learning. The nature of reality is defined from an objective perspective. Ontologically, postpositivists believe that truth is a reality that exists, and it is made up of stable pre-existing rules or patterns that may be uncovered. Moreover, truth is not limited to a specific time or context (Aliyu, Singhry, Adamu & Abubakar, 2015:3).

1.8 Research design

This study employed a descriptive research design.

1.8.1 Research approach

This study adopted a quantitative approach. The quantitative approach is preferred in this study over the qualitative and mixed methods approaches because it concentrated on the study's target population: 200 members of the academic teaching staff in public and private high schools in the Free State. Second, quantitative research generates factual data that can be expressed through statistics and numbers. Third, questionnaires were used in this study, which is quicker than using qualitative techniques.

1.9 Research methodologies and processes

1.9.1 Population

Twenty Free State public and private high school teaching staff members are the subjects of this study. The sample comprised 200 members of the academic teaching staff. This is due to the researcher's expectation for this study, which was met, being that the questionnaires would be distributed to at least 10% of the population. The results can be applied to the entire population of the Free State province because this number is representative of the general population.

1.9.2 Data collection instruments

To collect data from participants regarding digitalisation, this study used a structured questionnaire.

1.9.3 Sampling method

Purposive sampling was used in this study. This is crucial because the sample should be carefully selected to fairly represent the target population. Intentionally choosing study participants is known as "purposive sampling", and it depends on the researcher's judgement. This is based on their capacity to explain a particular theme, concept, or phenomenon – in this case, digitalisation in high schools in the Free State province. Due to the small size of the population – 200 – and the requirement that respondents be chosen from both public and private schools, this sampling technique was chosen.

Consequently, this method ensured that a representative sample was chosen for this study.

1.9.4 Sample size

A sample of 200 people was selected, with ten staff members from each school serving as the target population to ensure that the results could be generalised to the population. This is due to the researcher's expectation for this study, which was met, being that the questionnaires would be distributed to at least 10% of the population. There are over 3 000 schools in the Free State (DoE, 2014:1). This study excluded the administrators, sports team, grounds crew, or kitchen staff, who are non-teaching staff members who manage the school and perform administrative duties.

1.10 Data collection/fieldwork

The researcher distributed structured questionnaires to gather data.

1.11 Data coding and analysis

The statistical program for social research SPSS version 27.0, was used to analyse the data and derive the findings of this study.

1.12 Ethical considerations

The CPUT ethics committee's guidelines were followed when submitting the application for ethical clearance, and a structured questionnaire was used to gather data from the participants.

1.13 Outline of the dissertation

The structure of this dissertation is organised according to the guidelines provided by the Cape Peninsula University of Technology. It is divided into five main chapters that are organised chronologically and give the reader an idea of how this study was conducted. The following is the structure of this dissertation:

Chapter 1 – Introduction: provides a high-level background explaining why the subject is interesting in the particular context, along with a description of the research problem.

The context of this study and the formulation of the problem inform the presentation of the study's objectives and the research questions that aided them. Additionally, the delimitations are discussed to help readers understand how internal and external factors contributed to the development of this dissertation's scope.

Chapter 2 – Literature review: analyses the body of existing research, defines the key concepts and develops the theoretical framework. It intends to familiarise the readers with the topic. Therefore, this chapter offers a review of the literature on the digitalisation of schools with a focus on the opportunities and difficulties already present.

Chapter 3 – Research methodology: addresses the study's population and sample issues in detail. It also provides extensive descriptions of the research method chosen, the collection of data, data collection tools, data analysis and ethical implications considered.

Chapter 4 – Results, discussions and interpretation of findings: gives an account of the findings and a thorough interpretation of the findings. This chapter discusses both the research objectives and questions. Apart from summarising the findings, it also analyses them. Tables are used to present the findings.

Chapter 5 – Conclusions and recommendations: summarises the findings, examines the key conclusions and makes recommendations based on the data that was studied. It also presents a discussion on how this study contributes to the scientific knowledge and highlights managerial implications.

1.14 Demarcation/delimitation of study

Participation in this study was limited to only twenty high schools in the Free State province. This is so that the researcher could reach the 200 target population by selecting ten respondents from each chosen school. Furthermore, it is essential to point out that this research is delimited only to the use of tablets instead of textbooks as digital technology devices because the sample is composed of high-school academic staff. Therefore, if the schools use other digital technology devices or systems, these

will not be fully covered in this study. Thus, the concept of digitalisation is discussed from a low-level perspective, rather than focusing on all digital systems available because of the time constraints.

1.15 Conclusion

The study on the benefits and drawbacks of digitalisation in high school instruction in the Free State was introduced in this chapter. The problem statement was preceded by a description of the study's background. The purpose and goals of this study were then presented, followed by its justification and significance. Additionally briefly discussed were the research questions, conceptual framework, research design, methodologies and processes. The process for gathering data, coding it and analyzing it was described and the ethical considerations were discussed. Finally, the demarcation/delimitation of the study was explained. The literature pertinent to this study will be examined in the following section.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on a broad overview of the factors that influence the adoption of digital technologies in education. In particular, the focus area is schools in rural areas in the Free State province. This study compares the digitalisation of education across a few nations and examines how it has been accomplished in South Africa. The importance of online reading in education is being recognised more and more as being fundamental to surviving in the digital age (Hennessy, Onguko, Harrison, Ang'ondi, Namalefe, Naseem & Wamakote, 2010:1; Mullis, Martin, Foy & Hooper, 2017:1). According to OECD (2015a:1), Hesterman (2011:349) and Burnett (2010:247), digital media and ICT should only be used with young students, until their efficacy in the classroom has been proven.

Along with computer and information literacy, other researchers advocate for the use of ICT to enhance reasoning skills (Beetham & Sharpe, 2013:40-47; Fisher, 2014:33-35; Toki & Pange, 2014:183; Vasquez & Felderman, 2013:34). ICT can help improve online and print-based reading literacy, but its use should be governed by the context and instructional goals and integrated with curriculum objectives (Sharpe & Oliver, 2013:17; Lindberg, Olofsson & Fransson, 2017:122; Mills, 2010:246). Strategies for maximising ICT use for teachers and students are now the main topic of discussion in the educational debate, rather than the advantages and disadvantages of ICT (Meyer & Gent, 2016:1; Toki & Pange, 2014:183; Cicconi, 2014:57; Whittingham, Huffman, Rickman & Wiedmaier, 2013:1; Mills, 2010:246).

Digital literacy could be strengthened and the teaching and learning of reading literacy could be improved with a balanced approach to using technology in the classroom (McLean, 2017:1). In a world dominated by digital technology, there is a compelling case for developing both constructs because reading from paper-based materials and

reading online have some similarities but also some differences (Gilleece & Eivers, 2018:16).

2.2 Digital technologies in the information age and the fourth industrial revolution

The term "Industry 4.0" first appeared when Germany unveiled a high-tech strategy initiative that promotes the computerisation of manufacturing facilities. The term "Industry 4.0," which also refers to the current trend of automation and data exchange in manufacturing technologies, is used to describe 4IR. The internet of things (IoT), cloud computing and cyber-physical systems are all part of Industry 4.0. Cyber-physical systems that track physical processes are created by Industry 4.0 using "smart factories" with a modular design (Calitz, Poisat & Cullen, 2017:5). The shift from hunting-agrarian-industrial societies to post-industrial, knowledge-based societies, or the "third industry," according to Toffler (1991:1-10), has profoundly changed society. The information society (including the knowledge society), which was heavily discussed by Duff (1998:373) and Moodley (2004:330) in the 1960s, was a topic that Daniel Bell frequently brought up when developing the idea of the post-industrial society.

The "post-industrial workforce," "information flows," the computer and "information revolution" or "network society" are just a few trends that Castells, in his seminal book "The information age" (1996, 1997, 1998), described as being present when Bell lived in the 20th century. The extensive use of ICTs has led to this later stage, the knowledge and information society, which has a seamless information flow and knowledge sharing that some people find unsettling and others find to be extremely enlightening. The future and present of society are increasingly being impacted by the knowledge-based society.

Technology integration is the efficient application of technology in a class setting to enhance instruction and better prepare students from all social groups for the digital era. ICTs now have such a high value in many societies that they control every aspect of our daily lives, including how we work, interact, organise and plan our activities. They impact every aspect of our lives and are necessary to survive in today's interconnected,

modern society (Calitz, Poisat & Cullen, 2017:5). Wang and Bai (2016:247) argue that pressure has been put on SMTs in many countries to address reform and prioritise ICT in schools as a result of the continued integration of ICTs into schools, which is motivated by the belief that ICTs can significantly contribute to educational reforms and educational goals' advancement.

2.2.1 Policy challenges with digitalisation in schools

Some obstacles to the adoption of digital technologies in South African classrooms are listed in Table 1.

Table 1: Challenges faced in the implementation of digital technologies in South African schools

No.	Challenge	Description
1	Low literacy levels for reading both on paper and online.	Early and later grades are affected by children's lack of foundational reading skills. This issue has negative long-term effects.
2	The ICT usage and capacity monitoring in schools are insufficient.	Databases on schools' ICT capabilities and use are inaccurate. This may be because of inadequate oversight of how schools are operating generally.
3	The availability of reading materials on paper and online is significantly lower in African language schools.	Less school and classroom libraries and lack of ICT capability, are reported by African language schools. Less reading proficiency and greater poverty are linked to this.
4	The lack of ICT integration in classrooms and schools.	Even when ICT resources are accessible, teachers and institutions of higher learning do not always incorporate them into instruction.
5	ICT resources that are not properly maintained	The ICT resources in the ePIRLS study had not been used in the previous three years despite being accessible to half of the schools. The main contributors were out-of-date, inadequate, or broken equipment.

Source: Combrinck and Mtsatse (2019).

2.3 ICT plans, policies and practise in South Africa

Since 1994, educational reform has included integrating ICT into pedagogy. 1995 saw the launch of the technology enhanced learning initiative (TELI) (De Jager &

Nassimbeni, 2002:167). A draft policy paper that conformed to the TELI strategic plan was released in 1997 because of the initiative (Boekhorst & Britz, 2004:63). Blignaut and Howie (2009:1) assert that in 1997, SchoolNet was launched as a means of integrating ICT into education. The "White Paper on e-Education" was released seven years after the ICT initiative (DoE, 2004:1-13; Vandeyar, 2015:344). It was expected that by 2013, management, educators and students should all be computer literate and have access to ICT resources, according to the white paper on e-strategic education (DoE, 2004:1-13).

According to Meyer and Gent (2016:1) and GDE (2010:1), the lack of funding and departmental capacity has caused the policy's implementation to proceed slowly and erratically. Meyer and Gent (2016:1) contend that the lack of integrative methods and a versatile approach, which fails in South Africa's diversified education landscape are two other challenges. Poor national planning and execution have led to provinces taking the initiative and creating their own strategies. Only the Western Cape Education Department (WCED) and the Gauteng Department of Education (GDE) are proactive in this regard among the nine provinces.

The Khanya Project, initiated by WCED, aimed to provide computers to every school for use in administration, instruction and learning (Chigona, Chigona & Davids, 2014:8). For primary schools without these amenities, a project called Gauteng Online gave them access to internet-connected computer laboratories. The South African ePIRLS administration observed a lack of ICT resources even in the more urbanised province of Gauteng (Howie, Combrinck, Roux, Tshele, Mtsatse, McLeod Palane & Mokoena, 2017:1). South Africa was treated as a multiple case study and excluded from the global ePIRLS report due to lack of data for random sampling.

The GDE does not maintain an exhaustive list of schools with ICT capabilities, which suggests that there is insufficient oversight of the availability, use and implementation of computer laboratories and tablets. According to Howie *et al.* (2017:1), schools in underserved areas that do not fit the old Model C categorisation still experience

disadvantages, which is supported by the findings of this study. According to the Gauteng ePIRLS study from 2016, even in schools with some ICT capability, many lacked essentials such as keyboards and had outdated technology or unusable resources, for example inoperable computers (Howie *et al.*, 2017:1).

2.4 Interactive whiteboards

Many educational institutions worldwide outfit their buildings with the most recent technology to enhance the learning opportunities for students. It encourages the use of ICT, or ICTs, by teachers, such as the internet and computers. According to Türel and Johnson (2012:381), the IWB has received the most investment as part of the process of ICT integration, particularly from European nations. The ability to access a wealth of multimedia resources, switch effortlessly between traditional board work, video, other programs and the internet using the pen, computer mouse and on-screen icons, and be better able to manage the class while using the IWB are all benefits that teachers cite when using IWBs (Türel & Johnson, 2012:381). Whiteboards are frequently used by teachers to engage students' various senses and learning preferences (NCTE, 2008:1). This is similar to how teachers choose resources to address particular needs.

Various teaching techniques can be used effectively with an IWB, including teacher modelling, prompting, encouraging questioning, managing class discussions, reviewing ongoing work and whole class evaluation (Becta, 2004:1). According to Smart Technologies Inc. (2008:1), students who use the IWB are more likely to participate in class and find it easier to communicate on the whiteboard. The disadvantages should be considered even though there appear to be many benefits. Schools should carefully weigh their options given the price of each IWB package. Compared to inexpensive options, the IWBs' prices can only be justified when they are used to expand and transform learning (Becta, 2004:1). It is crucial to improve teachers' abilities. Teachers cannot be left to conduct independent experiments after receiving the required hardware training. They should be taught how to use the technology in the most effective ways (NCTE, 2008:1). According to Becta (2004:1), the demands that students

place on teachers to continuously improve their methods of delivery and the material they cover in lessons stem from the use of whiteboards. Creating multimedia teaching materials adds a significant amount of work at first.

2.4.1 South African case study of the use of digital technology

In this case study, a top school collaborated with several underfunded schools to manage an IWB network that began operating in Mpumalanga in April 2008. Lessons in science and mathematics were transmitted over the network. By providing classrooms with state-of-the-art technology, many educational institutions work to enhance students' learning opportunities. Most of the funding has gone to the IWBs and project has done a great job of bridging the urban-rural gap. The expanding ICT infrastructure in South Africa, along with the accessibility of tablets and smartphones for students to use for their studies, and the online learning opportunities made available by the extra lessons in Zoom and on SABC Education present enormous opportunities for enhancing high school education. ICT use in educational reform is essential. Two IWBs were purchased by a technology instructor at a school with plenty of resources in 2005 and he began to experiment with their use in his class. The instructor reasoned that because technology allowed him to communicate with his friend in England, it should be possible for him to do the same with other schools in the area. To accomplish that, though, there was no internet connectivity. If this could be accomplished, the community would benefit from the knowledge and abilities from one school being shared with other schools. His school decided to build an ICT learning environment so that it could work with schools in underserved areas.

It was a notion exclusive to South African schools. Several sponsors joined the effort and donated money after realising the potential of the project. An interactive ICT network using IWBs was introduced in April 2008 with the participation of the top school and three formerly underprivileged schools. Reaching out to the nearby rural schools was the main objective to enhance mathematics and science instruction for Grade 12 students. The network later included two additional schools. These five institutions collaborate on a shared file server housed at the top school. This file server houses the

science and mathematics reference materials, including lesson presentations, benchmark tests, examinations, recorded video lessons, and lesson notes for the remote students and instructors. The day before transmission, the lesson notes are printed, then handed out the following day. Every lesson the presenter delivers is recorded and saved to the file server for later review. As an alternative, it could be downloaded onto a flash memory drive and distributed to the pupils for home use.

A preliminary evaluation of the project indicates that it is a fantastic example that other provinces in South Africa can follow and that it is very successful in closing the digital gap between rural and urban regions. Using 21st-century technology, the top school's e-learning network helps underprivileged schools raise their standards of instruction and learning and boost their performance. The likelihood of schools succeeding increases significantly if they are managed well. Numerous obstacles were overcome, but the project persevered and has grown over time. The project has the necessary hardware and software, but the human element is much more unpredictable and the project is still susceptible to power outages and other problems. The fact that this ICT project survived and prospered is largely because of good management. ICT projects that are successful are the exception rather than the rule. Even though each school still had its own management structure, they had to figure out a way to manage the ICT network across conventional boundaries.

ICTs are still being introduced into schools, which has increased the pressure to address reform and give them top priority. Every classroom has an IWB – teachers can print lesson material directly from their school rooms; therefore, the most cutting-edge technology in a school can be used to determine which educational programme is the best. Each underprivileged school received an IWB system from a sponsor, and they have funds set aside to buy additional computers and IWBs. Science benefited most from the project because experiments became more approachable. The benefit was greatest for schools without laboratories. According to NCTE (2008:1), teachers should receive training in the best ways to use technology and the top school has taken steps to address this issue. The teachers at the top school are constantly expected to

enhance the lessons' content and delivery, which significantly increases their workload in the process of creating high-quality teaching materials. This matrix offers various benefits (Bobera, 2008:3). In accordance with the limitations of the sponsor funds and the school budget, the project manager took full ownership of project management. The project uses the expertise of professors who work in the practical departments of science and mathematics. Therefore, it eliminates departmental barriers and encourages people to bring their special talents to the project (Riley, 2014:1).

Without constant supervision, the project's teachers set their own goals and deadlines. Career advancement opportunities are offered by this project. Multiple reporting lines do not result in conflict, complication, or stress because management roles are clearly defined. If there is any ambiguity regarding the duties of each functional and project manager, the project may suffer, but in this instance, that did not occur. Uncertain job descriptions, interpersonal tensions between leaders, lack of trust between staff members, poor teacher communication, unclear roles, or a misunderstanding of who has the final say did not cause any problems (Sy & D'Annunzio, 2005:39). The goals of the organisation are achieved through the use of people, money and physical resources, as well as well-known management techniques like scheduling, hiring, organising, leading, problem-solving, and controlling people, goals and resources (Sy & D'Annunzio, 2005:39). The SMTs have control over all project processes. Line reporting to the HODs and principals was still in place despite the matrix's presence in rural schools; therefore, the project's management closely resembles but differs from a balanced matrix. The balanced matrix is suitable for dynamic, varied, distributed, and technically complex activities in a manner similar to this (Sy & D'Annunzio, 2005:39).

The same process could be used to develop other multi-school models. A general project manager from the top school is something we can anticipate. At the top school, the steering committee includes an administrator, an IT controller, or controllers and operatives. The project manager submits a report, which primarily consists of feedback, to the principal and the school governing body (SGB). For budget management in the rural schools, the principal and SGB are jointly responsible. A project coordinator should

be present in each school, though this person may not hold a formal position and may simply be in charge of the hardware, or responsible for ensuring that transmissions go through without any problems. Within the leading school and across all other schools, there is horizontal reporting to the administrative officer and project manager. There is vertical reporting to the principals and HODs in their capacity as functional managers.

Figure 1 shows the balanced matrix model used in this project.

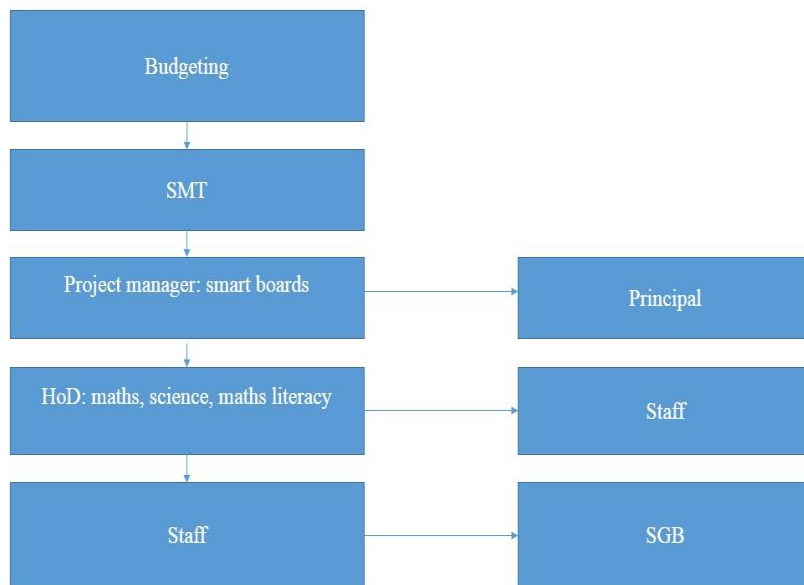


Figure 1: A balanced matrix structure.

Source: Adapted from Sy and D'Annunzio (2005:43).

2.4.2 Educational strategic management

In educational institutions, the value of efficient management is becoming more widely acknowledged. If schools are well-managed, they are likely to be much more productive. Many responsibilities that used to be handled by the national or regional government, such as managing the staff and finances, are now handled by schools. Because educational institutions are now in charge of this, leaders can use a strategic

approach by fusing various management facets to accomplish objectives (Bush & Coleman, 2000:1). Although the principal is not the only person who can manage, the principal typically collaborates with the SGB to conduct strategic management.

2.4.3 Management and leadership

Leadership and management are linked. The manager is in charge of organising, coordinating and planning; the leader is in charge of inspiring and motivating. Planning, budgeting, hiring staff, resolving issues and performance evaluation are just a few of the well-known management procedures that keep organisations running (Kotter, 2013:1). You can produce goods and services on time and within your budget with the help of management. Finding and seizing opportunities are all parts of leadership that are related to the future of an organisation. Vision and bringing people together around that vision are key components of leadership. It entails support, dialogue, inspiration, drive and the creation of positive change (Kotter, 2013:1).

2.4.4 The function of school governing bodies

To run a school, a governing body is either chosen or appointed. They serve as both the neighbourhood and the institution's representatives. Its main objective is to improve the school's performance. The rules and regulations for organising, conducting and overseeing school affairs are set by SGBs that are in charge of setting up rules and policies that will benefit the school, students and parents in addition to deciding how the school will be run. The SGBs are in charge of regulating the way the school is run. School management focuses on running the school daily. Together with the SMT, the principal manages the school (Equal Education, 2011:1).

2.5 South Africa's urban-rural digital divide

South African policymakers and decision-makers are aware of the difficulties associated with being a developing country in several ways. Despite this realisation, South Africa is not overly concerned about the digital divide that exists between it and other, more

developed countries. Some solace could be found in the fact that South Africa was 14th in the world for internet usage in 1996 (Pretorius, 2003:1; Goldstuck, 2002a:1). Approximately 3, 1 million people in the country used the internet at the beginning of 2002 (Burger, 2002:1). However, according to recent data (Goldstuck, 2002b:1), internet usage has been growing slowly in South Africa, which was most likely not even among the top 30 users of the service in 2003. According to Pretorius (2003:1), this may be a sign that internet usage is becoming saturated in some local industries.

The stark digital divide between urban and rural South Africans is currently the most urgent problem for policymakers and decision-makers. According to Jensen (2002:1) and Goldstuck (2002a:1), South Africa's internet users are disproportionately concentrated in urban areas, including Western Cape and Gauteng provinces. This indicates that internet users are typically well-off and educated. Rural areas in the nation lag behind urban areas not only in terms of internet access but also in terms of the very characteristics (such as high income rates, computer literacy and literacy rates) that could aid in bridging the urban-rural digital divide. This may be due to lack of sufficient internet infrastructure, outdated classrooms without digital technologies and lower income levels in most households, which make it difficult to afford digital devices that can support education.

Some have used ICT-based initiatives and computer training components to support the delivery of education or information in rural areas, albeit to a lesser extent. These are a few instances of government-sponsored or -initiated projects:

- The US Universal Service Agency's initiatives to open telecentres (Universal Service Agency, 1997:1).
- Support from the DoE for SchoolNet SA project, which seeks to provide schools with access to the internet (SchoolNet SA, 2001:1; SchoolNet SA, 2003:1; Riordon, 2002:1).

- The Web Internet Laboratories (DoC-WIL) project at higher institutions of learning that have historically received inadequate funding (Department of Communication, 1999:1).
- Initiatives from the "Public Information Terminal" series of Info.com projects from the Department of Communication (Mahlangu, 2001:1).
- The Multi-purpose Community Centres of the Government Communication and Information System (GCIS, 2002:1).

Most telecentre initiatives in South Africa, including the telecentre intervention of the Universal Service Agency, are, however, having issues, as the Telecentre 2000 study has already demonstrated. It was found that these telecentres' long-term economic viability has been their main issue and challenge. The access-provision programmes at the reputable universities mentioned earlier have been more concentrated and persistent, but their effects have not yet been felt in many deep rural communities. The multipurpose community centres run by the GCIS are also encouraging, although they are still in their infancy and undoubtedly face many of the same difficulties that the telecentres run by the Universal Service Agency faced before they were shut down. It is necessary to conduct additional research and pilot projects to better understand how to implement such rural ICT-related development initiatives. The failure of some of the aforementioned initiatives may be attributable to their singular focus on the provision of internet access in rural areas. However, there are other significant issues as well. Jensen (2002:1) lists the following six typical challenges as an example:

- Resolving the conflict between local development requirements and the push for technology.
- Some rural areas' lack of electricity.
- There is lack of adequate communication infrastructure in a remote area where an intervention is being conducted.
- The nearby rural community's lack of PC-related knowledge.

- There is lack of PC-related applications and long-term employment opportunities in the rural area in question.
- Additional social problems specific to the rural area in question (such as, local power relationships and political divisions).

Academic studies (Van Audenhove, 1999:1; Mansell & When, 1998:1; Burgelman, Nulens & Van Audenhove, 1999:1) suggest that developing nations should implement at least the following three measures in the affected regions to reduce the digital divide:

- Create an affordable, dependable ICT network.
- Introduce/create ICT applications that cater to regional needs. Ensure that local resources are available to modify ICT applications under regional conditions.
- Implement relevant and enabling legislation or policies (both relating to ICT and unrelated matters), such as measures to make the first two above-mentioned actions possible and supported.

For any ICT-based intervention aimed at bridging the digital divide or advancing development, these three recommendations can be seen as prerequisites. To enable these actions to occur and be successful, it is also necessary to create a new, tolerant political governance culture (Burgelman, Nulens & Van Audenhove, 1999:1).

2.6 Tapping into the Generation Z in digitalisation of education

"Generation Z" refers to children born between the middle of the 1990s and the present (Rothwell, 2008:72). In the digital age, these teenagers have grown up using the internet. They were moulded by technology from birth (Pollock & Pollock, 2011:81). They learnt to adapt and change because of growing up with new technology. For this generation, time and distance are not barriers to communication; they likely are not even a concern. A person's words today could instantly affect issues around the world. It is simple for tens of thousands of people to view a post on Twitter, Facebook, or Google+ in a matter of minutes. Although they are not of voting age, this generation has

the power to affect change. New media is now a popular "hangout" for Generation Z. At school, in bed, at home, or even while travelling, they "go there". Most of Generation Z's communication occurs online (Ivanova & Smrikarov, 2009:1). They also claimed that they have very limited verbal communication skills.

According to McCrindle (2006:1), it is reasonable to anticipate that this generation will build facilities for work and recreation that are superior to those made by their forebears. Mobile technology makes it possible for Generation Z users to receive instantaneous world news in their pockets, compared to traditional mass communication strategies. If properly led, the next generation of kids can change the world and make it a better place to live. To help Generation Z learn, Fudin (2012:1) offers the following recommendations:

- Use the instant feedback provided by technology to inspire students and boost their confidence in their capability to learn. Various students can feel empowered and accomplished by using computer-based educational games and independent projects.
- Plan projects and activities that allow students to work together online to engage with the class. Some new technologies that enable connections between students and students around the world include blogging, podcasting and digital media.
- Use video, PowerPoint presentations and digital images to enhance lectures to capitalise on Generation Z's enhanced visual learning capacity.
- Assist students in developing their critical thinking and problem solving skills, particularly when using technology. Describe how to locate trustworthy and reputable sources when searching online.
- Teach students to concentrate on one complex, in-depth task at a time. Set up obstacles for them to overcome that call for concentrated effort.
- Motivate students to schedule time for outdoor exercise. Plan field trips that let students interact with nature rather than just talking about it and showing them pictures.

According to Mentz (2000:56-60), in a developing nation such as South Africa, more emphasis needs to be put on teachers' and students' information technology training. Teachers must possess subject-specific knowledge to incorporate technology into their instruction.

2.6.1 Empowering students with mobile technology

Students can now connect to various Web 2.0 applications using their cellphones, which have evolved into sophisticated microcomputers. South Africa exhibits traits common to both first- and third-world countries. Despite having the most wired population in the world in 1997 (Mentz & Mentz, 2003:186), fewer than 1% of South Africa's schools have internet access. According to Davis (2019:1), ICT skills are important for teachers. Tao (2009:66) claims that in an era of educational reform, teachers' professional development in the use and application of technology is the most crucial factor in determining how well students perform. ICT training for teachers is especially needed in South African developing communities. Rural areas face unique challenges in the areas of empowerment, sustainability, contextualisation and lifelong learning. Gupta, Dasgupta and Gupta (2008:140) list deteriorating rural infrastructure, subpar education, ineffective telecommunications links and poor governance as the main problems confronting developing countries.

According to Kimmel (2005:14), the cellphone has taken the lead in how people are reimagining the world. The Global Technology Forum (2007:1) reports that both adults and children use cellphones regularly in South Africa, where their usage has undoubtedly increased quickly. A cellphone is now considered a necessity, despite once being thought of as a luxury item. According to Kimmel (2005:1), text messaging is the fastest-growing form of current communication and is accessible almost everywhere, at any time and in any location. In South Africa, 83% of the population currently has access to a cellphone (Ramburn & Van Belle, 2011:1). For marketing and advertising purposes, this makes it a very appealing medium. Multimedia messaging service (MMS)

advertising is experiencing tremendous growth; response rates typically range from 10% to 25% and unsubscribe rates are frequently less than 1%.

Dunlop (2012) contends that cellphones should not be viewed negatively or as a curse, but rather as a chance to advance learning and exploration. Banning cellphones would be counterproductive because they can be dangerous if misused. Dunlop (2012:1) states that students' ability to teach and learn is improved by using cellphones in the classroom. The Learning Academy Worldwide (2012:1), a non-profit organisation with offices in the USA, Sweden and South Africa, sends cellphones to South African schools to support projects aimed at raising students' literacy and social-emotional levels. The M-Ubuntu project implements the Zulu concept of Ubuntu, which can be translated as "I am what I am because of who we all are". Teachers receive training and mobile learning laboratories using inexpensive recycled smartphones are installed in classrooms. Students can create final products using interviews, photos and written narration while using their handheld computers to access various reading and learning materials for free for students in South Africa, the Grade 12 examinations present a significant challenge. The M-Ubuntu project gives students access to practise problems and extra instruction. While M-Ubuntu allows teachers to distribute free electronic texts to students' smartphones, many African classrooms lack the necessary teaching resources. The classroom is transformed into a cutting-edge learning laboratory by the addition of educational videos and audio programmes.

However, there are difficulties faced by stakeholders, such as lack of sufficient funding to purchase cellphones, tablets and laptops for use in schools. Most of them rely on supporters, sponsors and donors. Additionally, most schools lack security, particularly those in rural areas and some have fallen victim to thieves who steal these essential devices intended to improve lives and raise a better generation for the future. Because most of these resources are limited and must be shared between students and grades, not every learner can use them to their fullest potential in enhancing education.

2.6.2 Visual communication and Web 2.0

Many teaching aids have been improved by Web 2.0 so that they are now digitalised and visually interactive. Learners can interact with a wealth of information through visual communication on Web 2.0. To assist educators in using a blended approach, there are numerous web applications available. Alger (2011:1) described DoInk as a program that offers an online vector editor so users can express their creativity through animated drawings. Using pre-existing drawings, users of this application can create their own animations. The user does not need to be an accomplished artist to use the App. The ability to share animations through various social media platforms is made possible by several other Web 2.0 tools, including this one. Blackboard is another program that can effortlessly connect with various Web 2.0 tools and improve visual communication in the classroom through liquid-crystal display (LCD) projectors. Various tools and resources are available to teachers in the classroom today (Blackboard, 2010:1). Interactive software, digital imaging, audio and video editing software, on-demand video libraries, computers with LCD projectors and Web 2.0 tools are a few examples. With this new learning technology, the number is constantly increasing and the classroom becomes interactive.

Making connections, determining importance, synthesising information, evaluating information and offering criticism are all skills that can be learned through visual literacy (Frey & Fisher, 2008:1). Learners' comprehension is improved when visual literacy is connected to textual literacy. Teaching effective communication is the ultimate goal of education. Teachers should express their thoughts intelligibly and interpret the data they receive from others. Noting that messages are fabricated representations of social reality is important. Van Wyk (2011:117) defines cartoons as standalone illustrations, whether they have captions, and brief comic strip formats with the potential to be helpful. According to Van Wyk (2011:117), all students, regardless of their age or background, can respond in some way to the point being made when it is visually presented. According to Top Ten (2012:1), when adults see children watching cartoons with their mouths open, several memories from their own childhood come flooding back.

In the same way that they watched and relished cartoons when they were younger. Children attempt to imitate and behave like their favourite cartoon characters, which is a crucial fact that animation studios should consider. Indeed, a significant factor influencing a child's later behaviour is what they prefer in their early years.

Numerous psychologists contend that a person's childhood development has a lasting effect on their entire life. Therefore, parents should ensure that their children watch the appropriate cartoons that are best suited to their age and psyche. According to Lochrie (1992:8-9), the only way to introduce a humorous element when appropriate without detracting from the purpose of the teaching situation is through the careful selection and use of pertinent and appropriate cartoons. A well-known children's cartoon in 2012 was Garfield, a long-running cartoon character. The design of the script, which was made particularly for children, is what makes this cartoon unique. The issues with homework and school that kids face in real life are the main subject of this cartoon. The fact that images are stored in long-term memory is probably the most compelling argument in favour of using images in instruction, aside from addressing contemporary issues affecting children.

People are more likely to remember someone by their face than by their name (Frey & Fisher, 2008:11). Cartoons increase the variety of pedagogical strategies available to teachers (Behrendt *et al.*, 2001:138). They give students various visual alternatives to traditional concepts. They mainly aid in classroom instruction and learning. These comics can be used to start conversations, inspire research and increase learner engagement and motivation. Cartoons are effective for eliciting understanding and can help with learning assessment. The use of cartoons as a teaching tool, according to Van Wyk (2011:1), can promote positive learning, cooperative and collaborative learning among peers, and can be used to initiate class discussions and debates and to promote "critical thinking," which is a deeper level of engagement with issues. The processes that people use reflective thinking to gather, interpret and evaluate data to form an informed opinion or judgement are referred to as "critical thinking" (Van Wyk, 2011:1). According to Van Wyk (2011:1), by examining how visual texts, such as cartoons for

economics, influence people's feelings, attitudes and values, people's capacity to recognise and potentially challenge dominant discourses are improved. According to Van Wyk's (2011:1) research, cartoons help students develop their creativity, interpersonal relationships and communication skills.

2.6.3 Digital divide effects on Web 2.0 learning

The gap between the rich and the poor is wide across the globe (Kimmel, 2005:11). However, because of technological advancements and the growth of the internet, this is currently visible in real time. Those with access to ICT have benefited and got ahead of those without it. The term "digital divide" refers to the widening chasm between those who can access technology and those who cannot. Supporters of the Telecommunications Action Group (TAG) argue, as was noted by the Global Technology Forum in 2007, that South Africa's economic prospects are being negatively impacted by the high costs of internet bandwidth and telecommunications services. They either lack the ability to operate effectively or the motivation to make investments. South Africa's costs for broadband internet access are among the most expensive in the world, even when measured against other African countries such as Morocco, Egypt, Botswana and Mozambique. This may be explained by the nation's still-rising internet penetration. Additionally, government telecommunication policies should be reviewed in this regard to accommodate the underprivileged as South Africa is largely an unequal society and the higher-income groups can obtain better deals by purchasing in bulk as opposed to the lower income-bracket groups (Global Technology Forum, 2007:1).

2.6.4 Classrooms in the poorer areas

The conventional classroom setting may have been effective in the past and may have produced some excellent results. New knowledge and experience have broadened the scope of education and given rise to new teaching strategies. Some classrooms have hardly changed while education has expanded and evolved. It is necessary to redesign and transform classrooms into augmented learning spaces. The provinces with former homelands, such as the Eastern Cape and Limpopo, continue to be the worst-affected

by "multiple deprivation". This can be attributed to their geographic size and the lower amounts of money budgeted for constructing new schools and improving the infrastructure of existing ones (Pease, 2012:1). South Africa's underprivileged children have been let down by the country's health and educational systems. Pease (2012:1) states that by the age of eight, schoolchildren from the 20% of South Africa's population that are considered the richest, are already performing noticeably better than children from lower socioeconomic backgrounds who attend underfunded, dysfunctional schools.

2.7 ICT integration in schools in South Africa

All South African schools should have access to ICT and the necessary infrastructure, according to the country's 2004 White Paper on e-Education (DoE, 2004:1-13). The currently available literature describes this issue in detail and emphasises the need for significant funding to conduct the ICT in education project (DoE, 2004:1-13). The Department of Education (2004:1-13) contend that the use of ICT and, consequently, digital content in the classroom could be very beneficial for South Africa, similar to other developing countries; this is a worthwhile endeavour. There are more ICT devices available, but only a few grades or levels are given priority. According to Hart and Laher (2015:35), in many South African schools, there are currently more computers than students. Technical support for teachers in schools is also essential for the effective implementation of technology in the classroom (Chikasa, Ntuli & Sundarjee, 2014:137). The Khanya Project in the Western Cape and the Gauteng Online Project in Gauteng, both of which were provincial ICT in schools implementation projects that began in 2001, are two well-known ICT-related projects that South Africa has launched over the years (Isaacs, 2007:15). South Africa has implemented ICT policies and initiatives that cover everything from hardware to teacher preparation.

Notable is the support for e-books and ICT integration from other South African institutions that are not connected to the government. The Institute for Technology Strategy and Innovation and the South African Broadcasting Corporation (SABC) Education have launched an online library with more than 350,000 books; 45,000 of

which are free e-books (ITSI). These books consist of reference materials and academic works used in the CAPS3 curriculum (MyPR, 2019). In South Africa, the 16-year-old Pick n Pay School Club is a significant and cutting-edge public-private educational endeavour. It uses funding from the private sector to provide 3,025 schools with access to educational resources (Pick n Pay School Club, n.d.). Snapplify announced a plan in 2020 to help students during the Covid-19 shutdown by providing them with free, temporary access to digital books and other resources (Snapplify, 2020:1); the list of available content includes educational resources for the CAPS curriculum. It would be impossible to list all of the initiatives that have since been introduced as a result of Covid-19 that are similar to this one.

2.7.1 Electronic textbooks (e-books)

Basic and enhanced versions of electronic books are the two main categories (Engbrecht, 2018:6-10). The former are digitalised versions of paper-based textbooks that may have interactive features and tools, in contrast to the latter, which give the reader a more interactive reading experience and include features such as customising tools, hyperlinks, and links to videos and podcasts (Choppin, Carson, Borys, Cerosaletti & Gillis, 2014:11; Dobler, 2015:482). Some enhanced e-books also feature animations, music, sound effects, audio narration, dictionary features, note-sharing options, "discussion boards," where students can discuss the content of the e-book, and formative assessment features, whereby students receive immediate feedback on activities completed (Rockinson-Szapkiw, Courduff, Carter & Bennett, 2013:259; Choppin et al., 2014:11).

Enhanced e-books, which recognise reading difficulty and streamline the text for readers who have trouble understanding or reading the text, now include adaptive e-books (Dingli & Cachia, 2014:14). Another type of enhanced e-book is a "gamebook," which is a digital book with extra features. Through exercises, edu-games, trophies, badges, and leaderboards, gamification – the practice of integrating gaming mechanics into non-game activities – is used to encourage students to engage in learning in these books (Bidarra, Figueiredo & Natálio, 2015:24; Li & Chu, 2021:160). Implementing all

these new innovations may seem appealing, but research has shown that teachers are reluctant to do so because they do not want to alter their current teaching strategies (Bidarra, Figueiredo & Natálio, 2015:24). According to them, the benefits are transient and short-lived, and playing games or using social media during class is a waste of time (Li & Chu, 2021:160; Msiza, Malatji & Mphahlele, 2020:300).

The use of created and authorised paper-based textbooks was mandated by curriculum regulations in the past (Al-Mashaqbeth & Al Shurman, 2015:188). Electronic books used in educational settings are similarly evaluated and endorsed (Amornkitpinyo & Piriyasurawong, 2015:68). Physical and digital book purchases frequently follow similar procedures. E-books have the advantage of being downloaded or installed from a distance, speeding up delivery. The benefits are as follows (Fojtik, 2015:744): Easier distribution and purchase, straightforward backup and storage, the ability to change the font size, add text to multimedia, read on different devices and the capacity for multiple devices should all be features of electronic books.

2.7.2 Obstacles to using electronic textbooks (e-books)

The use of e-books is hindered by a number of issues. For instance, not every book that appears in printed textbook catalogues is currently available online (Al-Suqri, 2014:276; GDE, 2014:1). Some e-books can only be accessed with the purchase and yearly renewal of a license (Birdsong, Chen, Tseng & Victorino, 2015:64). Pierard, Svihla, Clement & Fazio (2019:1) identified 11 barriers to the adoption of e-books in a study with master's level instructional design students in the USA, with the main ones being that they are difficult to navigate, print, or download and have a difficult user interface. Other difficulties included being exhausting (for example, causing eyestrain), difficult to access (for instance, requiring login, taking a long time to check e-books in and out), annoying, encountering error messages, encountering session timeouts, not supporting device syncing, uncomfortable when reading electronically, and not supporting reading offline. According to Marques de Oliveira's (2012:536-560) research, eyestrain is another obstacle to the adoption of e-books. Obstacles include a lack of understanding of electronic books and reluctance to use them as research tools (Wang & Bai,

2016:247). Al-Suqri (2014:276) used the technology acceptance model (TAM) to examine how faculty at a non-Western university reacted to using e-books and found that most of them are in English, which creates a barrier in terms of language (for many of these staff members, Arabic is their first language).

In addition to technical issues, internet outages, the inconvenience of transporting a device, lack of computer skills, and the inconvenience of carrying a device. Al-Suqri (2014:276) discusses additional challenges such as the need for training to use e-book platforms. There are some specific difficulties with displaying e-books in library catalogs, such as the lack of standardisation, the difficulty adding and removing titles, and the generally subpar quality of vendor-supplied records (Zhang & Niu, 2016:212). Another obstacle that prevents libraries from ever purchasing e-books in the first place is the fact that e-books will eventually disappear if a library chooses not to buy them after a certain period (Thomas & Chilton, 2016:259). Technical obstacles, such as "restrictions on licence agreements, different purchasing models, inconsistent platforms and licensing agreements," make it more difficult for libraries to share electronic books between them (Zhu, 2018:343).

In conclusion, long-term learner satisfaction will be ensured by the implementation of e-learning and Web 2.0, although this will necessitate initial staff training and ongoing professional development. E-learning initiatives in Africa can undoubtedly benefit from mobile learning. Computers and portable electronics such as smartphones, tablets and iPads are frequently absent from African schools. Therefore, mobile learning devices can be used to create e-learning opportunities. Students can work outside of the typical classroom environment with the help of these tools. The use of cartoons and the incorporation of technology will create a dynamic learning environment that will encourage contextualised, small groups and constructive learning. If the implementation of technology in schools is successfully managed, South Africans will not only benefit locally but also contribute significantly to the global economy.

2.8 Limitations of the study

This study has the following limitations, which will open up the field for additional investigation in the future:

- Only a narrow geographical area (the Free State) and a relatively small sample (20 schools) will be included in the study, limiting the scope of responses.
- Another element that can limit a study is time constraints. Because the data will only be collected once, the results obtained may not be generalisable to a broad extent.

From what precedes, the findings of this study may not apply to all of South Africa's existing high schools.

2.9 Conclusion

This chapter gave a historical overview of South Africa's digitalisation. The management of South African schools and their importance in the adoption and sustainability of digital technologies were discussed. Additionally, the policies and regulations that affect digitalisation in schools in South Africa were highlighted. The background information provided in this chapter lays the foundation for understanding the contextualisation of digitalisation and its complexity in implementing digitalisation policies in South Africa. Discussions also included the difficulties and opportunities for digitalisation in South Africa, particularly in rural high schools. Pertinent studies and a summary of the research on South Africa's best practices for using digital technology were also presented in this chapter.

There are challenges encountered by stakeholders, such as lack of sufficient funding to purchase cellphones, tablets and laptops for use in schools. Most of them rely on supporters, sponsors and donors. Furthermore, most schools lack security, particularly those in rural areas and some have fallen victim to thieves who steal these vital devices intended to improve lives and raise a better generation for the future. Because most of these resources are limited and must be shared between students and grades, not

every learner can use them to their fullest potential in enhancing education. However, the expanding ICT infrastructure in South Africa, along with the accessibility of tablets and smartphones for students to use for their studies, and the online learning opportunities made available by the extra lessons in Zoom and on SABC Education present enormous opportunities for enhancing high school education.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the research methodology used in this study. The study's strategy is outlined in this chapter, along with details on how the goals and research questions were met. Research is primarily concerned with methodological investigation. The goal is to work on problems. To find solid solutions to problems, research involves gathering, analysing and interpreting data. The design of an exploratory study depends on the details of the issue being studied. The investigation's body of literature underwent a thorough analysis. By examining particular existing records, researchers can conduct in-depth research (Rao, 2008:1).

3.2 Research questions and research objectives

Below is a summary of the research problem, aim, questions and objectives.

3.2.1 Problem statement, aim and objectives

The foundation of research is an appropriate research question, which is crucial in answering the questions, identifying the issue to be studied and guiding the methodology (Ratan, Anand & Ratan, 2019:15). This study was guided by the following research goals and objectives.

3.2.1.1 Problem statement

Although significant efforts have been made to advance the use of digitalisation in South African schools, regrettably, many rural schools continue to be excluded (Dzansi & Amedzo, 2014:342). Additionally, Yehya (2021:2) adds that investing in technology infrastructure and systems is necessary because digitalising education addresses some fresh technical issues, such as software, virus attacks and data protection.

3.2.1.3 Study's research questions

The following research questions are generated based on the study's aim and objectives:

1. What are the issues that stakeholders encounter in the implementation and use of digital platforms in high schools?
2. What opportunities exist for high school children to effectively use digital platforms?

3.2.1.4 Research aim and objectives

This study aims to determine the benefits and drawbacks of using digital technology in high school instruction. Thus, it seeks:

1. To identify the issues that stakeholders encounter in the implementation and use of digital platforms in high schools.
2. To discover the opportunities available for high school children that allow them to effectively use digital platforms.

3.3 Research design and methodology

A well-defined research design, according to Kumar (2019:46), is a general research design that serves as the road map for researchers to follow as they embark on their research journey to uncover answers to research questions as cautiously, accurately, precisely and genuinely as possible to produce reliable results. The research design incorporates the researcher's insights and prevents dissatisfaction by tying the study together with a systematic approach that demonstrates how all of the major components of the study work together to address the research questions. Its goal is to offer an appropriate basis for research (Sileyew, 2019:2).

Various research designs can be used depending on the kinds of processes and related phenomena being studied, as well as the objectives and anticipated results. These designs include experimental research, hypothesis testing, exploratory research, analytical or explanatory research and descriptive research. This study used a descriptive research design. This was chosen because the goal of this study is to identify traits, occurrences, patterns and categories involved in the opportunities and challenges of digitalisation in high school learning in the Free State. Additionally, it enables the researcher to examine and analyse the distribution of one or more variables without considering any potential causal or other hypotheses. Descriptive research, according to Rebmann (2020:1), is an approach that explains the characteristics of the population or phenomenon under study. Additionally, tools for observation and survey data collection are frequently used because this research is more interested in what happened than in how or why it occurred (Nassaji, 2015:129).

3.3.1 Research philosophy

Saunders *et al.* (2016:135) distinguish four major philosophies in business and management, namely, postpositivism, transformative, interpretivism and pragmatism. This study is grounded in the postpositivist philosophy. McGlinchey (2022:1) states that postpositivism seeks objective conclusions by striving to understand and deal with limitations and biases in ideas and knowledge developed by researchers. It is related to quantitative approaches that allow for the identification of causal associations based on the premise of a cause-effect relationship between two variables and its common methods include statistical analysis and experimentation (Bonache & Festing, 2020:105).

Furthermore, this study uses the postpositivism philosophy because the acquired knowledge using a postpositivist perspective is based on meticulous observation and numerical assessment of external truth when analysing individuals' behaviour (Creswell & Creswell, 2017:7). For instance, this study seeks to investigate the opportunities and challenges of digitalisation in high school learning. The nature of reality is defined from

an objective perspective. Ontologically, postpositivists believe that truth is a reality that exists, and it is made up of stable pre-existing rules or patterns that may be uncovered. Moreover, truth is not limited to a specific time or context (Aliyu, Singhry, Adamu & Abubakar, 2015:3).

The findings of this study will therefore have some general applicability given objectivist ontology. Epistemologically, postpositivists advocate that knowledge is accurate, certain, systematic and probabilistic as it applies to many individuals, or to various situations (Aliyu *et al.*, 2015:5). Knowledge of digitalisation's challenges and opportunities in high school learning will be uncovered in this study by collecting data from a wide group of teaching staff in a structured way. Regarding axiology, post-positivists argue that absolute objectivity is impossible to attain, but that it can be approached (Okesina, 2020:57). Consequently, the conclusions will be based on the answers of most participants.

3.3.2 Research approach

According to Creswell (2014:31), study approaches are strategies for conducting research that cover everything from broad hypotheses to methodologically specific information gathering, analysis and interpretation. Research can be categorised into three categories: mixed-method, qualitative and quantitative (Mohajan, 2020:50). The quantitative research approach entails quantifying and analysing variables to produce results. It involves using and analysing numerical data using specific statistical techniques to conclude.

The research used a quantitative method. This method was chosen because statistical data can be used to reduce the amount of time and resources spent by the researcher describing and analysing the results. It is used to facilitate the quantification of data, allowing for the extrapolation of findings from a sample to the entire population of interest as well as the assessment of the predominance of various viewpoints and opinions in a specific sample (Mohajan, 2020:50).

Compared to the theory of testing, which is static, structured and focused on generalisation; quantitative research methods apply numbers and depend on the researcher's perspective. This strategy depends on solid, reliable data (Nardi, 2018:18; Walliman, 2018:131). To clarify, predict and guide phenomena, it is also used to challenge the relationships between measured variables. The goal is to establish generalisations and to validate or approve relationships (Leedy, Ormrod & Johnson, 2019:90).

According to Salkind (2017:173), quantitative studies are more empirical tests of a hypothesis and are context-free, objective and unbiased. Additionally, valid and reliable measurement techniques that use statistical analysis are required for qualitative studies (Salkind, 2017:173).

3.3.3 Research instrument

A tool must be dependable to deliver consistent results (Patten & Newhart, 2018:136). Therefore, this study used a questionnaire. Descriptive studies use a generalisable survey tool with quantitative 5-point Likert scale questions appropriate for the study (Fouche, Strydom & Roestenburg, 2021:161). The data required to complete the objectives of this study was gathered using a questionnaire.

There are three sections in this questionnaire: Section A consists of demographic information; Section B evaluates the opportunities of digitalisation through a 5-point Likert scale (1 represented strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree) and Section C measures the challenges of digitalisation through a 5-point Likert scale (1 represented strongly disagree, 2 disagree, 3 neutral, 4 agree and 5 strongly agree).

A questionnaire is also preferred because it is simple and quick to distribute in a population, saving valuable research time and producing significant samples to get a first understanding of the opportunities and challenges of digitisation in high school learning in the Free State.

3.4 Population

All individuals who meet a set of requirements or standards are referred to as the population (Datta, 2018: 1). This study focuses on 20 Free State public and private high school teaching staff. It consists of N=1200, 1200 academic teaching staff with approximately 50 staff per school. This is due to the researcher's expectation for this study, which was met, being that the questionnaires would be distributed to at least 10% of the population. The results can be applied to the entire population of the Free State province because this number is representative of the general population.

When conducting quantitative research, a representative sample should be used (Pascoe, 2019:135). A representative sample reflects the traits of a larger population. Before the questionnaire was made public, a pilot study was conducted. The effectiveness and calibre of the survey tool must, therefore, be improved through a pilot study, which should be conducted on a smaller scale.

3.5 Sampling

3.5.1 Sample method

The definition of sampling is taking any portion of a population as a representative of that population. A sample is a representative group of the target audience drawn fairly from the entire population. A reasonable sample size is necessary for a study to be valid and tenable. Sampling is a crucial component of research because it allows for various conclusions to be made, depending on who is conducting the study. To clarify the goal of this pertinent study, a purposive sample is intended (Cameron, 2018).

Consequently, this study used a purposive sample. The sample should be carefully chosen to represent the target population. After selecting a sample, a researcher should decide how and with whom to distribute questionnaires. Mkhabele (2018:237) suggested using a sample size of no less than five to twenty-five in-depth interviews.

3.5.2 Sampling frame

A sampling frame is an exhaustive list of the components from which a sample is derived. In the sample frame, every component of the population is displayed (Taherdoost, 2016:20). Therefore, the DBE database was used to obtain a list of high schools in the Free State.

3.5.3 Sample size

A sample is a selection made from a population that is significantly smaller than the population for a study. To minimise sampling error, it is crucial to choose an appropriate sample size (Oribhabor & Anyanwu, 2019:48). A sample was obtained using the historical method.

In this study, 200 academic staff members were selected as a sample based on the studies of Yehya (2021:1-10), Picciano (2017:166-190) and Isah and Ojetunde (2019:1). The male and female academic staff in this sample included Headmasters and Principals, Deputy Heads and Deputy Principals, HoDs, Grade Heads and educators (teachers and assistant teachers) from both public and private high schools in the Free State. A sample of 200 people was selected, with ten staff members from each school serving as the target population to ensure that the results could be generalised to the population. This is due to the researcher's expectation for this study, which was met, being that the questionnaires would be distributed to at least 10% of the population. There are over 3 000 schools in the Free State (DoE, 2014:1).

The target population was a sample of 200 people, with ten staff members per school, to ensure that the results could be generalised to the entire population. The non-teaching staff members who run the school and do the behind-the-scenes work, such as the administrators, sports team, grounds crew and kitchen staff, were excluded from this study.

3.6 Data collection instrument

Statistically significant data analysis, experiments, questionnaires that typically use Likert-type scales and texts with quantitative coding are examples of quantitative features. The most typical way to collect data for quantitative research is through a survey (Bonache & Festing, 2020:108). Surveys are snapshots of events, circumstances, or viewpoints at a particular time (Chege & Otieno, 2020:34).

Surveys are conducted to measure the characteristics of populations using statistical techniques. They combine a planned questionnaire with a scientific sampling procedure. To collect information from participants regarding digitalisation, this study used structured questionnaires. This method of data collection was chosen because, according to Asenahabi (2019:79), it provides a numerical description of the attitudes, viewpoints, or tendencies of a population based on a sample of that population. With the aid of this technique, researchers can gather much data, typically in the form of statistics from several people quickly (Asenahabi, 2019:79). Covid-19 pandemic resulted in the sending and gathering of questionnaires online.

3.7 Data coding and analysis

The quantitative research approach gathers data and analyses it with a focus on numbers and figures. The organisation and entry of the data into a computer-readable file is the first step in statistical analysis. Coding is the term used to describe it. Coding, according to Theron (2015:4), is the vital link between data collection and data analysis. A code is a descriptive construct developed by a researcher to capture the essence or main idea of the data (Theron, 2015:4).

Before gathering information from study participants, the questionnaire was pre-coded. Mathematical and statistical methods are used to gather data, analyse it and generalise the findings to the research population. These methods can be either experimental or nonexperimental (Asenahabi, 2019:79). The appropriate statistics vary based on the data and topic under investigation and are tools that help researchers analyse and

interpret the results of research projects (Chege & Otieno, 2020:35). The statistical package for social science (SPSS) version 27.0 was used as the data analysis program (Chege & Otieno, 2020:35).

There are two different types of data analysis: descriptive and inferential statistics. To summarise or present information in a quantitative format that is understandable, descriptive statistics are a type of quantitative data analysis (James & Simister, 2020:1). In this study, descriptive statistics are used to establish the foundation for the quantification-related justification. They aided in identifying and outlining the challenges and opportunities related to digitalisation. Both the descriptive statistics and the research instrument's validity were determined. Confirmatory factor analysis (CFA) was conducted as part of the exploratory data analysis for this investigation.

Data was analysed statistically, and interpretations and conclusions were drawn. Data analysis, knowledge creation from raw data and dissemination of research results using fundamental descriptive statistics are all tasks that fall under the purview of the researcher (Davis, 2019:75). To provide meaningful insights into this study, graphical representations of figures and tables, such as pie charts, were used.

3.8 Validity and reliability

3.8.1 Validity

These aspects primarily determine a study's credibility and academic value. The ability of a method to effectively probe and/or evaluate what it is meant to probe and/or evaluate is a key component of validity. According to Taylor, Sinha and Ghoshal (2006:1), differences in results between people, groups, or organisations may be interpreted as real variations in the characteristics being studied if a method is thought to be valid. Four essential methods are employed to evaluate the validity of a study: face, content, predictive and construct validity.

In this study, construct validity was used. According to Taylor, Sinha and Ghoshal (2006:1), this strategy's primary objective is to assess the degree of correlation between

the pertinent variable and other variables for which the researcher can forecast the level of correlation based on suitable theoretical justifications. To ensure that the study's participants provided accurate information while keeping in mind the research questions and objectives, this was taken into account when the questionnaire was designed and the interviews were conducted.

3.8.2 Reliability

According to Taylor, Sinha and Ghoshal (2006:1), this criterion relates to the consistency of the data obtained after using a particular research method. If a measure's results are consistent when it is used repeatedly under the same conditions (by different researchers, for example), it is thought to be reliable. The test-retest strategy, which involves accurately replicating the original study, is a method for assessing reliability, as this definition implies.

3.9 Ethical considerations

The following aspects were observed:

- A cover letter outlining the purpose of the study for the respondents was included with the questionnaire.
- To avoid plagiarism, proper referencing procedures (Harvard method) were used. Therefore, whenever the researcher refers to previous work, an appropriate acknowledgement has been achieved through source recognition (in-text referencing and reference list).
- Participants were allowed to sign an informed consent form before participating in this study. This was written in an easy-to-understand language for the participants. They had adequate time to think about participating in this study. They were notified of their right to withdraw from the study at any time during it.
- The right to privacy of the participants was protected by ensuring that the questionnaires were anonymous. They excluded the participants' names or any

other personal information that could identify them. Therefore, to preserve the respondents' identities, the term respondent or participant was used for the study.

- The information gathered was kept private because respondents' identities and data were not be shared with anyone else and were only be used for the study.
- Before collecting data, permission to conduct the study was requested from the school administration. The surveyed schools provided written authorisation or clearance.
- The researcher was honest in handling participants' responses using statistical tools and analyses to handle the data acquired.
- The participants were not subjected to any physical or mental trauma.
- The researcher guarantees that no facts are misrepresented to deceive readers with the findings. The interpretation of the researcher shall be objective and only based on the findings.

3.9.1 Participants' rights

The participant's right to withdraw at any time was made clear to them by the researcher, who made no attempt to persuade them otherwise. Therefore, participation is voluntarily made, which is a component of autonomy (Gaudet & Robert, 2018:130; Nardi, 2018:42).

3.9.2 Informed consent

A fundamental rule of social research ethics requires that participants receive the information they should make an informed decision about taking part in the study (Patten & Newhart, 2018:35). By including an introduction page in the survey, the researcher could obtain participants' informed consent. To proceed with filling out the questionnaire, participants had to read the entire document and acknowledge their understanding of it.

3.9.3 Confidentiality and anonymity

The researcher gave each participant a guarantee of privacy through the concept of non-maleficence (Nardi, 2018:38). No participant's information was identified or disclosed in this study.

3.10 Conclusion

This chapter examined the quantitative approach used in the research design and methodology. The steps for data collection and analysis were laid out. Both the population and sample size of the study were specified. Furthermore, the ethical issues surrounding the research were discussed. The most crucial research tool for gathering data is a questionnaire, which was used to accomplish the study's goals. The data was analysed using SPSS. Chapter 4 deals with the empirical data from the questionnaires that the selected participants filled out.

CHAPTER 4

RESULTS AND FINDINGS

4.1 Introduction

This chapter presents the analysis using tables. The goal of this chapter is to examine and clarify the findings of the literature review and the self-administered questionnaires. The purpose of this study was to identify the issues that stakeholders encounter in the implementation and use of digital platforms in high schools and to discover the opportunities available for high school learners that allow them to effectively use digital platforms. The statistical software for the social sciences, SPSS version 27.0, was used for the analyses.

4.2 Significant findings on employee demographics

4.2.1 Gender

The biographical details of the participants are the main subject of this section. According to the findings regarding gender, as shown in Table 2, women made up most of the respondents (53.3%) compared to men (46.7%).

Table 2: Gender

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Male	100	46.7	46.7	46.7
	Female	114	53.3	53.3	100.0
	Total	214	100.0	100.0	

4.2.2 Age

In terms of age, respondents under 30 made up the largest age group (31.0%), followed by those between the ages of 30 and 39 (30.5%), between the ages of 50 and 59 (24.9%), between the ages of 40 and 49 (10.3%) and respondents aged 60 and above (3.3%). These are depicted in Table 3.

Table 3: Age group

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Under 30 years	66	30.8	31.0	31.0
	30 - 39 years	65	30.4	30.5	61.5
	40 - 49 years	22	10.3	10.3	71.8
	50 - 59 years	53	24.8	24.9	96.7
	60 years or older	7	3.3	3.3	100.0
	Total	213	99.5	100.0	
Missing	6	1	.5		
Total		214	100.0		

4.2.3 Level of education

According to the study's findings regarding educational attainment, shown in Table 4, most respondents (60.1%) had bachelor's degrees, while 29.6% had a postgraduate degree. Additionally, respondents with diplomas (6.6%) and those with certificates (3.8%) were surveyed. According to Tao (2009:66), the most important factor in determining how well students perform in an era of educational reform is teachers' professional development in the use and application of technology. As most educators held a bachelor's degree, this is in line with the findings.

Table 4: Level of education

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Certificate	8	3.7	3.8	3.8
	Diploma	14	6.5	6.6	10.3
	Bachelor's Degree	128	59.8	60.1	70.4
	Postgraduate Degree	63	29.4	29.6	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.2.4 Current position

In terms of their current positions, depicted in Table 5, most of the respondents were educators (teachers and assistant teachers) – 74.3%. Grade heads consisted of 9.8%, Heads of Departments (HoDs) comprised 8.4%, Principals/headmasters consisted of 4.2% and 3.3% of the respondents were deputy principals/deputy heads. Some of the well-known management processes that are used to achieve the objectives of the organisation using human, financial and physical resources include planning, staffing, organising, leading, and controlling people, goals, and resources (Sy & D'Annunzio, 2005:39-48). Given that a sizable portion of the respondents hold managerial positions, this emphasises the significance of strong school management for the sustainability of ICT technology implementation and digitalisation in South African high schools.

Table 5: Current position

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Principal/headmaster	9	4.2	4.2	4.2
	Deputy principal/Deputy Heads	7	3.3	3.3	7.5
	Heads of departments	18	8.4	8.4	15.9
	Grade Heads	21	9.8	9.8	25.7
	Educators (teachers and assistant teachers)	159	74.3	74.3	100.0
	Total	214	100.0	100.0	

4.2.5 Work experience in the current position

Most respondents (32.1%) had less than five years of work experience in their current position. Respondents who had worked for more than 20 years represented (25.8%). 24.9% of the respondents had worked between six and ten years in their current position. This was followed by those who had worked between 11-15 years (9.1%) and those who had worked for between 16-19 years (8.1%). This is represented in Table 6.

Table 6: Work experience in the current position

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Less than 5 years	67	31.3	32.1	32.1
	6 -10 years	52	24.3	24.9	56.9
	11 - 15 years	19	8.9	9.1	66.0
	16 – 19 years	17	7.9	8.1	74.2
	More than 20 years	54	25.2	25.8	100.0
	Total	209	97.7	100.0	
Missing	System	5	2.3		
Total		214	100.0		

4.3 Other findings

4.3.1 Digitalisation replaces traditional workflow with digital processes

Most of the respondents (38.7%) were neutral on the assertion that digitalisation replaces traditional workflow with digital processes. 33% of the respondents agreed with this assertion, with 16% strongly agreeing. 3.8% of respondents strongly disagreed, compared to 8.5% of respondents who agreed. This is depicted in Table 7.

Table 7: Digitalisation replaces traditional workflow with digital processes

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	8	3.7	3.8	3.8
	Disagree	18	8.4	8.5	12.3
	Neutral	82	38.3	38.7	50.9
	Agree	70	32.7	33.0	84.0
	Strongly Agree	34	15.9	16.0	100.0
	Total	212	99.1	100.0	
Missing	System	2	.9		
Total		214	100.0		

4.3.2 Instead of clinging to successes, the digital revolution makes it more time-consuming to research new development strategies

Most respondents (34.1%) had an unfavourable opinion of the claim that as society becomes more digital, less time is spent clinging to past successes and more time is spent researching new development strategies. 20.1% of respondents strongly agreed, whereas 25.7% agreed with this statement. 17.8% of respondents disagreed with this statement while 2.3% strongly disagreed. This is shown in Table 8.

Table 8: Digitalisation increases the time spent on researching a new development strategy instead of holding on to achievements

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	5	2.3	2.3	2.3
	Disagree	38	17.8	17.8	20.1
	Neutral	73	34.1	34.1	54.2
	Agree	55	25.7	25.7	79.9
	Strongly Agree	43	20.1	20.1	100.0
	Total	214	100.0	100.0	

4.3.3 Findings on digitalisation changing the modern and professional working models

At 39.3%, most respondents in the sample group agreed and strongly agreed that digitalisation was changing the contemporary and formal working model. 5.6% of respondents disagreed, 0.9% strongly disagreed and 15.0% were neutral. These are shown in Table 9.

Table 9: Digitalisation is changing the modern and professional working models

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	2	.9	.9	.9
	Disagree	12	5.6	5.6	6.5
	Neutral	32	15.0	15.0	21.5
	Agree	84	39.3	39.3	60.7
	Strongly Agree	84	39.3	39.3	100.0
	Total	214	100.0	100.0	

4.3.4 Findings on digitalisation constantly improving the work life of employees

A significant number of respondents (44.1%) strongly agreed that digitalisation constantly improves the work life of employees. 33.6% agreed with this statement. 3.8% of respondents disagreed with this assertion, while 15.5% were neutral. Table 10 highlights this.

Table 10: Digitalisation is constantly improving the work life of employees

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Disagree	8	3.7	3.8	3.8
	Neutral	33	15.4	15.5	19.2
	Agree	78	36.4	36.6	55.9
	Strongly Agree	94	43.9	44.1	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.3.5 Findings on digitalisation increases the workflow efficiency

Most respondents (43.2%) strongly concurred with the statement that digitisation increases workflow effectiveness. Furthermore, 42.7% supported this claim. 4.2% of respondents disagreed with this statement, while 9.9% of respondents were neutral. Table 11 illustrates this.

Table 11: Digitalisation increases the workflow efficiency

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Disagree	9	4.2	4.2	4.2
	Neutral	21	9.8	9.9	14.1
	Agree	91	42.5	42.7	56.8
	Strongly Agree	92	43.0	43.2	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.3.6 Findings on digitalisation minimise technical errors

Most of the respondents (31.8%) had a neutral opinion regarding the statement that digitalisation minimise technical errors. This statement was supported by 27% (agreed) and 28.4% (strongly agreed) of respondents. However, 10% and 2.8%, disagreed and strongly disagreed with this assertion, respectively. Table 12 illustrates this.

Table 12: Digitalisation minimise technical errors

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	6	2.8	2.8	2.8
	Disagree	21	9.8	10.0	12.8
	Neutral	67	31.3	31.8	44.5
	Agree	57	26.6	27.0	71.6
	Strongly Agree	60	28.0	28.4	100.0
	Total	211	98.6	100.0	
Missing	System	3	1.4		
Total		214	100.0		

4.3.7 Findings on digitalisation apply new services and technologies quickly and flexibly

A significant proportion of the respondents (48.6%) agreed that digitalisation applies new services and technologies quickly and flexibly. 36% strongly agreed with this statement. 2.8% of respondents disagreed with this statement, while 12.6% were undecided. This is depicted in Table 13.

Table 13: Digitalisation apply new services and technologies quickly and flexibly

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Disagree	6	2.8	2.8	2.8
	Neutral	27	12.6	12.6	15.4
	Agree	104	48.6	48.6	64.0
	Strongly Agree	77	36.0	36.0	100.0
	Total	214	100.0	100.0	

4.3.8 Findings on digitalisation improve work quality and performance

The statement that digitisation improves work quality and performance was accepted by more than half of respondents (50.9%). Additionally, 34% of the respondents agreed with this assertion. 13.2% were neutral, whereas 1.9% of the respondents disagreed with this assertion. This is displayed in Table 14.

Table 14: Digitalisation improve work quality and performance

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Disagree	4	1.9	1.9	1.9
	Neutral	28	13.1	13.2	15.1
	Agree	108	50.5	50.9	66.0
	Strongly Agree	72	33.6	34.0	100.0
	Total	212	99.1	100.0	
Missing	System	2	.9		
Total		214	100.0		

4.3.9 Findings on digitalisation constantly increasing learners' productivity

The findings on responses regarding digitalisation constantly increasing learners' productivity 29.9% of the respondents in the sample group were neutral regarding digitalisation constantly increasing learner's productivity. Digitalisation has, in fact, steadily increased student productivity, according to 28.5% of respondents, while 27.6% strongly agreed with this claim. 10.7% of those surveyed disagreed, with 3.3% strongly disagreeing, that digitalization has consistently improved student productivity. The literature review emphasised how ICTs have become so highly regarded in many societies that they now control our actions, plans, interactions, and way of life. They have an enormous impact on all aspects of our lives and have developed into essential tools for surviving in a contemporary, globally connected society (Amornkitpinyo & Piriyasurawong, 2015:68-71).

Although it is consistent with the results of the literature review, as the following excerpt demonstrates, some educators are reluctant to use technology in education: Despite the fact that adopting these new innovations may seem appealing, research has shown that teachers are reluctant to do so because they simply do not want to change their current teaching strategies; they believe the effects are fleeting and unsustainable (Li & Chu, 2021:160); and they believe students waste valuable class time by playing games or visiting social media sites (Msiza, Malatji & Mphahlele, 2020:300). Table 15 exhibits these.

Table 15: Digitalisation constantly increases learners' productivity

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	7	3.3	3.3	3.3
	Disagree	23	10.7	10.7	14.0
	Neutral	64	29.9	29.9	43.9
	Agree	61	28.5	28.5	72.4
	Strongly Agree	59	27.6	27.6	100.0
	Total	214	100.0	100.0	

4.3.10 Findings on schools having trained personnel in the workforce to work in the digital environment

Table 16 presents the results of these findings. The study found that most respondents (28.7%) agreed that South African schools lacked the workforce's necessary level of training for working in the digital environment. The aforementioned statement was strongly agreed with by 24.6% of the respondents, while 24.1% were undecided. 17.9% of those surveyed disagreed, whereas 4.6% of them strongly disagreed. The literature review found that technical support, or the technical assistance provided to teachers in schools is crucial for the successful use of technology in the classroom, is essential for the effective use of ICT in education (Chikasa, Ntuli & Sundarjee, 2014:137).

Table 16: The school is facing a lack of skills in the workforce to work in a digital environment

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	9	4.2	4.6	4.6
	Disagree	35	16.4	17.9	22.6
	Neutral	47	22.0	24.1	46.7
	Agree	56	26.2	28.7	75.4
	Strongly Agree	48	22.4	24.6	100.0
	Total	195	91.1	100.0	
Missing	System	19	8.9		
Total		214	100.0		

4.3.11 Findings on the perception that the school lacks a strong information technology foundation to successfully conduct digitalisation

The perception that the school lacks a solid information technology foundation to successfully implement digitalisation was shared by 29.6% of respondents, who strongly agreed with this statement. 19.7% of respondents disagreed, compared to 25.8% who agreed with this assessment. 8.9% of respondents strongly disagreed, compared to 16% who were neutral on the subject. Table 17 presents these results.

Table 17: The school lacks a strong information technology foundation to successfully conduct digitalisation

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	19	8.9	8.9	8.9
	Disagree	42	19.6	19.7	28.6
	Neutral	34	15.9	16.0	44.6
	Agree	55	25.7	25.8	70.4
	Strongly Agree	63	29.4	29.6	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.3.12 Findings on the perception that the school leaders lack digital thinking and knowledge

Most of the respondents (30.7%) had a neutral opinion on the perception that the school leaders lack digital thinking and knowledge. 28.3% of the respondents disagreed with this perception. However, 15.1% of the respondents agreed with this perception, with 14.2% strongly agreeing. 11.8% of the respondents strongly disagreed with this perception. These findings are displayed in Table 18.

Table 18: The school leaders lack digital thinking and knowledge

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	25	11.7	11.8	11.8
	Disagree	60	28.0	28.3	40.1
	Neutral	65	30.4	30.7	70.8
	Agree	32	15.0	15.1	85.8
	Strongly Agree	30	14.0	14.2	100.0
	Total	212	99.1	100.0	
Missing	System	2	.9		
Total		214	100.0		

4.3.13 Findings on the perception that the school staff lack digital thinking, knowledge and skills

33.5% of respondents disagreed with the statement that school staff lack digital skills, knowledge and thinking. 25.5% of people had no opinion. 19.3% of respondents agreed and 18.4% strongly agreed with this assessment. 3.3% of the respondents, however, strongly disagreed with this opinion. Table 19 highlights these outcomes.

Table 19: The school staff lacks digital thinking, knowledge and skills

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	7	3.3	3.3	3.3
	Disagree	71	33.2	33.5	36.8
	Neutral	54	25.2	25.5	62.3
	Agree	39	18.2	18.4	80.7
	Strongly Agree	41	19.2	19.3	100.0
	Total	212	99.1	100.0	
Missing	System	2	.9		
Total		214	100.0		

4.3.14 Findings on the perception that the most prominent challenge for school digitalisation is access to finance and limited skills in entrepreneurship

Most respondents (37.6%) concurred that lack of access to capital and inadequate entrepreneurial skills are the biggest obstacles to school digitalisation. 20.7% of respondents were neutral, while 35.7% agreed with this impression. However, 5.6% of the respondents disagreed and 5% of them strongly disagreed with this perception. Table 20 highlights these conclusions.

Table 20: The most prominent challenge for school digitalisation is access to finance and limited skills in entrepreneurship

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	1	.5	.5	.5
	Disagree	12	5.6	5.6	6.1
	Neutral	44	20.6	20.7	26.8
	Agree	80	37.4	37.6	64.3
	Strongly Agree	76	35.5	35.7	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.3.15 Findings on the perception that the school management is facing cultural changes as they have to adapt to adopt unfamiliar technologies

Most of the respondents (32.4%) strongly agreed that the school management is facing cultural changes as they have to adapt to adopt unfamiliar technologies. 28.6% agreed with this perception as well. 23.5% were neutral. However, 13.1% of the respondents disagreed and 2.3% strongly disagreed with this perception. These results are depicted in Table 21.

Table 21: The school management is facing cultural changes as they have to adapt to adopt unfamiliar technologies

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	5	2.3	2.3	2.3
	Disagree	28	13.1	13.1	15.5
	Neutral	50	23.4	23.5	39.0
	Agree	61	28.5	28.6	67.6
	Strongly Agree	69	32.2	32.4	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.3.16 Findings on the perception that the school’s staff is facing cultural changes as they have to adapt to adopt unfamiliar technologies

28.6% of the respondents were neutral on the perception that the school’s staff is facing cultural changes as they have to adapt to adopt unfamiliar technologies. 24.4% of respondents strongly agreed, and 27.7% agreed. 14.1% of the respondents, however, disagreed, and 5.2% strongly disagreed. These results are depicted in Table 22.

Table 22: The school’s staff is facing cultural changes as they have to adapt to adopt unfamiliar technologies

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	11	5.1	5.2	5.2
	Disagree	30	14.0	14.1	19.2
	Neutral	61	28.5	28.6	47.9
	Agree	59	27.6	27.7	75.6
	Strongly Agree	52	24.3	24.4	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.3.17 Findings on the idea that the introduction of digital technologies is causing a fundamental change in the way that the entire school is perceived

Regarding the idea that the entire school is undergoing a radical change as a result of the advancement of digital technologies, 32.4% of the respondents were neutral. 27.2% concurred with this opinion. 19.2% of those surveyed said they strongly agreed with this impression. 17.4%, however, disagreed with this perception, and 3.8% strongly disagreed. In Table 23, these outcomes are shown.

Table 23: The entire school is undergoing a radical change due to the advancement of digital technologies

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	8	3.7	3.8	3.8
	Disagree	37	17.3	17.4	21.1
	Neutral	69	32.2	32.4	53.5
	Agree	58	27.1	27.2	80.8
	Strongly Agree	41	19.2	19.2	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.3.18 Findings on the perception that the school is facing increased competition exacerbated by globalisation

The perception that the school is dealing with increased competition made worse by globalisation was shared by 36.6% of respondents. While 23.9% expressed no opinion, 23.5% strongly concurred. However, 14.1% of respondents disagreed and 1.9% strongly disagreed with this perception. Table 24 presents these findings.

Table 24: The school is facing increased competition exacerbated by globalisation

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	4	1.9	1.9	1.9
	Disagree	30	14.0	14.1	16.0
	Neutral	51	23.8	23.9	39.9
	Agree	78	36.4	36.6	76.5
	Strongly Agree	50	23.4	23.5	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.3.19 Findings on the perception that the school's management is facing the stress of moving digitally before others to survive and gain competitive benefits

Regarding the perception that the school's administration is under pressure to go digital before others to survive and benefit from competition, 29.6% of the respondents had a neutral opinion. 26.3% and 24.9% agreed and strongly agreed with this perception, respectively. However, 16.4% disagreed and 2.8% strongly agreed with this perception. These findings are displayed in Table 25.

Table 25: To survive and benefit from competition, the school's administration is under pressure to go digital before others

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	6	2.8	2.8	2.8
	Disagree	35	16.4	16.4	19.2
	Neutral	63	29.4	29.6	48.8
	Agree	56	26.2	26.3	75.1
	Strongly Agree	53	24.8	24.9	100.0
	Total	213	99.5	100.0	
Missing	System	1	.5		
Total		214	100.0		

4.4 Descriptive statistics

Table 26 highlights the descriptive statistics on digitalisation. The variables tested include, digitalisation:

- i. Increases the workflow efficiency, with a standard deviation of .800.
- ii. Is constantly improving the work life of employees, with a standard deviation of .840.
- iii. Applies new services and technologies quickly and flexibly, with a standard deviation of .754.

- iv. Improves work quality and performance, with a standard deviation of .722.
- v. Is changing the modern and professional working model, with a standard deviation of .919.
- vi. Minimise technical errors, with a standard deviation of 1.077.
- vii. Constantly increases learners' productivity, with a standard deviation of 1.092.
- viii. Replaces traditional workflow with digital processes, with a standard deviation of .986.
- ix. Increases the amount of time spent investigating potential new development strategies rather than clinging to successes, with a standard deviation of 1.072.

Table 26: Descriptive statistics on digitalisation

	N	Minimum	Maximum	Mean	Std. Deviation
5. Digitalisation increases the workflow efficiency	213	2	5	4.25	.800
4. Digitalisation is constantly improving the work life of employees	213	2	5	4.21	.840
7. Digitalisation applies new services and technologies quickly and flexibly	214	2	5	4.18	.754
8. Digitalisation improves work quality and performance	212	2	5	4.17	.722
3. Digitalisation is changing the modern and professional working model	214	1	5	4.10	.919
6. Digitalisation minimise technical errors	211	1	5	3.68	1.077
9. Digitalisation constantly increase learners' productivity	214	1	5	3.66	1.092
1. Digitalisation replaces traditional workflow with digital processes	212	1	5	3.49	.986
2. Digitalisation increases the time spent on researching a new development strategy instead of holding on to achievements	214	1	5	3.43	1.072
Valid N (list wise)	205				

Table 27 highlights the descriptive statistics of various statements regarding digitalisation. The variables tested include:

- i. Access to capital and a lack of entrepreneurship skills pose the biggest obstacles to school digitalisation, with a standard deviation of 0.913.
- ii. The school management is facing cultural changes as they have to adapt to adopt unfamiliar technologies, with a standard deviation of 1.114.
- iii. The school is facing increased competition exacerbated by globalisation, with a standard deviation of 1.046.
- iv. With a standard deviation of 1.118, the school administration is under pressure to go digital before their competitors in order to stay alive and benefit from the competitive environment.
- v. The school's staff is facing cultural changes as they have to adapt to adopt unfamiliar technologies, with a standard deviation of 1.156.
- vi. With a standard deviation of 1.177, the school is struggling with a shortage of workers with the necessary skills to work in a digital environment.
- vii. With a standard deviation of 1.334, the school's information technology infrastructure is insufficient to successfully implement digitalisation.
- viii. With a standard deviation of 1.098, the entire school is undergoing a significant change as a result of the development of digital technologies.
- ix. The school staff lack digital thinking, knowledge and skills, with a standard deviation of 1.184.
- x. The school leaders lack digital thinking and knowledge, with a standard deviation of 1.213.

Table 27: Descriptive statistics on digitalisation

	N	Minimum	Maximum	Mean	Std. Deviation
5. The most prominent challenge for schools digitalisation is access to finance and limited skills in entrepreneurship	213	1	5	4.02	.913
6. The school management is facing cultural changes as they have to adapt to adopt unfamiliar technologies	213	1	5	3.76	1.114
9. The school is facing increased competition exacerbated by globalisation	213	1	5	3.66	1.046
10. The schools management is facing stress to move digitally before others to survive and gain competitive benefits	213	1	5	3.54	1.118
7. The school's staff is facing cultural changes as they have to adapt to adopt unfamiliar technologies	213	1	5	3.52	1.156
1. The school is facing a lack of skills in the workforce to work in digital environment	195	1	5	3.51	1.177
2. The school lacks a strong information technology foundation to successfully carry out digitalisation	213	1	5	3.47	1.334
8. The whole school is facing a radical change due to the development of digital technologies	213	1	5	3.41	1.098
4. The school staff lack digital thinking, knowledge and skills	212	1	5	3.17	1.184
3. The school leaders lack digital thinking and knowledge	212	1	5	2.92	1.213
Valid N (list wise)	193				

4.5 Conclusion

This chapter reviewed the study's findings and contrasted the most significant ones to the reviewed literature to identify trends, classify and compare the opportunities and challenges of digitalisation in high school learning in the Free State. Furthermore, the

data collected was analysed and conclusions drawn using descriptive statistics. The conclusions from this study and suggestions for further study are presented in the following section.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study's primary goal was to evaluate the viability of digitalising the educational infrastructure in local Free State high schools. Additionally, we sought to identify the challenges that high schools in the Free State communities faced as they attempted to digitalise their educational systems. Described in this chapter is the discussion of these research objectives. The researcher draws conclusions from the review of the literature, the research findings and the suggested actions.

5.2 Aim and objectives of the study

The purpose of this study is to evaluate the advantages and disadvantages of integrating digital technology into high school instruction. Thus, it seeks:

1. To identify the issues that stakeholders encounter in the implementation and use of digital platforms in high schools. For this objective, challenges encountered by stakeholders, such as lack of sufficient funding to purchase cellphones, tablets and laptops for use in schools were identified. Most of them rely on supporters, sponsors and donors. Furthermore, most schools lack security, particularly those in rural areas and some have fallen victim to thieves who steal these vital devices intended to improve lives and raise a better generation for the future. Because most of these resources are limited and must be shared between students and grades, not every learner can use them to their fullest potential in enhancing education.
2. To discover the opportunities available for high school children that allow them to effectively use digital platforms. For this objective, the expanding ICT infrastructure in South Africa, along with the accessibility of tablets and smartphones for students to use for their studies, and the online learning

opportunities made available by the extra lessons in Zoom and on SABC Education present enormous opportunities for enhancing high school education.

5.3 Contribution of the study

The following are the contributions of this study.

- For the digitalisation of education and the integration of ICT into teaching and learning to be successful, this study has highlighted the necessity of training the necessary personnel.
- The study demonstrates how crucial management and leadership structures are to high schools' ability to successfully integrate digital learning. The implementation of these initiatives should involve all parties involved for the benefit of the students, including the school governing bodies, parents and sponsors, if any.
- Lack of funding, as well as some rural schools' inability to access the internet or electricity, are obstacles to the successful digitalisation of learning in high schools. For the purpose of implementing digitalisation in rural schools, public-private partnerships are therefore required.
- In contrast to their counterparts in the rural areas, more and more urban schools are implementing digitalisation, highlighting the digital divide. All children can benefit from digitalisation and ICT integration in the classrooms if such schools that have the capacity collaborate with or support those that lack the necessary resources.
- It is impossible to overstate the role played by the provincial government in the adoption of digitalisation. The digitalisation of high schools being implemented by the Gauteng Department of Education and the Western Cape Government of Education is commendable, and other provinces that are still lagging in this area can learn from their best practices.

- More budget needs to be allocated not only to the training of educators in ICT, but also to enabling the required infrastructure and resources required for digitalisation, more so in the underprivileged schools.

5.4 Suggested future research

Future research that emphasises qualitative and mixed-methods designs may enhance the findings of this study. As the current study only included digitalisation of high schools in Free State, the sample group could be expanded to include schools in other provinces. Future studies may address the digitalisation of high schools on a broader scale, incorporating schools on the African continent.

5.5 Recommendations

The following suggestions are offered considering the literature review and study results:

- With the capacity of schools to successfully implement digitalisation in high schools, there is a need for an adequate human resource base, which includes trained educators who can work with technology. This is a problem that needs to be solved, and the necessary funds should be set aside to create this foundation.
- The study found that the lack of internet connectivity and, in some cases, access to electricity and/or power outages present a challenge in the implementation of digitalisation in high schools. Therefore, communities and school governing bodies should engage in these aspects and get resources to ensure that children are not left behind in the digital revolution. They can partner among themselves and with other schools and get sponsorships from the private sector and individuals who may assist.
- The management of schools is vital in the sustainability of digitalisation of high schools. Thus, the top management, including principals, head of departments and subject heads, should be incorporated in the implementation of digital

technologies and ICT to ensure that they are well managed and the infrastructure and resources are used well for posterity's benefit, as well.

- Under-resourced schools should be identified so that they may be assisted in any way possible. There may be willing individuals and organisations that can assist, but if they do not know these schools and their needs, they cannot assist.
- Schools, parents and all stakeholders should tap into digitalisation, with the available educational material that can easily be accessed on cellphones. Cellphones and even tablets are available in most South African homes. These are excellent avenues for the students to access learning material, even when not at school.
- Government agencies, not-for-profit organisations and individuals should consider donating computers, tablets and laptops to schools for their use by students, more so in the rural areas for their studies. These will complement the books that they have and improve their performance in the long-term.

5.6 Conclusion

This study examined the benefits and drawbacks of digitalisation in high school instruction in the Free State. It was found that schools in rural areas frequently suffer from lack of infrastructure, such as electricity and internet connectivity, which makes it difficult for them to adopt digitalisation in the classroom. This study also uncovered difficulties faced by high school stakeholders who use digital platforms, such as lack of funding for cell phones, tablets and laptops for classroom use. In particular, most of them depend on supporters, sponsors and donors. Additionally, many schools lack security, particularly those in rural areas, and some have been targeted by thieves who steal these essential devices meant to enhance lives and produce a better generation for the future. Not every learner can use these resources to their fullest potential in enhancing education because most of them are limited and must be shared among students and grades. However, there are many opportunities for improving high school education due to South Africa's expanding ICT infrastructure, the availability of tablets

and smartphones for students to use for their studies, and the online learning opportunities provided by the additional lessons in Zoom and on SABC Education. To ensure the successful adoption of 4IR technologies that will facilitate their adoption in rural schools, various stakeholders, including the government, private sector and donors, should collaborate. South Africa could set the bar for high school digitalisation with its extensive resources. The learning environment has changed as a result of 4IR and the Covid-19 pandemic and it should no longer be restricted to the traditional classroom with chalk and board.

References

Aesaert, K., van Braak, J., Van Nijlen, D. & Vanderlinde, R. 2015. Primary school pupils' ICT competences: Extensive model and scale development. *Computers & Education*, 81, 326-334.

Alger, J. 2011. DoInk "create animations online". [Online]. Available at: <http://edjudo.com/doink-animation-review> (Accessed 20 October 2022).

Aliyu, A.A., Singhry, E.M., Adamu, H. & Abubakar, M.M. 2015. Ontology, epistemology and axiology in quantitative and qualitative research: elucidation of the research philosophical misconception. Mediterranean Publications & Research International on New Direction and Uncommon. *Mediterranean Publications & Research International on New Direction and Uncommon*, 2(1): 1-27.

Al-Mashaqbeth, I & Al Shurman, M. 2015. The Adoption of Tablet and e-Textbooks: First Grade Core Curriculum and School Administration Attitude. *Journal of Education and Practice*, 6(21): 188-194.

Al-Suqri, M.N. 2014. Perceived Usefulness, Perceived Ease-of-use and Faculty Acceptance of Electronic Books. *Library Review*, 63(4/5): 276-294. <http://dx.doi.org/10.1108/LR-05-2013-0062>.

Altuna, J. & Lareki, A. 2015. Analysis of the use of digital technologies in schools that implement different learning theories. *Journal of Educational Computing research*, 53(2): 205-225.

Amornkitpinyo, T. & Piriyasurawong, P. 2015. Causal Relationship Model of the Information and Communication Technology Skill Affect the Technology Acceptance Process in the 21st Century for Undergraduate Students. *International Journal of*

Emerging Technologies in Learning, 10(1): 68-71.
<https://doi.org/10.3991/ijet.v10i1.4185>.

Asenahabi, B.M. 2019. Basics of Research Design: A Guide to selecting appropriate research design. *International Journal of Contemporary Applied Researches*, 6(5): 76-89.

Beetham, H. & Sharpe, R. (eds.) 2013. *Rethinking pedagogy for a digital age: Designing for 21st century learning* (2nd ed). New York, NY: Routledge.

Behrendt, H., Dahncke, H., Duit, R., Graber, W., Komorek, M., Kross, A. & Reiska, P. 2011. *Research in science education: past, present and future*. Netherlands: Kulwe Academic.

Bidarra, J. Figueiredo, M. & Natálio, C. 2015. Interactive Design and Gamification of Ebooks for Mobile and Contextual Learning. *International Journal of Interactive Mobile Technologies*, 9(3): 24–32. <http://dx.doi.org/10.3991/ijim.v9i3.4421>.

Birdsong, C., Chen, J., Tseng, M. & Victorino, C. 2015. Student Acceptance of Online Textbooks Across Multiple Engineering Courses. *Computers in Education Journal*, 6(3): 64-86.

British Educational Communications and Technology Agency (Becta) 2004. Getting the most from your interactive whiteboard: A guide for primary schools. Coventry, UK: Becta. [Online]. Available at: <http://www.dit.ie/lttc/media/ditlttc/documents/gettingthemost.pdf> (Accessed 20 October 2022).

Bobera, D. 2008. Project management organization. *Management Information Systems*, 3(1):3-9. [Online]. Available at: http://www.ef.uns.ac.rs/mis/archive-pdf/2008%20-%20No1/MIS2008_1_1.pdf (Accessed 20 October 2022).

Boekhorst, A.K. & Britz, J.J. 2004. Information literacy at school level: A comparative study between the Netherlands and South Africa. *South African Journal of Libraries and Information Science*, 70(2): 63-71.

Bonache, J. & Festing, M. 2020. Research paradigms in international human resource management: an epistemological systematisation of the field. *German Journal of Human Resource Management*, 34(2): 99-123.

Blackboard. 2010. Improving classroom learning. [Online]. Available at: http://www.blackboard.com/resources/k12/K12_Improving_Classroom_Learning.pdf (Accessed 20 October 2022).

Blignaut, S. & Howie, S.J. 2009. National policies and practices on ICT in education: South Africa. In T Plomp, RE Anderson, N Law & A Quale (eds). *Cross-national information and communication technology: Policies and practices in education*. Charlotte, NC: Information Age Publishing.

Burger, D. ed. 2002. *South Africa Yearbook 2001/2*. Durban: Universal Printers.

Burnett, C. 2010. Technology and literacy in early childhood educational settings: A review of research. *Journal of Early Childhood Literacy*, 10(3): 247-270.

Burgelman, J.C, Nulens, G. & Van Audenhove, L. 1999. De geschiedenis herhaalt zich altijd anders. In J C Burgelman, G Nulens, & L Van Audenhove, (eds) *De digital kloof. De informatierevolutie en het zuiden*. Antwerpen: Rombouts & Goemaerelei.

Bush, T. & Coleman, M. 2000. *Leadership and strategic management in education*. London: SAGE Publications.

Calitz, A.P., Poisat, P. & Cullen, M. 2017. The future African workplace: The use of collaborative robots in manufacturing. *SA Journal of Human Resource Management*, 15(1): 1-11.

Cameron, C. 2018. The evolution of a mixed methods study in work-integrated learning. *International Journal of Work-Integrated Learning*, Special Issue, 19(3): 237-247.

Castells, M. 1996. *The information age: economy, society and culture*. Vol.1: The rise of the network society. Oxford, UK: Blackwell.

Castells, M. 1997. *The information age: economy, society and culture*. Vol.II: The power of identity. Oxford, UK: Blackwell.

Castells, M. 1998. *The information age: economy, society and culture*. Vol.III: End of Millennium. Oxford, UK: Blackwell.

Chege, K.A. & Otieno, O.C. 2020. Research philosophy design and methodologies: a systematic review of research paradigms in information technology. *Global Scientific Journal*, 8(5): 33-38.

Chigona, A., Chigona, W. & Davids, Z. 2014. Educators' motivation on integration of ICTs into pedagogy: Case of disadvantaged areas. *South African Journal of Education*, 34(3): Art. # 859, 8 pages. <https://doi.org/10.15700/201409161051>.

Chikasa, S. Ntuli, M. & Sundarjee, R. 2014. ICT Integration in Teaching: An Uncomfortable Zone for Teachers: A Case of Schools in Johannesburg. *Education as Change*, 18(1): 137-150. <https://doi.org/10.1080/16823206.2013.847013>.

Choppin, J., Carson, C., Borys, Z., Cerosaletti, C. & Gillis, R. 2014. A Typology for Analyzing Digital Curricula in Mathematics Education. *International Journal of Education in Mathematics, Science and Technology*, 2(1): 11–25. <https://doi.org/10.18404/ijemst.95334>.

Cicconi, M. 2014. Vygotsky meets technology: A reinvention of collaboration in the early childhood mathematics classroom. *Early Childhood Education Journal*, 42(1): 57-65. <https://doi.org/10.1007/s10643-013-0582-9>.

Combrinck, C. & Mtsatse, N. 2019. Reading on paper or reading digitally? Reflections and implications of ePIRLS 2016 in South Africa. *South African Journal of Education*, 39.

Conradie, D.P. 1998. Using Information and Communication Technologies (ICTs) for Development at Centres in Rural Communities: Lessons Learned. *Communicare*, 17(1): 97-116.

Council of Education Ministers (CEM). 2019. The DBE's "Action Plan to 2019". [Online]. Available at: <
<https://www.education.gov.za/Newsroom/MediaReleases/tabid/347/ctl/Details/mid/8128/ItemID/6001/Default.aspx>> (Accessed 17 May 2022).

Creswell, J.W. 2014. *Research design: qualitative, quantitative, and mixed methods approaches*. 4th ed. Los Angeles: Sage Publications, Inc.

Creswell, J.W. & Creswell, J.D. 2017. *Research design: qualitative, quantitative, and mixed methods approaches*. 5th ed. SAGE Publications,

Datta, S. 2018. *Sampling methods*. West Bengal University.

Davis, C. 2019. The research rationale In: *Research Matters*. Claremont: Juta.

Davis, N., Preston, C. & Sahin, I. 2009. ICT teacher training: evidence for multilevel evaluation from a national initiative. *British Journal of Educational Technology*, 40(1): 135-148.

De Jager, K. & Nassimbeni, M. 2002. Institutionalizing information literacy in tertiary education: Lessons learned from South African programs. *Library Trends*, 51(2): 167-184. [Online]. Available at: https://www.ideals.illinois.edu/bitstream/handle/2142/8461/librarytrendsv51i2d_opt.pdf (Accessed 23 October 2022).

Department of Basic Education (DBE) 2021. Article details - media releases. [Online]. Available at: <https://www.education.gov.za/Newsroom/MediaReleases/tabid/347/ctl/Details/mid/8128/ItemID/6001/Default.aspx> (Accessed: 17 May 2022).

Department of Education. 2004. White Paper on e-Education: Correction notice. *Government Gazette*, 470(26734):1-13, August 26. [Online]. Available at: https://www.westerncape.gov.za/text/2004/11/ch1_introduction_26734.pdf (Accessed 20 October 2022).

Department of Education (DoE). 2004. White Paper 7 on e-Education. Pretoria: Department of Education. Retrieved from: <https://www.education.gov.za/Resources/Legislation/WhitePapers.aspx>

Department of Communication. 1999. DoC WIL: Web Internet laboratory. [Online]. Available at: <http://docweb.pwv.gov.za/department/docwils.html> <http://www.doc.gov.za/projects/multimedia/pit.html> (Accessed 17 May 2022).

Dingli, A. & Cachia, C. 2014. Adaptive Ebook. In 2014 International Conference on Interactive Mobile Communication Technologies and Learning (IMCL2014), 14-19. Greece: IEEE. <https://doi.org/10.1109/IMCTL.2014.7011096>.

Dladla, T. 2020. Exploring ethical leadership practices in challenging township school contexts: a multiple case study (Doctoral dissertation).

Dobler, E. 2015. E-textbooks: A Personalized Learning Experience or a Digital Distraction? *Journal of Adolescent and Adult Literacy*, 58(6): 482-491. <https://doi.org/10.1002/jaal.391>.

Duff, A.S. 1998. Daniel Bell's theory of the information society. *Journal of Information Science*, 24(6): 373-393.

Duffy, J. 2022. What is the Impact of Digital Learning on School and Education? [Online]. Available at: < <https://mussila.com/what-is-the-impact-of-digital-learning-on-school-and-education/>> (Accessed: 18 May 2022).

Dunlop, J. 2012. Don't ban cell phones from schools. [Online]. Available at: http://www.parent24.com/Teen_13-18/development_behaviour/Dont-ban-cell-phones-from-schools-20120515 (Accessed 20 October 2022).

Dzansi, D.Y. & Amedzo, K. 2014. Integrating ICT into rural South African schools: Possible solutions for challenges. *International Journal of Educational Sciences*, 6(2): 341-348.

Equal Education. 2011. School Governance and Management. Youth Group Fact Sheet 4. [Online]. Available at: <http://www.equaleducation.org.za/article/youth-group-fact-sheets> (Accessed 20 October 2022).

Engbrecht, J.R. 2018. Digital Textbooks Versus Print Textbooks. Master's diss., St. Cloud State University.

Fisher, R. 2014. Thinking skills. In T Cremin & J Arthur (eds). *Learning to teach in the primary school* (3rd ed). Abingdon, England: Routledge.

Fojtik, R. 2015. Ebooks and Mobile Devices in Education. *Procedia-Social and Behavioral Sciences*, 182: 742-45. <https://doi.org/10.1016/j.sbspro.2015.04.824>.

Fouche, C.B., Strydom, H. & Roestenburg, W.J.H. 2021. *Research at grassroots-for the social sciences and human services professions*. 5 ed. Pretoria: Van Schaik.

Frey, N. & Fisher, D. 2008. *Teaching visual literacy*. Thousand Oaks, CA: Sage.

Fudin, S. 2012. Gen Z & what does it mean in your classroom? [Online]. Available at: <http://mat.usc.edu/gen-z-whatdoes-it-mean-in-your-classroom/> (Accessed 20 October 2022).

Gaudet, S. & Robert, D. 2018. *A journey through qualitative research: From design to reporting*. London: Sage.

Gauteng Department of Education (GDE). 2014. Strategic Plan 2015–2020. Johannesburg, Gauteng, South Africa. [Online]. Available at: https://www.gov.za/sites/default/files/gcis_document/201606/dbe-strategic-plan-march-2016.pdf (Accessed 27 May 2022).

Gauteng Department of Education (GDE). 2010. GDE study on e-maturity and e-readiness. Johannesburg, South Africa: DBE.

Gerick, J., Eickelmann, B. & Bos, W. 2017. School-level predictors for the use of ICT in schools and students' CIL in international comparison. *Large-Scale Assessments in Education: An IEA-ETS Research Institute Journal*, 5:5. <https://doi.org/10.1186/s40536-017-0037-7>.

Gilleece, L. & Eivers, E. 2018. Characteristics associated with paper-based and online reading in Ireland: Findings from PIRLS and ePIRLS 2016. *International Journal of Educational Research*, 91: 16-27. <https://doi.org/10.1016/j.ijer.2018.07.004>.

Global Technology Forum. 2007. South Africa: let's talk. [Online]. Available at: http://www.ebusinessforum.com/index.asp?layout=rich_story&doc_id=10218&title=South+Africa%3A+Let%92s+talk&categoryid=31&channelid=4 (Accessed 20 October 2022).

Goldstuck, A. 2002a. South Africa How many use Web sites and who are they? Balancing Act News Update. Issue 71. [Online]. Available at: http://www.balancingactafrica.com/news/back/balancing_act_71.html.

2002b. The Goldstuck report: Internet access in South Africa, 2002. World Wide Worx. [Online]. Available at: <http://www.theworx.biz/access02.htm> (Accessed 27 May 2022).

Government Communication and Information System. 2002. Multi Purpose Community Centres. [Online]. Available at: <http://www.gcis.gov.za/mpcc/index.html> (Accessed 27 May 2022).

Gupta, B., Dasgupta, S. & Gupta, A. 2008. Adoption of ICT in a government organization in a developing country: an empirical study. *The Journal of Strategic Information Systems*, 17(2): 140-154.

Håkansson-Lindqvist, M. 2015. Gaining and sustaining TEL in a 1:1 laptop initiative: possibilities and challenges for teachers and students. *Computers in the Schools*, 32(1): 35-62.

Hart, S.A. & Laher, S. 2015. Perceived Usefulness and Culture as Predictors of Teachers Attitudes Towards Educational Technology in South Africa. *South African Journal of Education*, 35(4): 1-13. <https://doi.org/10.15700/saje.v35n4a1180>.

Hartley, P. (ed). 2003. The e-business handbook. The 2003 review of innovation at work in South African business. Cape Town: Triologue.

Hauge, T.E. 2014. Up-take and use of technology: bridging design for teaching and learning. *Technology, Pedagogy & Education*, 23(3): 311-323.

Hennessy, S., Onguko, B., Harrison, D., Ang'ondi, E.K., Namalefe, S., Naseem, A. & Wamakote, L. 2010. Developing the use of information and communication technology to enhance teaching and learning in East African schools: Review of the literature (Centre for Commonwealth Education & Aga Khan University Institute for Educational Development – Eastern Africa Research Report No. 1). Cambridge, England: University of Cambridge, Faculty of Education/London, England: Department for International Development. [Online]. Available at: https://www.educ.cam.ac.uk/centres/archive/cce/publications/CCE_Report1_LitRevJune0210.pdf (Accessed 20 October 2022).

Dlamini, R. 2022. Digital Equity in Schools: A Multilevel Analysis of In-Service Teachers' Technological Knowledge Competencies. *Journal of Educational Studies*, 21(2): 40-60.

Hesterman, S. 2011. A contested space: The dialogic intersection of ICT, multiliteracies, and early childhood. *Contemporary Issues in Early Childhood*, 12(4): 349–361. <https://doi.org/10.2304%2Fciec.2011.12.4.349>.

Holmgren, R., Haake, U. & Söderström, T. 2017. Firefighter learning at a distance: a longitudinal study. *Journal of Computer Assisted Learning*, 33(5): 500-512.

Howie, S.J., Combrinck, C., Roux, K., Tshele, M., Mtsatse, N., McLeod Palane, N. & Mokoena, G.M. 2017. ePIRLS 2016: South African Highlights Report. Pretoria, South Africa: Centre for Evaluation and Assessment. [Online]. Available at: https://repository.up.ac.za/bitstream/handle/2263/66172/Howie_ePIRLS_2017.pdf?sequence=1&isAllowed=y (Accessed 20 October 2022).

Howie, S.J., Combrinck, C., Roux, K., Tshele, M., Mokoena, G.M. & McLeod Palane, N. 2017. PIRLS Literacy 2016 Progress in International Reading Literacy Study 2016: South African children's reading literacy achievement. Pretoria, South Africa: Centre for Evaluation and Assessment. [Online]. Available at: <https://repository.up.ac.za/handle/2263/65780> (Accessed 20 October 2022).

Human Research Ethics Committee (HREC). HREC: G3-Harm and Risk in Research Last Updated: September 2021. Guideline: Harm and Risk in Research. [Online]. Available at: <https://www.ucd.ie/researchethics/t4media/HRECG3%20Harm%20and%20Risk%20in%20Research%20-%20140921.pdf> (Accessed:28 October 2022).

Iberactiv. 2021. Digitization in schools: advantages and trends. [Online]. Available at: < <https://www.iberactiv.com/en/blog/digitization-in-schools/>> (Accessed 18 May 2022).

Ilomäki, L. & Lakkala, M. 2018. Digital technology and practices for school improvement: innovative digital school model. *Research and Practice in Technology Enhanced Learning*, 13(25).

Isaacs, S. 2007. ICT in Education in South Africa. Survey of ICT and Education in Africa: South Africa Country Report 21:15–54. <https://doi.org/10.4018/978-1-59904-057-8.ch009>.

Isah, E.A. & Ojetunde, S.M. 2019. Digitalizing secondary school activities in Ibadan Metropolitan secondary Schools, Oyo State, Nigeria.

Ivanova, A. & Smrikarov, A. 2009. The new generations of students and the future of e-learning in higher education. International Conference on e-Learning and the Knowledge Society – e-Learning’09. [Online]. Available at: <http://www.iit.bas.bg/esf/docs/publications/TheNewGenerationsStudentsFutureE-learningHigherEdu.pdf> (Accessed 20 October 2022).

Jacob, S.J. 2003. Challenges encountered when using ICTs (Information and Communication Technologies) in support of development in rural African communities. *Engineering Management*, 30:33.

Jahnke, I., Bergström, P., Mårell-Olsson, E., Häll, L. & Swapna, K. 2017. Digital didactical designs as research framework – iPad integration in Nordic schools. *Computers & Education*, 113:1-15.

James, D. & Simister, N. 2020. Quantitative-analysis. [Online]. Available at: <https://www.intrac.org/wpcms/wpcontent/uploads/2017/01/Quantitative-analysis.pdf> (Accessed 22 May 2022).

Jensen, M. 2002. The African Internet a status report. Online publication of AfricaOnline [Online]. Available at: <http://demiurge.wn.apc.org/africa/afstat.htm> (Accessed 27 May 2022).

Kimmel, A.J. (ed). 2005. *Marketing communication new approaches, technologies, and styles*. New York: Oxford University Press.

Kivunja, C. & Kuyini, A.B. 2017. Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, 6(5): 26-41.

Kizito, R.N. 2016. Connectivism in learning activity design: implications for pedagogically-based technology adoption in African higher education contexts. *International Review of Research in Open and Distributed Learning*, 17(2): 19-39.

Kotter, J. 2013. Management is (still) not leadership. *Harvard Business Review*, 91 January. [Online]. Available at: <http://blogs.hbr.org/2013/01/management-is-still-not-leadership/> (Accessed 21 October 2022).

Kuhn, C. 2021. Digitalisation in schools: five tips for implementation. [Online]. Available at: <https://otrs.com/otrsmag/digitalisation-in-schools-five-tips-for-implementation/> (Accessed 18 May 2022).

Kumar, R. 2019. *Research Methodology: A Step-by-Step Guide for Beginners*. London: SAGE Publications.

Learning Academy Worldwide. 2012. Mobile Learning arrives in another rural town in South Africa 2012. [Online]. Available at: <http://www.m-ubuntu.org.za/> (Accessed 15 October 2022).

Leedy, P.D., Ormrod, J.E. & Johnson, L.R. 2019. *Practical Research: Planning and Design*. New York: Pearson.

Li, X. & Chu, S.K.W. 2021. Exploring the Effects of Gamification Pedagogy on Children's Reading: A Mixed-Method Study on Academic Performance, Reading-related Mentality and Behaviors, and Sustainability. *British Journal of Educational Technology*, 52(1): 160-178. <https://doi.org/10.1111/bjet.13057>.

Lindberg, O.J., Olofsson, A.D. & Fransson, G. 2017. Same but different? An examination of Swedish upper secondary school teachers' and students' views and use of ICT in education. *The International Journal of Information and Learning Technology*, 34(2): 122-132. <https://doi.org/10.1108/IJILT-09-2016-0043>.

Lochrie, K. 1992. Using cartoons as an effective learning and teaching strategy. *SCRE Newsletter*, 51: 8-9.

Mahlangu. 2001. Premier Mahlangu's speech at the launch of Public Information Terminals Siyabuswa; 18 October 2001. [Online]. Available at: <http://Mpumalanga.Mpu.Gov.Za/PremierFolder/PremierSpeeches/PitLaunch.Html> (Accessed 27 May 2022).

Mansell, R. & When, U. eds. 1998. Knowledge societies. Information technology for sustainable development. New York: Oxford University Press. A publication of the International Development Research Centre (IDRC) and the United Nations Commission on Science and Technology for Development. See also: <<http://www.idrc.ca/>>.

Marques de Oliveira, S. 2012. E-books Usage by Students at Andrews University: A Study of Attitudes, Perceptions, and Behaviors. *Library Management*, 33(8/9): 536-560. <https://doi.org/10.1108/01435121211279894>.

Mauthner, N.S. 2020. *How to keep your doctorate on track*. Newcastle University.

McCrinkle, M. 2006. *Word up*. Sydney: Lexington Books.

McGlinchey, S. 2022. Positivism, post-positivism and interpretivism. *E-International Relations*, 1-2.

McLean, K. 2017. Literacy, technology and early years education: Building sustainable practice. In CJ McLachlan & AW Arrow (eds). *Literacy in the early years: Reflections on international research and practice*. Singapore: Springer. <https://doi.org/10.1007/978-981-10-2075-9>.

Mentz, E. 2000. *Rekenaartegnologie-opleiding vir onderwysers: 'n uitkomsgebaseerde benadering*. Doktorale tesis, Potchefstroom Universiteit, Potchefstroom.

Mentz, E. & Mentz, K. 2003. Managing technology integration into schools: a South African perspective. *Journal of Educational Administration*, 41(2): 186-200.

Meyer, I.A. & Gent, P.R. 2016. *The status of ICT in education in South Africa and the way forward*. Centurion, South Africa: National Education Collaboration Trust (NECT). [Online]. Available at: <http://nect.org.za/publications/technical-reports/the-state-of-ict-in-education-in-south-africa/view> (Accessed 20 October 2022).

Mills, K.A. 2010. A review of the “digital turn” in the new literacy studies. *Review of Educational Research*, 80(2): 246-271. <https://doi.org/10.3102%2F0034654310364401>.

Mkhabele, C. 2018. *An exploration of procurement practices in the state-owned passenger rail agencies in Gauteng province* (Doctoral dissertation, Vaal University of Technology).

Mohajan, H.K. 2020. Quantitative Research: A Successful Investigation in Natural and Social Sciences. *Journal of Economic Development, Environment and People*, 9(4): 50-79.

Moodley, S. 2004. The 'Information Society': a critical assessment. *Mousaion*, 22(2): 330-254.

Morgan, D.L. 2018. *Integrating qualitative and quantitative methods: a pragmatic approach*. California: Sage Publications, Inc.

Msiza, G.M., Malatji, K.S. & Mphahlele, L.K. 2020. Implementation of an E-Learning Project in Tshwane South District: Towards a Paperless Classroom in South African Secondary Schools. *Electronic Journal of e-Learning*, 18(4): 300-310. <https://doi.org/10.34190/EJEL.20.18.4.003>.

Mullis, I.V.S., Martin, M.O., Foy, P. & Hooper, M. 2017b. PIRLS 2016 international results in reading. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Lynch School of Education, Boston College and International Association for the Evaluation of Educational Achievement (IEA). [Online]. Available at: <https://files.eric.ed.gov/fulltext/ED580353.pdf> (Accessed 5 October 2022).

MyPR. 2019. SABC Education and ITSI launches online library with more than 350 000 books. MyPr. [Online]. Available at: <https://mypr.co.za/sabc-education-and-itsi-launches-online-library-with-more-than-350-000-books/> (Accessed 11 October 2022).

Nardi, P.M. 2018. *Doing survey research: A guide to quantitative methods*. London: Routledge.

Nassaji, H. 2015. Qualitative and descriptive research: data type versus data analysis. *Language Teaching Research*, 19(2): 129-132.

National Centre for Technology in Education (NCTE). 2008. NCTE advice sheet - interactive whiteboards. Advice sheet 16. [Online]. Available at: <http://www.ncte.ie/documents/advicesheets/16InteractiveWBsNov08.pdf> (Accessed 10 October 2022).

OECD. 2010. Inspired by technology, driven by pedagogy. A systemic approach to technology-based school innovations. In Educational research and innovation. Paris: OECD Publishing.

OECD. 2011. PISA 2009 results: students on line: digital technologies and performance (volume VI). Paris: OECD.

OECD. 2014. PISA 2012 Results: creative problem solving: students' skills in tackling real-life problems (volume V). Paris: OECD Publishing.

OECD. 2015. Building responsive schools for 21st-century learners. In Schools for 21st-Century learners: strong leaders, confident teachers, innovative approaches. Paris: OECD Publishing.

OECD. 2015a. Skills for social progress: The power of social and emotional skills (OECD skills studies). Paris, France: OECD Publishing. <https://doi.org/10.1787/9789264226159-en>.

Okesina, M. 2020. A critical review of the relationship between paradigm, methodology, design and method in research. *Journal of Research & Method in Education*, 10(3): 57-68.

Olofsson, A.D., Lindberg, J.O., Fransson, G. & Hauge, T.E. 2015. Uptake and use of digital technologies in primary and secondary schools – a thematic review of research. *Nordic Journal of Digital Literacy*, 6(4): 103-121.

Oribhabor, C.B. & Anyanwu, C.B. 2019. Research sampling and sample size determination: a practical application. *Federal University Dutsin-Ma Journal of Educational Research (Fudjer)*, 2(1): 47-56.

Parveen, N. & Showkat, H. 2017. Non-probability and probability sampling. *Media & Communication Studies*, 1-9.

Pascoe, G. 2019. Sampling. In: *Research Matters*. Cape Town: Juta.

Patten, M.L. & Newhart, M. 2018. *Understanding Research Methods: An Overview of the Essentials*. London: Routledge.

Pease, J. 2012. Get schooling right – now. *Mail & Guardian*, 6 July. [Online]. Available at: <http://mg.co.za/article/2012-07-05-get-schooling-right-now/> (Accessed 15 October 2022).

Pettersson, F. 2021. Understanding digitalisation and educational change in school by means of activity theory and the levels of learning concept. *Education and Information Technologies*, 26: 187-204.

Picciano, A. G. 2017. Theories and frameworks for online education: Seeking an integrated model. *Online Learning*, 21(3): 166-190.

Pick n Pay School Club. n.d. Educating Future Leaders. Pick n Pay School Club. [Online]. Available at: <https://www.schoolclub.co.za/> (Accessed 15 October 2022).

Pierard, C., Svihla, V.L., Clement, S.K. & Fazio, B.S. 2019. Undesirable Difficulties: Investigating Barriers to Students' Learning with Ebooks in a Semester-length Course. College and Research Libraries (Forthcoming). [Online]. Available at: https://digitalrepository.unm.edu/cgi/viewcontent.cgi?article=1123&context=ulls_fsp. <https://doi.org/10.5860/crl.81.2.170> (Accessed 27 May 2022).

Pretorius, J. 2003. The nature and extent of digital inequality. Paper presented at the Politics of Digital Inequality seminar held at the University of Pretoria 10 April 2003.

Pollock, M & Pollock, A. 2011. *Generation: friend me*. Bloomington: Author House.

Pönni, T. 2015. Creating and delivering value with Design Thinking in technology design. Master of Science Thesis. KTH in Stockholm, Sweden.

Qualtrics 2022. Simple random sampling: Definition, examples, and how to do it. [Online]. Available at: <https://www.qualtrics.com/uk/experience-management/research/simple-random-sampling/?rid=ip&prevsite=en&newsite=uk&geo=ZA&geomatch=uk> (Accessed 16 May 2022).

Rao, A.B. 2008. Research methodology for management and social sciences. Excel Books India.

Ramburn, H. & Van Belle, J.P. 2011. Inhibitors and enablers of mobile data services use in South Africa. Communications of the IBIMA, 2011: Article ID 710870. [Online]. Available at: <http://www.webcitation.org/5YEmO0hEd> (Accessed 2 October 2022).

Ratan, S.K., Anand, T. & Ratan, J. 2019. Formulation of research question Stepwise approach. *Journal of Indian Association of Pediatric Surgeons*, 24(1): 15.

Rebmann, N. 2020. What is descriptive research design PDF? [Online]. Available at: <
<https://askinglot.com/what-is-descriptive-research-design-pdf>> (Accessed 22 May 2022).

Riley, J. 2014. Matrix structures. [Online]. Available at:
http://www.tutor2u.net/business/people/org_matrix_structures.asp (Accessed 14 October 2022).

Riordon, S. 2001. SchoolNet South Africa: Accessing a World of Learning. Online publication of International Development Research Center (IDRC). [Online]. Available at: http://www.idrc.ca/reports/read_article_english.cfm?article_num=853%20 (Accessed 27 May 2022).

Rockinson-Szapkiw, A.J., Courduff, J., Carter, K. & Bennett, D. 2013. Electronic Versus Traditional Print Textbooks: A Comparison Study on the Influence of University Students' Learning. *Computers and Education*, 63: 259-266.
<https://doi.org/10.1016/j.compedu.2012.11.022>.

Rothwell, W.J. 2008. *Adult learning basics*. Maryland: ASTD Press.

Salavati, S. 2016. Use of digital technologies in education: the complexity of teachers' everyday practice. Doctoral dissertation in Informatics. Linnaeus University.

Salkind, N.J. 2017. *Exploring Research, Global Edition*. London: Pearson Education.

Saunders, M., Lewis, P. & Thornhill, A. 2016. *Understanding research philosophy and approaches to theory development*. Pearson Education.

SchoolNet, S.A. 2001. Annual Report 2000, Johannesburg: Schoolnet SA. [Online]. Available at: <<http://www.schoolnet.org.za/research/snreports.htm>.

2003. Creating communities of learners and educators using ICT's. [Online]. Available at: <http://www.schoolnet.org.za> (Accessed 22 October 2022).

Sharpe, R. & Oliver, M. 2013. Designing for learning in course teams. In H Beetham & R Sharpe (eds). *Rethinking pedagogy for a digital age: Designing for 21st century learning* (2nd ed). New York, NY: Routledge.

Sileyew, K.J. 2019. Research design and methodology. In *Cyberspace: 1-12*. Rijeka: IntechOpen.

Siljebo, J. 2020. Digitalisation and digital transformation n schools: a challenge to educational theory? *Education in the North*, 27(2): 24-37.

Smart Technologies Inc. 2008. Case study: Montagu Drive Primary School Cape Town, South Africa. South African students engage in learning with SMART Board interactive whiteboards. [Online]. Available at: http://downloads01.smarttech.com/media/sitecore/en/pdf/customerstories/k12/montagu_hi-res.pdf (Accessed 4 October 2022).

Snapplify. 2020. Pupils can Access Thousands of Free E-books During the Coronavirus Shutdown Period with Snapplify." Snapplify, April 16, 2020. [Online]. Available at: <https://www.timeslive.co.za/sunday-times/books/news/2020-04-16-pupils-can-access-thousands-of-free-e-books-during-the-coronavirus-shutdown-period-with-snapplify/> (Accessed 12 October 2022).

Sy, T. & D'Annunzio, L.S. 2005. Challenges and strategies of matrix organizations: Top-level and mid-level managers' perspectives. *Human Resource Planning*, 28(1): 39-48. [Online]. Available at: http://www.boozallen.com/media/file/HRPS_Challenges_Strategies_Matrix_Orgs.pdf (Accessed 13 October 2022).

Taherdoost, H. 2016. Sampling methods in research methodology: how to choose a sampling technique for research. *International Journal of Academic Research in Management (IJARM)*, 5(2): 18-27.

Tao, Y. 2009. The relationship between motivation and online social presence in an online class. Eisenhower Parkway: Proquest LLC.

Taylor, B., Sinha, G. & Ghoshal, T. 2006. *Research methodology: A guide to for reseachers in management and social sciences*. PHI Learning Pvt. Ltd.

Theron, P.M. 2015. Coding and data analysis during qualitative empirical research in practical theology. *In die Skriflig*, 49(3): 1-9.

Toffler, A. 1991. *The Third Wave*. London: Bantam Books.

Toki, E.I. & Pange, J. 2014. ICT use in early childhood education: Storytelling. *Tiltai*, 66(1): 183-192. <https://doi.org/10.15181/tbb.v66i1.786>.

Top Ten. 2012. Ten most popular cartoons for kids in 2012. [Online]. Available at: <http://www.toptensthings.com/2012/04/top-10-most-popular-cartoons-for-kids-in-2012/> (Accessed 14 October 2022).

Türel, Y.K. & Johnson, T.E. 2012. Teachers' belief and use of interactive whiteboards for teaching and learning. *Educational Technology & Society*, 15(1): 381-394. [Online]. Available at: http://www.ifets.info/journals/15_1/32.pdf (Accessed 13 October 2022).

Universal Service Agency. 1997. Project Community: National Pilot Programme for the Implementation of Telecentres. Johannesburg: Universal Service Agency.

Van Audenhove, L. 1999. Uitdagingen voor het Zuiden. In J C Burgelman, G Nulens, & L Van Audenhove, *De digital kloof. De informatierevolutie en het zuiden*, ed. Antwerpen: Rombouts & Goemaerelei.

Vandeyar, T. 2015. Policy intermediaries and the reform of e-Education in South Africa [Special issue]. *British Journal of Educational Technology*, 46(2): 344-359. <https://doi.org/10.1111/bjet.12130>.

Van Wyk, M.M. 2011. The use of cartoons as a teaching tool to enhance student learning in economics education. *Journal of Social Science*, 26(2): 117-130.

Vasquez, V.M. & Felderman, C.B. 2013. *Technology and critical literacy in early childhood*. New York, NY: Routledge.

Viberg, O. & Mavroudi, A. 2019. *Digitalisation of education: application and best practices*. Stockholm: KTH Royal Institute of Technology.

Wallimam, N. 2018. *Research Methods: The Basics*. 2nd ed. London: Routledge.

Wang, S. & Bai, X. 2016. University Students' Awareness, Usage and Attitude Towards E-books: Experience from China. *Journal of Academic Librarianship*, 42(3): 247–58. <https://doi.org/10.1016/j.acalib.2016.01.001>.

Whittingham, J., Huffman, S., Rickman, W. & Wiedmaier, C. 2013. *Technological tools for the literacy classroom*. Hershey, PA: IGI Global.

Yehya, F. M. 2021. Promising Digital Schools: An Essential Need for an Educational Revolution. *Pedagogical Research*, 6(3): 1-10.

Zhu, X. 2018. E-book III in Academic Libraries: A Three-year Trend Report. *Journal of Academic Librarianship*, 44 (3): 343–51. <https://doi.org/10.1016/j.acalib.2018.03.006>.

APPENDICES

ANNEXURE A: ETHICAL CLEARANCE



P.O. Box 1906 | Bellville 7535
Symphony Road Bellville 7535
South Africa
Tel: +27 21 4603291
Email: fbmsethics@cput.ac.za

Office of the Chairperson Research Ethics Committee	FACULTY: BUSINESS AND MANAGEMENT SCIENCES
--	--

The Faculty's Research Ethics Committee (FREC) on **18 October 2022**, ethics **APPROVAL** was granted to **Cathrine Lobone (219122431)** for a research activity at the Cape Peninsula University of Technology for **M Tech: Business Administration (Project Management)**.

Title of project:	OPPORTUNITIES AND CHALLENGES OF DIGITALISATION IN HIGH SCHOOL LEARNING IN THE FREE STATE Supervisor (s): Mr S Fore
--------------------------	--

Decision: APPROVED

 Signed: Chairperson: Research Ethics Committee	1 November 2022 Date
---	---------------------------------------

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the CPUT Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study requires that the researcher stops the study and immediately informs the chairperson of the relevant Faculty Ethics Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines, and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, notably compliance with the Bill of Rights as provided for in the Constitution of the Republic of South Africa, 1996 (the Constitution) and where applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003 and/or other legislations that is relevant.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after two (2) years for Masters and Doctorate research project from the date of issue of the Ethics Certificate. Submission of a completed research ethics progress report (REC 6) will constitute an application for renewal of Ethics Research Committee approval.

Clearance Certificate No | 2022 FBMSREC 059

ANNEXURE B: PERMISSION-GRANTING LETTER

Enquiries: M.Z. Thango
Ref: Research Permission: N.C. Lebone
Tel. 051 404 8808
Email: MZ.Thango@fseducation.gov.za



173 Jac Van Rhyn Street
Universitas Ridge
Bloemfontein
9312

Dear Mrs. N.C. Lebone

PERMISSION TO CONDUCT RESEARCH IN THE FREE STATE DEPARTMENT OF EDUCATION: MOTHEO DISTRICT

This letter serves to inform you that you have been granted permission to conduct research in the Free State Department of Education within the Motheo Education District. The details in relation to your research project with the Cape Peninsula University of Technology are as follows:

Topic: Opportunities and challenges of digitisation in high school learning in Free State.

- List of schools involved:** Albert Moroka, Atlehang, Bloemfontein S/S, Bloemfontein South High, Brebner S/S, C&N H/Meisieskool Orange, Dr. Blok, Eunice S/S, Fichardtpark S/S, Goronyane S/S, Gray-Kollege, Itokisetseng Bokamoso S/S, Jim Fouche S/S, Kaelang S/S, Kgauho S/S, Ladybrand S/S, Le Reng S/S, Lefikeng S/S, Lekhulong S/S and Leratong S/S.
- Target Population:** Two hundred educators teaching in grades 8 to 12 at the selected schools.
- Period of research:** From the date of signature of this letter until 30 September 2022. Please note that the department does not allow any research to be conducted during the fourth term (quarter) of the academic year. Should you fall behind your schedule by three months to complete your research project in the approved period, you will need to apply for an extension. The researcher is expected to request permission from the school principals to conduct research at schools.
- The approval is subject to the following conditions:
 - The collection of data should not interfere with the normal tuition time or teaching process.
 - A bound copy of the research document should be submitted to the Free State Department of Education, Room 101, 1st Floor, Thuto House, St. Andrew Street, Bloemfontein or can be emailed to the above-mentioned email address.
 - You will be expected, on completion of your research study to make a presentation to the relevant stakeholders in the Department.
 - The ethics documents must be adhered to in the discourse of your study in our department.
- Please note that costs relating to all the conditions mentioned above are your own responsibility.

Yours Sincerely,


Mr. MZAMO W. JACOBS
DIRECTOR: QUALITY ASSURANCE, M&E AND STRATEGIC PLANNING

DATE: 13/09/2022

RESEARCH APPLICATION BY N.C. LEBONE. PERMISSION LETTER 13 SEPTEMBER 2022. MOTHEO DISTRICT
Strategic Planning, Research & Policy Directorate Private Bag X20565, Bloemfontein, 9300 - Thuto House, Room 101, 1st Floor, St Andrew Street, Bloemfontein

www.fsdoe.fs.gov.za

Enquiries: M.Z. Thango
Ref: Notification of research: N.C. Lebone
Tel. 051 404 8808
Email: MZ.Thango@fseducation.gov.za



District Director
Motho District

Dear Mr. Moloi

NOTIFICATION OF RESEARCH: PERMISSION TO CONDUCT RESEARCH PROJECT IN MOTHEO DISTRICT

This letter serves to inform you that Mrs. N.C. Lebone has been granted permission to conduct research in the Motheo District under the auspices of the Cape Peninsula University of Technology. The details in relation to the research project are as follows:

Topic: Opportunities and challenges of digitisation in high school learning in Free State.

- 1. List of schools involved:** Albert Moroka, Atlehang, Bloemfontein S/S, Bloemfontein South High, Brebner S/S, C&N H/Meisieskool Orange, Dr. Blok, Eunice S/S, Fichardtpark S/S, Goronyane S/S, Grey-Kollege, Itokisetseng Bokamoso S/S, Jim Fouche S/S, Kaelang S/S, Kgauho S/S, Ladybrand S/S, Le Reng S/S, Lefikeng S/S, Lekhulong S/S and Leratong S/S.
- 2. Target Population:** Two hundred educators teaching in grades 8 to 12 at the selected schools.
- 3. Period of research:** From the date of signature of this letter until 30 September 2022. Please note the department does not allow any research to be conducted during the fourth term (quarter) of the academic year nor during normal school hours. The researcher is expected to request permission from the school principals to conduct research at schools.
- 4. Research benefits:** This study will improve the socio-economic status of high school students in South Africa by revealing the gaps that exist in digital transformation at the high school level and by advancing educational inclusion through digital transformation. Digital transformation at the high school level can pave the way for faster adaptation at tertiary institutions across the globe, which are already embracing technology to achieve online activities and other educational outcomes.
- 5. Strategic Planning, Policy and Research Directorate will** make the necessary arrangements for the researchers to present the findings and recommendations to the relevant officials in the Department.

Yours Sincerely,

Mr. MZAMO W. JACOBS
DIRECTOR: QUALITY ASSURANCE, M&E AND STRATEGIC PLANNING

DATE: 13/09/2022

ANNEXURE C: LANGUAGE EDITING LETTER



December 2, 2022

Our Ref.: RUS/11/08

To whom it may concern

Re: Editing of Dissertation

This serves to confirm that the dissertation submitted in partial fulfilment of the requirements for the degree Master of Technology: Business Administration in Project Management at Cape Peninsula University of Technology, *Opportunities and Challenges of Digitalisation in High School Learning in the Free State*, has been edited by Rusinga Editors and Translators. Corrections have been suggested to the author, Nkgapane Cathrine Lebone.

Rusinga Editors and Translators is a registered private company in Pretoria, South Africa, offering editing, translation, interpreting and transcription services.

Please feel free to contact me for any further queries.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Stafford Osuri Osuri', written over a horizontal line.

Stafford Osuri Osuri

Director

Address: 210 Steve Biko Road Muckleneuk, Pretoria, 0002 Gauteng, South Africa

Email: osuriosuri@gmail.com

Cell: +27 72 996 3738

ANNEXURE D: QUESTIONNAIRE

QUESTIONNAIRE: OPPORTUNITIES AND CHALLENGES OF DIGITISATION IN HIGH SCHOOL LEARNING

This questionnaire consists of three sections: Section A consists of demographic information, Section B evaluates the opportunities of digitisation, and Section C measures the challenges of digitisation. Kindly select the response for each statement that best describes the current situation. There is no right or wrong answer. Your honest opinion is needed.

SECTION A: DEMOGRAPHIC INFORMATION

Kindly choose the single answer that best describes your status by crossing (x) the relevant block.

1. Gender

Male	
Female	

2. Age group

Under 30 years	
30-39 years	
40-49 years	
50-59 years	
60 years and over	

3. Level of education (Please only indicate the highest qualification)

Certificate	
Diploma	
Bachelor's degree	
Postgraduate degree	

4. Current position

Principal/headmaster	
Deputy principal/ Deputy Heads	
Heads of department	
Grade Heads	
Educators (teachers and assistant teachers)	

5. Work experience in the current position

Less than 5 years	
6 -10 years	
11 - 15 years	
16 – 19 years	
More than 20 years	

SECTION B: OPPORTUNITIES OF DIGITISATION

The following statements describe the different opportunities of digitisation in your institution. Please use the rating scale below to express the degree to which you agree or disagree with each statement. Kindly choose a single answer that best describes the perception you have by crossing (x) the relevant block.

Items	Strongly disagree	disagree	Neutral	Strongly agree	Agree
1. Digitisation replaces traditional workflow with digital processes	1	2	3	4	5
2. Digitisation increases the time spent on researching a new development strategy instead of holding on to achievements	1	2	3	4	5
3. Digitisation is changing the modern and professional working model	1	2	3	4	5
4. Digitisation is constantly improving the work life of employees	1	2	3	4	5
5. Digitisation increases the workflow efficiency	1	2	3	4	5
6. Digitisation minimise technical errors	1	2	3	4	5
7. Digitisation applies new services and technologies quickly and flexibly	1	2	3	4	5
8. Digitisation improves work quality and performance	1	2	3	4	5
9. Digitisation constantly increase learners' productivity	1	2	3	4	5

SECTION C: CHALLENGES OF DIGITISATION

The following statements relate to the challenges of digitisation in your institution. Kindly choosing a single answer that best describes the perception you have by crossing (x) the relevant block.

Items	Strongly disagree	disagree	Neutral	Agree	Strongly agree
1. The school is facing a lack of skills in the workforce to work in digital environments	1	2	3	4	5
2. The school lacks a strong information technology foundation to successfully carry out digitisation	1	2	3	4	5
3. The school leaders lack digital thinking and knowledge	1	2	3	4	5
4. The school staff lack digital thinking, knowledge and skills	1	2	3	4	5
5. The most prominent challenge for schools digitisation is access to finance and limited skills in entrepreneurship	1	2	3	4	5
6. The school management is facing cultural changes as they have to adapt in order to adopt unfamiliar technologies	1	2	3	4	5
7. The school's staff is facing cultural changes as they have to adapt in order to adopt unfamiliar technologies	1	2	3	4	5

8. The whole school is facing a radical change due to the development of digital technologies	1	2	3	4	5
9. The school is facing increased competition exacerbated by globalisation	1	2	3	4	5
10. The schools management is facing stress to move digitally before others to survive and gain competitive benefits	1	2	3	4	5

Thank you for your participation

ANNEXURE E: TURNITIN SIMILARITY REPORT

Opportunities and Challenges of Digitalisation in High School Learning in the Free State

ORIGINALITY REPORT

17 %	15 %	6 %	7 %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	repository.up.ac.za Internet Source	1 %
2	ijournalse.org Internet Source	1 %
3	hdl.handle.net Internet Source	1 %
4	uir.unisa.ac.za Internet Source	1 %
5	researchspace.ukzn.ac.za Internet Source	1 %
6	etd.cput.ac.za Internet Source	1 %
7	etd.cput.ac.za:8080 Internet Source	<1 %
8	www.tandfonline.com Internet Source	<1 %