The impact of the collaboration between University of the Free State ideas lab and the Free State Department of Education on the academic achievement by Grade 12 learners

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Submitted: 31 March 2025

DECLARATION

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ABSTRACT

This study was conducted to determine the impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on the academic achievement by Grade 12 learners. A dominantly post-positivist paradigm was adopted, using the combined (quantitative and qualitative) approaches. The quantitative part of the study made use of historical secondary data representing the pass marks of the selected Grade 12 learners in the Free State Province, which spans a five-year period (2014-2018). The qualitative part used interview data drawn from interactions with teachers from the selected schools (Further Education and Training Band) within the Motheo District of the Mangaung Metropolitan, the Motheo FET schools' district subject specialists in three selected Grade 12 subjects under study, Free State Department of Education (FSDoE) head office FET schools' subject specialists in three Grade 12 subjects that formed part of the study and staff from the University of the Free State's (UFS) Internet Broadcasting Project (IBP). Data collected in the form of the secondary data representing pass marks of Grade 12 learners between 2014 and 2018, was analysed using the statistical Package for Social Sciences (SPSS 29.0) to generate descriptive and inferential statistics, two-way ANOVA (Univariate Analysis of Variance, Descriptive statistical Dependent Variable, Levene's Test of Equality of Error Variances and Profile Plots) for all the three selected subjects (English First Additional Language, Mathematics and Physical Science). The qualitative data in the form of interviews (teachers, FSDoE district, FSDoE head office specialist and UFS ideas lab staff) was analyzed, using content analysis and thematic analyses using the NVivo, a software that analyses qualitative data. The adopted theoretical framework was the original Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh, Morris, Davis and Davis (2003). The model's constructs were aligned to the results obtained from the qualitative data to make sense of the impact the IBP has on achievement of the Grade 12 learners in the Free State Province. Ethical considerations were made regarding informed consent forms, approval seeking, permission and confidentiality. The response from the teachers showed that they were not only comfortable with the use of IBP, but also the commitment of their learners made it easier to integrate the technology in teaching and learning. Social influence like the other three constructs (PE, EE and FC) was equally influencing behavioural intention and ultimate usage of the IBP in teaching and learning. There was also a positive relationship between the UTAUT constructs and the dependent variable (achievement). The findings also showed that there was a better performance by IBP schools in comparison to the non-IBP, thus confirming that the technology had a significant impact on the

Grade 12 learners' achievement. The findings further indicated that the IBP service was evolving and increasing its portfolio to respond to the ever-changing times, thus ensuring that performance was sustainable, and the service was on par with the rest of the world. The study recommended that the focus should shift from the quantity or high number of passes to quality or improvement in Bachelor passes at higher levels of performance. Another recommendation is to consider expanding access to the IBP to all public high schools to ensure that all leaners have equal chances to achieve at higher levels, due to equal access to similar quality education that is offered through the integration of the IBP in teaching and learning.
Key words: UTAUT model, educational technology, Internet Broadcasting Project, schools-academic institutions collaboration, technology integration, learner achievement, secondary schools' education, educational technology policies, private public partnerships, equity in education, resource-sharing in teaching and learning, theory and practice in educational technology.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA: Analysis of Variance

ARMT: Alabama Reading and Mathematics Test

BI: Behavioural Intention

CAPS: Curriculum Assessment Policy Statements

COGTA: Cooperative Government and Traditional Affairs

COVID-19: Coronavirus disease

CRR: Chemical Reaction Rate

CSBI: Computer Simulation-Based Instruction

C-TPB-TAM: Combined TAM and TPB

DBE: Department of Basic Education

EE: Effort Expectancy

EFAL: English First Additional Language

EMIS: Education Management Information System

EMINTS: Enhancing Missouri's Instructional Networked Teaching Strategies

FC: Facilitating Conditions

FET: Further Education and Training

FSDoE: Free State Department of Education

IBP: Internet Broadcasting Project

ICT: Information Communication Technology

ICTISE: ICT innovation in School Education

IDT: Innovation Diffusion Theory

IIIEP: International Institute for Educational Planning

LOLT: Language of Learning and Teaching

MATH: Mathematics

MBL: Microcomputer-Based Laboratories

MM: Motivational Model (MM)

MPCU: Model of Personal Computer Utilisation

NQF: National Qualifications Authority

NSC: National Senior Certificate

NVivo: a qualitative data analysis software

OECD: Organisation for Economic Co-operation and Development

OHMS: Online Homework Management Systems

PE: Performance Expectancy

PISA: Programme for International Student Assessment

PHYSC: Physical Science

PISA: Programme for International Student Assessment

PLC: Peer Learning Community

RQ: Research Question

SABC: South African Broadcasting Corporation

SACE: South African Council of Educators

SAQA: South African Qualifications Authority Act

SCT: Social Cognitive Theory

SI: Social Influence

SMT: School Management Teams

SPSS: Statistical Package for the Social Sciences

STAAR: The State of Texas Assessments of Academic Readiness

STEM: Science, Technology, Engineering and Mathematics

TAM: Technology Acceptance Model

TPB: Theory of Planned Behavior

TRA: Theory of Reasoned Action

UNESCO: The United Nations Educational, Scientific and Cultural Organisation

UKZN: University of KwaZulu-Natal

USA: United States of America

UTAUT: The Unified Theory of Acceptance and Use of Technology

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

The study investigated the impact that the Internet Broadcasting Project (IBP) has on achievement of Grade 12 learners in the Free State Province. There are many changes that have been brought about by the introduction of technology in the education sector and that includes the Internet Broadcasting Project (IBP). For example, teaching and learning at school level are being transformed using such technologies. However, inequalities in schools have led to low-quality output at Grade 12 level (Leepo, 2015:1 and Weiss, 2017:1). Hence, the introduction of private and public intervention programmes that promote the integration of technology in schools.

The Free State Department of Education (FSDoE) has partnered with the University of the Free State' (UFS) ideas lab to initiate the Internet Broadcasting Project (IBP) that delivers live broadcasting, on specific dates and times to, initially, 83 secondary schools across the Free State Province (Leepo, 2015:2, Businesswire, 2016, Weis, 2017:1, University of the Free State, 2017a, Mail and Guardian, 2018a, University of the Free State. 2019a). Although there are remote laboratories in education, expectations may be more imagined projections by the creators of the tools when compared to realities in schools (Petko et al., 2018, Le & Dinh, 2018 and Viegasa et al., 2018:201). Furthermore, despite the presence of these interventions in many countries, few studies have concentrated on the impact of IBP on student learning outcomes across all grades (Skryabin et al., 2015:49-58). Consequently, the present study evaluated the IBP offered by UFS ideas lab to augment learning.

The study seeks to ascertain the impact that the collaboration between the University of the Free State ideas lab and the Free State Department of Education has on achievement of Grade 12 learners in the Free State Province. The research objectives, questions and the statement of the problem guide the research in its quest to uncover the extent to which the collaboration mentioned above has on achievement of Grade 12 learners in the Free State Province.

1.2 Background to the study

According to Romm (2018:971), the right to quality education that is enshrined in the South African Constitution compels the Department of Basic education (DBE) to introduce various intervention programmes, including the Internet Broadcasting Project (IBP), to bridge the widening gap between the resourced and under-resourced public schools. The collaboration between the Free State Department of Education (FSDoE) and the University of the Free State (UFS) ideas lab is a case in point (ictise@ufs, 2012a, ictise@ufs, 2014b and ictise@ufs, 2014c). The University of the Free State (UFS)' ideas lab, formerly known as ICT Innovation in School Education (ICTISE), had, for six years, been relying on the Mediasite platform to offer live streaming and recorded quality educational videos that are accessible to all high schools in the Free State Province (ictise@ufs, 2012a, ictise@ufs, 2014b and ictise@ufs, 2014c, Businesswire, and 2016 and Jackson, 2016:1). The introduction and implementation of interventions in the African and South African education landscapes have a documented history that dates back to colonial and post-colonial times (Advantech Consulting, 2017:17, Rakometsi, 2008:350 and Bloch, 2009:17). Accordingly, the outcome of the collaboration would be the creation of a platform that allows for access to quality education across all public schools in the Free State Province, irrespective of their socioeconomic status. This collaboration, emanated from the Provincial Strategy on Learner Attainment (PSLA), is seen as a unique innovation that leapfrogged many disadvantaged schools into the digital world and, thus narrowing the inequality gap (Free State Department of Education, 2012:1, Jackson, 2016:1 and Businesswire, 2016). Hence, the need to establish the extent to which IBP integration has impacted the achievement of Grade 12 learners in the Free State Province. The introduction of the IBP as an intervention strategy, cannot be divorced from the history of the education system in South Africa, whose colonial past impacted not only schooling, but also the achievement of black learners at Matriculation level.

South Africa's Department of Basic Education (DBE) is a product of the amalgamation of nineteen pre-1994 departments of education that were formed along racial lines with each managing its own budget (Graven, 2014:1040 and Department of Planning Monitoring and Evaluation, no date:4). Morris and Hyslop (1991:259) opine that during the early 19th century, the mission schools were non-racial and admitted both black and white learners, but towards the late 19th century the racial and imperialist ideology dominated, leading to racial segregated schooling between black and white learners (Fredrickson, 1982 in Morris & Hyslop, 1991:259).

Subsequently, the passing of the Bantu education policy, between 1954 and 1967, led to mass education literacy amongst the black children and their enrolment increased at an average rate of 5.5% per annum from 1948-1994, and an improved school attendance rate that jumped from 24.5% to 84.5% (Sadie, 2005:15 in Giliomee, 2009:194). The level of enrolment versus achievement rate of black learners as observed over time is depicted in Table 1 below and covers the years between 1970 and 1993. The relationship between number of enrolments and achievements over time as indicated in Table 1 shows that there were only 2,846 learners who sat for the Matriculation examinations in 1970 (65.2% overall pass rate), while in 1990 there were 255 669 (43% pass) candidates. Table 1 further shows that during the same years (1970 and 1990), the percentage of university passes was 35.6% and 9% respectively. This indicates that although the number of candidates who sat for the Matriculation examinations increased over the years, there was a marked and continuous decline in the quality of the passes, which is measured by the number of Bachelor or university entrance passes. There was, therefore, an inverse proportion between an increasing enrolment at Grade 12 level and a decreasing quality of passes between 1970 and 1993.

Table 1
Public schools' level of achievement at Matric between 1970 and 1993

Year of enrolment	Total who wrote matric	Overall Matric passes	% of total Matric passes	Total university entrance passes	% total university entrance Matric passes
1970	2 846	1, 865	65.2%	1, 013	or 35.6%
1975	8 445	5 400	63.9%	3 520	41.7%
1980	29 973	15 946	53.2%	4 714	15.7%
1985	82 815	38 923	47%	9 938	12%
1990	255 669	109 938	43%	23 010	9%
1993			37%		8%

Source: Cronje 2010

Furthermore, another positive review associated with the Further Education and Training (FET) school band was that, as observed over the years, there was a marked high enrolment and high matric pass rate across the country (2000:9). For example, Table 2 shows that between 2009 and 2015 the lowest enrolment for NSC examinations was in 2011: 496 090 while in 2018 there were 644 536 (Department of Basic Education 2009-2018). Enrolment figures also indicate that

between 2009 and 2018 there was a rise in enrolment from 107 000 to 172 000 respectively, which was a 62% increase. Despite this increase, critics questioned the quality of throughput rates (Roodt, 2019:1). Table 2 also indicates that the lowest matric pass rate was in 2009 at 60.9% while in 2018 the pass rate was 78.2% (Department of Basic Education 2009-2018). The Grade 12 historical data that forms part of this study, was selected to establish if performance in the selected schools can be described as below standard, stagnant, or escalating and to ascertain if there is proof of quality or not from the performance data.

Table 2 also shows the distribution of quintile schools between 2009 and 2018 (Department of Basic Education 2011:52). In 2009 75% of the public schools fell between quintile levels 1-3 while in 2018, 78% of the public schools that offer Grade 12 fell between quintile levels 1-3 (Department of Basic Education 2009-2018). In the South African education system, public schools are catergorised into quintiles 1-5 that is informed by the poverty index of the area in which the school is located (Department of Basic Education, 2011:13-14). The linkage between poverty index and the socio-economic status of the communities assit to determine the performance of the public schools at NSC examinations (Department of Basic Education 2011:13-14).

Table 2 Public schools' (quintile 1-3) level of achievement at Matric between 2009 and 2018

	Total who wrote matric	Overall Matric passes	% of total Matric passes	Total university entrance passes	% total university entrance Matric passes	% of quintile 1-3 offering NSC
2009	552,073	334,718	60.9	109,697	32.8	75
2010	537 543	364 513	67.8	126 371	23.5	73
2011	496 090	348 117	70.2	120 767	24.3	70
2012	511 152	377 829	73.9	136 047	26.6	77
2013	562 112	439 779	78.2	171 755	30.6	76
2014	532 860	403 874	75.8	150752	28.3	80
2015	644 536	455 825	70.7	166 263	25.8	79
2016	610 178	442 672	72.5	62 374	26.6	79
2017	534 484	401 435	75.1	153 610	28.7	72
2018	624 733	400 761	78.2	171 787	33.5	78

Source: Department of Basic Education National Senior Certificate examination reports 2009-2018.

The introduction of the quintile system was described as a breakthrough when it comes to funding models that address the needs of the disadvantaged schools, but like the Norms and Standards, they have not fully achieved the envisaged equality across all race groups in South Africa and thus compromised on quality teaching and learning (DBE, 2021 and Chanee, 2020:1). However, some authors, such as Taylor (2008:2) opines that South Africa is outperformed by eight neighboring countries that include Mozambique, Kenya, Uganda and Tanzania, who are not financially well-off in comparison to their South African counterpart (Msila, 2014:341). The above assertions indicate that it is possible to produce quality education with limited resources, but the reality is that South African teachers also lack motivation with some not having the necessary qualifications (Msila, 2014:341).

Other findings by Reddy et al. (2012) indicate that within the South African context, on average, Grade 9 learners in Quintiles 1 and 2 are three years behind in mathematics learning when they are compared to their counterparts in the same Grade but enrolled in Quintile 5 schools. This was attributed to the existence of a widening gap that can be traced back to the socioeconomic status that directly impacts achievement in mathematics (Ogbonnaya & Awuah, 2019:107). Similarly, for Physical Science, the number of learners has been declining since 2009, but the percentage of Grade 12 learners achieving above 40 percent has been increasing from 21 percent to 39 percent (DPME, n.d.:31). The introduction of Mathematical Literacy is also seen as one of the factors that negatively affected enrolment of high school learners in pure Mathematics and there was a marked decrease from 290 407 in 2009 to 225 874 in 2012 (Department of Planning Monitoring and Evaluation, n.d.:31). However, South Africa continues to experience a low to average performance in Mathematics and Sciences, which means that South African learners are performing below the level expected for Grade 12 learners and this reflects the wide disparities in society and in schools (Department of Planning Monitoring and Evaluation, n.d.:31).

The history of curriculum in the South African education sphere is historical and over the years, it has undergone metamorphosis that directly impacted on the achievement of Grade 12 learners in the Free State Province. Vandeyar and Jansen (2008: viii) add that transforming the curriculum was never going to be an easy process after many centuries of colonialism.

Professor Kader Asmal (1999), the former National Minister of Education in South Africa, noted that transforming a broken and unequal education system was never going to happen within a short period of time (Department of Education, 2000: iii). However, he acknowledged that there was a political will to fulfil what the Constitution requires, including respect, protection and the promotion of the rights for all citizens to access basic education (2000: iii). Hence, the need to seek views from different stakeholders on how far the IBP integration in the Free State Province's public high schools has gone, to fulfill the rights laid down in the Constitution that includes equal access to quality education.

Before the current South African National Curriculum that is referred to as CAPS (Curriculum Assessment Policy Statements) was introduced in 2012, its predecessors received a lot of criticism including vagueness and difficulty to implement (Department of Planning Monitoring and Evaluation, n.d.:33). Accordingly, this study, through Research Question (RQs) 1 and 2, highlighted policies and views of specific stakeholders on the role that the curriculum plays in ensuring that IBP integration in public high schools in the Free State becomes an achievable reality.

The introduction of CAPS curriculum was a policy shift toward the presentation of a unified and concise curriculum document, whose aims would be to provide detailed information on what teachers need to teach and assess at specific grade levels and in a subject area (Department of Planning Monitoring and Evaluation, n.d.:33). Another notable success, associated with the post-apartheid education system in South Africa, was the establishment, in 1995, of the South African Qualifications Authority Act (SAQA) (Department of Education, 2000:9). Its main responsibility included the establishment and Implementation of the National Qualifications Framework (NQF), a body tasked with setting-up learning achievements, as well as quality in education and training (2000:9). The NQF framework consisted of different bands, including the Further Education and Training (FET) schools, under which Grade 12 falls (2000:9). The scale of achievement at Grade 12 level, as stipulated in the Department of Basic Education (DBE)'s curriculum and assessment policy documents, pertaining to all registered subjects, divides achievement into seven levels (Department of Basic Education, 2013:36). As indicated in Table 3 below, level 1 represents poor or no achievement, level 3 represents a moderate achievement, while level 7 is considered as an outstanding achievement (2013:36). Consequently, the achievement levels are linked to the RQs 1 and 3 that spell out, through

relevant policies, how achievement would be assessed in reference to the IBP integration in teaching and learning and the National Senior Certificate (NSC) outcomes are a case in point.

Table 3
Scale of achievement for the National Senior Certificate (NSC): Grades 10-12 (2013:36)

Achievement level	**Achievement Description**	**Marks %**
7	Outstanding Achievement	80-100
6	Meritorious Achievement	70-79
5	Substantial Achievement	60-69
4	Adequate Achievement	50-59
3	Moderate Achievement	40-49
2	Elementary Achievement	30-39
1	Not Achieved	0-29

Source Department of Basic Education 2013 (2013:36)

According to Motshekga (2021), the National Senior Certificate examination (NSC) results are still regarded as the barometer used to measure success within the South Africa education system (DBE, 2021:2). What makes this education system to be lauded for a credible and successful public examination system, is the upholding of the principle of integrity and that is recognised by both the higher education institutions and the employers (DBE, 2021:2). The selection of the historical secondary data that represents the achievement of Grade 12 learners in the Free State Province, over a five-year period, highlights the achievement of learners according to the set levels. Conclusions can also be drawn on how the influence of technology integration affected the performance of Grade 12 learners in the Free State Province, according to levels of achievement.

Marwala (Mail & Guardian, 2021), the former vice-chancellor at the University of Johannesburg believes that there is an urgent need to transform the South African education system, including basic education, by introducing a curriculum that prepares both teachers and learners for the future driven by the Fourth Industrial Revolution (4IR) technology. He warns that, even though there will be causalities in the form of job losses during the 4IR introduction, the successful implementation of a transformed curriculum will create new vacancies (2021). The new jobs will be propelled by Science, Technology, Engineering and Maths (STEM), Data analysis, Computer science and Engineering (Mail & Guardian, 2021). Hence, the need to delve into the current curriculum (CAPS) to ascertain its role in promoting the involvement of technology-driven intervention programmes, including IBP to empower learners and teachers

with relevant skills needed to tackle the critical subjects that include Mathematics, Physical Science and English. It is equally important to acknowledge the introduction of education policies that support integration of technologies within the teaching and learning sphere with e-learning forming a solid foundation. There are researchers (Engelbrecht, et al., 1999), who call for an integrated and inclusive curriculum that not only takes into consideration the learners' context but also embraces South Africa's diverse communities. The following sub-topic deals with the location of this study.

1.3 Location of the study

The Free State Local Government sector is constituted by the Mangaung Metropolitan Municipality, the first metropolitan municipality of the Free State Province and is also the capital city of the Free State Province (Free State online, n.d.). Figure 1 below indicates that the Metro has three urban centres (Bloemfontein, Botshabelo and Thaba Nchu) and surrounding rural areas (97.17% of the entire municipal area) that include small towns, namely, Dewetsdorp, Wepener, Van Stadensrus and Soutpan/Ikgomotseng (COGTA, 2020: 8-9).

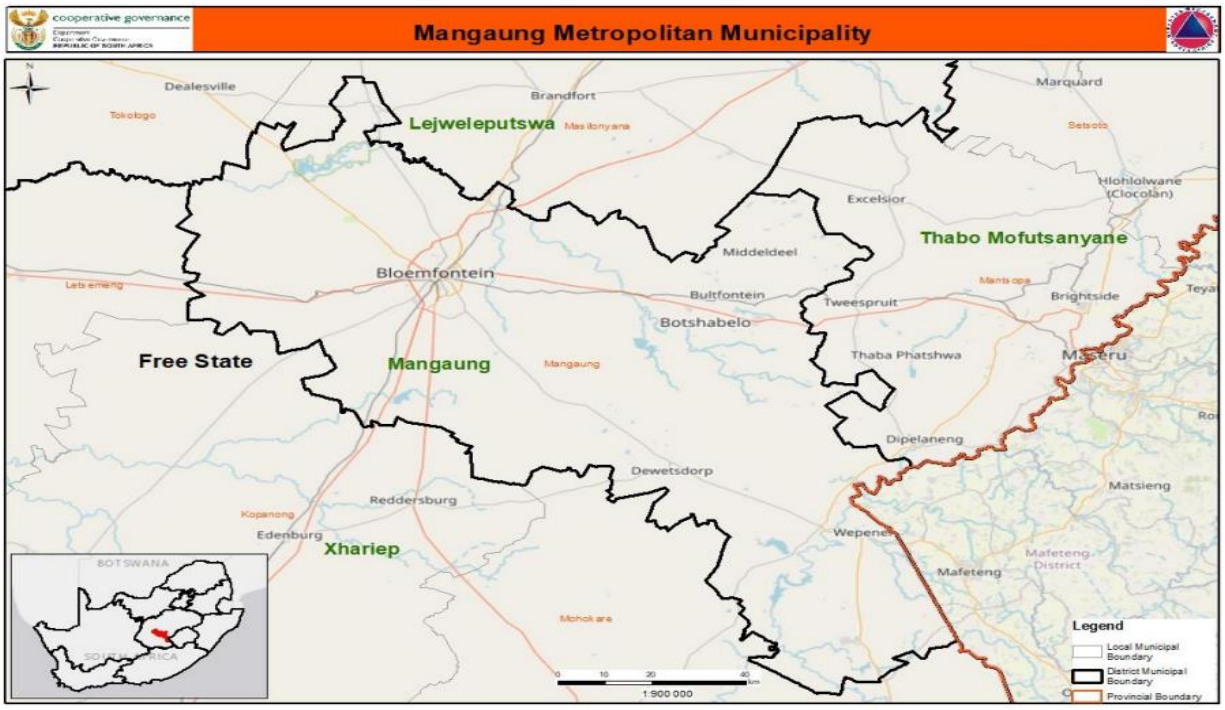

Figure 1 source: COGTA: 2020:8

The selection of this location for this study, specifically schools in Bloemfontein, Botshabelo and Thaba Nchu, was based on the researcher's familiarity with the terrain, ease of reach and cost-effectiveness. The sites were chosen because they are located within the Mangaung Metropolitan Municipality and meet the criteria set out for participation (see detailed selection

criteria in chapter four). In addition, and for economic reasons, the researcher can reach the University of the Free State ideas lab, including the district and head offices of the Free State Department of Education (FSDoE) with ease. Furthermore, since the sample consists of the examinations marks that Grade 12 learners received after sitting for the National Matriculation Certificate (NSC), the findings were likely to reflect the provincial and national footpath (see section on sampling in chapter four). Below is the statement of the problem that is linked to the stated research questions.

1.4 Statement of the problem

Although it is three decades after the elimination of apartheid and its repressive laws, its legacy, including the colonial practices within the education system, is still felt and the deep divisions along racial lines are a case in point (Hyslop, 1991:259, Fiske & Ladd, 2004 and Letseka & Maile, 2008:4, Spencer, 2014: xvi and Juan et al., 2019:2). Accordingly, this study sought to highlight the extent to which the IBP, an online video learning intervention strategy, impacts on the achievement of Grade 12 learners in the Free State Province. The IBP is premised on the provision of quality teaching and learning to Grade 12 learners across the Free State Province (Weiss, 2017:1). It wholly relies on the use of online video-based learning, allows for quick and cost-effective communication between teachers and students and thus eliminating barriers, including distance (Jackson, 2016:4 and Weiss, 2017:1). However, there is a lack of understanding of the experiences of teachers and learners when it comes to ICT integration initiatives and frameworks that support learning in the developed and developing countries (Alfaki & Khamis, 2018, Alrasheedi & Capretz, 2018 and Goh, 2018). Accordingly, the current research aimed to get a clearer understanding of the satisfying and unsatisfying experiences of the pupils and teachers in the FSDoE/UFS ideas lab initiative to advance South African and global knowledge in this area. This research also delved into the role that context, technology adoption patterns and preference for different devices play in teaching and learning environments (2016:4). However, only a few studies have measured the impact of educational technology on the academic achievement of learners (Karabulut-Ilgu et al., 2018:399). Beyond the potentials mentioned above and possibilities, there is a crucial need to highlight the ICT-led factors that influence the learners' academic performance. In this light, the study identified the core factors of the UFS ideas lab that are associated with the academic achievement of Grade 12 learners in the Free State Province.

Research on IBP integration in learning is expanding, focusing mainly on enhancing traditional classroom activities (Haythornthwaite, et al., 2016:4). However, successful implementation is yet to be determined, due to complexities (Zhu et al., 2018:222 and Ayooluwa, 2016). Dukuzumuremyi and Siklander (2018) and Dixon (2018) call for research on how IBP-led interventions assist learners to achieve academically. Hence, the recommendations for future studies to explore the impact IBPs have on individual subjects (Howard Chan & Caputi, 2015:360). Accordingly, the purpose of this research was to also compare similar experiences of teachers and learners on how IBP integration was implemented on a global platform. Unfortunately, some intervention programmes do not always produce desired outcomes, due to inconsistencies during implementation (McNaughtona et al., 2018:312; Leepo, 2015:5). Research must also unravel the implications of IBP-led collaborative interventions on specific grades, as previous researches focused mostly on higher education (Luengam et al., 2018 and Shepherd, 2018). Furthermore, despite the presence of these interventions, few studies have concentrated on the impact of IBP across all levels (Skryabin et al., 2015: 49-58).

Studies on ICT-led interventions (Livingstone, 2012:3-4 and Leepo, 2015:97) positively confirm IBP's impact on learner attainment and improvement. It is also while using these ICTs technologies that learners have shown improvement in their retention and memory, while teachers have found it easier to breakdown and explain difficult concepts that learners could easily comprehend (2015:97). However, in some schools, there are many challenges that include affordability, connectivity problems and malfunctioning of the equipment and in some schools the IBP tools have never functioned properly since installation (2015:97). Accordingly, this study sought to highlight these challenges and how they can be overcome and thus positively impact the achievement of Grade 12 learners in the Free State Province. Creators and designers of educational technologies often report on the potentials and possibilities with limited evidence on the impact on learners' academic achievement (Petko et al., 2018 and Mahmood et al., 2018). The study's research objectives are clearly indicated below.

1.5 Objectives of the study

The overriding purpose of the study was to determine the impact that the Internet Broadcasting Project (IBP) has on the achievement of the Grade 12 learners in the Free State Province, with specific research objectives guiding the study to:

i. Identify the legal and legislative frameworks that support the creation and integration of ICTs at the Grade 12 level.
ii. Understand the experiences of learners and teachers on the provision of IBP intervention programme for Grade 12 learners in the Free State.
iii. Investigate the UFS ideas lab-led factors that influence academic achievement by Grade 12 learners in the Free State.

1.6 Research questions

The primary research question is *how has the collaboration between the Free State Department of Education and the University of Free State' ideas lab impacted the academic achievement of Grade 12 learners?*

The secondary research questions are as follows:

1. What are the legal and legislative frameworks that support the creation and integration of ICTs at the Grade 12 level?
2. What are the experiences of learners and teachers on the provision of IBP intervention programme for Grade 12 learners in the Free State?
3. What are the UFS ideas lab-led factors that influence the academic achievement by Grade 12 learners in the Free State?

1.7 Significance of the study

This study fell under the ICT/e-learning research, which recognizes the role of the Internet and different ICT applications in developing societies (Ayooluwa, 2016 and Ngcobo, 2016). Consequently, this study established the impact that IBP has on the achievement of Grade 12 learners in the Free State Province. The 21st century Information scientists possess different ICT skills that are needed to empower students to be independent lifelong learners, rather than passive recipients of information (Padma, 2018:376). They also assist learners to go beyond the traditional textbooks by empowering them with computer technology, critical-thinking and information-seeking strategies (2018:376). Therefore, a goal of this research was to determine specific features of the IBP that associate with the academic achievement of Grade 12 learners in the Free State Province. From a policy point of view, when ICT strategies and their interventions are fully implemented, they can produce empowered and skilled societies, who are not only digitally savvy, but expand theory and practice at both local and international

levels (Chisa & Hoskins, 2014:49). The presence of current and relevant information that focusses on technology integration across all modern libraries, ensures that theory is not only easily accessible to all patrons using advanced tools, but also forms an integral part of the digital society (Veeranjaneyulu, 2018:15 and Ngcobo, 2016). Consequently, this study highlighted the various theories and forms of practice that contribute positively towards advancement of the digital and literate society. In the LIS field, there is an agreement that improved research skills, due to the introduction of ICT intervention programmes, has positively impacted on the performance of librarians and ICT contributes toward sustainable library development (Olasina, 2018:1). This study also sought to highlight various stakeholders' experiences at both local and international levels on the suitable technology integration techniques that are driven by valid and credible theories, whose aims are to ensure social inclusivity and sustainability within the knowledge economy (Krishna & Madon, 2018: xiii). This study further sought to identify the legislative frameworks that seek to promote the integration of ICTs in teaching and learning. School librarians can improve teaching and learning by using their information literacy skills, engaging in intervention projects, and supporting classroom teaching, collaboration and support (Lo & Dickson, 2015:696 and Ngcobo, 2016). In the next sub-section is a brief coverage of the selected theoretical framework that underpins this study.

1.8 Theoretical framework

This study adopted a Unified Technology Acceptance and Use of Technology (UTAUT) model by Venkatesh et al. (2003) that is discussed in detail in chapter two. The UTAUT model was selected, based on the criteria for determining theoretical perspectives for research approved by Creswell (2008; 2013). Resultantly, some related theories, such as the Technology Acceptance Model (TAM), the interpersonal theory behaviour, the social cognitive theory, the diffusion of innovation theory, the uses gratification theory and the Unified Theory of Acceptance and Use of Technology (UTAUT) were considered. The selection criteria included appropriateness, analytic level, empirical support, uniqueness, falsifiability, logical consistency, and the need to cover the research questions of the study (Creswell, 2013). It was based on the adopted theory selection method that the UTAUT was chosen.

The UTAUT model is a combination of eight technology acceptance models, whose different variables were identified and used to develop it (Venkatesh et al., 2003:467 and Mtebe & Raisamo, 2014:4).The model is made up of three direct determinants of intention to use:

Performance Expectancy (PE), Effort Expectancy (EE), and Social Influence (SI) and two direct determinants of usage: Behaviour Intention (BI) and Facilitating Conditions (FC) (Venkatesh et al., 2003:467 and Ahmad, 2015:1). It also consists of influential and integral moderating elements that include experience, voluntariness, gender, and age (Venkatesh et al., 2003:467, Ahmad, 2015:2 and Kocaleva et al., 2015:24). As it is discussed in detail in chapter two, this study has not modified the original UTAUT model and applied it as it is. The model explains that individual differences influence technology use. Table 3 below provides a mapping of the research questions to the constructs of the adopted UTAUT model.

Table 4 Relationship between the research questions and the constructs of the UTAUT model

Serial Number	Research Question	Relevant UTAUT construct
1.	What are the legal and legislative frameworks that support the creation and integration of IBPs at the Grade 12 level?	Facilitating Conditions (FC)
2.	What are the experiences of learners and teachers in the provision of IBP initiatives support for Grade 12 learners in the Free State?	Performance Expectancy (PE), Effort Expectancy (EE) Social Influence (SI)
3.	What are the UFS ideas lab-led factors that influence academic achievement of Grade 12 learners in the Free State?	Facilitating Conditions (FC) Performance Expectancy (PE) Effort Expectancy (EE)

Source: created by the researcher

1.9 Limitations of the study

This study was limited to Motheo District that represents one out of five districts in the Free State Province. Within this District it was narrowed further to only three out of seven

administrative towns within the Mangaung Metropolitan Municipality (see also section 1.3 above). The inclusion of subject specialists from both district and head office means the latter will add perspectives that cover their experiences from across the Free State Provinces. The IBP laboratory staff serve all the districts, and their experiences will add a provincial perspective to the study. The time and cost factors made it practically impossible for the study to cover all five Free State district offices. The University of the Free State (UFS) ideas lab offices are also located within the Motheo District at the UFS South Campus and that made it easier for the researcher to set up meetings with the targeted staff members. Another limitation was that this study made use of the quasi-experimental research design (see chapter four) that used the historical secondary data from 2014 to 2018, alongside a qualitative approach. A different experimental study, for example, would include physical visitation of sites, may also be another opportunity to expand this study. The next section deals with the preliminary literature of the study with a detailed account shared in chapter three.

1.10 Structure of the dissertation

The thesis is divided into the following chapters:

Chapter One: Introduction. This chapter covers the introduction and background to the research problem, statement of the problem, objectives of the study, research questions, significance of the study, and limitation of the study.

Chapter Two: Theoretical framework. This chapter provides the theoretical framework upon which the study was based. The Unified Theory of Acceptance and Use of Technology (UTAUT) was chosen to underpin this study.

Chapter Three: Literature review. This chapter presents a detailed review of existing theoretical and empirical literature relating to the study. It highlights what has been done, existing gaps and the contribution of the study in addressing the gaps in literature.

Chapter Four: Methodology. This chapter focuses on and discusses the research methodology, and methods employed in achieving the objectives of the study. It provides details on paradigms, approaches, research design, study population, sampling techniques/sample size, data collection methods, validity and reliability of the instrument, data analysis and ethical issues.

Chapter Five: Data analysis and presentation of findings. This chapter analyses and presents both the quantitative and qualitative data obtained from survey research questionnaires and structured interviews respectively.

Chapter Six: Discussion of findings. This chapter presents and discusses the findings of the study, using relevant theories and extant literature.
Chapter Seven: This chapter provides a summary of the findings, recommendations, and suggestions for further research and conclusion.

1.11 Summary

This chapter provided context of the study through the discussion of the impact that that the IBP integration has on the achievement of Grade 12 learners in the Free State Province, the statement of the problem, research objectives, research questions and limitations of the study. The theories, theoretical framework, statement of the problem, research questions and objectives of the study were also discussed. The chapter sought to locate the study in the current debate on IBP acceptance, use and impact thereafter on the achievement within the Further Education and Training (FET) schools' sector in the Free State Province. The chapter further aimed to delineate specific variables that are thoroughly discussed in the theoretical framework (chapter two) and literature review (chapter three) respectively.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 Introduction

This chapter deals with the selected Unified Theory of Acceptance and Use of Technology (UTAUT) theoretical framework and eight related models that are associated with technology acceptance, adoption and usage that are briefly discussed below. A brief synopsis of this chapter is covered in chapter one of this study (see section 1.8). The UTAUT model was selected to make sense of the impact that the Internet Broadcasting Project (IBP) has on the achievement of Grade 12 learners in the Free State Province.

Although there are many definitions of the concept, theoretical framework, Eisenhart (1991:205) defines it as "a structure that guides research by relying on a formal theory, constructed by using an established, coherent explanation of certain phenomena and relationships." This study adopted the UTAUT model that serves as the formal theory upon which the relationships between variables were established. According to Creswell (2003), the inclusion of theories in research studies empowers researchers with relevant concepts that assist them to answer the research problem and research questions in the studies that they are pursuing. They also assist researchers to give a justification on why they have selected specific theories over the others and how they will be used as a lens to guide towards the realisation of their aims and objectives (Creswell, 2003). Hence, the need to identify a suitable theoretical framework whose role is to make sense of the impact that UFS ideas lab has on the achievement of Grade 12 learners in the Free State Province. Moreover, there are instances wherein researchers may be forced to translate some variables within the framework into graphics for them to be easily understood by the audience, who rely on visualizations to make sense of the interconnections between such variables (Creswell, 2014:88). Consequently, the selected UTAUT model made use of visualization that is composed of constructs and moderators to assist in establishing a relationship between the integration of the IBP and achievement of Grade 12 learners in the Free State Province.

It was important for this study to delve into earlier models, to highlight their origin, how they relate to the pre-existing models, their strengths, weaknesses and the UTAUT's strengths. The brief discussions on the eight models that were developed prior to the UTAUT model is

important, because they have contributed to over three decades of research on technology acceptance works (Davis, 1989, Comeau & Higgins, 1995:189, Goodhue, 1995:213 and Leonard-Barton & Deschamps, 1988:1252 and user behaviour (Hu et al., 1999:93) at both private and public institutions with contexts often cited as playing a critical role (Marikyan & Papagiannidis, 2023:2). In some cases, the outcomes from the applied models produced variance in technology use, which was about 40% (Davis, 1989, Davis et al., 1989, Taylor & Todd, 1995 and Venkatesh & Davis, 2000). Delving into the eight models would justify why the UTAUT model was selected for this study. Accordingly, the models that make up the UTAUT model help frame the organisation of the chapter as follows: section 2.2 - Theory of Reasoned Action (TRA), section 2.3 Theory of Planned Behaviour (TPB), 2.4 - Technology of Acceptance Model (TAM), 2.5 - Innovation Diffusion Theory (IDT), 2.6 - The Combined Theory of Planned Behaviour/Technology acceptance Model (C-TAM-TPB), 2.7 - Motivation Model (MM), 2.8 - Social Cognitive Theory (SCT), and 2.9 - The Model of PC utilization (MPCU) (Marikyan & Papagiannidis, 2023:2-3). Sections 2.2 to 2.9 below represent the summaries of the eight models and 2.10 is a detailed discussion of the selected UTAUT model. The Theory of Reasoned Action TRA is the first of the eight earlier developed models to be discussed.

2.2 Theory of Reasoned Action (TRA)

TRA is regarded as the precursor to several models that focus on human behaviour within the technology adoption realm (Ajzen & Fishbein, 1980, Fishbein & Ajzen, 1975, Venkatesh et al., 2003 and Dwivedi et al., 2019:720). As social psychologists, Fishbein and Ajzen (1975 and 1980) sought to create a theory that would contribute towards a better understanding of why individuals display specific behaviours when participating in specific activities.

The major constructs of the TRA are Behavioural Intention (BI), Attitude toward behaviour (A) and Subjective Norm (SN) (Ajzen, 1975, 1980, Ghobakloo et al., 2010:10, Saulus, 2017:23 and Osayande, 2019: 25). According to the model, individuals behave in specific ways, due to the influence of their Behavioural Intention (BI), that is, in turn, linked to an individuals' attitude (A) and subjective norms (SN) (Fishbein & Ajzen, 1975 and Dwivedi et al., 2019:720).

Behavioural Intention (BI) measures an individual's intention to engage in a particular behaviour (Ajzen & Fishbein, 1975). It tends to dominate in areas where it is applied and is also

regarded as the strongest and most proximal predictor of volitional behaviour (Montano & Kasprzyk, 2015). Attitude toward behaviour (A) is described by Ajzen and Fishbein (1975) as an individual's positive or negative feelings towards performing a certain behaviour. Subjective Norm (SN) is described as the propensity by an individual to engage or not engage in a specific behaviour, due to the inherent perceptions that important people within their sphere hold the same views (Tavallaee et al 2017:23). It is also determined by an individual's normative beliefs (Ajzen & Fishbein, 1975, Sutton, 2001, Moore & Benbasat, 1996:133, Birch, 2009:24, Silverman, 2016, Mimiaga, 2009 & Saulus, 2017:23).

What makes TRA stand out, is its versatility as a behavioural theory and this characteristic feature is seen as key in the studies that seek to establish a correlation between attitude and behaviour (Kripanont, 2007, Samaradiwakara & Gunawardena, 2014). Despite its popularity within the social sciences, Ajzen and other researchers have identified some imperfections and limitations within the TRA (Tavallaee et al., 2017:11). For example, Samaradiwakara and Gunawardena (2014:28) do not agree that individuals have the propensity to form unique beliefs that shape their intentions to engage in certain behaviours. They contend that there are always distractions in the way that may limit that freedom, and they cite, for example different abilities and talents, time factors, the influence from the environment or the limits offered by an organization itself and the presence of unconscious habits that may limit the freedom to act (Mutsvunguma, 2019:22). TRA, according to Botha and Kris (2005), lacks the ability to describe and explain how an individual makes the decision to adopt or reject an innovation, because it only describes the drivers of an individual's behavior (Eyaufe, 2017:15). This limitation has been cited by many. Furthermore, its generality, rationality, volitional and inability to consider external factors makes it unsuitable to be used in a teaching and learning environment, like the Free State Department of Education (FSDoE).

Although TRA has gained acceptance for its predictive validity, some studies stretched it beyond the specified parameters (Sheppard et al., 1988). This contributed towards the development of a comprehensive Theory of Planned Behaviour (TPB) (Ajzen, 1991) that is discussed in the next sub-section and a widely used and parsimonious Technology Acceptance Model (TAM) (Davis, 1989, Davis et al., 1989) that follows further down in section 2.4.

2.3 Theory of Planned Behavior (TPB)

According to the Theory of Planned Behaviour (TPB), individuals' participation in specific actions are determined firstly by their intentions and perceptions and, secondly, by their attitude towards behaviour, SN, and Perceptions of Behavioural Control (PBC) (Ajzen, 1991, 2001 and Dwivedi et al., 2019:720).

As an extension of the TRA, TPB, differs from its predecessor in that it included an additional construct, Perceived Behavioural Control (PBC) that is determined by controlled beliefs and perceived power (Tavallaee et al., 2017:12). PBC posits that individuals are encouraged to pursue a particular behaviour after examining its strengths and weaknesses and predicting its success rate when it is performed or not (2017:13). The inclusion of PBC was in response to the criticism laid earlier about TRA that it tended to ignore the other factors that may be externally influencing decisions to execute certain behaviours (Ajzen, 1991). The PBC construct was therefore introduced to strengthen the argument around an individual's decision-making processes that take into consideration the prevailing external factors and whose influence may either facilitate or constrain the performance of a specific behaviour (Ajzen, 1991). The identified factors whose influence led to behavioural change, include skills and resources that originate internally and externally (Taylor & Todd, 1995 and Eyaufe, 2017:16). The presence or absence of such resources and the type of control systems at play may either enhance or impede the performance of a specific behaviour (Osayande, 2019: 29).

Samaradiwakara and Gunawardena (2014:28) drew from the studies that applied TPB, and their findings revealed that the theory has an explicit and flexible theoretical foundation that is easier to apply in different contexts. TPB is also considered to be a general behavior model that is used to study and predict the intention to use different information systems (Taylor & Todd, 1995 and Mathieson, 1991). Moreover, there is enough empirical evidence that confirms that TPB displays a better understanding of the complex patterns that seek to establish a correlation between antecedents (such as beliefs and attitude) of behavioral intention and other acceptance models (Eyaufe, 2017:17). Another strength associated with TPB is that it is parsimonious and engages with a few variables, whose role are aimed at achieving a correct prediction of behaviour. It also provides clear guidelines on how to measure cognitive elements to ensure predictive precision (Ajzen & Fishbein, 1980 as cited by Saulus, 2017:30). As a modified model that has elements from TPB, the widely used and improved UTAUT model has also

gained recognition for being parsimonious in that it makes use of only four constructs, whose responsibilities include those associated with TPB. For example, BI in TPB plays an equal and influential role in the UTAUT model. In addition, PE, EE and SI draw some of their elements from constructs found in TPB including beliefs, attitudes and the influence of society.

Despite the above strengths associated with TPB, it has limitations. One of them is that, despite the inclusion of PBC, the TPB retained several weak traits associated with TRA (Montano & Kaspyzyk, 2002, Barnett & Presley, 2004 and Osayande, 2019: 30). For example, it does not matter how aware an individual may be towards the execution of certain behaviours, the results do not always produce the envisaged behaviour (Armitage & Conner, 2001). In addition, TPB is unable to predict or explain how it can be successfully applied when it comes to environments with low volitional control (Mutsvunguma, 2019:25). The presence of weaknesses in TPB that could be traced to the TRA and its inability to give a clear description of how it will perform in instances that have low volitional controls, makes it unsuitable to answer both the research problem and questions in this study. The next sub-section discusses TAM.

2.4 Technology Acceptance Model (TAM)

TAM that was introduced by Davis (1989), is a modification of TRA and its objective is to highlight the role that external factors play on an individual's inner beliefs, attitudes and intentions to use other options. Since the TAM model is made up of both the descriptive and predicting approaches, they allow decision-makers to reach conclusions based on patterns emanating from the performance of the identified technology and if needs be, intervention programs to remedy the situation, may be applied (Tavallaee et al., 2017:10).

The two constructs of the TAM model, are Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) and both variables are influenced by external variables that include social, cultural and political factors (Davis, 1989, Surendran, 2012, Saulus, 2017:25 and Eyaufe, 2017:22). The construct, PU, refers to an extent to which an individual believes that using a particular technology will enhance their job performance. Due to its subjective nature, PU is associated with the perception that an individual's use of technology may uncover a positive attitude towards that specified technology (Davis, 1989). PEOU is an extent to which an individual perceives that with a specific technology will be easier in terms of navigation through, with little or no effort at all (Davis, 1989). This means that if there are individuals who think that the

selected technology is easy to use, the chances are high that their attitude will lead to them using that technology (Davis, 1989).

TAM is one of the widely used models that is applied in many studies and different situations that involve making sense of technology adoption processes (Olasina, 2019:365). In comparison to the previous models, TAM performs better when it comes to understanding the impact that attitude has towards the use and acceptance of technology (Mathieson, 1991). Despite its popularity, TAM has some shortcomings that have been cited by some researchers whose interests are in technology acceptance and use. TAM has been criticised for amongst others, identified weaknesses, its naivety and simplicity (Bagozzi, 2007 as cited by Olasina, 2019:365). Consequently, the elements of naivety, simplicity and dominance of attitude as a strong determinant of adoption of the selected models, have made the UTAUT model suitable for the study, due to its constructs that include the PE, EE, SI and FC, which overcome the cited weakness in TAM. The following sub-section deals with the Innovation Diffusion Theory (IDT).

2.5 Innovation Diffusion Theory (IDT)

IDT is one of the widely used theories of acceptance, whose foundation is based on understanding on a conceptual level, as well as acceptance of innovations across different contexts over a stipulated period (Dillon & Morris, 1996). IDT was initially introduced in 1962, with modifications done by Rogers in 1995, with the focus of getting a better understanding of the rate at which newly introduced technologies penetrate the sphere of the targeted individuals or institutions (Rogers, 1962 and 1995). Unlike other theories that tended to focus on individuals, IDT is premised on the evolution of innovations every time they enter spaces where humans operate (2003:10). Rogers (2003:10) also argues that IDT looks at how innovation is communicated through specific individuals, using certain channels over an observed period.

Lee et al. (2011:126) posits that IDT has five important innovation constructs, namely, relative advantage, compatibility, complexity, trial-ability and observability. Firstly, the relative advantage refers to the degree to which an innovation is considered as better than the previous one that it replaced. Many studies have identified it as a strong predictor for adoption of an innovation (Rogers, 1995). Secondly, compatibility refers to the degree to which innovation aligns with potential users' innate values, prior experience and needs. Thirdly, complexity

refers to the end-users' perceived level of difficulty in understanding innovations and their ease of use. Fourthly, trial-ability is degree to which innovations can be tested on a limited basis. Lastly, observability is the degree to which the results of innovations can be visible by other people (Rogers, 1995; Lee et al., 2011:126 and Osayande, 2019: 36).

Over the years, IDT has been used by different researchers across fields of study in their quest to make sense of innovations that influence their daily operations (Venkatesh et al., 2003: 431). Although IDT has undergone some innovations over time, it has been applied in areas that use technology and positive results were discovered (Brancheau & Wetherbe, 1987, Agarwal & Prasad, 1997). IDT has been criticized for not giving an explicit explanation of how users accept and use an innovation (Dillon & Morris, 1996 and Eyaufe, 2017:21). Another limitation on identified from IDT is that it tended to be stronger as a descriptive tool than an explanatory one (Eyaufe, 2017:21). Furthermore, the model has been cited as lacking the ability to predict outcomes and provide guidance on how to speed up the rate at which technologies are adopted by individuals or institutions (Clarke, 1999 and Osayande, 2019: 36).

Based on the above limitations that include adoption levels and the use of technology that are time-bound and the models' descriptive over explanation nature, it made it not suitable for this study. The IBP has been in existence for years and continues to offer the service to selected schools across the Free State and there is no time limits imposed on its operations. With regards to the objectives of the study, IDT lacks tangible evidence through research, to support the evolution of attitude that leads to the adoption and the use of technology (Olasina, 2014 and Osayande, 2019: 35). The next discussion is on the combined TAM and TPB (C-TPB-TAM).

2.6 Combined TAM and TPB (C-TPB-TAM)

The C-TPB-TAM, which drew its variables from both TPB and TAM was formed to produce an integrated and comprehensive model that will offer a better understanding of technology adoption (Taylor & Todd, 1995). Although it shows similarities to the TPB when it comes to predicting intention, the C-TPB-TAM model, as indicated, combined attitude, subjective norm and behavioural control to be part of its belief structure to reflect the adoption of the technology (Venkatesh et al., 2003). As a combined model, it is also made up of predictors from both TPB and TAM (Taylor & Todd, 1995 and Dwivedi et al., 2019:720).

Taylor and Todd (1995) discovered that TAM has an ability to predict BI and provide an extent to which behaviour leads to technology adoption (Tavallaee et al., 2017:12). Despite TAM's popularity, some researchers identified, as a weakness, the absence of social and control factors within the model. It has also been cited that the same two factors play an important role within the TPB model (2017:12). Hence, their inclusion in the new and combined model to form prominent variables: attitude, subjective norm and perceived behaviour control that were added to TAM (2017:12). The decision by Taylor and Todd in 1995 to include the two factors was reached, because they were interested in identifying the determinants of technology usage and because they identified them as very predictable and widely used within the social psychology field of study (Taylor & Todd, 1995a and Samaradiwakara & Gunawardena, 2014:26). Furthermore, during their initial study to form a consolidated model, they proposed decomposing attitudinal belief into three factors: Perceived Usefulness (PU), Perceived Ease Of Use (PEOU), and compatibility (Kriponant, 2007). They drew conclusions that the three identified factors displayed consistent results towards acceptance and usage of the identified technologies (Samaradiwakara & Gunawardena, 2014:26).

TPB has been applied in many research studies with self-efficacy regarded as an important element within the PBC, since it affords an individual the ability and belief to perform specific tasks. In this study, the use of IBP would allow individual Grade 12 learners to be in charge of their learning and thus leading their achievement (Harrison et al., 1997; Limayem et al., 2000 and Tavallaee et al., 2017:14). Besides learners being in control of their learning, there is a need for the creation of resources and facilitating conditions, wherein proper technological infrastructure can be provided for the seamless integration, for example, of IBP in teaching and learning in the selected Grade 12 schools in the Free State Province (Tavallaee et al., 2017:14). Drawing from the two models, BI stands out as the strongest predictor that leads to a successful performance of that specific behaviour. It should also be indicated that although there is a positive relationship between intention and behaviour, the bond is not absolute, since there are some influential factors at play that may constantly affect intention. The longer the time between intention and behaviour, the bigger the chances for interference by unforeseen factors on intention. As has been noted from the discussions about the individual models, their constructs within the C-TPB-TAM were aimed at strengthening and get a better understanding of technology acceptance and use.

In many studies that applied the combined model, the findings from experienced and inexperienced researchers identified it as a proper model that could determine acceptance and usage of technology by individuals in different fields of study (Samaradiwakara & Gunawardena, 2014:26). During its formation, researchers hypothesised that usage of specific technology is impacted upon by behavioural intention, which, in turn, is influenced by attitude, subjective norm, perceived behavioural control and perceived usefulness (Al-Mamary et al., 2016:153 and Mutsvunguma, 2019:28). It also highlighted the existence of a relationship amongst these constructs, which is moderated by user experience (Taylor & Todd, 1995 and Mutsvunguma, 2019:28). To finally adopt any technology, such as mobile learning, it was found to be directly influenced by culture as well. Limitations, such as equal distribution and availability of mobile devices, low resolution, network speed and incompatible digital platforms, contributed negatively towards successful implementation of new technologies (Tavallaee et al., 2017:27). The possibility of influences by external factors on behaviour and intention, due to extended time, makes this model unsuitable for this study. The following sub-topic discusses the Motivational Model (MM).

2.7 Motivational Model (MM)

The motivational model has been widely used within the psychology field by researchers whose interest is on individual behaviour, and some have gone further and modified the theory to suit specific interests (Igbaria et al., 1996, Vallerand, 1997, Venkatesh & Brown, 2001 and Dwivedi et al., 2019:720). Others, including Davis et al. (1992) applied the MM to make sense of the acceptance and use of new technologies (Venkatesh & Speier, 1999 and Dwivedi et al., 2019:720).

Although motivation and its processes continue to be a subject of discussion, the concept is associated with internal processes that give impetus to behaviour in terms of intensity, timeframe and direction (Deci & Ryan, 1985, Reeve and Deci, 1996). Such behaviour has its origins from several sources, including needs, cognition and emotions that lead to an accomplishment or neglect of a particular behaviour. Researchers distinguish motivation into intrinsic and extrinsic factors with the former originating from internal sources, such as curiosity, interest and innate strivings for personal growth (Meece and McColskey 1997 & Meece et al., 2006). On the other hand, extrinsic motivation has its origins from external sources that include praise or tangible rewards (Meece, 1997). The motivation theory that falls within the field of psychology, has been applied in many studies that aim to make sense of

individual behaviour towards acceptance and use of various technologies (Igbaria et al., 1996; Venkatesh & Brown, 2001; Venkatesh et al., 2003: 428).

There are many studies that have applied the MM theory in its original form and in some cases, modified and adapted it to fit the various situations (Igbaria et al., 1996, Vallerand, 1997, Venkatesh & Brown, 2001, Venkatesh et al., 2003). Davis et al. (1992) applied the theory in several studies to understand how individuals accept, adopt and use new technologies (Venkatesh & Speier, 1999 and Dwivedi et al., 2019:720). Although in many studies, perceived usefulness has been cited as a strong determinant and predictor of the use of technologies by individuals and institutions, little has been researched on the impact that enjoyment has on usage intentions (Davis et al., 2006). MM has also been criticised for being complex and depending on several influences and this means that it cannot easily be used for simple analytical applications in administrative (practices) or organizational activities (Vallerand, 2001; Venkatesh et al., 2008 and Osayande, 2019:33). It has also been criticised for not providing a strong foundation for future information technology research. It is also seen as failing to offer a simplified predictive application within organisational contexts (Venkatesh et al., 2013 and Saulus, 2017:31). MM's inability to operate in simple contexts within different administrative and organizational structures and lack of relevant information that the model provides for future research activities, made it unsuitable for this study. The following sub-section deals with the Social Cognitive Theory (SCT).

2.8 Social Cognitive Theory (SCT)

The social cognitive theory's origin could be traced back Bandura's social learning theory (Bandura1969 & Bandura & Locke 2003) and is premised on the belief that the surrounding factors, including societal pressure, unique cognitive, individual traits and demographics, play a critical role in predicting behaviour. Within this theory there are variables that include age, gender and experience, which were studied to ascertain if they have an influence on technology acceptance (Losh, 2004, Colley & Comber, 2003, Venkatesh & Davis, 2000, Samaradiwakara & Gunawardena, 2014:25).

According to Sharma and Mishra (2014:20-21), SCT is premised on the foundation that the reasons for individual to behave in a particular manner, is normally influenced by the pre-conceived outcomes that are associated with personal and performance-related gains. Tied to

the above is usually the issue of self-efficacy, wherein the choice and use of a particular technology depend on how individuals feel about their abilities to interact with such technology. The Personal-Behavioural or P-B reciprocal causation, Environmental-Personal or E-P reciprocal causation and Behavioural-Environmental or B-E reciprocal causation confirm the flexibility of the model, in allowing for the constructs to influence each other at different times. The P-B reciprocal causation relationship depicts that, "the interaction between thought, affect, and action, expectations, beliefs, self-perceptions, goals and intentions give shape and direction to behaviour" (Bandura, 1989: 3). The influence of SCT has been highlighted in many studies with self-efficacy identified as one of the strong determining factors of an individual's task performance and whose effects occur within a diverse human psychosocial functioning environment (Bandura, 1965, 1977, 1986, 1997 and Carillo, 2010:21). SCT's role in the technology and information systems ecosystems give researchers a better understanding of how individuals within different institutions accept and use different technologies by depending on the pre-determined outcomes (Carillo, 2010:21). Carillo (2010:29) as cited by Mutsvunguma (2019:23) noted that despite its role in explaining individual behaviour, SCT has not been fully utilised, due to a lack of will by many researchers to make use of all the model's constructs in a single study. Within the teaching and learning ecosystem, the SCT theory has been cited as influencing one way or the other. The theory also encourages the development of self-regulation techniques and skills that will assist learners to improve their behaviour (Zhou & Brown, 2017:28).

Although the SCT has been used widely, it has some limitations. According to the Boston University School of Public Health (2016), the theory assumes that changes in the environment will automatically lead to changes in the person, when this may not always be true. The theory is loosely organised, based solely on the dynamic interplay between person, behavior and environment. It is unclear the extent to which each of these factors translate into actual behavior and if one is more influential than another. The theory heavily focuses on processes of learning and in doing so disregards biological and hormonal predispositions that may influence behaviours, regardless of experience and expectations (Osayande, 2019:37). The theory does not focus on emotion or motivation, other than through reference to experience. There is minimal attention to these factors. Based on the limitations identified above (assumption that the environment automatically affects an individual's behaviour with no tangible findings on the extent to which this happens and the lack by researchers to fully utilise the model's constructs mean they have not been tested in different contexts), the SCT was not considered

suitable for use in this study. Below is a discussion of the Model of Personal Utilisation (MPCU).

2.9 Model of Personal Computer Utilisation (MPCU)

The model of personal computer utilization, is based on the theory of human behaviour that was proposed by Triandis (1977). Although MPC is associated with Triandis' (1977) theory of human behaviour, there are some resemblances that could be drawn from other theories, including TRA and TPB. When the theory was developed, the main objective was to concentrate and predict usage behavior, rather than the actual intention by individuals to use and accept different theories (Dwivedi et al., 2019:720).

According to Mutsvunguma (2019:25), the application of MPCU in many studies has been highlighted as a concern, due to the widespread use of computers in many institutions, including universities and schools. Although the model is considered as relevant in research areas that focus on technology acceptance and use in environments where its use is mandatory, in some areas it is no longer considered as optional (Mutsvunguma, 2019:25). The above sentiments (use of computers has become a norm in many organizations and the lack of research that focuses on environments where computer usage, is not mandatory) about the model made it unsuitable for use in this study and therefore it was not considered. The selection of the UTAUT model, together with its relevant constructs was undertaken, based on the set objectives of this study, regarding the impact that IBP integration on teaching and learning has on the achievement of Grade 12 learners in the Free State Province. The identification of the constructs and their accompanying moderators within the UTAUT model was purposely done to provide insights on the critical factors that impact on the introduction of IBP within the education sphere. When addressed individually, the above eight models have shown some weaknesses that have been identified by researchers, who criticised them and based on the researchers' arguments and the ones listed above, there was therefore inadequate information to support any of them as a suitable option for the study. Furthermore, the eight models directly or indirectly possess variables that serve as a precursor or for the development of the UTAUT model. The UTAUT model qualified to be part of this study, due to its robustness and integrated approach.

According to Table 5 below, theorists, such as Azjen (TRA and TPB) and Davis (TAM and MM) have contributed to more than one model. This is an indicator of how weaknesses in prior models were modified by the same contributors in the new models. There are also constructs whose influence transcends models, meaning their contribution was seen as not only confined to one model (BI, A and SN in TRA and TPB; PU, PEOU, SI in TAM/TAM 2 and C-TPB-TAM). When it comes to the UTAUT model, some constructs were initially part of the earlier theories, such as SI processes, voluntariness in TAM / TAM 2; voluntariness of use in IDT and BI in TRA, TPB and C-TPB-TAM. These implicitly and explicitly expressed relationships that exist amongst these models, are be highlighted in the selected UTAUT that is discussed in the following section. This thin line is also shown by linking the research problems and questions to the prior theories and how they were addressed in the consolidated UTAUT model that, as a theoretical framework, underpinned this study.

Table 5
Summary of 8 theories that make up the UTAUT (source Sharma and Mishra 2014)

Theory/model	**Creator**	**Constructs**
TRA	Ajzen and Fishbein (1975 & 1980)	BI, A and SN
TPB	Ajzen (1991 & 2001)	BI, A, SN and PBC
TAM/TAM 2	Davis (1989)/Venkatesh and Davis (2000)	PU, PEOU, SI process (SN, voluntariness and image), and cognitive instrumental processes (job relevance, output quality, result demonstrability and PEOU
MM	Davis et al. (1992)	Extrinsic motivation (such as PU, PEOU and SN) Intrinsic motivation (such as perceptions of pleasure and satisfaction

IDT	Rogers (1962 &1995)	Relative advantage, Ease of use, image, visibility, compatibility, results demonstrability, and voluntariness of use.
MPCU	Thompson et al. (1991)	Job fit, complexity, long term consequences, affect towards use, social factors and FC.
SCT	Bandura (1965, 1969, 1977, 1986 & 1997)	Affect and anxiety
C-TPB-TAM	Taylor and Todd (1995)	PEOU, PU, A, BI, SN and PBC

The above table confirms that all the eight models had some commonalties in terms of authors and the constructs that form part of them. The earlier models were indeed built from the earlier ones and that is indicated by the some of the similar constructs or new ones that have a strong resemblance to those found in the earlier models. The UTAUT model that forms part of this study is discussed in detail and the relationships with the above eight models established.

2.10 The Unified Theory of Acceptance and Use of Technology (UTAUT)

As indicated earlier, while the model was originally developed in the United States and tested primarily in corporate and Western settings, its applicability in African contexts has been increasingly validated, particularly in educational and public sector environments. The approach employed to manage the constraints of the UTAUT model in the current research involved incorporating qualitative data to contextualise the UTAUT variables in the lived experiences of teachers and education stakeholders in the Free State (Bervell & Umar, 2018).

Most published papers on ICT integration that come from academic institutions whose origin is in the western world and whose context has little or no relation to the African settings or realities (Liebenberg et al 2018:161). It is from this reality that the UTAUT model was selected for this study since there is a lack of relevant literature that reflects realities in the African educational settings (Liebenberg et al., 2018:161).

When the UTAUT model was initially introduced, Venkatesh et al. (2003) argued that the model accommodated the limitations that were identified in the earlier models that includes flexibility when applying a model in different situations. Some researchers have applied the model in contexts that assisted to explain the bigger proportion of variance when it comes to intention and behaviour towards acceptance and use of different technologies (Olasina, 2018:268). The diversity and robustness associated with the UTAUT model, together with its primary constructs, whose elements bear traits from the eight earlier models, have proven to be a suitable choice when dealing with studies that seek to understand technology acceptance and use (2018: 268). The fact is that its constructs have also been able to explain 70% of the total variance when it comes to BI towards adoption of different technologies (2018: 268).

After conducting studies wherein data was collected from four companies, Venkatesh et al. (2003:425) discovered that upon application of the eight models mentioned above, and by using the three-point measurement, the model explained between 17 and 53 percent of the variance in user intentions towards the use of information technology. These findings led to the formation of the Unified Theory of Acceptance and Use of Technology (UTAUT) model (see Figure 1 below), which has four constructs, four core determinants of intention and usage, and four moderators of key relationships (2003:425). Although initially seven constructs were hypothesized as possible direct determinants of intention or usage, only four (see Figure 1 below) proved to be having a positive impact as direct determinants of acceptance and usage (Venkatesh et al., 2003:446). They are Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitating Conditions (FC), while the other three not considered, are attitude towards using technology, self-efficacy and anxiety (2003:446). The detailed description of the eight models above and their summary in Table 2.3 indicate the presence of attitude in the following models: TRA, TPB, C-TPB-TAM, self-efficacy in SCT and Anxiety in SCT and their presence, serve as foundation for the formation of the UTAUT model. As a theoretical framework, the UTAUT model provides a lens on the evolvement of the

determinants of intention and behaviour over a period (Kriponant, 2007, Samaradiwakara & Gunawardena, 2014:27 and Venkatesh et al., 2016:328).

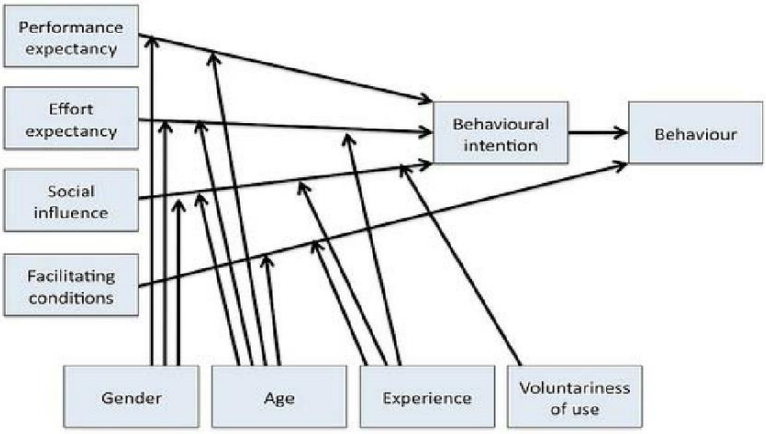

Figure 1 A Unified Theory of Acceptance and Use of Technology (UTAUT)

(Source: Morgan, 2013)

2.10.1 Performance Expectancy (PE)

According to Venkatesh et al. (2003:447) PE has its roots in five theories: perceived usefulness in TAM (see section 2.4) and C-TAM-TPB (see section 2.6), extrinsic motivation in MM (see section 2.7), Job-fit in MPCU (see section 2.9), relative advantage in IDT (see section 2.5) and outcome expectations in SCT (see section 2.8). One of the MPCU model's constructs, 'outcome expectation' has been applied in many studies where it was sometimes referred to as perceived usefulness, and the same role can be linked to Performance Expectancy (PE) in the UTAUT model with the latter having moderators to strengthen this study's case on how IBP technology impacts the achievement of Grade 12 learners in the Free State Province (Carillo, 2010:24). Although the UTAUT model was developed after the Technology Acceptance Model (TAM), its constructs: PE, EE, SI and FC have a stronger association with those from TAM. It has also been discovered that there is a strong relationship between PU in TAM and PE in UTAUT, but unlike PU, the latter construct in UTAUT has been strengthened by the inclusion of gender and age moderators to make sense of the stated relationship between technology usage and job performance. With reference to the Motivational Model (MM), its extrinsic motivation construct is associated with TRA, TPB and TAM, while in the UTAUT model it has a link to the PE, EE and SI constructs. There is also a strong association between PE and EE constructs in the UTAUT model and job performance in the MM in the sense that, the ease that a particular technology display may lead to individuals forming either a positive or negative

attitude towards it. The advantage that the UTAUT displays over, for example MM, is that the UTAUT model can measure specific aspects, including gender, age and experience and thus highlighting the extent to which patrons accept, adopt and use the introduced technology. This strength that the UTAUT model has over other eight models, including MM and as indicated above and through the RQ 2 of this study, opens an opportunity to answer the research question related to perceptions by individual learners and teachers on how the integration of IBP in teaching and learning contributes towards the achievement of Grade 12 learners in the Free State Province.

The main arguments within the UTAUT model indicate that the above constructs assist the UTAUT model to give a clear prediction of the technology adoption (Olasina, 2018: 268). The PE construct also contributes towards answering the research problem and RQ 2 and 3 of this study that sought to understand the impact that IBP integration in teaching and learning has on the achievement of Grade 12 learners in the Free State Province. It also has a direct link to RQ 1 at legal level wherein the documentation would specify the requirements the practical functions that the IBP should have to assist the FSDoE so that it achieves its objective of increasing performance of Grade 12 learners in the Free State Province. In many technology adoption studies, including those focussing on the education sector, PE has been cited as the strongest predictor of behavioural intention and moderated by age and gender (El-Masri & Tarhini, 2017). The studies revealed that younger individuals and possibly males, tended to experience no challenges whenever new technologies were introduced (Venkatesh & Davis, 2000; Venkatesh et al., 2003) In contrary, similar studies that, when conducted in third world countries and included age and gender, the results identified the two as insignificant moderators of behavioural intention (Baker et al., 2007, Afarikumah & Acheampong, 2010, Rahman et al., 2011). Such findings also indicate that PE cannot be universally described as a strong predictor of BI whenever age and gender are included as moderators, since, for example, culture may play a critical role (Mutsvunguma, 2019:33). In addition, two studies were conducted in Qatar and the United States of America (USA) on the adoption of e-learning by students and on the identification of factors that influence acceptance of YouTube by both students and educators, respectively. The findings from both samples revealed that PE had a positive impact when it comes to predicting BI from both studies (Bardakcı, 2019:263). Another study that applied the UTAUT investigated the impact that Online Homework Management Systems (OHMS) have on acceptance and usage by students (Morgan, 2014:102). The study posits that there is a positive correlation between PE and BI if OHS is viewed as a contributor to improved

performance by learners (2014:102). This supposition is also seen as a strong predictor for the intent to use. When it comes to gender and age there is also a strong correlation between higher PE in male learners than in their female counterparts. It has also been shown that younger learners display higher PE than older ones (2014:103). If the learners perceive the OHS as a contributor to better grades, the likelihood is that the whole class may accept the technology and use it (Morgan, 2014:103). Below is a discussion of the Effort Expectancy (EE) construct.

2.10.2 Effort Expectancy (EE)

There are also some links between the Effort Expectancy (EE) construct and the eight models that were discussed earlier, including the Theory of Reasoned Action (TRA). However, the presence of moderators in the UTAUT model, including age, gender, experience, as well as voluntariness of use, assist to strengthen and validate the results that come from data collection and analysis**.** Similarly, the intrinsic motivation constructs that form part of the Motivational Model (MM) are covered in the EE and FC constructs within the UTAUT model. EE fits within Research Question (RQ) 1, in that the Provincial Strategy on Learners Attainment (PSLA) (2012) sought to identify an intervention that would be easier for the identified IBP public high schools to integrate in teaching and learning. In addition, RQs 2 sought to find answers relating to experiences of learners and teachers and how the IBP assists towards the achievement of Grade 12 learners in the Free State Province, and this relates to EE in relation to their interaction with the technology. Furthermore, RQ 3 fits with EE in that it delves into the IBP operations that sought to highlight its EE compliance. EE in the UTAUT model, together with its moderators, have covered the role played by the above construct. With reference to the Model of Personal Computer Utilisation (MPCU), the construct long term consequences refer to the outcomes whose payoffs will be realised in the future. It has a link to the age and experience moderators that form part of the UTAUT in that, for example, it covers the effects of technology usage over a specified period.

There are three constructs from other models from which EE is associated with when it comes to technology acceptance: PEOU in TAM and TAM2, complexity from MPCU and ease of use from IDT (Davis, 1989, Davis et al., 1989, Venkatesh et al., 2003:450, Ahmad, 2015:2 and Venter, 2015:40, Venkatesh et al., 2003: 450 and Ahmad, 2015:2). Another advantage that EE has, is that it is moderated by age, gender and experience towards BI and is considered stronger for women, older workers, including those with very limited experience. EE has also been cited

in may studies wherein the findings revealed a positive impact during the early stages of engaging with the technology, which gets slower over time (Venkatesh et al., 2003:468, Eyaufe, 2017:17 and Mutsvunguma, 2019:33). The model also indicated that EE has a strong association with PEOU and complexity when it comes to prediction of selected technology usage (Olasina, 2018: 268). Besides this construct's quest to solve the stated research problems, EE also contributed through RQs 1, 2 and 3 to provide answers that will lead to making sense on how the introduction of the IBP technology in Grade 12 classes across the Free State impacts learner achievement at Grade 12 level across the Free State Province.

In another study that applied UTAUT and involved students enrolled for a teaching qualification, who were examined on their intentions to use specific technology in their studies EE, it was revealed as a strong determinant of BI to use and accept technology (Teo & Noyes, 2014). Ngampornchai and Adams (2016) also confirmed that the UTAUT model aligns well with studies on the readiness of students to use specific technology with EE, displaying a positive impact as a strong determinant towards usage of the technology. This study sought to understand how EE portrays the impact that the IBP that is offered by the UFS ideas lab, has on the achievement of Grade 12 learners in the Free State Province. It also denoted how PE affects teaching and learning in a positive way and thus leading to the enhancement of the performance of Grade 12 learners in the Free State. As revealed by Venkatesh et al. (2003), PE has been displayed as the strongest determinant of users' BI to accept and use technology. Both PE and EE have constantly been portrayed as strong determinants of BI (Venkatesh et al., 2003, Šumak & Šorgo, 2016, Hoque & Sorwar, 2017, Khalilzadeh et al., 2017, Šumak et al., 2017 as cited by Chao, 2019).

Drawing from the above, this study intended to highlight the perceptions and experiences of learners and teachers on the use of IBP in teaching and learning. The researcher also anticipated different experiences from learners and teachers on the integration of IBP in the Grade 12 classes. The next sub-topic discusses the Social Influence (SI) construct.

2.10.3 Social influence (SI)

According to Venkatesh et al. (2003:451), the following constructs have a relation with SI: subjective norm in TRA, TAM2, TPB and C-TAM-TPB, social factors in MPCU, and image in IDT. Furthermore, UTAUT reveals that SI has its strength based on the experience and

knowledge acquired about technology, which exerts little or no impact towards adoption, since individuals depend on the important people in the circle of influence during times of uncertainty about the introduced technology (Workman, 2014 as cited by Olasina, 208: 268). Through this construct, this study sought to find answers as laid down in RQ 1 and 2 that are related to the introduction of the IBP technology in selected Grade 12 classes in the Free State Province.

The direct determinants of Behavioural Intention (BI) in Theory of Reasoned Action (TRA) are individuals' attitudes towards performing the behaviour, as well as the subjective norms associated with a particular behaviour. RQ 2 and the SI construct in the UTAUT model were included in this study to make sense of the experiences of the Grade 12 learners and teachers towards the integration of IBP in teaching and learning. Moreover, the influence of the people within their spheres was also taken into consideration and that is represented in UTAUT by the SI construct. Regarding RQ 1 of this study and by taking cognisance the parameters under which this study was operating, the use of the UTAUT model has therefore been selected to uncover how governing structures and policies impact on the integration of IBP in teaching and learning in the Free State Province. Within MPCU, attitude is a personal trait that can be linked to the RQ 2 that sought to find out the experiences of Grade 12 learners and teachers about the integration of IBP in teaching and learning in the Free State Province. In addition, the SI and FC constructs in the UTAUT model deal with the influence of society and thus the facilitating conditions creates a platform that addresses the attitude that would lead to acceptance and use of technology. Unlike the MPCU, the inclusion of the moderating conditions within the UTAUT model assist to break down such an influence according to specified criteria. The TAM, PEOU and PU had, to a certain extent, an association with RQs 2 and 3 of this study, whose emphasis was on perceptions, experiences and factors that are associated with the integrations at Grade 12 level, of IBP in teaching and learning in the Free State Department of Education (FSDoE).

Attitudes towards use (A) refers to an extent to which individuals assess and evaluate the possible options and opportunities that are attractive for the adoption of a specific technology (Davis, 1989). An individual's attitude towards use is influenced by PU and PEOU and that means there are strong perceptions that are influenced by the two constructs with a positive attitude being shaped towards the use thereof (Davis, 1989). Attitude (A) has a strong correlation with SI in UTAUT and unlike A, the latter has been strengthened by adding gender, age, experience and voluntariness moderators to highlight a relationship between effort in using technology and the influence of people within an individual's sphere of influence. SI is

premised on the belief that individuals engage in specific behaviours, because of the perceptions that the people that they consider to be influential or important, would agree or disagree with the technology's adoption (Rashotte, 2010:1). The model identifies SI as the only construct that is moderated by age, gender, experience and voluntariness. According to Venkatesh et al. (2003:468), Behavioural Intention (BI) has also been identified as stronger within women, elderly workers and commonly in work environments wherein technology use is mandatory with limited work experience. Drawing from the above, individuals engage in specific behaviours in different situations for different reasons that may include the need to comply, for identification or internalisation purposes (Malhotra & Galletta, 1999:3 cited Kelman, 1958 and Mutsvunguma, 2019:34). By complying all the time means individuals are intentionally trying to avoid being punished or denied any rewards that accrue out of using such technologies. Through identity, individuals adopt a self-satisfaction that strengthens their influence in relation to the people within the sphere of influence. When it comes to internalisation, an individual displays behaviour that are aligned to the values that he subscribes to (Mutsvunguma, 2019:34).

What makes SI to be a strong determinant of BI, rests on the belief that individuals rely on the influence from significant people, who may sway them the other way even if they were not initially intending to engage in such an action (El-Masri & Tarhini, 2017). The above assertions have been proven in many empirical studies wherein SI plays a role as a strong determiner of BI (Hao et al., 2017, Im et al., 2011). When comparing different models, Venkatesh et al. (2003) found SI to be irrelevant when it comes to the intention to use the identified technology and that becomes significant when the use of that technology is compulsory. This assertion becomes irrelevant with continued use of such technology (Bardakcı, 2019:263 and Venter, 2015:42). Hence, the need to explore the role that gender and age will play in the integration of IBP in teaching and learning at Grade 12 level. Despite SI's influence on BI, there are studies that have highlighted its subjectivity and influence on individual behaviour through compliance, internalization and identification mechanisms. Although internalization and identification are associated with conversion of individuals' beliefs and thus leading to them responding in a way that will be deemed beneficial, compliance is seen as leading an individual in changing his or her intention, because of the influence from the significant others or peer pressure within society (Ahmad, 2015:3). The role that social pressure plays on individuals has been seen when individuals get rewarded for engaging in desired behaviour and reprimanded for negative behaviour.

When it comes to the role that moderators play within this construct's sphere of influence, females tended to be more sensitive to the influence or opinions of the society or significant people and thus leading to them to form a strong intention to use a new technology (Miller, 1976, Morris and Venkatesh 2000, Venkatesh and Morris 2000, Venkatesh et al 2003, Ahmad 2014:3 and Kocaleva et al., 2015:24). What has also been observed and linked to the above, is that the more they gain experience, women tend to rely less on members whom they initially thought were influential (Ahmad, 2014:3 and Kocaleva et al., 2015:24). These observations indicate the presence of complicated and interactive relationships between these moderating factors, leading to a final moderating impact on the relationship between social influence and intention to use technology (Venkatesh, 2003, Venter, 2015:41 and Ahmad, 2015:3). Due to the complexity associated with SI, it is not easy to conclusively agree on the role that the different elements within different societies play (Ahmad, 2014:3).

2.10.4 Facilitating Conditions (FC)

Venkatesh et al. (2003:450-468) identified the following constructs that have been drawn from the eight earlier discussed models (PBC in TPB, C-TAM-TPB, and MPCU, FC in MPCU, Compatibility in IDT) as having a relationship with the UTAUT's FC construct. The UTAUT model also recognizes the variables of gender, age, experience and voluntariness that are assumed to mediate the impact that the four core constructs have on usage intention and behavior (Venkatesh et al., 2003 and Eyaufe, 2017:18). According to Mutsvunguma (2019:35), the presence of technical support, networks, internet connections, appropriate infrastructures and guidance, normally increases the intention to use a selected technology. FC, as a construct that forms part of this UTAUT model, has also been discovered to predict a correlation between a proper organizational and technical infrastructure and an individual decision to use such technologies (Ali et al., 2024:1-2 & Ali et al., 2016:86). Besides the study's quest to answer the research problems, it also, through RQ 1 and 3, sought to find contributing factors that impacted on the achievement of Grade 12 learners after the integration of IBP in teaching and learning in selected schools across the Free State Province.

In comparison to the Facilitating Conditions (FC) in the UTAUT model that cater for the provision of technical support or infrastructure for users to facilitate the use of technologies, in the MPCU, the provision of PCs for users serves a similar role and gives assurance that the

users will be taken care of beyond the purchase and delivery of the PC to specific users. Furthermore, the FC in the UTAUT model, together with moderators, have been added to make sense of the extent to which the collaboration between the UFS ideas lab and FSDoE impacts the achievement of Grade 12 learners in the Free State Province. The presence of the moderators gives the UTAUT model an urge over earlier models, including the MPCU. With reference to the combined TAM and TPB (C-TPB-TAM), they have the following constructs: attitude toward behaviour, subjective norm, resource facilitating conditions and technology facilitating conditions that have a link to the RQs 2 and 3, but the presence of the FC and moderators in the UTAUT model makes the latter model stronger in terms of addressing user acceptance, adoption and use of the introduced technology. Consequently, the RQ 1 in this study sought to find answers relating to the presence of legal legislative processes that have led to the introduction and application of the IBP in selected high schools with Grade 12 classes and how that impacts on the achievement of learners in such schools. This study sought to uncover the impact that the IBP has on selected schools within the Free State, as observed over a five-year period of its existence.

The absence of the Facilitating Conditions (FC) and their moderators in the TRA makes the use of the UTAUT model a suitable option that is necessary to answer RQs 2 and 3 that are linked to individuals' thinking processes and the presence of supporting structures that influence either way, the achievement or not, of Grade 12 learners in the Free State. The selection of the UTAUT model over, for example TRA, was based on empirical evidence from other studies that indicate that it does accommodate the above-mentioned elements. It is therefore through RQ 3 that this study sought to uncover is how, since its inception, has IBP been impacted by various factors that impact on the achievement by Grade 12 learners in the Free State. RQ 2 sought to ascertain the individual learners' and teachers' experiences towards the integration of IBP in the teaching and learning ecosystem in the Free State Province. The presence of the individual behaviours in the TPB, for example, sought to highlight the interference of external elements and the outcomes that unfold thereafter. External variables from TRA refer to those that have an impact on technology acceptance and use and whose source include social, cultural and political variables (Davis, 1989). RQs 1 and 3 have a direct link to this construct in that it addresses the infrastructure and conducive conditions, needed for the IBP to be adopted, accepted and used. The influence of the facilitating conditions and their accompanying moderators in the UTAUT model makes it a more suitable choice than TRA when seeking to identify the contributing factors that lead to individuals displaying behaviours that lead to the

acceptance and use of specific technologies. RQs 2 and 3 sought to identify such factors that, through the integration of the IBP, impact on the achievement by Grade 12 learners in the Free State Province. With regards to the UTAUT model, SI and FC in UTAUT, together with their respective moderators, take care of these variables and assist in the answering of both research problem and questions in this study.

Many studies have been conducted in the education sector that involved the application of the UTAUT model wherein FC played a significant role (Lin et al., 2013 and Wong, 2016). For example, some studies explored FC in terms of context, participants and technological features, as observed from the introduction of different technologies by different institutions (Lin, 2013 and Wong, 2016). In a study by Wong (2016) on how primary school teachers in Hong Kong reacted to the introduction a new technology, the findings revealed that FC was a strong determining factor when compared to the other constructs, including PEOU and PU (Bardakcı, 2019:264). Consequently, the current study used the lens of FC, based on the UTAUT model to shed new light on learners who are benefitting from the IBP that is offered through the UFS ideas lab. Perhaps, the role of FC in the context of learners in a video-based class will be different from the experience of teachers in Hong Kong.

Morgan's (2014:103) findings on the study involving the introduction of online homework management systems (OHS) indicate that FC produced positive results on the perceptions, regarding the actual usage of the technology by both learners and teachers. In addition, when it comes to age and experience that served as moderators, younger learners and experienced teachers tended to be hopeful of getting continuous support during the introduction of the new technology. The stronger the perceptions that there will be support available all the time, the stronger the likelihood is the accept and use OHS for teaching and learning (Morgan, 2014:103). Furthermore, it is also anticipated that the nature of the infrastructure, associated with IBP, will have a direct influence on the use and acceptance of the technology in teaching and learning at Grade 12 level. Even though some research cautions against the strengths of FC when it comes to predicting BI, the expectations are that they will influence the intention to use and integrate IBP in teaching and learning at Grade 12 in the Free State (Williams et al., 2011 and Zuiderwijk et al., 2015:431).

2.10.5 Behavioural Intention (BI)

Fishbein and Ajzen (1975:288) defined Behavioural Intention (BI) as an innate individual's probability that he or she may engage in a specific behaviour. BI can also be described as an extent to which an individual expresses a conscientious and planned desire to execute or not execute a specific behaviour in future (Bardakcı, 2019:264). Behavioural Intention (BI) refers to the extent to which an individual may engage in a specific performance that could lead to the adoption of a particular technology (Davis, 1989). Like TAM, the UTAUT model has a BI whose determinants are PE, EE and SI and all the three constructs have elements that are associated with the TAM constructs, with the latter constructs having an advantage of moderators to make a strong case about individuals' intention to use a specific technology. According to Chuttur (2009), an individual's actual use of a technology, as portrayed in TAM, is directly or indirectly affected by individuals' behavioural intention, attitudes, PU and the PEOU of that selected technology. This therefore means the extent of the impact that has been brought about through the collaboration between the UFS ideas lab and FSDoE on the achievement of Grade 12 learners in the Free State Province can be affected by individual behaviour that RQ 1 sought to uncover. In addition, Behavioural Intention (BI) is not only a component of TRA, but also one of the variables within the selected UTAUT model (Fishbein & Ajzen 1975, Ajzen, & Fishbein, 1980, Ghobakloo et al., 2010:10 and Osayande, 2019: 25). Unlike the UTAUT model that is made up of elements drawn from earlier models, TRA is described as thriving well in instances that require the interpretation of the determinants that are associated with a conscious state of mind or behaviour (Osayande, 2019: 25).

It has also been discovered in many studies that user behaviour is usually influenced by behavioural intention and prediction for individuals to use such a technology depends on their experience after the first attempt (Ali et al., 2016:86). Hence, the belief by some researchers that BI is a proxy factor when it comes to the use and acceptance of technology (Venkatesh et al., 2003 and Venkatesh et al., 2012). One such study that confirmed the role of BI as a determinant of use and acceptance of technology, involved the exploration of the high school students' preferences and intentions when it comes to the integration of YouTube in teaching and learning (Bardakcı, 2019:264). In this study, Behavioural Intention would be referred to as the Free State Grade 12 learners' intention to use the Internet Broadcasting Project (IBP) or teaching and learning. As it has been observed in studies that, including social psychology, experience can moderate the effect of behavioural intention on behavior. It is anticipated that in

this study, for example, as Verplanken et al. (1998) showed in a field study, that the frequency of IBP use reduces the effect of behavioural intention on future IBP (Venkatesh et al., 2012:166). According to Ahmad (2015:4), some studies have revealed that there was a significant positive impact that BI had on the use of any introduced technology. Accordingly, the present study unravels the impact of BI on the use of IBP by learners across the Free State Province.

2.10.6 Usage behaviour

The actual usage of different technologies has been reported extensively in many studies with others citing behaviour (actual usage) as being impacted upon by individual's attitude (user satisfaction) (Igbaria & Tan, 1997:115). Since user satisfaction is a product of several related factors that relate to technologies and services, user satisfaction depends greatly on the degree of user satisfaction and that in turn affects the amount of time spent using the specific technologies (1997:115).

The higher the levels of satisfaction, the greater the chances that such individuals will spend more time using the system and thus leading to higher job satisfaction levels (1997:115). Mutsvunguma (2019:35) argues that usage behaviour or actual use combines all the predetermined set of activities that an individual puts together as a reaction triggered by some cognitive processes. When it comes to this study, the actual usage of the IBP technology offered by UFS the ideas lab, was measured against a few variables to understand the extent to which they affect the achievement by Grade 12 learners in the Free State Province.

2.10.7 Moderator effects

Moderator Effects (ME) in the UTAUT model are represented by gender, age, experience and voluntariness of use, and are regarded as the direct determinants of the model's four constructs: Behavioural Intention (BI) and actual use of the technology (Venkatesh et al., 2003). Williams et al. (2015:443) contend that a thorough examination of the individual constructs in the world of work contributes towards getting a true picture of how individuals' intention to use an identified technology is impacted upon by specific factors that may lead to acceptance or rejection of technology with context also playing a key role. It is anticipated that since IBP's implementation in selected Grade 12 schools in the Free State and as guided by relevant

policies, it has an influence that is in line with the above assertions when it comes to compulsory environments. The application of the UTAUT models in different contexts has produced findings that are discussed below, and most have influenced its selection for this study. Unlike the TRA that has excluded demography, the presence of the moderators that include age and gender in the selected UTAUT model, is one of the mitigating factors that contributed to its selection in this study, since such key demographic factors cannot be excluded in studies that involve technology acceptance and use (Al-Mamary et al., 2016:145 cited by Davis et al., 1989 and Mutsvunguma, 2019:22).

With reference to the findings from Venkatesh et al. (2003) that are linked to the studies that included the eight models that were discussed above, the UTAUT model outperformed all of them (adjusted R^2 of 69 percent) (2003:425). This then placed the UTAUT model in a better position when compared to the earlier models. The model was further subjected to data drawn from two additional organizations (adjusted R^2 of 70 percent) and similar results were obtained and thus confirming it as the best out of the eight models that were discussed earlier (2003:425). Lastly, unlike the eight earlier developed models (sections 2.2 to 2.9 above) that were developed to predict acceptance and usage, Venkatesh et al.'s (2003)'s model, consistently produced a 70% predictive efficiency and that was far better that TAM (30%) or TAM2 (40%) (Oye et al., 2014:253)." Although many studies applied an original UTAUT model, some made use of the modified models that drew some of the constructs from other theories. For example, in one study by Olasina (2019:365), to determine the human and social factors impacting on the decision that students take to accept e-learning, FC construct was not included and was replaced by the construct Attitude, which was identified as suitable to address the emotional part of the research problems and questions. The findings also revealed the important role that human, social and cultural factors play in understanding technology acceptance and use (Olasina, 2019:365).

Chao (2019) conducted an empirical cross-sectional study to determine the factors that affect students' BI towards using mobile learning (m-learning). The study applied the UTAUT model and included the following additional constructs: perceived enjoyment, mobile self-efficacy, satisfaction, trust and perceived risk moderators. The findings revealed the following: BI was impacted upon by satisfaction, trust, performance expectancy and effort expectancy, and perceived enjoyment, PE and EE correlated positively with BI. Mobile self-efficacy positively affected perceived enjoyment, perceived risk produced a negative moderating effect on the

relationship between PE and BI (Chao, 2019). According to Chao (2019), the findings from the modified UTAUT models may also serve as important reference educational tools for institutions at all levels that are intending to introduce any technology for teaching and learning purposes (Chao, 2019). Furthermore, in another study by Olasina (2018:265) that aimed to provide a diagnostic insight on the role that different factors play towards e-learning's best practices, it also applied a modified UTAUT model, whose findings revealed the influence that factors, including PEOU, complexity, ease of use, attitude, subjective norm, social factors and image has toward best practices within the e-learning sphere. By applying a modified model, the study further brought forward an urgent need for research that focusses on the influence that human and change behaviour play within the e-learning field of study (2018:265).

What makes the UTAUT model stand out amongst the other eight models that focus on technology acceptance and use is its robustness that has been discovered after several empirical tests were conducted and they, on average, produced a high variance when it comes to technology acceptance and use (Holden & Karsh, 2010, Oye et al., 2011). In addition, Polancic et al. (2009) contend that the UTAUT model received such recognition because of its ability to explain the role played by the different factors towards acceptance/rejection and/or use of technologies. UTAUT's stability, validity and viability in technology acceptance studies within various contexts, have also been identified and practically confirmed (Waehama et al., 2014). It has also been cited as flexible and adaptable to different studies with outcomes applying equally comparable models (Saravani & Haddow, 2011 and Saulus, 2017:39). Waehama et al. (2014) posits that UTAUT's predictive efficiency that increased to 70 % in comparison to the previous models, is seen as a major improvement that led to it being praised for playing a mitigating role that counter-balanced the weaknesses that were identified in the previous models (Saulus, 2017:39).

One of the advantages of using UTAUT, is its ability to be applied across different generations to predict adoption of different technologies (Magsamen-Conrad, et al., 2015). This approach that makes use of the different moderators in the UTAUT model, including gender and age, can dissect the adoption practices by both young and older generations (Olasina, 208: 268). According to Ghobakloo et al. (2010:11), the model's ability to traverse across different cultures contributes towards a better understanding of the impact that culture has on acceptance and use of different technologies. Its four constructs have specifically been cited as very influential towards behavioural intention to use and accept specific technologies (Al-Mamary et

al., 2016 and Osayande, 2019: 45). The strength of UTAUT is further confirmed by Wu et al. (2007), who argue that its effectiveness is comparable to earlier studies and related models that are used to study technology acceptance and use. Osayande (2019: 46) shared a study that was conducted by Al-Shafi and Weerakkody (2009) to understand the citizens' behavioural intention to adopt an e-government technology. The findings, that have a societal influence revealed that EE and SI were the strong determinants of the citizens' BI to adopt the technology (Osayande, 2019: 47). As an amalgamated product that is drawn from 32 constructs, the UTAUT model has all the elements that have been drawn from the other eight models with its four constructs: performance expectancy (perceived usefulness, outcome expectations), effort expectancy (perceived ease of use, complexity) behavioural intention, use behaviour (e-learning acceptance), as well as social influence (subjective norm, social factors and image), confirming that assertion (Olasina, 2019:365).

Furthermore, the UTAUT model can be used on a large scale and as it transcends continents, empirical evidence indicates that its constructs also appeal to the third world researchers, away from its source of origin in the Western world (Olasina 2014:21). The convergence of the different constructs within this UTAUT model, such as PE, EE and SI, are aligning well with the RQs, and they also have the potential to answer the critical problems raised. The study sought to make sense of the impact that IBP integration on teaching and learning has on achievement by Grade 12 learners in the Free State Province. According to Kiwanuka (2015), the model has been seen to limit mediating factors of technology acceptance to only age, gender, experience and voluntariness of use. It has also disregarded attitude as an important variable in the technology acceptance arena (Venkatesh et al., 2003 Saulus, 2017:39 and Eyaufe, 2017:19). This strategy to eliminate attitude, is based on the belief that their impact on BI is not that strong and only appears in cases where PE and EE are not included in the studies and the two constructs are seen as playing that role without an attitude included (Venkatesh et al., 2003; Saulus, 2017:39 and Eyaufe, 2017:19).

Eyaufe (2017:19) argues that when a critical overview of the model is investigated, and that has been confirmed by Verdegem and De Marez (2011). Researchers have raised the following concerns about the model's ability to produce accurate outcomes on how decisions to accept and use technologies are made. UTAUT's ability to clearly segment the underlying traits displayed by those who accept or reject the introduced technologies and the validity of the selected constructs to perform and produce expected results, as drawn from different potential

users and non-users, operating in different contexts (Eyaufe, 2017:19). One notable limitation is that the criticisms identified in the original models, are likely to affect the results from UTAUT, as such limitations are carried over to the consolidated model (Thomas et al., 2013 and Saulus, 2017:39). Despite such limitations, strengths tended to outweigh the limitations (Waehama et al., 2014 and Saulus, 2017:39). Choosing the UTAUT for this study was informed by its robustness, as well as comprehensive and high predictive nature that is better than the related models and theories that deal with technology acceptance and use (Venkatesh et al., 2003).

UTAUT has gained a global audience and identified an application of choice in studies that seek to understand acceptance and use of technology by different individuals. In some cases, the model has also been modified by adding some variables, in order to strengthen the identified limitations and thus leading to it being able to accurately predict user acceptance and use of different technologies (Martins et al., 2014, Maillet et al., 2015, Cimperman et al., 2016, Kabra et al., 2017 and Khalilzadeh et al., 2017 as cited by Chao, 2019). One study by Kabra et al. (2017) applied the modified UTAUT to evaluate the factors that have an impact on users' individual BI to use a specific technology. In another one by Khalilzadeh et al. (2017), self-efficacy, risk, trust, security and attitude were included as additional variables to evaluate impact factors that influence users' BI towards the acceptance and use of mobile payments. Furthermore, in a study to determine factors that impact users' BI towards a specific technology, Alalwan et al. (2017) identified trust as crucial, whereas Chang et al. (2017) in his study, identified perceived enjoyment as important when wanting to understand acceptance and use of mobile technologies (Chao, 2019). For this study, no additional variable was included, as the researcher felt there was no need, but the original UTAUT model sufficed and assisted to answer both research problems and questions on the impact that UFS ideas lab has on the achievement by Grade 12 learners in the Free State.

In conclusion, the choice of a theoretical framework in any study involves not only choosing the relevant model but also proving that the rejected models do not address the research problem and questions that the study sought to find or answer. Theories not only gives credibility to the study that is undertaken but also allows the researcher to use the theoretical framework as a lens that would allow the audience and readers to use as they move towards the findings of the study. Since the UTAUT model has its roots in the eight other models that were discussed earlier, it gives it an advantage in that it is built from their strengths and has also eliminated the weakness observed from them during their application in different technology

studies. The UTAUT model has the proper constructs and moderators that were used to make sense of the collaboration between the UFS ideas lab and FSDoE on the achievement by Grade 12 learners in the Free State Province.

2.11 Synthesis of theoretical frameworks

Although UTAUT is the selected theoretical framework for this study, there are other eight earlier developed theories that formed the foundation of this study. The eight models include Theory of Reasoned Action, Theory of planned behaviour, the Technology Acceptance Model, the Innovation Diffusion Theory, Combined TAM and TPB, Motivational Model, Social cognitive theory, and Model of Personal Computer Utilization (Ajzen 1991; Davis 1989; Davis et al. 1989; Fishbein and Ajzen 1975; Thompson et al. 1991). Together these models expose the reader to different perspectives and experiences to acceptance and use of the adopted technologies and that are based on the different factors at play that are further dictated upon by the different contexts and attributes.

There is a relationship between the old and new theories that could be traced to the people who pioneered the theories and the terminology that they are using. TRA and TPB are associated with Ajzen and Fishbein (1975 & 1980) and Ajzen (1991 & 2001). TAM and TAM2 have a link to Davis (1989)/Venkatesh and Davis (2000). MM is associated with Davis et al. (1992) while the selected UTAUT model is associated with Venkatesh et al (2003). There are also noticeable variables that are either common across theories or serve as the foundation for the new theories. For example, in TRA the variables are BI, A and SN and in TPB they are BI, A, SN and PBC. TAM and TAM 2 the variables are PU, PEOU, SI process (SN, voluntariness and image), and cognitive instrumental processes (job relevance, output quality, result demonstrability and PEOU while in MM they Extrinsic motivation (such as PU, PEOU and SN) Intrinsic motivation (such as perceptions of pleasure and satisfaction. This confirms the interconnections between the theories. The identified strengths and weaknesses are also covered and include the reasons for them mot being selected for the study. The UTAUT model and its four constructs (PE, EE, SI and) played a role when a final selection was made and the fact that they are flexible and can accommodate the African contexts. Below is the summary of the chapter.

2.12 Summary of the chapter

The chapter highlighted the eight models that serve as the precursor to this study's selected UTAUT theoretical model. The empirical and theoretical reviews suggest evidence of technology incorporation in education in Ghana, Tanzania, Kenya and South Africa, with case studies from public and private collaborations in education and research evaluating the impact of diverse technologies in academic performance contexts, but the current study prioritises secondary level education and video technology (Mtebe & Raisamo 2014). What makes the UTAUT model widely accepted, is its diversity and robustness that are associated with its primary constructs and moderators, whose elements bear traits from the eight earlier models that have proven to be suitable choices, when dealing with studies that seek to understand technology acceptance and use. What makes the UTAUT model stand out is the original reason for its introduction by Venkatesh et al. (2003), who contend that, unlike the eight earlier created models, the model accommodates the identified limitations, like the ability to apply flexibility when applied in different contexts. Some may require a bigger proportion of variance when it comes to intention and behaviour towards the acceptance and use of different technologies (Olasina, 2018:268). The UTAUT model bears most of the characteristic features from the earlier models and they are infused in its constructs. The higher variance percentage and flexibility that the UTAUT model possesses in comparison to the earlier developed models made it a suitable choice for this study. The next chapter delas with a literature review. The interconnectedness amongst the eight earlier developed models is glaring and some of the variables cut across to indicate this relationship.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

The proliferation of ICTs in the education ecosystem has directly impacted teaching and learning at both public and private schools' levels (Scherer & Brito, 2020:3). The first decade of the 21st century witnessed the introduction of e-learning, a revolution within the education sphere, that gave birth to new modes of teaching and learning, including the integration of technologies that comprise the Internet Broadcasting Project (IBP) (Kocaleva et al., 2015:23 and Li., 2022). This study focused on the impact that the Internet Broadcasting Project (IBP) has on the achievement of Grade 12 learners in the Free State Province.

Although the literature review is centered on the IBP integration in teaching and learning, the different topics and sub-topics link back to the research problem, questions (see chapter 1), and the constructs from the selected UTAUT theoretical framework (see chapter 2). The sub-topics covered in this chapter include the evolution of educational technology globally and in South Africa, ICT-related policies and legal frameworks that support the implementation of educational technologies, including the IBP, and factors that impact successful integration. With reference to the literature review, limited research has been conducted to highlight a shift from conducting simple searches and forming summaries of previous research to developing creative and critical literature reports with deeper insights and connections (Webster & Watson, 2020:129). Webster and Watson (2020:130) emphasise that a literature review exercise should not just be a collection of articles, an annotated bibliography and manuscripts that do not make sense, but should link well to the research topic, problem and selected methods. In line with the literature review prescripts, researchers are expected to establish a relationship between a selected topic and the type of literature review to be included in the study (Creswell, 2014:30). Ocholla (2021:1) adds that researchers must ensure that, at all stages, there is a harmonious alignment of all the different elements of research, including the literature review that will result in logical, coherent and clear correlations. This means that, from the beginning, the content from the selected literature review must inform the reader of the approach that the researcher has adopted, which could be author-centric or concept-centric (Watson & Webster, 2020:130). Accordingly, this study followed a concept-centric approach with the Internet Broadcast Project (IBP) as the focus, together with identified aims and objectives, which sought to investigate how its integration in teaching and learning impacts the achievement of Grade 12

learners in the Free State Province. Within the literature review realm, the discussion includes reviews that are driven by the model's variables. Although the literature chapter is guided by the study's research questions (RQs), the reviews have been intentionally framed by the relevant UTAUT variables. Accordingly, the revised literature review includes subsections for each UTAUT construct, such as Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). The evolution of technology at local and global stages will be discussed in the following sub-topics. The chapter covers the evolution of technology as seen from a global and local perspectives, the legal and policy prescripts related to the South African e-Education policy and the factors that impact integration of technology in teaching and learning.

3.2 Evolution of educational technology: a global perspective

Globally, the research studies on the integration of educational technologies in the education sphere, including the IBP, have a direct link to the broader E-learning concept (Mishra & Koehler, 2006:1023). Consequently, this study focused on both global and local approaches to technology integration in the teaching and learning sphere and its impact on the achievement of Grade 12 learners in the Free State Province.

Research on technology integration in education has, for some time, been lacking, due to the absence of a relevant theoretical foundation (Mishra & Koehler, 2006:1016). Many researchers tend to focus on technology and not how it is used (Mishra & Koehler, 2006:1016). Although not all teachers have embraced and integrated these technologies in learning, due to lack of knowledge and general fear or lack of confidence, the digital world continues to occupy their spaces and thus forces them and their learners to be part of the revolution (2006:1023). Accordingly, this study was underpinned by the Unified Theory of Acceptance and Use of Technology (UTAUT) theoretical model, to ascertain the impact that the Internet Broadcasting Project (IBP) has on the achievement of Grade 12 learners in the Free State Province.

Although pockets of e-learning or online education are found throughout the world, the COVID-19 pandemic expanded and sped up the integration initiatives (Zhou et al., 2020:504). Such initiatives, for example, were introduced to encourage schools and teachers to remotely integrate technologies in teaching and learning (2020:504). The seven models that underpinned e-learning practices that schools had to adopt, included the following: live broadcast, recording broadcast, resource package, live broadcast plus recording broadcast, live broadcast plus

resource package, recording broadcast plus resource package, live broadcast plus recording broadcast plus resource package, etc. (Zhou et al., 2020:504). Accordingly, IBP is associated with the above principles, especially the use of live broadcasts, together with recordings of the lessons that are delivered by identified specialist teachers throughout the Free State Province.

Some countries, including Indonesia, for example, have, for years been integrating technologies using different e-learning platforms that are government sponsored (Almanthari et al., 2020:1). They are also making use of additional educational technology interventions programmes from private companies dealing with online learning applications, including MejaKita, ICANDO, Ganeca Digital, Kelas Pintar, Quipper School, Ruang Guru, Sekolahmu, Zenius, Cisco Webex, and Pahamify who made it possible for learners and students to continue teaching and learning remotetly (Almanthari, 2020:1-2).

The above educational technology interventions across different parts of the world confirm that the process of integrating online teaching and learning intervention programmes, is not always smooth and effective (Almanthari et al., 2021:2). However, there is an acknowledgement by affected countries, including the United States of America (USA), that integration of technology is crucial in the development of learners' critical, problem-solving, communication, and innovative skills (P21 Partnership for 21st Century Learning, 2009 in Li et al., 2019:501). However, for the above to succeed, there are factors that influence integration, including teachers, learners, different educational technologies, policies and relevant legislation together with support from district, head office and school-levels (Grof & Mouza, 2008; Spector, 2010 in Li et al., 2019:501). Lessons on technology integration indicate that, even in Indonesia that has a decentralized education system, the influential role that the central government plays through the provision and administering of educational policies and overseeing of the implementation of the curriculum, together with the national exams, cannot be overemphasized (Almanthari et al., 2020:2). Consequently, this study highlighted the relationship between the National Department of Basic education (DBE) and the provincial Free State Department of Education (FSDoE), whose objective is integrating the IBP to enhance the achievement of Grade 12 learners, whose certification processes fall under the two departments.

Almanthari et al. (2020:1) conducted a study on the barriers that affect technology integration in Indonesian schools. The findings revealed that there were more barriers on learners than on the teachers' (2020:1). The findings link well to this study, in that Indonesia, like South Africa, is a

developing country and, it has the fourth largest education system in the world (Almanthari et al., 2020:7). The existence barriers compel the policymakers to develop technology integration policies that bridge the gap between the technologies that are introduced and the beneficiaries who are both learners and the teachers (2020:7). Hence, this study's quest is to ascertain if there are sound policies and legislation that support the integration of IBP and how that impacts on the achievement of Grade 12 learners in the Free State Province.

Globally, researchers (Tapscott, 1998 and Prensky, 2001) that focus on educational technology continue to expand debate on the relationships that different generations have developed with different technologies and the extent to which they integrate such technologies in teaching and learning (Evans and Robertson, 2020:269 and Reid et al, 2023:579). Concepts like Digital natives, Net Generation or Net Set, Google Generation and Generation Z have become an integral part of the research lexicon that is used to categorize the different generations according to the levels of familiarity with different technologies (Reid et al 2023:574). For example, digital natives grew up in a world that was already filled with different technologies technology, Generation Z are described as confident, diverse and tech-savvy (2001). Digital Native, are sometimes called the 'native speakers' of the universally accepted digital technology language and on the other hand, the digital immigrants are the older generations that had to learn and adjust to fit into the world of internet, computers and digital technologies (Thalberg, 2019:4 and Evans and Robertson 2020:269 and Reid et al 2023:579).

The digital natives spend on average more than seven hours interacting with different types of technologies (Thalberg, 2019:4). They are referred to as a new breed of learners, who are shaped differently by the technologies to think, learn and experience the teaching and learning world around them (Hicks, 2011 in Thalberg, 2019:4). They are believed to live in a media-rich digital world that is not only multi-connected, but a platform that enhances their digital skills and competencies (Porat et al., 2018:23). Despite the above categories there are studies (Brown and Czerniewicz 2008) that question the relevance of the above terminologies if heterogenous groups that are born within the same era are taken into consideration (Reid et al 2023:579). There are little or no conclusive and consistent research findings that link or prove that there is common preferences among generational groups (Reid et al 2023:579). In a study that investigated the perceived digital skills possessed by the about 280 junior-high-schools digital natives against the actual performance in such skills, the results revealed only a few had the requisite digital skills that led to their actual performance in a digitally driven world (Porat et

al., 2018:23). They can navigate in hypertext and hypermedia, non-linear environments with ease (2018:23). In addition, they display an ability to use their cognitive abilities to find, gather, relevant information, build complex and comprehensive multiple texts and integrating textual, graphic and multimedia drawn from inter-disciplinary sources (Barzilai & Eshet-Alkalai, 2015a; Barzilai Tzadok & Eshet-Alkalai, 2015b in Porat et al., 20218:23).

In a study by Lacka et al. (2021:163) on the impact of virtual technology learning, the results indicate that learners who are exposed to such technologies achieve at a higher level, since such an exposure supports their cognitive outputs, leading to improved learning. However, for that to happen, it requires that learners set aside time to engage with such technologies to enhance productivity and achievement in their respective subjects (2021:163). There are also theoretical and practical implications whose empirical evidence identified the existence of a gap between learners' experiences with technology integration and that of managers of the institutions that introduced the technologies. (2021:163). Iglesias-Pradas et al. (2021:3) argue that although for years, different studies have been conducted on achievement of learners, the results from data analyses depend on the adopted approaches. A single subject analysis of learner-achievement produces different results in comparison to a combination of different subjects and as Urtel (2008) added, that also depends on how the subjects were taught (online or traditional) (2021:3).

Gómez-García et al. (2020:3) noted that even though learners may have access to the Internet and relevant gadgets, they tend to develop advanced digital skills that are focused on the social media engagement and less, if none on education-related skills. As a result, if the learners are not monitored when using different technologies during teaching and learning, their academic achievement is negatively affected (2020:2). The negative impact gets higher if it started at lower levels and becomes difficult to correct (2020:3).

In a study conducted by Sahin et al. (2020:7) to identify the effects of AR technology on middle school students' academic achievement towards their science course, the findings revealed that there was a significant difference in achievement between the experimental and control groups. The learners who were learning Science, using AR technology, obtained higher test marks in comparison to their counterparts, who were only learning through the traditional methods (2020:7). Another study conducted in middle-school Mexican schools, showed higher levels of achievement in Geometry by learners, who integrated the AR technology in their learning (Ibáñez et al., 2020:1). A notable difference was also identified between learners from either

public or private schools (2020:1). Private schools tended to have a variety of these technologies that are not only effective but also improve the learners' learning outcomes in Geometry (Ibáñez et al., 2020:8). Banda and Nzabahimana (2023:127) conducted a study to investigate the impact of PhET simulation-based learning on learners' academic achievement among Malawian secondary school learners (Banda & Nzabahimana, 2023:127). The findings reveal that technology enhanced the physics learners' knowledge and improved their test marks, when compared to their counterparts who were taught, using only the traditional methods (2023:127).

Alneyadi et al. (2023:1) conducted a quasi-experimental study on the effect of using smart e-learning apps on the academic achievement of eighth-grade learners in United Arab Emirates (UAE)' city of Al Ain. The results indicate that the experimental groups had better mean scores in scientific ideas test scores, in comparison to the learners who were in the control group (2023:1). The following subtopic covers the legal prescripts and policies that deal with integration of educational technologies as observed from the global perspective.

3.2.1 Legal and policy factors: a global perspective

Teo et al. (2018:511), posit that the successful integration of educational technologies, including IBP, in South Korea, are influenced by the presence of policies and efforts that address and manage their effectiveness and social legitimacy. The above links well with the Research Question (RQ) 1 of this study, which sought to find if there are any legal or legislative frameworks supporting the creation of IBP integration in selected Grade 12 classes across the Free State Province. The effectiveness of e-learning is associated with providing proper infrastructure and continuous standardization, while social legitimacy was linked to sound and sensible regulatory systems, suitable online pedagogy, creation of awareness programmes and building e-learning communities of practice (Teo et al., 2018:511). This aligns well with objective 3 and Research Question (RQ) 3 of this study that sought to identify all the IBP-related factors that contribute towards the achievement by Grade 12 learners in the Free State Province.

Besides planning that is seen as an important contributor to an impactful integration of technology in education, enough time is cited as equally crucial before the actual integration (Atmojo & Nughroho, 2020:72). From a policy perspective, the above aligns well with

Research Question (RQ) 1 that sought to identify policy and legal frameworks that contribute positively towards the achievement of Grade 12 learners in the Free State Province. Teacher training and provision of sufficient knowledge and skills to maximize teaching practices, is another policy matter that researchers feel needs immediate attention (Atmojo & Nughroho, 2020:72). In addition, a sound policy must be clear on how learners are provided with ongoing empowerment with digital skills and debunking of misconceptions, about integration of technology in their learning (Atmojo & Nughroho, 2020:72). However, the reality is that, since many learners come from poor backgrounds and are unable to fully engage with integrated technologies and digital learning platforms, policies must make provision for learners to access relevant tools, for example, smartphones, stable internet connection and free or cheap data (Atmojo & Nughroho, 2020:72). Even advanced countries that include the USA, continue to refine their policies, align them with sound legal frameworks, as well as identify proper integration and testing of suitable ways that can transform teaching and learning, using technology (Li et al., 2019:501). The above confirms that globally, the alignment and modification of policies that address integration and its impact, thereafter, are a never-ending exercise, due to the ever-changing circumstances. The United States of America (USA), for example, had to refine old policies and develop an Action and P21's Framework for 21st Century Learning (Li et al., 2019:501). Drawing from the global experience, the study narrowed the approach to the local South African context, in a quest to highlight the strides already made, as well as the policies, opportunities and challenges encountered during the integration of different technologies, including IBP, within the teaching and learning sphere.

The above assertions remind the education managers that they have the responsibility to develop strategies and plans that incorporate policies on the integration of educational technologies in the different school environments (Morel & Spector, 2022:156). Policymakers are also warned that when adopting the technologies for integration into teaching and learning, they must ensure that the designs of the technologies take the learners' needs into consideration (Morel & Spector, 2022:156). This also means that such educational designs must accommodate and reflect the learners' values, knowledge and cognitive abilities (2022:158). Besides investment on learners, government, education departments and external stakeholders with an interest in education, have the responsibility to support teachers to integrate educational technologies effectively in teaching and learning (Yurtseven Avci et al., 2020:160). The next sub-topic deals with the evolution of the educational technologies from a South African perspective.

3.3 Evolution of educational technology in South Africa: a policy perspective

South Africa became the first country in the continent to develop and formally integrate an ICT policy into the national curriculum (Wallet, 2015). The prioritization of ICT as an important strategy to form part of the education ecosystem, was supported in 2002 by the Presidential Advisory Council on Information Society and Development (Shiohira, Keevy & Gibbs, 2018:1). In a quest to expand integration of ICT into teaching and learning, the South African Government, together with relevant departments, developed a White Paper on e-Education; the Presidential National Commission on Information Society and Development; the Electronic and Communications Transaction Act, No 25 of 2002 (Mncube & Olawale, 2019:38). In addition, they also approved the establishment of different intervention programmes to promote the integration of ICTs into teaching and learning (2019:38). The above policy development and legal framework, align with this study's objective 1 and research question 1 that sought to identify relevant integration of technologies official documents. Nevertheless, it is crucial to regularly evaluate the impact of ICT (and policy) integration, using the lens of Grade 12 learners in the Free State in line with the call for more research by Agyei (2021) and Rupere and Jakovljevic (2021).

3.4 The South African e-Education Policy

When the current e-Education Policy was first introduced by DBE in 2004, the intention was to assist all participating stakeholders within the education technology sphere with the correct tools needed to implement ICT in teaching and learning (Ngqondi & Mauwa, 2019:3). The Policy advocates for an inclusive approach wherein ICT integration is grounded on relevant pedagogies (2019:3). It must also take into consideration critical and higher order thinking skills that must form a priority (2019:3). Accordingly, the Research Objective (RQ) 1 and Research Question (RQ) 3 of the current study align with the above assertions, as the study sought to identify policy-supported factors that lead to and sustain the academic achievement of Grade 12 learners in the Free State Province. It further gives a proper action plan on different roles and responsibilities that stakeholders should play from initial stages to the full integration of ICTs in the curriculum (2019:3). Although it has set itself a policy goal that says: "every learner in the primary and secondary sectors should be ICT capable in 2013", this is yet to be

realized, since not all schools have suitable and current technologies that contribute and enhance quality teaching and learning (Ngqondi & Mauwa, 2019:3). Drawing from the above, the study sought to investigate if the above goal, as witnessed from the selected IBP and non-IBP schools' teachers' perspectives, has been achieved.

Furthermore, South Africa is still facing the "the Digital Divide" phenomenon that makes it difficult for the maximum installation and connectivity of digital tools and internet and thus making integration and access equitable throughout the country (2019:38). Educational technology specialists, including Dr Mmaki Jantjies, an associate professor in information systems at the University of the Western Cape, agree that South Africa has sound policies that promote and provide guidance on how to implement ICT in education (Mncube & Olawale, 2019:38 and Mail & Guardian, 2021). Jantjies (2021) adds that the 2004 White Paper on e-Education has a clear objective and learning outcomes that acknowledge technology as an enabler that plays a critical role in supporting teaching and learning across all school levels (Mail & Guardian, 2021). Hence, the need to conduct a study to ascertain if there is a general acknowledgement from teachers from IBP and non-IBP schools that technology impacts positively on the performance of Grade 12 learners in the Free State Province. Accordingly, this study also sought to engage district and head office from FSDoE, to establish, from a policy perspective, the strides already made to narrow the digital divide mentioned above. Furthermore, in alignment with Research Question (RQ) 3, this study intended to identify factors that either promote or stifle integration of educational technologies, including IBP, at public high school level.

Table 6 below, gives a detailed timeline of how policies that promote the integration of technology in teaching and learning have evolved over time, in response to the changing circumstances (Meyer & Gent, 2016:12). It also confirms that despite its existence since 2004, the rate of integration, at classroom level, cannot positively match nearly two decades of existence (2016:12).

Table 6
Summary of the policy environment of ICT in education and key concerns (Meyer & Gent, 2016:12).

Policy environment	Concerns
Deployment of ICT to every	

school in South Africa, a full integration of ICT in the curricula and an e-skilled educator workforce - in order to improve the quality of education - defined collectively by the following documents: National Education Policy Act (27/1996). The National Policy framework for teacher education and development. White paper 7 on e-Education (1896/2004) Transforming Learning and Teaching through Information and Communication Technology. Action plan 2019 Towards realization of schooling 2030. National integrated ICT policy green paper. Strategy for Information Technology in Education (DBE, 2001).	Policy dialogue on ICT in Education (2014) Some progress in school administration and provision of teaching and learning But impact compromise due to slow and uncoordinated implementation GDE study on e-maturity and e-readiness (2010) Unreliable connectivity, lack of leadership and vision of school administrators, lack of ICT skills of educators, limited learner access to ICTs are the major inhibitors to e-readiness.
Phakisa has six focus areas for the integration of ICT in	• Lack of a clear, context-sensitive definition of objectives

education: Management systems, curriculum content, TPD, ICT infrastructure, and connectivity.	• Lack of integrative strategy • Clear prioritization within the constraints of the budget • One-size-fits-all approach, that does not recognize the diversity of South African schools

Source: Meyer and Gent 2016:12).

According to Rasool and Naidoo (2024:1), the ambition to expand the ICT education is South Africa is historical and beside the e-Education white paper policy (2004), the following relevant documents represent the timeline indicating the strides that the DBE had taken to address the inequalities in ICT distribution across the South African Landscape:

• National Development Plan for 2030 (NDP);
• Department of Basic Education (DBE) ICT Strategy;
The Khanya Project of the Western Cape DoE in 2011
• The Gauteng-on-line Project in 2012 •
Operation Phakisa in Gauteng in 2016
• Classroom of the Future Initiative in 2015

Acknowledging the delays in the implementation of the different ICT policies and related guides, Ms Angie Motshekga, the former Minister of Basic education said: "We knew we had to [implement] it, but we had no resources because we must feed, give out free books, free education, pay salaries and build classrooms, etc. At the end of the day, it ends up that there's no money for e-learning (Mzekandaba 2022)."

Although from a policy framework perspective, there is a need to create an environment where there is equitable distribution and integration of technologies in schools across the country, reality dictates and, as indicated in Table 6, must be taken into consideration. The policies (e-Education) and action plans (2019) are sound on paper, but the concerns depict the presence of an uneven playing field (slow and uncoordinated plan and inexistence of relevant infrastructure). According to Ngqondi and Mauwa (2019:3), and in reference to Table 6 above, additional initiatives that were introduced after the 2004 Policy, include the Guidelines for Teacher Training and Professional Development in ICT in 2007. It contained competencies that addressed ICT knowledge, skills, values and the attitude that teachers must acquire and integrate in the curriculum (2019:3). There are also 2014 guidelines for school principals that were developed by DBE to assist school managers to seamlessly manage ICT acquisition and

implementation in their respective schools (2019:3). Accordingly, this study interviewed teachers in both IBP and non-IBP schools to ascertain the type of support that the school management teams are offering in support of integration of technology in teaching and learning. The integration of different technologies does not follow a one-size-fits-all approach but is impacted by different factors that are discussed in the next sub-topics.

3.5 Factors that impact the successful integration of technology in teaching and learning

There are various factors that influence the achievement of Grade 12 learners and literature sources confirm that they contribute towards and generate differentiation of educational performance (Graven, 2014:1041). They include learners' and teachers' inherent features, teachers' experience as specialists, relevant pedagogical methodologies applicable to online learning, the demographic variables, teachers' area of specialization, technology language, instructional design, training and technical support. The selected factors have a link to the research questions, objectives and relevant constructs within the UTAUT theoretical framework that has been selected to form part of the study. The impact of integration of different technologies on achievement learners who are the main beneficiaries of the IBP integration is discussed below.

3.5.1 Learners' inherent features

Literature acknowledges that the current generation of learners is well informed when accessing and using various technologies (Alfaki et al., 2018:136). Their familiarity with various technologies stems from the belief that different and current technologies were introduced to them at 'birth' (2018:136). Although many learners no longer consider the Internet as an innovation, its introduction to the classroom, together with different technologies, are still considered to be novel (Das, 2021:313). Some researchers label these technologies as the learners' first language (2018:136). This is because many learners spend a lot of time interacting with these technologies and in some cases, unconsciously learning various things about them (2018:136). Since context is key, the present study sought to ascertain if the learners have the necessary digital skills that, as indicated in the UTAUT model, allows them to seamlessly navigate and integrate the IBP in teaching and learning.

However, Pedro and Piedade (2019:6) warn that learners are not homogeneous, and education systems encounter different cohorts over the years. This means, when introducing different

technologies, schools need to consider this, since integration of ICTs into teaching and learning differs from context to context and generation to generation (2019:7). One of the noticeable causes of the differences is that some of the teachers, who were born in different eras from their learners, also known as digital immigrants, get frustrated since they fail to understand they are teaching digital natives, and this tension leads to the two talking past each other (2019:7). It is therefore key that immigrants create an environment that is suitable for teaching natives. Such an environment must be surrounded by different digital educational tools that include the Internet, computers, tablets, mobile technology, videogames and digital music players, whose presence has an impact on how the curriculum is developed (2019:7).

The unique qualities mentioned above that the digital natives have, are confirmed by UNESCO's International Institute for Educational Planning (IIIEP) (2021), who argue that they make use of their different learning styles to search, select, share, store and communicate, in pursuit of learning and its opportunities (2021). Over 87% of the learners who integrate technologies in their learning prefer to learn by accessing information in visual and tactile modes (2021). This is different from the normal reading and hearing learning styles that may not be appealing to some learners (2021). The presence of mobile apps with unique features, serve as additional support for learners, who want to learn differently or have special needs. The presence of special features that include touchscreens with menus and instructions, control features, a combination of graphics, text and audio and instant feedback, all make learning an enjoyable experience for leaners, who believe in self-pacing themselves (2021). The above information was sought from both IBP and non-IBP teachers, who were participants in this study and their insights are likely to confirm or refute the learning styles and behaviour of the current generation. The impact of proper integration of technologies in teaching, according to Ngqondi and Mauwa (2019:1), is seen as positively contributing to the learners' literacy skills. Many of the learners can explore, discover, create and communicate effectively with each other and their teachers, using different technologies (2019:1). The opportunities presented by such technologies motivate learners to expand their horizons to become fully competent and comfortable with the 21st century skills that include the technical skills, information management skills, communication skills, collaboration skills, creativity, critical thinking skills, and problem-solving skills; that are now part of the workplace (Ngqondi and Mauwa 2019:1 and Roshid and Haider. 2024:4). Hence, there is a need for the teachers from both IBP and non-IBP schools to confirm the levels of competencies that their learners possess and how they affect integration of technology in teaching and learning and performance thereafter.

Another notable discovery was a small gap or generational technological gulf between the learners and their teachers, in contrast to what was earlier discovered by Prensky and others (Kennedy et al., 2008a, Kennedy et al., 2008b and Judd, 2018:99). Some discoveries confirmed that even though most learners were technically adept, the level of advancement in these different technologies mainly rested on their preferences and expectations, which automatically revolutionize their learning across the board (Judd, 2018:99). The additional information also revealed that adoption rates differed, due to the learners using different technologies for different uses. By exploring both historical data, together with interview data from Grade 12 teachers in selected IBP and non-IBP schools, the study sought to ascertain if the use of different technologies, including IBP, improves their digital skills; many of whom are observable during the execution of different activities. It is from the studies mentioned above and many similar studies that evidence is combined to develop unique digital literacies that could leverage technological affordances and build requisite and relevant competencies that make it possible to integrate various technologies into teaching and learning (Smith et al., 2020:1). The Thabo Mbeki Foundation (2019:8) discovered that 21st century learners are different, in that they are no longer passive recipients of content but, using various technologies, can actively participate by exploring and producing knowledge from different subjects at their own pace. The Foundation argues that these learners need to be empowered by four important pillars: problem-solving, critical-thinking, collaboration and digital literacy (2019). Furthermore, the Foundation suggests that if proper technologies are introduced into teaching and learning, they are likely to produce learners with relevant competencies that are needed in the 21st century knowledge economy (Thabo Mbeki Foundation, 2019a:8 and Thabo Mbeki Foundation, 2021b). Equally important, are the roles that teachers play during the integration of educational technologies in teaching and learning.

3.5.2 Teachers' inherent features

In her reply message during her homecoming celebration, the former South Africa Deputy President and former Executive Director for Women at the United Nations, Dr Phumzile Mlambo-Ngcuka, indicated that there was a need to embark and support specific projects in education and leadership (SABC News 2021 and Umlambo Foundation 2022). After conducting her initial research on digital literacy, she had thought she was going to focus on learners but discovered that "the biggest problem was with teachers (2021). She believes that

teachers need to be brought on board, allowed to master technology first and that will make it easier for them to integrate it into teaching and learning (2021). The above arguments are aligned to this study's research questions 2 and 3, research objectives 2 and 3 and the UTAUT model that sought to uncover the extent and confidence levels that technology users, in this case, IBP, have, and how that impacts the performance by Grade 12 learners in the Free State Province.

Some studies (Mncube & Olawale, 2019:36) concur with Mlambo-Ngcuka's (SABC News 2021) contention that for any country to be in line with the world when it comes to embracing digital technologies, it should start with integration of educational technologies, including IBP, at school level. The exponential rate at which these technologies develop, implies that teachers must continuously update themselves and be able to create relevant content for their learners (2019:36). However, many studies (Mncube & Olawale, 2019:36) reveal that teachers are still lagging when it comes to empowering themselves with skills and knowledge about ICT. Despite the presence of various technologies within the education sphere, teachers, who are expected to enhance learners' daily experiences by effectively integrating such technologies, are still encountering challenges (Li et al., 2019:502). Another notable observation is that the use of technology differs from teacher to teacher, ranging from administrative activities, teachers' instructional practices, to helping individual learners perform specific activities related to their learning (Li et al., 2019:502). In addition, teachers' experience, when it comes to using technology, varies with some teachers for example, preferring Smart boards or interactive whiteboards to share relevant content, while on the other hand, others prefer practical problem-solving or inquiry-based learning activities (Gregorcic et al., 2017 in Li et al., 2019:502). In many studies, it has also been discovered that the focus was more on the number of times teachers use various technologies with little time spent on the reasons for using such technologies or on learner-centered practices (Li et al., 2019:502).

Some crucial barriers to overcome, include a high number of teachers without requisite didactic skills and those who must undergo in-service training on ICT integration into teaching and learning (2019:38). The interviews that form part of this study ascertained the level of technology-know-how that teachers in both IBP and non-IBP schools possess and established if there is any in-service training support offered by relevant stakeholders within the FSDoE-UFS collaborative effort. Ngqondi and Mauwa (2019:1) have identified computer literacy as an important and basic requirement that may lead to a successful integration of technologies in

teaching and learning. They posit that with many teachers lacking such skills, integration of technologies in many high schools has not only become slow, but unable to attract teachers, who are confident and properly qualified. In some schools, teachers have confessed that they were uncomfortable integrating different technologies to deliver their subject content, due to lack of relevant knowledge needed in teaching and learning (2019:1). The successful implementation of any technology within the education sphere, including the IBP integration, rests solely on the above need that teachers must acquire. Some studies that investigated teachers' use of technology have come up with different findings. For example, when it comes to teachers' background**,** they revealed that elements that include gender, age and teaching experience, have varying consequences when it comes to integration of technology (Li et al., 2019:503).

In some findings it has been revealed that male teachers tended to use technology quiet often in comparison to their female counterparts, whereas others cited experienced teachers were likely to integrate technology into their teaching practices, in relation to their less-experienced counterparts (Li et al., 2019:503). It has also been found that when it comes to age, older teachers see the integration of technology into teaching and learning as less important, in comparison to their younger colleagues (O'Bannon & Thomas, 2014; Scherer et al., 2015 and Vanderlinde et al., 2014 in Li et al., 2019:503). When it comes to teachers' beliefs, attitude and self-efficacy, there is a positive correlation to prior experience in using different technologies, with computer literacy featuring prominently (Li et al., 2019:503). In addition, it has also been found that the lack of confidence may negatively affect usage of different technologies where those with more passion and feeling comfortable with various technologies, tend to spend more time integrating technologies into their teaching practices (Li et al., 2019:503). Although they would assume a different role, teachers' professional development is critical for the successful integration of technologies in teaching and learning (Pedro & Piedade, 2019:13). Teacher competencies are viewed as important, since many struggles to develop proper competencies that can take innovation and digital transformation into account (2019:13).

Equally important is the research and development of teachers' in-service training programmes that accommodate the 21st century skills and prepare them for the task of integrating technology into the curriculum (2019:13). Due to a lack of relevant skills, many teachers tend to develop a negative attitude towards the introduction of ICT-based methodologies and may go as far as resisting attempts towards the adoption of new technologies (Ngqondi & Mauwa, 2019:1). The

lack of computer skills, is seen as a major factor that clearly contributes negatively on the teachers' willingness and ability to integrate suitable technologies into their daily teaching and learning tasks (2019:1). Many teachers, who are incompetent in computer knowledge and skills, always find it difficult to integrate them into teaching and learning (Alfaki et al., 2018:136). Although many schools have various technologies, including videos, tablets, interactive whiteboards and so on, they still rely heavily on the traditional 'chalk-and-talk thing' with a pen used as a reliable tool on the side-line (2018:136). They believe in taking the centre stage, instead of allowing new technologies to enhance their jobs (2018:136). The experience that teachers acquire as specialists in their respective school subjects and how that impacts integration of technologies is discussed in the next sub-topic.

3.5.3 Experience as teacher-specialists

According to Zhu et al. (2018:226), prior experience refers to an attitudinal stimulant that relates to behaviours that individuals have engaged on, in the past. On the other hand, technical know-how is a cognitive stimulant that relates to an individual acquiring specific knowledge about a certain discipline or subject.

With reference to different educational technologies, studies reveal the relationship between prior experience and the number of times that such a technology is used, as contributing towards certain attitudes that are formed towards such technologies (Zhu et al., 2018:226). Consequently, this study, through Research Question (RQ) 2, sought to uncover the level of experience that the participants who engage with IBP have, and how that impacts on the achievement of the Grade 12 learners in the Free State Province. Although measuring attitude is difficult, researchers argue that computer experience has a positive correlation to computer attitudes. Therefore, a conclusion can be drawn to the extent that attitude plays towards adoption and usage of that specific technology (2018:226). It has also been found that individuals, who lack requisite knowledge and experience, are likely to display negative attitudes towards a particular technology (Zhu et al., 2018:226). According to Hung et al. (2018:184), when comparing experienced and inexperienced technology users, the differences usually depend on their individual behaviours, habits and learning styles. It has also been discovered that, people who are closer to those lacking experience, usually help and through actual usage, over time, the inexperienced users usually find that such technologies do not need a lot of effort (2018:184). The presence of continuous support in the form of training and

updated manuals may also assist in empowering them in terms of experience and the seamless navigation of technologies (2018:184).

Researchers have often cited the role that correct pedagogies play and the involvement of Grade 12 teachers in this study sought to establish their views on the impact that has on full integration into teaching and learning in the Free State Province. In terms of alignment, research objectives 2 and 3 and research question 2 and 3, together with the UTAUT model's constructs, play a critical role in this study's quest to ascertain the role the pedagogy plays in the achievement of Grade 12 learners in the Free State Province.

3.5.4 Relevant pedagogical methodologies within the online teaching sphere

Pedagogy refers to the deeper knowledge, concerning the practices and processes or methods of teaching and learning a specific subject (Mishra & Koehler, 2006:1026). It also highlights aims, objectives, general purposes and relationships, guided by specific values and ethics (Mishra & Koehler, 2006:1026). Research questions 1 and 3 sought to uncover the type of policies and the parts of the CAPS curriculum for integrating IBP, using the best teaching and learning practices.

It further delved into the unique teaching strategies and techniques that a teacher may apply when interacting with learners and the type of assessment and evaluation tools relevant to that group of learners. Pedagogy further means knowledge of how learners acquire and build knowledge and skills, as well as internalizing certain habits and beliefs that may lead to specific positive dispositions towards learning. Accordingly, this study, through RQ 2, highlighted the views of participants on the suitable pedagogies that have been adopted during the integration of IBP in teaching and learning. It further refers to a better understanding of cognitive, social and developmental theories of learning and how they relate to individual learners in classroom. (Mishra & Koehler, 2006:1027). According to Singleton (2017), despite efforts that are in place for integration of technologies, teachers' attitude and beliefs that are grounded on their pedagogical practices, may either lead to them showing either positive or negative attitudes towards such technologies (Thalberg, 2019:5 and Li et al., 2019:504). For example, teachers with well-established knowledge and skills in computer literacy have positive constructivist beliefs that make it easier for them to integrate technology in teaching and learning activities

(2019:504). They tend to apply their competencies, attitudes, beliefs and pedagogical approaches in support of the stated educational objectives. Such teachers tend to have inherent learner-centered beliefs, but more research is needed to investigate the extent to which such beliefs lead to a total integration of technology in their classrooms (Li et al., 2019:504). The assumption that is always made when introducing technology in schools, is that teachers should be the first target and yet when those teachers do not understand how to use it effectively, they develop a negative attitude and are likely not to integrate it as part of their teaching practices.

The study intended to identify the relevant UTAUT model constructs that promote and align teachers' state of mind towards the integration of IBP in teaching and learning. Although many policymakers know that for teachers to effectively integrate technology in teaching and learning, it requires technological and pedagogical skills, but many teachers, despite training and support, are yet to master these important elements locally or globally (Wilichowski & Cobo, 2021). Policymakers have an important role of empowering teachers with relevant digital skills needed to enhance their teaching practices. However, such a foundation is hardly built, due to the haphazard implementation processes that do not take important factors into consideration (Wilichowski & Cobo, 2021). Consequently, for this study and through RQ 1, relevant policies and strategies are equally important to influence teachers to seamlessly integrate the IBP in teaching and learning. Hence, the need to answer RQ 2 on how the participants have developed pedagogies that integrate IBP in their respective teaching and learning areas of influence.

The empowerment of teachers through digital teaching and learning is a panacea that empowers them with basic digital skills and expand their pedagogical foundation that is key during the integration of digital tools and resources in teaching and learning (Alfaki et al., 2018:38). Equally important is the impact that e-learning integration has on learners that include exploration, manipulation, experimentation and collaboration (Mncube & Olawale, 2019:38). Once fully mastered, the new pedagogies that make use of different technologies in teaching and learning become part of the daily teaching and learning practices and should be viewed as both a process and a product (Pedro & Piedade, 2019:11). This also means teaching and learning processes, through a transformed curriculum, must include searching, identifying, selecting and critical implementing of the relevant information, using different digital platforms (Pedro & Piedade, 2019:7). Teachers are also forced to accommodate the learning needs and styles of the digital natives that include moving at a faster pace, using a few steps and by

creating platforms that allow for individual and group higher-order creative and critical-thinking (2019:7). This generation are also challenging the current pedagogy models with a move from the teacher-focused approach to the learner-centered approach that narrows the gap between what happens in both school and the outside world. Accordingly, RQs 2 and 3 respectively sought to highlight the perceptions and experiences aligned to IBP integration practices that are applied to accommodate Grade 12 learners' individual differences and needs.

Pedro and Piedade (2019:9) dispel the myths within the education experts that once a curriculum has been developed with stated objectives, its content, which is introduced to learners by teachers, is easier to assimilate and comprehend. They suggest that learners' prior knowledge of the digital world, that they bring from the outside world, must be infused into the curriculum, namely its objectives, content, and teaching methods (2019:8). Hence, the need through RQ 2 to confirm if there is a platform that is open to accommodate the learners' prior experience during the IBP integration. They contend that the promotion of technology in teaching and learning is changing how learners deal with both the classroom and contexts of practice outside classroom (2019:9). Das et al. (2021:311) observed that integration of technologies is flexible and can be applied across different subjects, including Geography, Fine Arts and Physical Education. This means, for the successful development, use and acceptance of these subject-inspired technologies over the Internet, the creators must include activities that accommodate the real world (Das, 2021:311). The fact that many students are exposed to these digital tools from early ages, means technology developers have the responsibility of ensuring that such technologies prepare learners, from the formative years, to learn solving problems by relating them to the real world (2021:311). Research questions 1 and 3 therefore sought to uncover the extent to which the policies and selected technologies, including IBP, take teachers, learners and different contexts into consideration and how that impacts on the achievement of the Grade 12 learners across the Free State Province.

Furthermore, the provision of the in-service training to teachers is made difficult, not by the introduction of ICT, but also a lack of knowledge that is aligned to the pedagogical practices (Scherer & Brito, 2020:3). Although the process of integration of technology, including IBP, is not an easy one, it presents opportunities that may allow learners and teachers to learn from each other, but on the other hand it has many challenges that may serve as valuable lessons.

3.5.5 Demographic variables

The 21st century education and teaching environment requires both male and female teachers, who are familiar with creative skills, empowering themselves with such skills and being able to implement them in their respective classrooms (Craft, 2010, Harris et al., 2017, Harris et al., 2018, Henriksen et al., 2018, in Li et al., 2022 and Henriksen et al., 2021). Accordingly, this study highlighted the extent to which gender differences are impacted by the lack of IBP technology integration. Studies on gender disparity, when it comes to the use of technologies, continue to highlight under-representation of women from strategic levels, through research to the shop floor and male dominance that continues unabated (Gómez-Trigueros & Yáñez de Aldecoa, 2021:1334). There is therefore a need to address such discrepancies across all school levels. This also ensures that there are equal opportunities afforded for both the boy and the girl children when technologies like IBP are introduced to the learners in all subjects across the Free State Province. However, if female teachers and learners are left behind, there is a likelihood of intentionally or unintentionally perpetuating the gender imbalances. Furthermore, the practice is likely to deny learners opportunities and exposure to various digital literacy skills that are needed to encourage creative-thinking, brainstorming, problem-solving and unleashing of innovative abilities (Collard & Looney, 2014, Craft, 2001, Cropley, 2012, Katz-Buonincontro & Anderson, 2020 in Li et al., 2022). Although socially and culturally speaking, ICTs and access to STEM subjects are still associated with males, different interventions are being introduced to address the disparities and increase female students' enrolment in such studies. (Gómez-Trigueros & Yáñez de Aldecoa, 2021:1334). Narrowing the gap between males and females when it comes to the adoption of technologies would require continuous training and empowerment of females on the correct ways to identify and use suitable technology and thus boosting their confidence (2021:1346).

When it comes to the integration of different technologies across different school subjects, the Programme for International Student Assessment (PISA 2018) and OECD (2020:142-144) revealed a narrowing of the gender gap in mathematics performance in some countries, including Czech Republic, Denmark, Macao (China), Singapore and Slovenia, and both genders operating at the highest levels (Schleicher, 2019:18). The empirical evidence presented by Schleicher (2019:18 and OECD, 2020:142), has also indicated that it is possible to lift the low performing learners to higher levels without affecting those who are already high up. A study by Almanthari (2020:7), also indicates that the influence of demography differs from person to person. Gender and age for example, have been cited in detail with each influencing and being

influenced by integration of educational technology differently (2020:7). The above findings link to the UTAUT theoretical model where demography is part of the moderating factors. Demography also aligns to the research objective 3 and seeks to establish how this concept impacts achievement during the integration of IBP in teaching and learning. Since teachers are specialists in different subjects, their areas of specialization are critical and align well with this study's quest to uncover factors that influence the achievement by Grade 12 learners in the Free State Province.

3.5.6 Teachers' area of specialization

As specialists, teachers are expected to have a deeper knowledge of the subjects that they are teaching with content featuring prominently. Content refers to one's knowledge of the actual subject matter that he or she is going to teach, for example Titration in Physical Science, Drama in Language or Probability in Mathematics (Mishra & Koehler, 2006:1026). It is also expected that specialist teachers will get a full grasp and knowledge of the subjects that they teach, and more emphasis must be on the main facts, concepts, theories and procedures within a given subject. Furthermore, teachers are expected to have a deeper understanding of explanatory frameworks that underpin and link content and ideas together with the relevant rules of evidence and proof (Mishra & Koehler, 2006:1026). Such skills also link to attitude and confidence that have been extensively discussed in the chapter on the theoretical framework.

During the ICT integration in schools, intervention programmes tend to focus first on teachers, since they are specialists in the various subject content that they teach (Ngqondi & Mauwa, (2019:2). In most cases, as studies indicate, teachers lack the requisite skills that are critical for the integration of such IBPs (2019:2). If they are left behind during integration, they become barriers that lead to the failure of any attempts to encourage them to use IBPs in schools (2019:2). It has been discovered that their ability and willingness to integrate IBP technologies is determined by the amount of knowledge that they possess on integration on IBP integration within their areas of specialization (2019:2). It becomes a far-fetched dream to expect teachers with little or no knowledge of such integration processes to deliver successful lessons in their classrooms and in most cases, such teachers resist attempts to participate in such initiatives (2019:2). The above assertions are aligned to Research Question (RQ) 2 on perceptions that teachers have regarding the integration of IBP in teaching and learning. In addition, it aligns with the UTAUT model's main constructs that include PE, EE, SI and FC that all sought to find

factors that contribute towards the achievement of Grade 12 learners in the Free State Province. Some studies (Viberg et al., 2020:2) for example, reveal that Mathematics teachers lack the suitable skills needed to design effective learning experiences that can easily integrate different technologies that are underpinned by sound mathematical pedagogical practices. The encroachment of the technologies within the mathematics education sphere is also seen as contributing positively to how learners understand the subject and thus leading to above normal achievement (Das, 2021:313). Any envisaged successful integration efforts and practices of technology on school subjects, including Mathematics, must be aligned to three critical factors (2020:2). The first one is how technology is designed to, "fit-for-purpose (2020:2)". Linked to the design would be the different learning activities and tasks that form part of the integration process (2021:2). Secondly, it is the different roles that would be played by different teachers as they integrate technologies into teaching and learning (2020:2). Lastly, and what is also key, is for integration of such technologies within the education sphere to take context into consideration (Viberg et al., 2020:3). The facilitation role of teachers has also been singled out as crucial in that they are expected to bring together and consolidate the learning outcomes linked to technology-rich tasks and activities (2020:3). Teachers are required to simplify navigation procedures and relate such experiences to related activities that use either the same or different technologies (2020:3).

Furthermore, as subject specialists, teachers are expected to play a transformative role as co-designers and researchers with the ability to transform their subjects' practices as they integrate them with different digital technologies (2020:3). During the design process, teachers have an important role of ensuring that the terminology, from both the subject content and the technology's design and analysis, align well (2020:3). This also means that all elements within the selected technology, including the selected software and its related design activities, must seamlessly create a platform for interaction between learners' and teachers' implementation of different scaffolding processes (2020:3). To achieve the above would require continuous in-service training and support of teachers on issues that include technological and pedagogical content knowledge (2020:3). When considering context, it means the selected technologies must be embedded in a coherent manner with many factors taken into consideration (2020:3). The above link well with experience, the UTAUT model, Research Objectives and Research Questions in that they sought to highlight contributing factors that have an impact on the achievement of Grade 12 learners in the Free State Province. Since teachers are playing a role in the integration of educational technologies that include the IBP, what is also equally

important, is the type of language that these technologies use, if the learners' and teachers' acquisition of the language of instruction is to be taken into consideration.

3.5.7 Technology language in use

The type of language used when developing different education technologies is important in that it makes it easier for the users to easily understand the navigation messages (UNESCO, 2022). The above suggestions also apply to minority languages (2022). Although some see the technology language as competing with the users' mother-tongue, it is not only unique but can be applied to solve mathematical problems whose solutions are likely to solve the world's problems (Das, 2021:313). Many technology users, whose mother tongue is not English, usually struggle with access to the digital tools, Internet or digital content, since their approach is usually from the second language speakers' perspective (UNESCO, 2022). The above assertions resonate well with this study on the performance of Grade 12 learners, since all selected schools fall under quintile levels 1-3 and their learners and teachers are non-mother-tongue speakers of English that is also the language of instruction within the FSDoE.

The absence of technologies whose material, for example, is written in learners' and teachers' mother tongue, poses as a disadvantage in that they struggle to understand the instructions when compared to their counterparts whose mother tongue is English (UNESCO, 2022). This unavoidable situation compels them to perform key ICT-driven functions that include searching, comparing, selecting, gathering, storing and communicating different types of messages to fellow learners and teachers, using a foreign language (2022). Despite possible language barriers, with practice, they continue to engage these different ICT functions and thus leading to an improvement in their navigation, searching, communication and comprehension skills, including automatic speech recognition, audio-visual materials and chat functions (2022). It is through interaction with teachers, district, head office, and IBP officials that the above can be confirmed as barriers or making no difference during integration of different technologies including IBP, in teaching and learning. Equally important is the instructional design that aligns well with the language that the selected educational technologies are using.

3.5.8 Instructional design for video-based teaching

One of the fundamental and guiding principles for successful creation of networked environment, is the presence of instructional design plans that are aligned to different educational technologies (2018). Consequently, this study, Research Question (RQ) 3 addressed the IBP-aligned factors that have an impact on the achievement of Grade 12 learners across the Free State Province. It is also worth noting that even though technology experts can design various technologies that assist in the achievement of deep learning, it has not been easy to translate that into actual learning, since experiences cannot be prescribed in a similar way (Jan & Vlachopoulos, 2018:1). Accordingly, this study's Research Question (RQ) 3 sought to ascertain the teachers' and learners' experiences on the integration of the IBP and how that impacts the achievement of Grade 12 learners across the Free State Province.

Besides RQ 3, this study aligned with the selected UTAUT theoretical framework, whose constructs (PE, EE, SI and FC) assist to determine the extent to which the IBP impacts on the achievement of Grade 12 learners in the Free State Province. Alshammari (2020:118) cites a study that revealed that instructional designs are strong predictors when it comes to learners' adoption tendencies with specific focus on users' perception about the ease of use and not on the perceived usefulness of the system. They also concluded that adoption tendencies also depended on the nature of the instructional design, for example, its simplicity, clarity and user-friendliness. Despite such variables likely to lead to the acceptance and use of technologies, there is no conclusive evidence that it will be regarded as useful (Alshammari, 2020:133). Hence, the need to understand the teachers' and learners' experiences with IBP and its impact on the achievement of Grade 12 learners in the Free State Province. Alshammari (2020:131) shared a study conducted by Hussein et al. (2007) in Indonesia on the impact that instructional design had on students and the findings revealed that it had a positive effect on the perceived ease of use "PEOU" and on perceived usefulness "PU" and thus leading to them adopt the technology. Alshammari (2020:131) further examined a study that was conducted by Al-hawari and Mouakket (2010) on the impact that specific instructional design features have on learners' e-retention and satisfaction levels that turned out to be positive and identified as determining factors towards acceptance and use of technologies.

Studies also suggested that if the instructional designers served as strong determinants of adoption of such technologies, there was therefore a need for policymakers to pay attention to specific features within such technologies that would make it much easier and user-friendly. The focus on the features above, including content and ease of use, would need to be monitored

on a regular basis and with improvements based on it (Alshammari, 2020:133). For successful implementation and actual usage of the systems, it is important for enough time to be dedicated towards designing user-friendly interfaces and high-quality features that would make navigation a seamless exercise (2020:133). Designers have an additional responsibility to dedicate enough time to customization of the interfaces to accommodate the different needs of learners and the fact that they are from different backgrounds. In addition, training as an ongoing process, would also need to be provided that will focus on the instructional design features and lead to learners getting used to the technologies. Familiarity may be making it easier for them to acquire more knowledge on the effective use of such technologies and thus strengthening their behavioural intention to use the technologies (Alshammari, 2020:133). Although the learning designs reflect the designer's pedagogical intentions, they would not be able to capture the learners' perceptions, experiences, and actualization of the intended design (Jan & Vlachopoulos, 2018:1).

In addition, such designs are unable to capture the way learners engage with the provided designs or the impact they would have on them after the learning process has taken place (2018:1). Therefore, it is important for the learning design to provide a platform of information on how teaching and learning has taken place by making use of the relevant and corresponding learning analytics, since such a relationship may inform teaching and learning practices that takes place anywhere, anytime (2018:1). An instructional approach that leans more towards a student-centered approach creates a platform wherein learners are independent thinkers, who are given space to co-create their learning experiences, while the teachers are viewed as individuals that facilitate collaborative efforts amongst learners (Li, 2019:506). There is therefore a need for a well-established instructional design that promotes and empowers learners with relevant digital literacy skills. The current classroom teaching practices need a complete overhaul, since they preserve the existing traditional teaching practices, instead of digital literacy competencies (Porat et al., 2018:26). Teachers have an important responsibility to design and implement learning and assessment activities that nurture digital literacy skills of learners (Porat et al., 2018:32).

Research indicates that some learners find teaching technologies difficult to access and navigate (Hung et al., 2018:172). They also cite difficulties when working on internet-enabled devices that pose as distractions, since there may be other messages popping up, including emails and various social media platforms. There is therefore no conclusive evidence on the perceptions

that learners have when it comes to using the technologies as part of their learning (Hung et al., 2018:172). Accordingly, the current study sought to provide some evidence, from the teachers' perspectives, on the experiences of learners in the ecosystem of the Internet Broadcast Project (IBP). Furthermore, the study regarded training and technical support as an important contributing factor that needs to be explored and linked with performance by learners.

3.5.9 Training and technical support

Training refers to the assistance that is given by knowledgeable specialists in the ICT field, which include software products and computer hardware, which may be linked to online support, access to knowledge bases and remote software services (Alshammari, 2020:117). Technical support has been mentioned in some studies that focused on their impact on acceptance and use of different educational technologies, as observed from different contexts. The findings in many studies (2020:117) also revealed that successful integration of many technologies depends on the constant support offered by the technical staff to both students and learners. Also, such support leads to a positive adoption of such technologies within the teaching and learning environments (2020:117).

Ngqondi and Mauwa (2019:2) assert that thorough ICT training, a requirement when introducing technology education in teaching and learning, has benefited many teachers across the country. The downside is that such training is often once-off and does not delve deep into other different ways of integrating ICTs into teaching and learning (2019:2). The once-off basic computer skills that are popular in-service skills, have been found to offer little or limited ICT knowledge and require competencies on how to integrate various educational software in the classrooms (2019:2). It is through regular, follow-up and sustainable in-service teacher training programmes that ICT integration in the classrooms will have a lasting impact that will boost teachers' confidence and willingness to perform at higher levels (2019:3). Although the adoption of many technologies that are integrated into teaching and learning is widely reported, there is a high acceptance and usage rate amongst the developed countries, while barriers that include technical support, instructional design and self-efficacy, have been cited as common amongst the developing countries (Alshammari, 2020:112). With little literature available to give reasons, there is still a lot that needs to be done in the form of research. There are some studies that cite the interplay of both internal and external factors; many of which have an impact on the adoption rate of these technologies (2020:113). Alshammari (2020:131) also

examined another study, conducted by Hussein et al. (2007) in Indonesia, on the impact that instructional designs have on students towards the introduced technologies, and they discovered that in the same study, the technical support was cited as an important salient factor that shapes and influences learners' acceptance and use of the technologies (Alshammari, 2020:132).

This above is seen as an important finding that may assist the policymakers to make informed decisions when it comes to identification of suitable technical support services to support adopted technologies (2020:132). It is therefore incumbent upon educational institutions to allocate enough resources, time and technical support that would have a motivating effect on learners and without such technical support may have a negative impact on the use and acceptance of such technologies (2020:132). Cursory evidence reveals that most teachers, who are introduced to technology, usually show a negative attitude with many who successfully embrace technologies, attributing that to the professional development training they receive and support thereafter (Wilichowski & Cobo, 2021). This proves that effective and continuous training of teachers on the integration of technologies is necessary and that it must always be a bottom-up initiative (2021). In as much as training, leadership and technical support are viewed as positive contributors towards technology integration, those that specifically focus on the curriculum and pedagogical practices have been cited as likely to increase integrations efforts by teachers during their teaching practices (Sandholtz & Reilly, 2004 in Li et al., 2019:504). This study also considered demography as crucial at different levels, including the UTAUT model where it features prominently as moderators. The review of the UTAUT constructs (PE, EE, SI and FC) is intentional in that its variables are linked to the relevant content covered in the literature review.

Empirical studies show that perceived usefulness of educational technologies significantly predicts user adoption (see also 3.5.4, 3.5.7, 3.5.8 and 3.5.9) (Venkatesh, et al. 2003 and Liebenberg, et al, 2018:162 and Hart, 2023:10). The users' perception is that the introduced technology in the case of this study, the IBP, would directly impact on their job or teaching performance and in case of learners' new knowledge (Venkatesh, et al, 2003, Graham, et al 2020:759, Hart, 2023:10 and Bayag & Madimabe 2024:49). In a study by Bayag & Madimabe (2024:58), the findings revealed that PE as an UTAUT construct significantly influenced behavioural intention (BI) of mathematics teachers to use the selected technologies in teaching and learning sphere. Similar findings from research by Bandoh et al (2024:1) confirms that there PE produced a positive and significant impact on the intention by the mathematics

teachers in Ghana to adopt and integrate technology. Mohamed and Hassan (2023:1076) revealed that there was a strong association from PE and EE on the intention to use the selected technology. In other cases, it was discovered that besides the PE and EE association, additional constructs that included hedonic motivation had a direct impact on the intention to use the mobile devices in a teaching and learning sphere (Bere, 2014:84).

As part of the UTAUT model, the EE construct is premised on the users' perception that by integrating the selected technology, they will not encounter any challenges, and that the technology will be free of effort and easy to use (Venkatesh and Davis 2000). Research in African education contexts demonstrates that perceived ease of use often correlates with teacher adoption of ICT tools (see 3.5.1, 3.5.2, 3.5.4, 3.5.7, 3.5.8 and 3.5.9) (Liebenberg et al, 21:162, Bayag & Madimabe 2024:49). The teachers' views that are covered in section 3.5.2 experience in section 3.5.3 and direct interaction with the technology see 3.5.4 and 3.5.7 and 3.5.8) significantly impacts behavioural intention by mathematics teachers to use different digital technologies in their classrooms (Bayag & Madimabe 2024:49). Studies in both South Africa and Ghana confirmed that EE was a strong predictor of BI to use technology (Liebenberg et al, 2018:164 and Bayag & Madimabe 2024:59).

Studies reveal that peer, and institutional influence significantly affects behavioural intention to use new technologies in school settings (see 3.5.1and 3.5.2) (Liebenberg et al, 21:162 and Bayag & Madimabe 2024:49). The SI construct addresses individual teachers or learners' inner feelings or attitude that, together with the influence from the immediate or wider society lead them to accept and use the selected technology (Venkatesh et al. 2003 and Bayag & Madimabe 2024:49). It during this decision-making process that such an influence is measured against the behavioural intention construct (2024:59). The successful integration of technology in a South African situation, for example, depends on the attitude and willingness that teachers, learners and all stakeholders display towards BI and thus leading to adoption and use of such technologies (Mohamed and Hassan 2023:1076 and Bayag & Madimabe 2024:47 and Bandoh et al 2024:1). In a study by Bandoh et al (2024:1), the findings revealed that even though the SI was significant there was a noticeable negativity associated with the teachers' intentions. What strengthens the impact that SI has on technology adoption is the presence of a well-established network that can reach out and influence the affected parties or create a platform that advocates for the acceptance and adoption of such technology (Mohamed and Hassan 2023:1070 and Bayaga and du Plessis, 2024:9707). However, there may be instances that SI may be negatively

impacted if the stakeholders like teachers, learners or schools' management feel that they did not have time to accommodate the introduced technology or did not feel it would add value to teaching and learning (Graham et al 2020:760 and Hart, 2023:10). Successful integration according to Graham et al (2020:760) depends on the attitude of the stakeholders, teachers and learners recognizing the technology as an aid to efficiency or a valuable technology tool within teaching and learning.

The availability of infrastructure, training, and support structures are shown to critically shape the actual use of technologies (see 3.5.7, 3.5.8 and 3.5.9) (Venkatesh et al. 23 and Liebenberg et al, 21:162). The successful adoption of the introduced technology depends on the presence of facilitating conditions that may lead to stakeholders (teachers, learners and school management team) embracing the technology and thus significantly impacting on behavioural intention to adopt the technology (Bayag & Madimabe 2024:49). In a study by Bandoh et al (2024:1) the findings identified the presence of the positive Facilitating Conditions that impacted positively on the mathematics teachers' intentions to adopt ICT. The findings also concluded that FCs served as positive predictors of the behavioural intention of mathematics teachers adopt and use the technology (Bandoh et al 2024:1). However, there are instances where the FCs are negatively affected due to negativity associated with the introduction the technology (Mohamed and Hassan 2023:1076). The absence of relevant infrastructure, lack of training or awareness campaigns, Pedagogical incompatibility, lack of support from school management and ambiguous policies could negatively impact on the facilitating conditions and thus lead to a negative behavioural intention to adopt such technology (Graham et al 2020:750, Hart, 2023:10 and Mohamed and Hassan 2023:1076).

3.6 Summary

The IBP integration-related processes, as reported in literature, can only make sense if they are aligned in a logically coherent and easy to understand way. The prominent part, as highlighted in research objective 1, 2 and 3 respectively is that policymakers, school managers, service providers, the curriculum, teachers and learners contributing to this whole integration, confirms the need to always put everything in alignment, to have a successful integration of IBP. With reference to research objective 2, learners who are the main beneficiaries of the integration of IBP in schools, are a unique generation that needs to be studied well so that corresponding pedagogies can be applied by the teachers and thus lead to them achieve positively. As

facilitators in the whole IBP process, teachers and the service providers, as linked to the research objective 3, are equally important for the success of the integration programmes in the classrooms and therefore a common ground must be created to ensure that technology supports teaching and learn and thus lead to the achievement of Grade 12 learners in the Free State Province. Finally, integration can be likened to a web that connects many important elements and for it to be sustained there is a need for constant research, since educational technologies and pedagogies change all the time.

Literature review underscores the critical and foundational role that the selected theoretical framework UTAUT, is playing within literature review whose focus is on making sense of the adoption of technology within the education sphere. The alignment of UTAUT constructs literature reviews to assist in making sense of the research questions and the research objectives that seek to make sense of the impact that the IBP integration has on achievement of Grade 12 learners in the Free State. The nature and function of the IBP, the perceptions that the stakeholders have towards it and the presence of the facilitating conditions impacts the adoption and use of the technology and the UTAUT constructs bring the theoretical part to the study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction and background

This chapter delves into the history and the foundation of research methodology and how different sub-topics assist to answer both the research problem and questions. It also explains the various terms and concepts aligned to the title of this research and thus making sense of the whole research cycle (Tran, 2016:1). Using an 'onion' schema to describe research methodology, social science researchers draw parameters that guide the whole study and thus give the readers convincing evidence for selecting such a methodology (Saunders et al., 2009 and Yimer, 2019:47). Accordingly, this study employed a post-positivist philosophy, combined methods research, quasi-experimental, non-equivalent pre-test and-post-test, as well as survey research designs. The above different components are aligned to make sense of the impact that an Internet Broadcast Project (IBP) has on the achievement by Grade 12 learners in the Free State Province.

In this study, the primary research question was how has the collaboration between the Free State Department of Education (FSDoE) and the University of Free State's (UFS) ideas lab impacted achievement at Grade 12 level of learners?

The secondary research questions were as follows:

1. What legal and legislative frameworks support the creation and integration of IBP at the Grade 12 level?
2. What are the experiences of learners and teachers on the provision of an IBP intervention programme for Grade 12 learners in the Free State?
3. What are the UFS ideas lab-led factors that influence academic achievement by Grade 12 learners in the Free State?

Research on the achievement of learners in public schools, using different methodologies, is a challenge that many specialists continue to address and subsequently find solutions for (Shoots, 2015:98). The achievement gap between schools that are drawn from different socioeconomic backgrounds, including minorities, is still widening and different interventions and relevant methodologies are being sought to level the playing field (Shoots, 2015:98). Hence, the need to answer the research questions and establish the factors that impact the achievement of Grade 12 learners in the Free State Province.

The sub-sections within this chapter are divided as follows: research paradigm, research approach, research design, population of the study, sampling procedure, data collection, data collection instruments and procedures, administration of the research instruments, validity and reliability, data analysis and interpretation, ethical considerations, and summary. The justification of all methodological choices is embedded within appropriate sections. In this research methodology chapter, the research paradigm is the first to be described in terms of choice, suitability and alignment to the whole research cycle.

4.2 Research paradigm

The selection of post-positivist paradigm for this study was premised on prior comparison of different paradigms applied in different research studies, thus leading to the justification of its selection. The positivist paradigm is one such example that the researcher considered and compared with the selected post-positivist paradigm. Unlike the positivists, for example that posit that there is an absolute or single truth of knowledge, the post-positivists disagree and challenge this traditional thinking (Phillips & Burbules, 2000, Burrel & Morgan, 1979 in Cohen et al., 2001 and Maree et al., 2019:37). Post-positivists contend that it would be impossible to assume and apply only a singular approach to knowledge, generated from human behaviour (McMillan & Schumacher, 2014:52014:6). Hence, this study used a multiple realities approach, and based on research question 2, sought to establish the impact that the Internet Broadcasting Project (IBP) has on the achievement of Grade 12 learners in the Free State Province.

Ontologically, positivists hold the view that one reality exists and that it is the researcher's job to discover that reality (Guba & Lincoln, 1994). Post-positivists, on the other hand, challenge such beliefs by stretching them beyond just a mere single reality and add that reality cannot be seen as perfect, due to the researcher's innate limitations (Mertens, 2005:9). Accordingly, this study assumed that the research results cannot be construed as a near-perfect picture of the impact that the integration of IBP has on the achievement of Grade 12 learners in the Free State Province. Since reality is interpreted as a product of various factors, research question (RQ) 3 sought to uncover and align them with the research problem. From an epistemological point of view, positivists argue that a researcher and the phenomenon under study are independent and cannot influence each other (Lincoln & Guba, 2000). In challenging this belief, the post-positivists contend that "theories, hypotheses, and background knowledge held by the

investigator can directly influence what is observed" (Reichardt & Rallis, 1994). Consequently, the selection of the Unified Theory of Acceptance and Use Theory's (UTAUT) theoretical framework, in chapter 2, is aligned with the chosen post-positivist paradigm in that its construct that include Effort Expectancy, Performance Expectancy and Social Influence allow the participants and the researcher to share knowledge about the phenomenon understudy. Paradigms are therefore described as parts of theories and not full theories on their own and are sometimes described by other researchers as an "interpretive framework (Denzin & Lincoln, 2005)." In agreement with the above assertions, Ngulube et al. (2015) state that throughout the research cycle, alignment of different parts is crucial, and this study's selected post-positivism has an influence on the selected quasi-experimental and survey research designs that are an integral part of the study.

The selection of the combined research approach, whose methods are discussed in the next sub-sections, aligns well with the post-positivists paradigm that allows for various interpretations of the different perceptions and experiences that contribute towards making sense of the achievement of Grade 12 learners in the Free State Province. Equally important, is the selection of the research design that, together with the paradigm respond to the stated research problem and questions.

4.3 Research approach

The study adopted a combined method approach that consists quantitative and qualitative research approaches (Oluseyi, 2016:22). Within the combined realm, the researcher sought to ascertain the impact that integration of IBP has on the achievement of Grade 12 learners in the Free State Province. The use of historical secondary Grade 12 data (quantitative) and the interviews (qualitative) informed the selection, in this study, of the combined methods approach. It also offered the researcher an opportunity to validate the results from the quantitative data analysis with those obtained from the results from the qualitative data analysis, thus leading to the triangulation process (Oluseyi, 2016:22). The approach also agrees with studies that involve the collection of both qualitative (interviews) and quantitative (historical data) within one research (Ngulube, 2010). In this case, an assumption was made that it is possible to apply more than one research method to enhance, make sense and produce accurate findings about the phenomenon under study (Ngulube, 2010). However, such an approach has not yet been fully understood, and more studies still need to be conducted (Ngulube, 2010:255

and Romm & Ngulube, 2015:158). Accordingly, this study is cognizant of the extent to which prior studies that adopted this approach, navigated through both datasets to make sense of the phenomenon under study.

According to Olasina (2018:270), studies that involve a combination of quantitative and qualitative approaches are equally important in that they fit in situations where either of the methods can singularly assist in responding to the purpose of the study and the research questions. Furthermore, the combined methods approach gives the researchers an expanded platform to answer the research questions, despite the recent studies that indicate elements of bias towards one method "due to paradigm debates or competing views of what constitutes scientific rigour and validity" (Ferreira, 2012:128-129). Arguments supporting this practice, stem from the belief that since quantitative and qualitative methods have their roots in different epistemological and ontological assumptions, it would therefore be impossible to reach conclusive results, since they are incompatible with each other and thus unable to inform each other very well (2012:129). Some researchers refute such thoughts as coming from the conservatives who do not want to expand their horizons beyond the current way of thinking and thus deny themselves an opportunity to discover new knowledge that would be drawn from such a combination (2012:129). In line with the influence of ICTs in many education institutions, the researcher hoped that using the combined methods would enlarge the knowledge base on how it affects the achievement of Grade 12 learners in the Free State Province. The detailed account and comparison of the two methods is equally important in this study in that, although they are different, in the end, they formed part of the triangulation process that was drawn from all of them. The quantitative part of the study is first to be discussed.

4.3.1. Quantitative research

The quantitative part of the research is aligned to the primary research question, in section 1.5, of chapter 1, which sought to establish how the collaboration between the Free State Department of Education (FSDoE) and the University of Free State's (UFS) ideas lab has impacted the achievement of Grade 12 learners. The selected historical Grade 12 secondary data in three subjects that form part of this study, spans over a five-year period from 2014 to 2018 and represents the quantitative part of this study. Like any quantitative research, numerical data is analysed using mathematical and statistical tools to make sense of the phenomenon under

study (Creswell, 1994, Shuttleworth, 2008 in Eyaufe, 2018:58). The numerical part in this study was represented by examination marks, collectively referred to as the historical secondary data, drawn from three selected Grade 12 subjects from participating IBP and non-IBP schools. This historical Grade 12 secondary data covered learners' performance in the three selected subjects, namely English First Additional Language (EFAL), Maths (MATH) and Physical science (PHYSC) as observed from 2014 to 2018. It is also worth-noting that many quantitative studies are theory-driven in that they are responsible for application, testing or verification of theories without necessarily contributing to their development (Ngulube at al., 2015:57). The above assertion refutes the claims that quantitative studies are a-theoretical in nature and are neither here nor there, since theories are part of almost all phases of the research cycles (2015:57).

The selected quantitative approach that makes use of the historical secondary data is also aligned to the Unified Theory of Acceptance and Use of Technology (UTAUT) theoretical framework that underpinned this study (see chapter 2). To make sense of the impact that IBP has on the achievement of Grade 12 learners in the Free State Province, the quantitative approach and theory complemented each other, thus leading to the answering of the research questions. Relevant elements that distinguish quantitative research from other approaches, include the involvement of a large population, the application of the deductive approach, the test of the hypothesis/theory, the use of standardised data, as well as the ability to provide and predict extensive explanatory and statistical analysis. The above practices are performed in an objective and value-free environment (Johnson & Onwuegbuzie, 2004, Johnson & Christensen, 2004 and Eyaufe, 2018:58). Due to their deductive approach, quantitative studies are also likened to a container from which data is poured (Ngulube et al., 2015:57).

The theory further leads to the acceptance or rejection of the theory with the possibility of revising it for future research (Ngulube at al., 2015:57). The UTAUT theoretical framework in chapter 2, together with literature review in chapter 3, were directly aligned to the selected quantitative approach that involves the historical Grade 12 secondary data from selected IBP and non-IBP schools in the Free State. The selection of the qualitative approach in this study was in line with the adopted combined research approach. The next sub-topic deals with the qualitative approach.

4.3.2 Qualitative research

The qualitative research part of this study focused mainly on Research Questions (RQs) 2 and 3 that sought to explore the various views and the nature of the factors that impact the provision of the IBP intervention programme for Grade 12 learners in the Free State Province. According to Creswell (1994), qualitative research refers to inquiry research, whose methodological traditions focus on the exploration of the social world. Qualitative research differs from quantitative research in that it is a social inquiry that contributes toward a better understanding of people and their immediate surroundings (Myers, 2000). Based on the above, the researchers usually conduct the inquiry, using the participants' natural setting, thus developing a holistic picture that provides a detailed analysis and reporting of text, as drawn from the participants' views (Eyaufe, 2018:58). In this study, the participants that include teachers from both IBP and non-IBP selected schools, FSDoE's FET schools head office and district subject specialists in three selected subjects and UFS ideas lab staff, met the above criteria in that the interviews were mainly in their work environments. Qualitative studies generally use an inductive approach, and theories are part of the results that come out of that process (Ngulube at al., 2015:58). The selected participants contributed to this study by sharing their experiences or lack thereof when it comes to the integration of IBP in teaching and learning. Some studies have revealed that qualitative studies also test theories about a phenomenon under study. The UTAUT theoretical framework that underpinned this study confirmed that all elements within the research cycle, were aligned with each other (Silverman, 2000, and Bryman, 2016). Since the researcher is at the centre of the research process, he cannot be isolated from the context that is being explored to make sense of the phenomenon under study. It is during the research process that the researcher discovers, makes sense, and interprets the multiple realities that are unfolding (Eyaufe, 2018:60). The researcher is the driving force in the whole inquiry, due to the different skills, values, attitude, intellect, discipline and creativity that are brought forth as part of the whole research process (Joubish et al., 2011). The research findings depend on the applied judgment and the discipline drawn from the researcher (Eyaufe, 2018:60). The selection of the research design is an equally important component that assists to answer the research questions and problem.

4.4 Research design

For this study, quasi-experimental and survey designs have been selected to address both the research questions and the research problem. Since a combined methods approach has been adopted, the post-test and convergent designs were aligned to the quantitative part of this study, while semi-structured interviews formed part of the qualitative research method. Cohen et al. (2007: 81) contend that there is no permanent blueprint for research designs and each selection is propelled by the idea of "fit for purpose". This idea or purpose compels researchers to align selected research designs with specific research methodologies and thus respond to the research questions and problem (2007:78). Hence the choice for a quasi-experimental and survey designs to establish the impact that the Internet Broadcasting Project (IBP), has on achievement of Grade 12 learners in the Free State Province. According to Plano Clark and Ivankova (2016), the above steps and procedures provide pointers or relevant models, suitable for combining quantitative and qualitative methods. The choice of the suitable research design depends on many specific design types, for example, the selected convergent combined, offers unique advantages and options that lead to the answering the research questions and problem.

The convergent combined methods design, that formed part of this study, allowed for the researchers to collect and analyse both quantitative and qualitative data concurrently (Creswell & Plano Clark, 2018). It differs from the explanatory sequential design that involves collecting quantitative data first, followed by qualitative data collection thereafter (Plano Clark & Ivankova, 2016, Creswell & Plano Clark, 2018). Unlike in an explanatory sequential design, in a convergent combined design, data analysis from both methods is conducted in parallel or simultaneously (2018). This type of design gained popularity within the combined methods research and works well in situations where researchers are interested in simultaneous analysis of data about a phenomenon under study (Plano Clark & Ivankova, 2016). Due to cost and time constraints, the Grade 12 historical secondary data in three subjects that form part of this study were collected on the day interviews were conducted in both IBP and non-IBP schools and thus following the convergent combined design prescripts. In line with the convergent combined designs' rules, data was later merged to make sense of the research problems under investigation (Plano Clark & Ivankova, 2016).

In combined research studies, for example, on student achievement within traditional or online classrooms, a convergent design may be applied wherein a researcher may conduct a survey and focus group interviews from the two groups and immediately compare each method, leading to a convergence or merging of the two (Maree, 2019:338). The advantage of convergent design is

that it is less-time consuming when compared to sequential designs, and bringing two types of data is usually a seamless exercise (Maree, 2019:338). However, the two challenges associated with this design are that there is a lot of effort needed to collect and analyse two different types of data at the same time and secondly, the researcher must provide a clear plan on how the different sets of data can be seamlessly merged and what options will be used in cases where there are incompatibilities (Ivankova et al., 2019:338). The selected design sought to make sense of the impact that the integration of IBP has on the achievement of Grade 12 learners in the Free State Province. Equally important, within the research design ecosystem, is the understanding of the selected quasi-experimental design that is discussed below.

4.4.1 Quasi-experimental designs

The quasi-experimental designs, sometimes referred to as nonrandomized, pre–intervention study designs, are common in studies that require intervention programmes (Harris et al., 2004:1586). The Internet Broadcasting Project (IBP) was introduced as an intervention initiative to address poor performance of Grade 12 learners in the Free State Province. Although the use of experimental studies, wherein random samples are assigned, is not common in education research, due to ethical reasons, for many years, researchers have been deliberately or inadvertently engaging in some form of experimentation (Shandish et al., 2002:1, Boruch, 2007, Cook, 2003, Sykes et al., 2009:143, White & Sabarwal, 2014:2 and Van Hezewijk, 2015:6). As a critical rationalist, Campbell (1963) suggested that in cases wherein experimental designs do not fit, due to pragmatic, ethical and other reasons, an alternative, quasi-experimental design, was a viable option (Van Hezewijk, 2015:6).

In combined method studies, including this study that made use of numbers and text, researchers may engage participants in interviews to give life to historical secondary data (Leedy & Ormrod, 2014:171). The selection of the 2014-2018 Grade 12 historical secondary data, together with semi-structured interviews of Grade 12 teachers in the selected IBP and non-IBP schools, are informed by the above assertions that promote making sense and bringing life out of the historical data. The use of historical secondary data has also proven to be a viable option when applied, using quasi-experiments in school settings and in cases where there may be concerns about one group being denied access to an intervention or when a school programme is disturbed to accommodate the new changes (Walser, 2014:1). Accordingly, this study did not disrupt or affect current teaching and learning in the selected IBP and non-IBP

schools, since it makes use of the quantitative historical secondary Grade 12 data, whose emphasis is on three Grade 12 subjects, namely, Mathematics (MATH), Physical Science (PHYSC) and English First Additional Language (EFAL). Such historical secondary data assists researchers to draw inferences about certain occurrences during a particular period or may identify frequencies and speculate about possible trends (Leedy & Ormrod, 2014:171). In line with the FSDoE's policies, interviews of teachers were conducted at the times when teachers were not in class and thus did not compromise teaching and learning times. In agreement with McMillan and Schumacher (2014:449), historical past may be as recent as a few years, and it must be stored in reputable archival or data repositories.

In this study, the selection of the 2014-2018 historical secondary data coincided with the researcher's initial registration for the studies in 2018 and can therefore be considered as fulfilling the recent past criterion as indicated above. The selected years were also informed by the changes in the curriculum that were brought about by the Department of Basic Education (DBE) in 2012 (DBE 2012). The National Curriculum Statements (NCS) for Grades R-9 and Grades 10-12 were combined to form one comprehensive National Curriculum Statement Grades R-12 (DBE 2011). The implementation was carried out as follows: Grades -R and 10 in 2012, Grades 4-6 and 11 in 2013 and Grades 7-9 and Grade 12 in 2014 (DBE 2011). Therefore, the researcher considered the selected study period as representative of the time when the National Curriculum and Assessment Policy Statement (CAPS) was implemented. This time was also considered by the researcher as representing five uninterrupted years, wherein there were no, or minimal changes introduced to the curriculum. There are quasi-experimental studies that have been conducted to determine achievement of Grade 12 learners within the education sector but unlike them, this study highlights collaboration and the impact that the Internet Broadcasting Project (IBP) has on achievement of Grade 12 learners across the Free State Province. DeRouen (2018:61), for example, conducted quasi-experimental research based on the post-positivist research assumptions to determine if there was a causal relationship between the instructional method of teaching Calculus I, had the assistance of a computer-assisted technology, MyMathLab (independent variable) and the final test scores (dependent variable). Venables (2008: i) conducted a quasi-experimental study to investigate the effect that Microcomputer-Based Laboratories (MBL) systems have on the achievement of high school Chemistry students. In the same study, Venables (2008: i) was also able to investigate MBL's impact on achievement, due to gender, ethnicity, or socioeconomic background.

Thomas (2020: iv) conducted another study, wherein the State of Texas Assessments of Academic Readiness (STAAR)' scores of 4th and 5th grade learners were examined and compared after the experimental group was exposed to the 21st Century Community Learning Program, an afterschool academic enrichment opportunity offered to schools to narrow the achievement gap. The above studies are aligned to this study's objectives to determine the achievement levels of learners after exposure to various intervention programmes, including the Internet Broadcasting Project (IBP). The above studies further confirm that the introduction of various technologies, within the social studies realm, has made it possible to make use of archival data, for example in the quasi-experimental studies, to determine academic achievement and enhance quality in schools (Shoots 2015:98). One notable and similar study that employed archival data was conducted, using the Alabama Reading and Mathematics Test (ARMT) to determine if there was a difference in achievement between eMINTS (enhancing Missouri's Instructional Networked Teaching Strategies) classrooms and those that taught in traditional classrooms (Shoots, 2015:98). The eMINTS classroom (treatment) was well equipped with more computers and digital devices, while the traditional classroom (control) had limited access to the digital devices (Shoots 2015:104).

The above study compared the scores obtained by students, who were in a classroom exposed to high levels of eMINTS technology with scores of those students who had limited access to digital devices in non-eMINTS classrooms (2015:104). The expectation was that technology-laden classrooms in eMINTS classrooms were likely to outperform the non-eMINTS classrooms and thus the design was considered appropriate (Shoots, 2015:104). According to Gravetter and Forzano (2009), the above quasi-experimental studies assist researchers to get a better understanding of the relationships between two variables (independent and dependent).

The use of the post-test design that falls within the quasi-experimental design that formed part of this study, was also applied by researchers to prove the validity and reliability of this study.

4.4.1.1. Quasi-experimental non-equivalent control group post-test design

For this study, the non-equivalent control group post-test design or comparison group design had been selected as suitable to answer both the research questions and problem (Leedy & Ormrod, 2013:232, McMillan & Schumacher, 2014:298 and Privitera & Ahlgrim-Delzel, 2019:339).

Within the nonrandomised control group post-test design, a dependent variable (for example achievement in this study) was measured after treatment in one group (IBP schools) was administered, while the control group (non-IBP schools) was not exposed to such a treatment (Leedy & Ormrod, 2013:232, McMillan & Schumacher, 2014:298 and Privitera & Ahlgrim-Delzel, 2019:339). In this study, the two groups of selected schools were divided into IBP and non-IBP schools. The post-test was conducted on both groups to prove or refute the claims, associated with administering a treatment in group 1 (Leedy & Ormrod, 2013:232; McMillan & Schumacher, 2014:298). The historical secondary Grade 12 data that was part of the quantitative study, represented examination scores that were obtained, at the same time, by leaners from IBP and non-IBP and whose examinations' processes and administration falls under the National, Provincial, District and school levels. Even though the challenges of validity may still exist within the quasi-experimental design, threats between control and treatment groups are usually mitigated by identifying similar characteristics that may strengthen validity, and the conclusion reached at the end of the study (2014:1). The choice of both the IBP and non-IBP schools was informed by the presence of similar characteristics, for example, all selected schools are from the same quintile categories 1-3 (see chapter 3). Furthermore, to confirm the presence of similar characteristics within the dependent variable and to allay fears, due to the absence of a random selection, initial observations (pre-test) could be adopted (Leedy & Ormrod, 2013:237). If it is established that after an experimental treatment has been administered in one group, there are marked differences thereafter, a conclusion may be reached that the differences at post-treatment are caused by the treatment (Leedy & Ormrod, 2013:237).

The identification of matched pairs in the two groups is one way of strengthening the post-test control group design (2014:237). The marked difference between the IBP and non-IBP schools, is in the provision of an intervention in the former selected schools, while the latter had no access to the broadcast streamed live from the UFS ideas lab studios. Learners who were part of this study, attend school full-time and have direct contact with different teachers, who are specialists in different Grade 12 subjects, and they all follow, and are guided by the same CAPS curriculum prescripts (DBE 2011 and Martin & Collie, 2019:862). Furthermore, teachers were also exposed to the same district and head office FET schools' subject specialists, who exposed them to the same pedagogical principles informed by DBE's CAPS curriculum. Since learners, who formed part of this study, are at Grade 12, the assumption was that they operate and

possess minimum level of intelligence that allows them to participate in activities requiring reasoning, planning, problem-solving, comprehending ideas, communicate clearly, as well as think critically, creatively and abstractly (Makola, 2007:52). Teachers' interaction with learners has a direct influence on learners' academic achievement (Martin & Collie, 2019:863). In this study, the historical Grade 12 secondary data represented learners who are of school going age, mixed gender, with the majority between 18 and 20 years old, an appropriate age for Grade 12 learners. This age group was considered fit-for-purpose, since learner engagement declines as learners exit or are beyond school-going age (Jacobs et al., 2002; Martin, 2009 in Martin & Collie, 2019:863). Learners in this study were also assumed to possess an innate ability to perform different activities, including projects, collaborative activities, individual tasks, tests and examinations.

These activities are drawn from the same CAPS curriculum, and they are all executed to predict their performance levels as measured against set criteria (Isaacson, 1985, Sax, 1989 in Makola, 2007:52).

4.4.2 Survey designs

This research design was mostly applicable to research question number (RQ) 2 that asks: What are the experiences of learners and teachers on the provision of IBP intervention programme for Grade 12 learners in the Free State? The researcher sought permission to interview Grade 12 teachers from IBP and non-IBP, who teach the selected three subjects in this study. The adopted quasi-experimental and survey research designs follow the post-positivist philosophical assumptions and the deterministic approach that purports those examining relationships amongst variables, is central to answering the research problems and addressing the stated problems (Creswell & Creswell, 2018:147). Since this is combined methods research, the selected participants shared their experiences in relation to the integration of the IBP or the lack thereof (non-IBP) and the impact that has on the achievement of Grade 12 learners in the Free State Province. Unlike the traditional experimental studies, where there is manipulation of variables, in survey research, and specifically a sample, a record of selected people who are being interviewed is kept and the results are used to generalize or make inferences about the population (Creswell, 2014:173, Creswell & Creswell, 2018:12, Neuman, 2011:49 and Leedy & Ormrod, 2013:189). MacMillan and Schumacher (2014:381) argue that within the combined or

mixed methods design, the survey design, in the form of qualitative interviews, may be conducted following an informal conversation, the interview guide or open-ended approaches.

The simple descriptive survey design approach that forms part of this study allowed for the researcher to conduct a short survey within a single location, whose aims were to describe specific characteristics within the selected sample (Mertens, 1998:108). For example, in a standardised open-ended interview, similar questions are asked in the same order to different participants, with little or no form of flexibility being exercised (2014:381). In an interview guide approach, the interviewer has the luxury to choose, in advance, the topics, sequence and wording of areas of concern that need to be addressed with the participants. Just like the informal conversation and interview guide, approaches are conversational and situational (MacMillan and Schumacher, 2014:381). What makes the selected design suitable depends on the questions that form part of the survey instrument, for example, it becomes a challenge to interpret responses drawn from open-ended results, since they are open to many interpretations in some cases, may be viewed as too restrictive and making it difficult to reach conclusive decisions (Wilde, 2004:14). The conversation centred on the Research Question (RQ) 2 and made use of the constructs within the UTAUT theoretical framework, in chapter 2 that include PE, EE, SI and FC respectively. The presence of different literature studies that cut across and made use of either or both quasi-experimental and survey designs, assisted in making sense of this study's adopted research approach. The sub-section that follows deals with the selected population for this study.

4.5 Population of study

In this combined research study, the population was drawn from and reflected perspectives from both the quantitative and qualitative approaches. From the quantitative part, the population was represented by the Grade 12 historical secondary data on learner achievement in three subjects (EFAL, MATH and PHYSC) from 12 selected public high schools in the Motheo District, and it spans over a five-year period from 2014 to 2018.

The term "population" refers to an "abstract idea of a large group of many cases from which a researcher draws a sample, from results that can be generalized (Neuman, 2011:241)." Some strands of data, all in the same format, were drawn from Free State Department of Education (FSDoE)'s Education Management Information System (EMIS) public access portal, schools'

and FSDoE EMIS head office's access points. The EMIS public, schools and departmental access portals can be accessed through the following links: EMIS School Portal (fs.gov.za) and Log In (fs.gov.za) with the latter link accessible through the provided login details. Data was drawn from the 12 selected Further Education and Training (FET) Motheo District schools that are divided into six IBP and six non-IBP schools. The three selected subjects were English First Additional Language (EFAL), Mathematics (MATHS) and Physical Sciences (PHYSC) and they are offered in the 12 selected IBP and non-IBP schools. For the qualitative part, the population was drawn from Grade 12 FET schools' teachers from the selected six IBP and six non-IBP public schools in the Motheo District (see section 1.3), Motheo FET schools' district, and head office (FET schools) subject advisers from the Free State Department of Education. Another part of the population was represented by two University of the Free State (UFS) ideas lab staff. The above confirms that a population reflects a group or individuals within a specific location, who are of interest to the researcher (Fraenkel & Wallen, 2009).

Tables 7 and 8 also indicate the categorisation of the selected schools into IBP and non-IBP, the three selected subjects under study and the years to be covered. From the total of 12 (six each) selected, IBP and non-IBP schools, the Grade 12 subjects that form part of the historical secondary data are English First Additional Language (EFAL), Physical Science (PHYSC) and Mathematics (MATH) and the data span over a five-year period (2014-2018). The district, and head office FSDoE officials and UFS ideas lab staff members are indicated in Table 9.

Table 7
units of research in IBP schools

Name of IBP school	**Number of teachers per selected subject**		
	English First Additional	Mathematics	Physical Science
Albert Moroka	1	1	1
Kgauho	1	1	1
Kgorathuto	1	1	1
Moroka	1	1	1
Sethjaba-se-maketse	1	1	1
Strydom	1	1	1

Source: IBP schools administration staff 2021

Table 8
units of research in IBP schools

Name of IBP school	**Number of teachers per selected subject**		
	English First Additional	Mathematics	Physical Science
Christiaan Liphoko	1	1	1
Kopanong	1	1	1

Lefikeng	1	1	1
Leratong	1	1	1
Popano	1	1	1
Vulamasango	1	1	1

Source: IBP schools administration staff 2021

Table 9
units of research in FSDoE officials and UFS ideas lab staff

Targeted officials	**Total number**
EFAL	
Mathematics: district	1
Mathematics: head office	1
Mathematics: district	1
Physical Science: head office	1
Physical Science: district	1
UFS ideas lab: manager	1
UFS ideas lab: coordinator	1

Source: IBP schools administration staff 2021

As indicated in Table 10 below, the qualitative part of the study that involves interview sessions with selected participants on a voluntary basis, was composed of the following categories of participants:

- Grade 12 FET schools' teachers from both IBP and non-IBP schools who are subject specialists in the three selected subjects (English First Additional Language (EFAL), Mathematics (MATHS) and Physical Science (PHYSC).
- District (FET schools) and head office (FET schools) officials who are subject specialists in three subjects at Grade 12 level.
- UFS ideas lab staff members.

Table 10
units of research: historical secondary data and participants where the population of teachers for the 3 selected subjects come from

Units of research	Targeted subjects	Criteria for selection	Additional scope covered
Grade 12 teachers	English First Additional Language: IBP and non-IBP	Currently teaching subjects	Specialist in the subjects
Grade 12 teachers	Mathematics: IBP and non-IBP	Currently teaching subjects	Specialist in the subjects
Grade 12 teachers	Physical Science: IBP and non-IBP	Currently teaching subjects	Specialist in the subjects

District and head office specialists	English First Additional Language	Specialist in the subject	Advising the subject at Grade 12 level
District and head office specialists	Mathematics	Specialist in the subject	Advising the subject at Grade 12 level
District and head office specialists	Physical Science	Specialist in the subject	Advising the subject at Grade 12 level
UFS ideas lab	IBP Head, Coordinators, and technical services	Active participants in the IBP implementation process	Know policy and daily IBP operations

Source: researcher 2021

To prove the importance of making sound decisions when selecting participants, Arowolo (2009:33) conducted a study in a well-resourced, single-sex school in Gauteng Province of South Africa. Participants were drawn from two classes (30 learners in the experimental class and 26 learners in the control class) of Grade 11 Physical Science learners, aged between 15-17 years (2009:33). There were 110 learners in Grade 11 and the two groups were selected, based on their abilities and previous performance in different tests and examinations (Arowolo, 2009:33). In another study by Kimble (2020:22) that followed the quasi-experimental design prescripts, the selected participants consisted of two groups: the experimental group made up of 20 or more fourth-grade math students and the control group that consisted of 20 or more students that received the same classroom instructions as the experimental group (2020:22). The two groups were taught by the same experienced curriculum specialist teacher, with the former group receiving gamification as part of their math instruction, while the latter did not (2020:22). In this quasi-experimental study, it is also important to apply sound sampling procedures that contributes towards answering both research questions and problem. In line with the above assertions, this study targeted the Grade 12 teachers from IBP and non-IBP schools, who teach three selected subjects (EFAL, MATH and PHYSC), district and head office FSDoE subject specialists in the three selected subjects and UFS ideas lab staff members. The sampling technique for this study is discussed in the next sub-section. Since the study made use of historical secondary data drawn over a five-year period, all learners in the three selected subjects, as provided by EMIS section of FSDoE, were selected (see tables 4.5.4 and 4.5.5 above). Below is the section sharing the applied sampling procedures in this study.

4.6 Sampling procedures

After the site and participants have been identified and confirmed, it is incumbent on the researcher to give a detailed account of the type of sample targeted, as well as when, how and where data will be collected (Merriam 1998). The sampling procedure to be discussed below is aligned to the adopted combined research with the quantitative part of the procedure discussed first, followed by the sampling procedure for the qualitative part of the study. Approved ethical clearances from the Free State Department of Education, University of the Free State and the University of KwaZulu-Natal were used by the researcher to gain access to the targeted population (see appendices 1-3 in sections 9).

From the qualitative part, the non-probability purposive and convenience sampling techniques were adopted as approved by Creswell (2003, 20014 & 2018). Within the quantitative approach, the census has also been selected, and its selection was informed by the chosen Grade 12 historical secondary data that spans over a five-year period (2014-2018) and covers the following subjects: English First Additional Language (EFAL), Mathematics (MATH), and Physical science (PHYSC). The choice of the census option means that all the historical secondary data representing the selected subjects in all selected schools that form part of this study, were sampled. Depending on the nature of the targeted population in terms of accessibility and intention to get richer data, it is sometimes possible to reach out to the entire population. Within the combined methods approach, the sizes of both sets usually differ, with the qualitative data smaller than the quantitative (MacMillan & Schumacher, 2014:239). The differences are caused by the fact that a small sample for the qualitative data can provide rich and credible data, whereas the quantitative data is able to provide meaningful statistics when large sets of data are involved (2014:239). In a study by Olasina (2014:99), to determine the predictors of legislators' ICT acceptance and use in the performance of legislative functions, a census was chosen, since it was suitable for the quantitative part. Another important area to consider is the size and nature of such samples when approached from the adopted combined research perspective.

There are researchers (Curry in Yount, 2006, Israel, 2013), that believe in the adoption of a strategy wherein the entire population, usually small, is selected, provided the desired outcomes will be proven to be valid and credible. Although a sample is selected from the entire population, census occurs when all adopted variables for the study are applied within the population (Babbie, 2007 and Brady, 2008 in Olasina, 2014:99). In this combined methods research, census played a crucial role in quantitative and qualitative sampling procedures that

sought to ascertain how IBP integration impacts the achievement of Grade 12 learners in the Free State Province. The researcher has also noted that the number of learners who sat for exams in the three selected Grade 12 subjects over the five-year period, was so minimal that they all formed part of the study. Similar approaches have been adopted in other studies where census seemed to be the only viable option with supporting statements to confirm the decision.

In a study by Olasina (2018:271), to characterise e-learning practices and improve the understanding of the students' e-learning experiences, the entire 5000 UKZN student population registered in the Social Sciences school across two campuses was targeted. In this study, for the quantitative part, the historical secondary data is bigger and covers final marks of Grade 12 learners in 12 schools, six of which were categorised as IBP, while the other six fell under the non-IBP schools. The qualitative part targeted Grade 12 teachers in the three selected subjects, the three head office FET schools' subject specialists, three district office FET schools subjects' specialists and two UFS ideas lab staff. Typical of quantitative studies, an increase in sample size leads to an increase in the statistical power of the convenience sample (Suen et al., 2014:105). Similarly, the targeted participants in this study have been selected due to the relevant and rich information they possess in relation to the research problems and questions.

The Free state Department of Education' (FSDoE) Education Management Information Systems (EMIS) portal served as the source of the historical Grade 12 secondary data and the portal is obtainable from the following link: http://www.fsdoe.fs.gov.za/EMISPortal/Default.aspx. The list of public high schools that form part of the Internet Broadcasting Project (IBP) were obtained from the UFS ideas lab coordinator. Upon receiving access to EMIS portal, the researcher approached the search by following the set criteria: selected schools were from Motheo District (within the Bloemfontein, Botshabelo and Thaba Nchu precinct), they were public high schools or combined schools, and they fell between quintile levels 1-3. The proximity to the three selected towns and the limited costs served as a criterion for not including other towns within the Motheo District. The choice of quintile 1-3 schools was intentional and formed part of the research problem. The school finder link allows for the search to be customised to suit the needs: http://www.fsdoe.fs.gov.za//SchoolFinder/Schoolfinder.aspx

The initial search resulted in 38 schools that matched the criteria: 17 IBP (six were located outside of the study's focus) and 15 non-IBP schools (FSDoE 2021). The prevailing COVID-19 conditions also informed the final 12 at the time that made it impossible for physical visitations

to targeted schools to take place. After several reminders were sent to schools seeking permission to conduct the study, and with time not on the researcher's side, the final 12 that responded positively was selected as the final number. Since the search was done during COVID-19, between 2020 and 2021, where physical visitation to schools was prohibited, the researcher relied on the EMIS portal for the schools' contact details (telephone, cell phone and/or email address) that matched the criteria. Most schools had a landline, and few had mobile contact details in the portal. There were instances where the contact details were either not provided and if present, they were not functional, and schools could not be reached. It was only those schools that responded (and matched the set criteria) that the researcher sent formal email requests to their school managers to collect historical secondary data and conduct interviews with selected Grade 12 teachers. Furthermore, there were instances, after responses were received, where the administrators were reluctant to participate, citing COVID-19 and never responded thereafter, while in other cases the emails were never responded to after formal requests were sent. The choice of the three Grade 12 subjects was based on the following: English First Additional Language (EFAL) is a common subject that is not only taught across all quintiles 1-3 schools but is considered as the Language of Learning and Teaching (LoLT) in all selected schools. Mathematics (MATH) and Physical science (PHYSC) are also Grade 12 subjects that are offered in all selected quintile 1-3 schools that formed part of the study and are directly linked to the language of instruction (EFAL). In addition, the researcher chose from the STEM (Science, Technology, Engineering and Maths) subjects, while engaging with preliminary literature research for this study. In addition, the exclusion of other subjects for example, the commercial subjects were informed by their unavailability in all schools and that was the case during the researcher's high school days. The same could be said of the other subjects, including Tourism, Agricultural Sciences or Geography, that are not always in all schools.

The qualitative part adopted a convenient sampling wherein semi-structured interviews were conducted with Grade 12 FET schools' teachers, FET schools' district, and FET schools' head office subject specialists and UFS ideas lab staff. In line with the traditions, qualitative researchers' approach to sampling is often intentionally, non-random, and purposeful (Leedy & Ormrod, 2013:152 and Plowright, 2012:42). If they fit the listed needs or aims of the research, such individuals are brought together to be part of the research sample (2012:42). The selected Grade 12 teachers from both IBP (six schools) and non-IBP (six schools) fitted the criteria, because they are subject specialists who are teaching the three subjects' understudy: English First Additional Language (EFAL), Mathematics (MATH) and Physical Science (PHYSC).

This also meant that the participants' selected characteristics assisted the study in answering the research questions and provided maximum responses concerning the phenomenon under study (2013:152). Tables 11-12 represent the targeted population from FSDoE district and head office, who are subject specialists in three selected (EFAL, MATH and PHYSC) subjects at Grade 12 (FET schools' band).

Table 11
targeted FET schools district officials

Population	**Target**	**Number of teachers**
Motheo District	EFAL	1
	MATH	1
	PHYSC	1

Table 12
targeted FET schools Head office FET schools officials

Population	**Target**	**Number of teachers**
Head office	EFAL	1
	MATH	1
	PHYSC	1

The above criterion also fitted both FSDoE FET schools' district office and head office officials who are not only subject specialists at FET schools in the Mangaung District but also serve the same schools that were part of this study. The same can be said about the UFS ideas lab staff who also serve all the participating schools by providing live broadcasts or recorded videos. The choice of convenience sampling is a commonly used sampling technique that is also the sub-set of the non-probability category (Castillo, 2009 in Markette, 2012:72). It is a mostly preferred research type, because it is easily accessible and available at a cost-effective rate and can be applied within a specified period (Castillo, 2009 in Markette, 2012:72). The choice of convenience sampling in this study was based on the location of both IBP and non-IBP schools, similar socioeconomic status, quintile level and the participants being available in one setting all the time and easier for the researcher to always interact with them (Markette, 2012:72). However, the challenges with convenience sampling, as seen by other researchers (Kerlinger & Lee, 2000 and Castillo, 2008) are that although popular and frequently used, it is difficult to generalise to different populations. Shadish et al. (2002:9) argue that "limited generalization may be just as valuable as those that demonstrate broad generalization." This is applicable to research studies with limited generalizability, for example, a study on an online Christian worldview course may be appealing to a few and not be of general interest (Markette, 2012:72).

This means that there are studies whose value and credibility do not depend on generalizability, making convenience sampling appropriate (Markette, 2012:72). In short, the quintile 1-3 schools, Grade 12 teachers in three selected subjects, subject specialists and UFS ideas lab staff were drawn based on purposive sampling.

Tables 13 and 14 respectively represent the targeted population from both IBP and non-IBP schools that offer the three selected subjects at Grade 12.

Table12 13
targeted IBP schools' population

Population	**Number of schools**	**Target**	**Number of teachers**
IBP school	6	EFAL teachers	6
	6	MATH teachers	6
	6	PHYSC teachers	6

Table 14
targeted non-IBP schools' population

Population	**Number of schools**	**Target**	**number**
Non-IBP	6	EFAL teachers	6
	6	MATH teachers	6
	6	PHYSC	6

The researcher individually contacted them (email and mobile phones), making an appointment to conduct interviews (see section 9). Since the district officials were not yet allowed to enter their district offices, the interviews were mostly conducted at a local restaurant after seeking permission from the owners. One head office official was interviewed in his office while the other two at the restaurant and hotel, respectively. The COVID-19 protocols were still in place and had to be always adhered to (mask, social distance and use of sanitiser). The names of the UFS ideas lab officials were identified through the UFS webpage that has the list that included the head of the unit and the coordinator. Table 15 represents the targeted population from UFS ideas lab who were responsible for the transmission of live broadcast, recording and distribution of the recorded videos that included the three selected subjects.

Table 15
targeted UFS ideas lab officials

Population	**Target**	**Number of teachers**
UFS ideas lab	head	1
	coordinator	1

The researcher sent email requests to both the schools' managers' and the selected coordinators, seeking permission to interview the selected participants on the dates that would suit them. Constant communication with all participants assisted, even though dates had to be changed several times due to COVID-19 related incidents (levels changing from relaxed to strict) and in some cases, with participants schedules changing, due to unforeseen circumstances, leading to alternative dates being suggested. There were schools wherein permission was granted by the school managers, but teachers did not honour the invitation, citing different reasons, many of whom acted in a way that made the researcher to conclude that they were not willing to partake in the study (dates and times and times would be confirmed, but teachers would not avail themselves). There were also instances wherein COVID-19 cases were confirmed on the day of the interviews and the researcher would, on the way to the interviews, meet teachers and learners on their way out of the schools, because protocols dictated that everyone had to evacuate the premises if there were officially confirmed COVID-19 cases. MacMillan and Schumacher (2014:429) share an action research study that adopted a quasi-experimental design and a non-probability sampling, using concurrent triangulation, with focus on specific characteristics possessed by participating teachers and schools. Such features were compared to specific control schools to ascertain the impact that the prevailing conditions within schools have in teacher effectiveness. In this same study, the researchers simultaneously adopted two sampling procedures (2014:430). Like the above study, the Grade 12 teachers, who formed part of the interviews are specialists in the three selected Grade 12 subjects. The fact that they are currently subject specialists in the selected subjects, meant that their experience mattered in this study that sought to understand the impact of the integration or non-integration of IBP on achievement learners across the Free State Province. The teachers who were aligned to either IBP (treatment) or non-IBP (control) schools, assisted in making sense of the impact that IBP integration has on the achievement of Grade 12 learners in the Free State Province.

Data collection needs to be explained in detail once the sampling procedures in a quasi-experimental MMR have been confirmed. When reporting and validating research data, the only options available to researchers are during the data collection, analysis, and interpretation stages (Creswell & Plano Clark, 2011).

4.7 Data collection

For the quantitative part of this study, Grade 12 historical secondary data in three subjects and spans from 2014 to 2018, were drawn from FSDoE' EMIS, EMIS schools and FSDoE departmental officials' portal: http://www.fsdoe.fs.gov.za/emisportal/ and Log In (fs.gov.za). EMIS (Education Management Information System) forms part of the Department of Basic Education's (DBE) sub-directorates and has been allocated the responsibility of creating, maintaining, and sustaining an integrated education information system that assists in the management of the entire education (EMIS 2018).

EMIS has national and provincial footprints with representatives' contact details listed at both National and Provincial EMIS webpages (EMIS 2018). The selection of the schools was based on the criteria that it must be a school offering Grade 12 tuition and the period must include 2014 to 2018, which formed part of this study. The selected schools have also been categorised as IBP or non-IBP, depending on whether they receive live broadcast from the UFS ideas lab or not. The schools from both categories fell under quintile levels 1-3, commonly referred to as the non-fee-paying schools. The selection was based on the two lists that were obtained from FSDoE' EMIS schools' list and the list of all IBP schools in the Motheo District, that fell under the Mangaung Municipality. The school finder webpage is downloadable and contains detailed information that can be customised according to the users' needs: FSDoE School Finder. Since the identification of the schools happened during the COVID-19 where physical visitation was impossible, the researcher used the telephonic contact details to seek the relevant contact details from each targeted school that met initial criteria. The final number of schools participating in this study depended on the responses from targeted schools listed in the database. Data was collected during this period**.** Amongst the challenges encountered by the research at this stage, included a lack of commitment to assist or provide the names of the relevant contact persons. In some cases, the contact persons had personal health issues, most of which were COVID-19 related. The choice of the number could not be left open, especially in cases where there were promises to assist, but it took longer to respond, despite several follow-ups made. The unpredictability of the pandemic forced the researcher to work with the 12 schools that finally formed part of the study. Ideally, and under non-COVID-19 conditions, more schools within the Mangaung Municipality (Motheo district) would have been included. Both lists are included in the appendices that form part of this study.

For the qualitative part of this study, a semi-structured interview approach was selected. They included Grade 12 teachers from selected IBP (six schools) and non-IBP (six schools) who

teach English First Additional Language (EFAL), Mathematics (MATH) and Physical Sciences (PHYSC). Upon agreeing to participate in the interview sessions, an interview guide and a tape recorder were used to guide the conversation that was aimed at making sense of the impact that the IBP has on the achievement of Grade 12 learners in the Free State Province. The interview guide was centred on the main constructs that form the UTAUT theoretical framework that formed part of this study. The constructs were PE, EE, SI and FC and were determining factors for the impact that IBP integration had on achievement of the Grade 12 learners in the Free State Province. Tied to the above theoretical framework, were Research Questions (RQs) 1,2 and 3 respectively that specifically sought to ascertain how integrating IBP, as seen by the relevant stakeholders, leads to the achievement of Grade 12 learners in the Free State Province. Appendix I that has been prepared and included in this study, confirmed the above adopted approach. There are quasi-experimental studies that researchers with interest in learner achievement, have conducted. The successfully conducted data collection exercises are shared below and have been drawn from different studies, whose focus were on achievement of learners in different subject areas. In a study by Ogbonnaya and Awuah (2019:110), a paper and pen achievement test tool was developed to collect data, whose focus was on concepts of probability in the Mathematics curriculum. Ogbonnaya, Mji and Mohapi (2016:707) also conducted a data collection study that explored the factors that hinder students' Mathematics achievement in South Africa. In this case, data was collected from Mathematics teachers, due to the anticipated rich data that they possess, regarding teaching, learning and achievement thereafter. The above two studies fulfilled the quantitative and qualitative approaches, respectively. In a study by Olasina (2018:271), on the e-learning experiences amongst the University of KwaZulu Natal (UKZN) students, a high response rate of 2,718 from UKZN students was received (Olasina, 2018:271). This response is attributed to a recruitment procedure that was initiated through the faculty and the response rate maximisation methods that were employed to eliminate the potential for nonresponse error (2018:271).

Another useful strategy during data collection that Olasina (2018:271) shared, was using appropriate schedules for the learners, motivating them, and ensuring that many students buy-in into the project. Furthermore, the study focussed on how to characterise e-learning practices and improve the understanding of the e-learning experiences amongst UKZN students, which made it appealing to the targeted students (Olasina, 2018: 271). In another study by Kimble (2020:22) on the impact of gamification on teaching and learning, data collection procedures consisted of learners' pre-test and post-test scores from the IOWA assessment database and Prodigy gaming

program. The collected data drawn from the gamification application Prodigy, included skills and learners' achievement in both pre-test and post-test (2020:22). Other data on learners' achievement was also collected from within grade-level content (2020:22). The content of the collected data included the learners' national rankings from pre and post-test in areas that include Computation and Mathematics (2020:22). Accordingly, this study made use of secondary achievement data that were drawn from different cohorts of Grade 12 learners who sat for Free State Matric examinations between 2014 and 2018. The next sub-topic focuses on the data collection instruments and procedures.

4.8 Data collection instruments and procedures

For the quantitative part of this study and following a quasi-experimental approach, the Grade 12 historical secondary Grade 12 data were drawn from databases provided by the Education Management Information System in the Free State (EMIS FSDoE) and the UFS ideas lab. The three selected subjects (EFAL, MATH and PHYSC) were selected, because they are common in all schools that offer Grade 12 tuition. The ethical approved clearances have a detailed list of the schools and the selected subjects (see section 9).

Access to the Grade 12 secondary data was sought through EMIS officials, who were provided with approved ethical clearances from FSDoE, UKZN and UFS. To obtain an ethical clearance from FSDoE, an application was filled in and submitted to the sub-directorate dealing with such approvals (see section 9). During an application process, the information sought, included amongst the others, the title of the research, population, names of schools, participants, duration, and period that the study will be undertaken, research methods, data collection procedures, adherence to sound ethical considerations and a promise to share the findings, once the study was completed. The researcher emailed letters of correspondence, a sample of the application form and the approved letter forms part of the Appendices (see section 9). There are two ethical clearance letters that are addressed to the researcher and the Motheo District office where the schools under study are located (see also section 9). The letters were presented to the FSDoE EMIS, FSDoE head of FET school's curriculum, Motheo District's head of curriculum, three head office FET schools' subject specialists in the three Grade 12 subjects under study, three district office FET schools subject specialists in Grade 12, three selected subjects and the UFS ideas lab staff, responsible for the implementation and operations of the IBP throughout the Free State Province. The whole application process happened prior COVID-19 processes at the end of 2019 and early 2020 and the impact of the pandemic when the country went into the

hard lockdowns, meant there was a complete halt in the whole data collection process. Ethical clearance renewals were sought from UKZN, UFS and FSDoE since the original approvals elapsed. Renewal processes were happening during the COVID-19 pandemic, wherein many protocols had to be observed. The renewals were sought twice since the approvals last for a 12-month period. For FSDoE, research cannot be conducted during the fourth quarter, and that made it difficult for data collection to take place seamlessly.

The strict COVID-19 protocols that affected the targeted sites and participants and the general psychological impact, associated with the pandemic, contributed to the delays. The effects of the new normal meant all the processes had to be adjusted to fit the strict COVID-19 varying lockdown protocols that depended on the country's level, regarding the rate of infection and the associated risks thereafter. Planned visitations to EMIS FSDoE offices, head office FET schools offices, district FET schools offices, IBP, non-IBP schools, and UFS ideas lab offices were challenging and unpredictable, due to visitations aligned to COVID-19 protocols. Email correspondence, calls, cell phone messages were also not as quick as one would expect in the old normal, due to the real impact that the pandemic was having on general human-to-human interaction, irrespective of the mode of communication. All the correspondence are part of the Appendices. For the quantitative data, EMIS and schools were targeted as sources of the historical Grade 12 secondary data. Although an FSDoE EMIS staff shared, through an email correspondence, a link to the public access webpage to the database, schools' data had to be physically collected. The EMIS, public access portal, allowed the researcher to download the lists of all schools in the Motheo District that forms part of the Mangaung Metropolitan Municipality. An UFS ideas lab official shared a list of IBP schools in the Motheo/Mangaung District.

For the qualitative data, Adler and Adler (1994) describe unstructured interviews as those that allow the interviewer and the interviewee a platform to freely engage in the question-and-answer session with free expression of feelings from both sides (Mertens, 1998:323). The aim of this type of interview is to establish a human-to-human interaction relationship and a rapport between the interviewer and the participants (1998:321). A qualitative approach allows both structured and unstructured interviews to be conducted as part of engaging with participants (Mertens, 1998:321). Since the qualitative aspect of this study involved a small number of respondents, it was considered best to use semi-structured interviews. This study employed the semi-structured interview, because it provides a very flexible technique for small-scale research and helps to discover perspectives missing from questionnaires (Gorsuch, 2002). The semi-

structured interviews adopted for this study, involved teachers, the UFS ideas lab staff and FSDoE district and head office officials, whose contributions sought to provide answers to both research question and research problem. In a study by Ogbonnaya et al. (2016:707), they confirm that the design of the interviews, together with the relevant accompanying constructs, are informed by the research's stated objectives, literature review (Gedik et al., 2012, Chen et al., 2012), and the theoretical framework underpinning the study. For the data collection instrument, they developed a self-report questionnaire that was divided into two parts: the demographic information and the open-ended questions, relating to the factors contributing to students' poor achievement in Mathematics (2016:707). By choosing open-ended questions, the researchers wanted to allow individual teachers to provide their subjective and unencumbered opinions about the phenomenon under study (Creswell, 2008). In a study by Olasina (2018:271), and to justify the nature of the adopted semi-structured template, data collection instruments included four constructs from the UTAUT model that were intentionally selected to frame the survey instrument. Like this study, when it comes to creating categories, they were formed to capture the identified factors and understand the best practice of e-learning (2018:271). Cohen et al. (2007: 96) suggested using semi-structured interviews to gather employees' views on the impact that the school's culture and sub-cultures affect the school's daily operations. Semi-structured qualitative interviews, in this case, may be conducted with employees individually or as a group, to eliminate the fear of intimidation, and opt for group interviews (2007: 96). Equally important is the administration of all the research instruments that are part of the research.

4.9 Administration of research instruments

Based on the combined methods approach, this section is on the administration of the selected research instruments and makes sense of how the data collection processes were navigated in response to the research questions and problem. Although the applications for ethical clearance were initially approved late 2019 and early 2020 (see section 9), the COVID-19 pandemic made it impossible to conduct data collection within the specified period, due to forced lockdowns that prevented the researcher from visiting the identified sites and participants. It was only in September 2021 that the collection of most of the quantitative and qualitative data was initiated at the selected sites.

South Africa was operating between COVID 19 adjusted levels 2 and 3 within some relaxed protocols still to be observed (South Africa 2011). The adjusted level 3 operated between 26 July 2021 and 12 September 2021, while the adjusted level 2 was in effect between 13th of September and 30th of September 2021. The rest was collected at the time when the country was operating between adjusted level 1 and the actual lifting of the National State of Disaster (South Africa 2022). The adjusted level 1 operated between 01 October 2021 and 04 April 2022. The National State of Disaster was lifted on 05 April 2022 (South Africa 20220). Most schools have assigned the task of handling researchers to specific teachers, who served as a middleman and contact persons. For the qualitative part, the researcher developed an interview guide linked to the research questions and problem before conducting interviews with different targeted participants (see Appendix). The guide was also developed and centred around the selected UTAUT model whose aim was to ascertain the impact that the IBP has on the achievement by Grade 12 learners in the Free State Province.

As indicated in Table 16 below, the quantitative part involved requesting the Grade 12 historical secondary data in three subjects over a five-year period.

Table 16
Timeline for the request of EMIS Grade 12 historical data in participating schools

Date	**Location**		**Subject**
07 September 2021	School 1	Non-IBP	Physical Sciences
13 September 2021	School 2	Non-IBP	EFAL
13 September 2021	School 2	Non-IBP	Physical Sciences
16 September 2021	School 3	IBP	English
16 September 2021	School 3	IBP	Mathematics
16 September 2021	School 3	IBP	Physical Science
17 September 2021	School 4	Non-IBP	EFAL
17 September 2021	School 4	Non-IBP	Mathematics
17 September 2021	School 4	Non-IBP	Physical Science
20 September 2021	School 5	Non-IBP	EFAL
20 September 2021	School 5	Non-IBP	Mathematics
20 September 2021	School 5	Non-IBP	Physical Science
21 September 2021	School 6	Non-IBP	EFAL
21 September 2021	School 6	Non-IBP	Mathematics
21 September 2021	School 6	Non-IBP	Physical Science
25 September 2021	School 7	Non-IBP	EFAL
25 September 2021	School 7	Non-IBP	Mathematics
27 September 2021	School 8	IBP	EFAL
27 September 2021	School 8	IBP	Physical Sciences

28 September 2021	School 9	IBP	EFAL
28 September 2021	School 9	IBP	Mathematics

As indicated in Table 17 below, a total of nine schools that participated at different levels, were guided by principles of voluntariness. Most interviews were held mid-September 2021 after endless emails and physical visitations were carried over. The number of participants was dependent on the teachers' willingness and availability.

Table 17
Timeline showing dates when interviews and collection of Grade 12 historical secondary data were conducted in both IBP and non-IBP schools in the Motheo District of the Mangaung Metropolitan Municipality

Date	Location		Subject
07 September 2021	School 1	Non-IBP	Physical Sciences
13 September 2021	School 2	Non-IBP	EFAL
13 September 2021	School 2	Non-IBP	Physical Sciences
16 September 2021	School 3	IBP	English
16 September 2021	School 3	IBP	Mathematics
16 September 2021	School 3	IBP	Physical Science
17 September 2021	School 4	Non-IBP	EFAL
17 September 2021	School 4	Non-IBP	Mathematics
17 September 2021	School 4	Non-IBP	Physical Science
20 September 2021	School 5	Non-IBP	EFAL
20 September 2021	School 5	Non-IBP	Mathematics
20 September 2021	School 5	Non-IBP	Physical Science
21 September 2021	School 6	Non-IBP	EFAL
21 September 2021	School 6	Non-IBP	Mathematics
21 September 2021	School 6	Non-IBP	Physical Science
25 September 2021	School 7	Non-IBP	EFAL
25 September 2021	School 7	Non-IBP	Mathematics
27 September 2021	School 8	IBP	EFAL
27 September 2021	School 8	IBP	Physical Sciences
28 September 2021	School 9	IBP	EFAL
28 September 2021	School 9	IBP	Mathematics
29 September 2021	School 10	IBP	EFAL, MATH, PHYSC
29 September 2021	School 11	IBP	EFAL, MATH, PHYSC
29 September 2021	School 12	IBP	EFAL, MATH, PHYSC

The Head office and district officials' interviews, as indicated in Table 18 below, were conducted parallel to the ones conducted in different selected IBP and non-IBP. Since this is a

voluntary exercise that depends on their availability, different venues were chosen with the COVID-19 pandemic still a dominant factor. One was conducted at the local hotel in the evening, where a workshop was held with another subject specialist from the Free State Province. Out of four, three were held in a nearby local restaurant, due to inaccessibility to the district office and the fourth was to accommodate the official, who was on the way to a workshop that morning. One was held at the head office during the 2021 Grade 12 examinations.

Table 18

Timeline showing dates when interviews for both FET schools head office and FET schools district office were conducted

District and head office interviews			
	Date	Location	Subject
1	16 September 2021	Head office	Physical Sciences
2	27 September 2021	District	Physical Sciences
3	30 September 2021	District	EFAL
4	19 October 2021	District	Mathematics
5	17 November 2021	Head office	EFAL
6	19 November 2021	Head office	EFAL

Since most of the UFS staff members were operating from home, the only time that interviews were conducted was in November when the university was about to close in December. Because of COVID-19, it became impossible to get an opportunity to interview another official after several email communications failed. The only available time, as indicated in Table 19 below, to conduct interviews with the three other staff members, was in June 2022.

Table 19 Timeline showing dates when interviews with UFS ideas lab staff were held

UFS ideas lab interviews			
	Date	Location	position
1	14 December 2021	Bloemfontein	Coordination
2	19 June 2022	South Campus	Management

For the quantitative part of the study, the contact persons in the schools listed below were dedicated teachers, with a few school managers, taking over the responsibility of handling the process. The researcher was introduced to the EMIS administrative staff members, who were supplied with all the relevant information. In most cases, the researcher had to send subsequent requests, due to insufficient information supplied and there were times when it could not be

retrieved further, due to the limitations from the schools' EMIS systems. The researcher also discovered that some administrative staff lacked full knowledge of the entire EMIS system, making it difficult for them to navigate seamlessly. One of the interviewed teachers confirmed this, who indicated that the tasks rest with school managers, who usually relegate it to the administrative staff. Although the administrative staff were, in most cases, willing to assist, the researcher noted their navigating limitations. It was common, for example, to receive incomplete data in most subjects and the EMIS system in some schools could not go back to certain years and retrieve the required information. The inconsistencies in such retrievals convinced the researcher that it was not just the system that was insufficient, but that training afforded to the administrative staff, must be on a continuous level. Hence the need to also consult the EMIS head office staff for assistance. Table 20 below indicates how data was collected from the targeted population.

Table 20
Timeline showing dates wherein data was sought from schools' EMIS

IBP and non-IBP schools' interviews			
Date	**Location**		**Subject**
07 September 2021	School 1	Non-IBP	Physical Sciences
13 September 2021	School 2	Non-IBP	EFAL
13 September 2021	School 2	Non-IBP	Physical Sciences
16 September 2021	School 3	IBP	English
16 September 2021	School 3	IBP	Mathematics
16 September 2021	School 3	IBP	Physical Science
17 September 2021	School 4	Non-IBP	EFAL
17 September 2021	School 4	Non-IBP	Mathematics
17 September 2021	School 4	Non-IBP	Physical Science
20 September 2021	School 5	Non-IBP	EFAL
20 September 2021	School 5	Non-IBP	Mathematics
20 September 2021	School 5	Non-IBP	Physical Science
21 September 2021	School 6	Non-IBP	EFAL
21 September 2021	School 6	Non-IBP	Mathematics
21 September 2021	School 6	Non-IBP	Physical Science
25 September 2021	School 7	Non-IBP	EFAL
25 September 2021	School 7 2	Non-IBP	Mathematics
27 September 2021	School 8	IBP	EFAL
27 September 2021	School 8	IBP	Physical Sciences
28 September 2021	School 9	IBP	EFAL
28 September 2021	School 9	IBP	Mathematics
29 September 2021	School 10	IBP	EFAL, MATH, PHYSC

29 September 2021	School 11	IBP	EFAL, MATH, PHYSC
29 September 2021	School 12	IBP	EFAL, MATH, PHYSC

The available historical Grade 12 secondary data from the EMIS public portal, through IBP and non-IBP schools' EMIS historical Grade 12, seemed to be missing some data and the head office provided additional data. The common missing data, for example, was one out of three subjects not covered in one or more years under study. Table 21 below indicates the timelines that cover the period wherein the additional information was sought.

Table 21
Timeline showing dates when missing data was sought from FSDoE EMIS

Supplementary data on IBP and non-IBP schools' interviews			
Date	**Location**		**Subjects**
23 February 2022	EMIS	IBP and non-IBP	EFAL Mathematics Physical Sciences

The Grade 12 secondary data, obtained from FSDoE and the UFS ideas lab was analysed quantitatively, using SPSS 29.0 data analysis software and the two-way between-groups Analysis of Variance (ANOVA) was specifically selected to execute the tasks, whilst the interviews were analysed, using the NVivo software analysis for qualitative data. It is expected that, during the research, a researcher should consider how the data will be analysed and develop a plan or layout on how the selected instrument will be used (Cohen et al., 2007: 86). Such an instrument must correctly accept data and read it thereafter, otherwise an incorrect data and output may be obtained (2007:86). In studies that use a combined methods approach, the researcher can compare two datasets by reporting on the results from the quantitative statistics first, then report on the themes and patterns that emerged from the qualitative data (Creswell, 2014:243). In such studies, including this study, the numerical data were analysed mathematically to produce frequencies drawn from the analysis of statistics, whilst the narrative data was analysed to produce counts, frequencies and percentages (Plowright, 2012:121). The validity and reliability of the study is discussed below.

4.10 Validity and reliability

It is incumbent upon the researchers to clearly articulate the steps that they will follow to ascertain the accuracy and credibility of the research findings (Creswell & Creswell, 2018:199). In a combined research study, the steps that are followed to prove validity and reliability differ (quantitative or qualitative), since each data source presents itself differently. Below, validity

that involves the qualitative data, is discussed first, followed by the ones from the quantitative part.

4.10.1.1 Internal validity

Internal validity is the degree to which plausible responses are given to prove the credibility of the research findings (MacMillan & Schumacher, 2014:284). The above general definition can be linked to different elements that need to be addressed to prove that this study met the internal validity test. One of those is content validity. Sireci and Faulkner-Bond (2014) define content validity as the degree to which the content of a test or examination is congruent with testing examination objectives. Although not statistical by nature, content validity consists of a systematic analysis of the content to be assessed that leads to the drawing of conclusion on the presence of a sample that serves as the behaviour domain to be measured (Anastasi & Urbina, 1977 in Parra, 2016:61). For this study, the selected historical Grade 12 secondary data, was drawn from three selected Grade 12 subjects from 12 selected (six IBP and six non-IBP) schools, as observed over a five-year period (2014-2022). The collected data is nationally recognised and based on the standards and prescripts created and approved by the Department of Basic Education (DBE): Further Education and Training (FET) schools' band and UMALUSI's quality assurance. All Grade 12 examination papers that were written by Grade 12 learners during the period under study were examined and moderated by experts with proven records within the DBE ecosystem (Umalusi, 2019 and DBE, 2021). The involvement of Umalusi, the quality assurer, indicates that the test, or examination scores obtained by the Grade 12 learners, in the three subjects (EFAL, MATH and PHYSC) under study, were not only valid, but also of international standard. This applied to the selected schools in this study that have been categorised as either IBP or non-IBP.

Furthermore, Umalusi, the quality assurer, conducts a standardisation process that ensures that all Grade 12 subjects that learners are tested against, during the National examinations, are free from external factors that may "unduly advantage or disadvantage a specific cohort of learners under consideration (Umalusi, 2019 and DBE, 2021)." The Curriculum Assessment Policy Statement (CAPS) is nationally administered, and it is the source of the teaching and learning and later, tests and examination data that was obtained by all Grade 12 learners in these three (EFAL, MATH and PHYSC) selected subjects (DBE 2021). There are also notable internal validity threats when dealing with historical cohort data, including the historical Grade 12 secondary data under study that must be taken into consideration and they include: the

selection, history, maturation, regression, testing and instrumentation (Shadish et al., 2002:149). The researcher is aware of the plausible threats to internal validity that include clear and direct threats to the dependent variable and that there must be proof that the identified threat is affecting only one group over the other (MacMillan and Schumacher, 2014:284). Researchers must ensure that, at the end, the final analysis will be judged, based on researchers' self-critical approach and an eye to identify such threats and know how to control them (MacMillan and Schumacher, 2014:284).

In this study and based on the explanation given about the role of DBE, CAPS and Umalusi, at Grade 12, both treatment and control groups entered Grade 12 classrooms at the beginning of the year with similar prior knowledge (from previous Grades), with IBP experience in the form of live broadcasting offered to the learners where IBP was implemented, while the other Grade 12 control group had no experience or exposure to the live IBP broadcast. Another identified threat to internal validity is history associated with the participants in the study (Van Hezewijk 2015:8). When it comes to history, historical cohort data's internal validity may be threatened by differences in time of data collection and to mitigate this threat, a non-equivalent control group was added to the design and measured at the same time point as the treatment cohorts, so that we hope to address history in this way (Shadish et al., 2002:151). This study on historical Grade 12 secondary data spans over a five-year period (2014-2018), with a control group referred to as the non-IBP control group. The presence of the control group within the historical cohort data study serves as a solution to threats that may be posed by history (Walser, 2014:4). The use of instruments as measuring tools is another threat that plays an influential "wear and tear" role that may be mistakenly attributed to the intervention and in cases where human beings are involved, in testing the difference in test scores may be mistakenly linked to the treatment when in fact tiredness or fatigue, played a key role as a hidden contributory factor (Van Hezewijk 2015:8). In this case, the integration of the IBP from the centralised UFS ideas lab at the South Campus ensured that all treatment schools were exposed to a similar broadcast service that used same instruments and thus levelling the playing field. There are also instances wherein research findings are affected by internal validity, due to different measuring techniques that may prove to be unreliable (Creswell, 2014:285).

With instrumentation, threats are likely to occur when the measures change over time and when there is a time lapse between the data collection for the historical data cohort for the treatment and control groups and even if the same people conduct the data collection, there is a high

likelihood that they may gain experience along the way (Walser, 2014:5). In this study, the physical and human IT resources used were sourced and implemented equally by the UFS ideas lab and thus ensuring that, over time, a similar transmission service was provided across all the IBP schools across the Free State Province. At the data analysis level, the collected Grade 12 historical secondary data was subjected to different analytical tools to make sense of the research questions and problem. For this study, the pretesting process was applied as another factor, wherein testing was conducted prior to the treatment, affecting the participants (Creswell 2014:285). The focus was to ensure that before the intervention starts, both groups were divided, since the IBP group received live broadcasting, while the non-IBP group was not exposed to the live broadcasting. Since this was a combined research study, attrition was non-existent in the quantitative part that involved the historical Grade 12 secondary data that covers 2014 to 2018. In the qualitative part, the likelihood of participants losing interest along the way was mitigated by the researcher dedicating the month of September 2021 as the period to conduct the interviews and the outcome was that most of the participants voluntarily took part in the process.

This also meant that maturation was not going to be a factor, since the research was conducted within a short period with little or no likelihood of participants getting older, wiser, or stronger than at the beginning of the research (Creswell, 2014:285). The selected Grade 12 historical secondary data was also not subjected to maturation, since secondary data remains as the true reflection of the performance of Grade 12 learners in the selected schools over the 2014 to 2018 period. The researcher's decision to divide the selected schools into IBP (treatment) and non-IBP (control) groups was informed by the well-documented categorisation agreement between FSDoE and the UFS ideas lab and thus eliminated the diffusion of intervention that usually occurs in some studies, due to the one group having access to the intervention prior to it being implemented, which affects the outcomes of the research findings (MacMillan & Schumacher, 2014:285). Since the study focused on integrating IBP from 2014 to 2018, the Grade 12 historical secondary data was unlikely to be influenced by such an influence. Since the researcher had no direct or indirect association with either the FSDoE' FET schools or the UFS ideas lab activities, there was little, or no influence caused by the experimenter effects (MacMillan & Schumacher, 2014: 285). The first influence occurred at the time when the ethical clearance processes were initiated and when interviews were conducted in the selected schools (see section 9). With the focus on the IBP integration and its impact on the achievement of Grade 12 learners in the Free State Province, the period under study has not been impacted

by the intervention replications that may have an impact on the achievement variable (MacMillan & Schumacher, 2014: 285).

Although in an ideal world randomised samples would be used and thus leading to less biases and threats to validity, in quasi-experiments, they are unavoidable, despite being less evident, with plausible assumptions whose conclusions are not convincing enough and difficult to model (Shandish et al., 2002:484). The above assertions describe the fuzzy part and internal validity threats that make some researchers prefer randomised or true experimental routes, rather than quasi-experiments (Shandish et al., 2002:484). One example of a study that addressed validity convincingly was conducted by Munje and Maarman (2016:185) to ascertain the impact that a school's learner progression policy has on learner achievement of learners in three primary, quintile 1 schools in Cape Town. The three primary schools are in an informal settlement where there is high level of poverty. In addition, the learners have similar experiences, accessing similar amounts of resources and support from DBE (2016:185). Furthermore, based on the above similarities, the assumption is that the three quintile 1 primary schools are performing at similar levels (2016:185). Like the internal validity above, research studies require that researchers prove the validity of the study. Below is the discussion on external validity.

4.10.1.2 External validity

Within quasi-experimental research studies, including this one, external validity regards generalization as a key component that must be proven to ensure the study gains acceptance and credibility. External validity is the extent to which the generated results can be generalised to a broader population, including those that did not participate in the study (Leedy & Ormrod, 2013:262). Scher and Kisker (2015:2) confirm that the above definitions can be applied in studies involving the quasi-experimental designs, wherein experimental and control groups are subjected to comparative exercise and thus prove external validity. In this study, the presence of an experimental group, represented by the IBP schools and the control group, represented by the non-IBP schools, provided a strong case for generalisation. The Grade 12 historical secondary data in the three selected subjects (EFAL, MATH and PHYSC) was a performance representation linked to a National Curriculum and Assessment Policy Assessment, commonly called CAPS. CAPS is a nationally applied curriculum following similar standards, including assessments and examinations with a national footprint. Therefore, all IBP and non-IBP schools are exposed to the same curriculum and teachers follow the same pedagogical principles that are implemented by both district and head office FET schools' subject specialists. The teaching and

learning activities occur in both IBP and non-IBP Grade 12 classrooms within the confines of a nationally recognised and accepted timetable. All Grade 12 teachers are expected to have covered and exposed their learners to nationally agreed and applied contents, within specific period followed by common examinations usually conducted at the end of March, June, September and the final one in October/November. Although the two groups of Grade 12 learners at IBP and non-IBP schools were exposed to similar teaching and learning experiences, the former was exposed to live IBP teaching that was presented by teachers or subject specialists who are experts in their respective fields of work.

These teachers are outside the confines of the IBP schools and serve as supplement, an experience that Grade 12 learners from non-IBP schools do not have, even though they sit for similar examinations at the end of the year. The categorisation of the two groups into treatment (IBP) and control (non-IBP) was a dividing factor that, from this study, needed to be proven whether it leads to the achievement of Grade 12 learners in the Free State Province or not. The general agreement within the Social Sciences ecosystem is that, in most cases, generalization depends on the internal validity (Van Hezewijk, 2015:7). Although internal validity influences external validity, its influence is considered not only to be necessary, but also sufficient (Van Hezewijk, 2015:7). Accordingly, this study recognised that content validity that is linked to internal validity, was also intertwined with generalisation that was associated with external validity. Another factor to consider and that also applied to this study, is that when interventions are successfully applied in a study, whose context is very small and tightly controlled, the findings may not be generalised on a wider scale (MacMillan & Schumacher, 2014:287). In this case, since the examinations are administered at provincial and national levels, the outcomes could therefore be generalised to other contexts. According to Leedy and Ormrod (2013:89), validity is "the extent to which an instrument measures what it is intended to measure." This means that the selected research tool must estimate what it is supposed to measure and prove that the collected data is valid (Johnson & Christensen, 2019, Saunders et al., 2009, Fraenkel & Wallen, 2009 in King, 2011:74). This also means that for the research results to be considered significant and contribute to expanding knowledge, the selected quasi-experimental research design and the quantitative and qualitative methodological approaches must lead to the production of valid data (King, 2011:74).

Cronbach (1971) posits that validity depends largely, not on the test or examinations only, but mostly on how the test scores are interpreted or used (Bonner, 2013:88). Accordingly, the

historical Grade 12 examinations secondary data and the interview data that formed part of this study, provided a platform for the interpretation processes that conform to validity principles. The two types of validity, namely internal and external validity, contributed towards proving that the study met the acceptable standards. Leedy and Ormrod (2013:262) further emphasise that when dealing with validity within the combined studies, researchers must ensure that the measurement techniques truly represent and delve into all variables associated with the phenomenon under study. Despite the presence of strategies that indicate similarities, there is no perfect mirror image to measure the presence of equivalence in areas that include gender, race, achievement, or experience (Scher & Kisker, 2015:2). This therefore means it would be impossible to test and prove the presence of such "unobserved" differences, for example the level of motivation to engage in a newly introduced intervention programme (Scher & Kisker, 2015:2).

One of the available options involves triangulation wherein an examination from different data sources is carried out to establish and give a coherent justification for the emerging themes and sub-themes (Creswell & Creswell, 2018:200). In this combined research study, triangulation fit well in that the quantitative data that was represented by the Grade 12 historical secondary data, was aligned to the responses from different participants, who were interviewed to make sense of the impact that the IBP has on the achievement of Grade 12 learners in the Free State. Another possible option was member-checking, wherein the accuracy of the qualitative findings are proven by presenting a final report back to the participants, who are expected to confirm their accuracy (Creswell & Creswell, 2018:200). This also allows both the researcher and the participants to arrange a follow-up, in case there is a need for additional clarification of specific parts of the findings (2018:200). Another possibility to prove validity of the findings involves providing a detailed description of the setting that would make it easier for the reader to make sense of the whole research processes and thus proving it to be realistic and richer (2018:200). Another approach is the researcher's clear discussion and comments that he brings to the whole research and by bringing an open and clear reflection, the researcher receives fair and acceptable responses from the readers and fellow researchers (2018:200).

4.10.2 Reliability

Reliability is “the consistency with which a measuring instrument yields a certain, consistent result when the measured entity has not changed” (Leedy & Ormrod, 2013:91 and MacMillan & Schumacher, 2014:284).

According to Creswell and Plano Clark (2011) in most studies, reliability plays a minor role when compared to the validity in qualitative research (Parra, S. 2016:64). Although validity refers to the ability to measure what is supposed to be measured, reliability refers to the consistency of a measure (Abramson, 2012). According to Poetschke (2002) and Patton (2002), reliability in qualitative studies can be proven during data analysis stage. While Golafshani (2003) posit that that trustworthiness, which is establishing confidence in the findings, forms an important element when establishing the reliability of the study. Guba (1981) contends that to prove trustworthy within the qualitative study, the following criteria must be applied, namely credibility, transferability, dependability, and confirmability and each has corresponding strategies. Shenton (2004 in Parra 2016:64).

Creswell (2014:243) argues that the use of the convergence within the combined methods approach, as is the case with this study, involves the creation of quantitative and qualitative validity that is drawn individually from the two databases. It is also worth noting that establishing validity within the convergent approach may be a challenge that includes the imbalance in sample sizes between the quantitative and qualitative data sets (2014:243). Research that involves quasi-experiments often cites Campbell and Stanley’s (1963) 12 common threats to internal and external validity and the recent (Shadish et al 2002) and expanded conceptualisation has identified statistical conclusion, internal validity, construct validity and external validity as equally important factors (Walser 2014:4). According to Wilde (2004:18), research on performance assessments is deemed to be valid when they measure what they are intended to measure and that the research outcomes can be generalized and used to make decisions that would affect the future and subsequent studies.

They are also deemed reliable if they are consistent over a specified period in different contexts and groups (2004:18). In this study, the quantitative data drawn from the FSDoE and UFS ideas lab Grade 12 examinations observed over a five-year period is bigger than the 30 participants who contributed towards the qualitative data. In addition, trying to compare and later merge the two data sets is always hindered by the different concepts or variables used by

the different databases. The lack of follow-up on conclusions when the scores and themes diverge also represents an invalid strategy of inquiry (Creswell (2014:243). Data analysis is important but, if it is conducted in a poor way, or incorrectly, it may invalidate the study and if it is described poorly, it can make it difficult to reach an acceptable conclusion that may be easily understood by the targeted audience (Wilde, J. 2004:18). The researcher's biasness in a quantitative study may be avoided by getting the researcher's detailed biography that may assist to ascertain if there are any elements of biasness that may either intentionally or inadvertedly affect data interpretation and outcomes from the research findings (Carter and Hurtado 2007 in Markette 2012:68). The correct application of validity and reliability provide assurance that the study was scientifically conducted (Maree 2019:43). The above confirms that proving validity and reliability of data is not a one-size-fits-all but depends on the context under which the study is conducted (Hammersley and Atkinson 1983).

Like validity, reliability takes different forms in different situations (2013:91). Golafshani (2003:598) posits that reliability can be achieved if the results remain consistent over a period and are likely to be replicated in different settings. However, Chisholm (2015:24) warns that technology is not static and unpredictable, but changes over time and is likely to affect the outcomes of the study, for example if a learner experiences prolonged periods of load-shedding, that could have an impact on the results. The steps followed in this combined research that include the use of the historical Grade 12 secondary data and the interview sessions that include selected Grade 12 teachers, FET schools' subject specialists at both head office and district and UFS ideas lab staff, may be repeated, since the same technology has been in use for years and provided by the UFS ideas lab. Interrater refers to the extent to which the same conclusions are reached by two or more people, measuring the performance of a particular instrument. The use of NVivo and SPSS software for qualitative and quantitative parts of this study respectively, allows for the repetition of the test by different researchers with the same aim of ascertaining the achievement by Grade 12 learners in the Free State Province. Test-retest reliability is the extent to which similar results are obtained every time two or more people administer the same instrument. The Grade 12 historical secondary data from the EMIS database and the use of the internationally renowned software tools, indicate that this research is open to repetition by the same or different researchers elsewhere.

Equivalent forms of reliability refer to the extent to which two similar versions of instruments can bear similar results. Using the international acclaimed SPSS and NNIVO software, means

that access to similar tools may lead to the testing of the same data elsewhere in the world. Internal consistent reliability refers to the extent to which items within an instrument can provide the same results (Leedy & Ormrod, 2013:91). In this study, the combination of data that was drawn from both quantitative and qualitative methods, using different software, allows for the manipulation of the instruments to get similar results that sought to ascertain the impact that IBP has on the achievement of Grade 12 learners in the Free State Province. To prove the above, researchers normally conduct the same test to the same participants at reasonable intervals (Creswell, 2008:169). The researcher and the supervisor can access data and retest it at regular intervals. MacMillan and Schumacher (2014:285) contend that strong external validity may be maintained in research by ensuring that the same experimental groups are repeated, using the same subjects, but in a different context.

Qualitative reliability or consistency or reliability has the responsibility to create a journal wherein they document all the processes, steps and procedures for any interested reader to follow unaided (Yin, 2009, Gibbs, 2007 in Creswell & Creswell, 2018:201). This may also involve analysing the transcripts to ensure that there is consistency in the way they are reported with mistakes easy to correct. There must also be consistency in the way the codes are created and combined to form themes and sub-themes (Creswell & Creswell, 2018:202). For this study, the researcher believed that even though the focus would be carried out on IBP and non-IBP schools within the Motheo District, the same may be carried out on other schools in other districts throughout the Free State Province. The importance of data analysis and interpretation is key when seeking to make sense of the phenomenon under study.

4.11 Data analysis methods

According to Edwards and Talbot (1994:98), data carries little information until it is compiled, analysed and interpreted. Merriam (2009:175) opined that “data analysis is the process of making sense out of the data” (Kankam, 2018: 155). Data analysis in this study sought to highlight the impact that IBP integration has on the academic achievement of Grade 12 learners in the Free State Province.

Data analysis of historical secondary data and survey interviews were adopted to be part of the study’s combined research, in line with the post-positivist paradigm. During data analysis, the collected data was divided into relevant parts that are examined and distinguished from each other in relation to the original whole (Oso & Onen, 2009 in Kiruki, 2018: 86). This also

involves the reduction of big data collected by the researchers to make sense out it (Bryman, 2003 in Kiruki, 2018: 86). The combined methods approach is an integrated data analysis process that combines statistical and thematic analysis techniques to make sense of the collected data (Teddlie & Tashakkori, 2009 in Mwageni, 2017:85). This section outlines how the quantitative and qualitative parts of this research were analysed using different tools and techniques. For the quantitative part, descriptive statistics were adopted to highlight the following: frequency, percentage and cross-tabulation that describe the characteristics of the research demographics in the form of tables and figures. The inferential statistics were selected to determine if the differences in the descriptive statistics are statistically significant by making use of a test of significance or p-value. However, this will be performed based on the observed distribution in the descriptive statistics. Inferential statistics are premised on the two-way between-groups analysis of variance (ANOVA) (Pallant, 2010:265). The output from the tests (see Table 22 below) includes the descriptive statistics, Levene's test of equality of error variances, interaction effects, main effects and plots (2010:269).

Table 22
Output from two-way Analysis of Variance (ANOVA)

Output from two-way Analysis of Variance	
Name of the test	**Components of the output**
Descriptive statistics	• Mean scores • Std deviations • N for each subgroup
Levene's Test of Equality of Error Variances	Sig. level
Interaction effect	Presence of the significant interaction effect
Main effects	Effects of independent variables
Effect size	Minimal impact
Plots	Visual display of relationship between variables
Plots	

Source: Pallant 2010:269-271

The above that forms part of the quantitative data analysis made use of the SPSS version 29.0 as the most suitable tool for the study. Due to the nature of the historical Grade 12 secondary data that has been selected for this study, and the quest to conduct a comparative analysis, the SPSS version 29.0 was suitable data analysis software that fits the objectives laid down in

chapter 1 (section 1.5) of this study. The software can analyse secondary data, using descriptive and inferential statistical tools to make sense of the research questions. An SPSS software can analyse data, using the descriptive analysis approach to compare different datasets and in the case of this study, the selected Grade 12 secondary data in three selected subjects that are English First Additional Language (EFAL), Mathematics (MATH) and Physical Sciences (PHYSC). Through the inferential statistics functionality found in the SPSS software, the researcher, initially wanted to make use of the one-way analysis of variance (ANOVA) and t-test, but upon delving into data, it became apparent that the two-way between-groups ANOVA fitted the set objectives of the study. For the qualitative part of data analysis, NVivo was the preferred data analysis software for this study. The software has content analysis functionality that allows for the analysis of the collected interviews' data whose primary source were the different participants. Content analysis technique includes determining the presence of certain words, themes, or concepts within some given qualitative data (i.e., transcript text). The researcher quantified and analyzed the presence, meanings, and relationships of certain words, themes, or concepts. The NVivo software was preferred for qualitative data analysis, because it has functionalities that allows for the individual perspectives to be infused with different views to make sense of the research questions. In addition, the researcher was exposed to the software after it was presented for staff members and was described as an institution's software of choice that was selectively installed for only those staff members who showed interest.

In preparation for data analysis, data cleaning was conducted to ensure data accuracy and completeness (Brink et al., 2006 in Mutsvunguma, 2019:85). The collected data that was subjected to descriptive analysis made use of the mean, standard deviation and frequency count. To establish, for example, the extent and the difference between the means, an analysis of variance software (ANOVA) was selected that falls under an inferential statistical analysis type of data analysis sphere. Inferential statistics assist to establish and examine the extent of the relationships between variables within a selected sample, which leads to the generation of inferences, generalisations, or predictions about such variables, in relation to the population under-study (Trochim et al 2016). The use of the t-test inferential statistic was selected to establish the existence of relationships between means of the two selected groups under study. Cross tabulations were generated to display the relationship that existed between the selected groups (Kiruki, 2018:86). For the qualitative data, the qualitative data analysis software, NVivo was selected to assist with transcription from voice to data, including the creation of codes, and the establishment of themes and patterns (Olasina, 2014:109). Qualitative data analysis is

"creative, challenging, time-consuming and consequently expensive", due to the bigger volumes of data that researchers must deal with (Mutsvunguma, 2019:106). As indicated in Table 23 below, descriptive and inferential statistical analysis were applied in this study to establish the predictive capabilities of various variables that form part of this study. In line with the standard practice, data was reduced to accommodate three Grade 12 subjects. This lessened the volume of raw data to reasonable and manageable chunks of facts, aligned to the stated research objectives (Muchaonyerwa, 2016:96 in Mutsvunguma, 2019:106). The selection of SPSS version 29.0, for the quantitative part and NVivo for the qualitative part was based on their ability to answer both the research questions and problem.

Table 23
techniques and tools in this study

Data Analysis			
Quantitative data analysis		**Qualitative Data analysis**	
Techniques	**Description**	**Techniques**	**Description**
Descriptive Statistics	Frequency, percentage and cross-tabulation that describes the characteristics of the research demographics in the form of tables and figures. Furthermore, this section outlines the basic difference between IBP and non- IBP schools.	Content analysis	Content analysis has been selected to analyse the interviews audio record from the participants. Content analysis technique includes determining the presence of certain words, themes, or concepts within some given qualitative data (i.e. transcript text). The researcher will quantify and analyse the presence, meanings, and relationships of certain words, themes, or concepts.
Inferential Statistics	The inferential statistics will be used to determine if the differences in the descriptive statistics are statistically significant by making use of a test of Significance or p-value. However, this will be performed based on the observed distribution in the descriptive		

	statistics. Inferential statistics includes Two-way analysis of variance (ANOVA).		
Analysis Tools			
SPSS version 29.0		NVivo	

Source: SPSS 29.0

The quantitative data, for example, may involve analysing derived scores on a specified ability between the experimental and control groups (Plowright 2011:121). Within the qualitative data analysis, the strategy may involve counting the number of times the interviewees' attitude towards a phenomenon under study is mentioned in a recording (Plowright, 2011:121). In this study, since a combined approach was adopted, the analysis within the quantitative data involved descriptive and inferential numeric analysis, whilst the qualitative data analysis adopted a thematic analysis (Creswell, 2003:220). In a study by Ogbonnaya and Awuah (2019:110), on the factors that hinder students' achievement in mathematics, they selected both descriptive and inferential analysis, using SPSS 23 and whose results focussed on the mean and standard deviations of the learners' scores at each level of Bloom's taxonomy (2019:110). This was intentionally done to ascertain the overall performance of the quintiles at each level of Bloom's taxonomy (2019:110). The use of the inferential analysis further explored whether any difference in the achievement of the quintiles was statistically significant (2019:110). In this study different techniques have been applied to prove its validity and reliability, and this is crucial to prove the credibility of the study and the recognition that it will positively impact and expand the knowledge base.

4.12 Ethical considerations

One of the important steps within the research cycle that researchers need to attend to, is an anticipation of the ethical issues that are likely to arise during their studies (Berg, 2001, Hesse-Biber & Leavy, 2011, Punch, 2005, Sieber, 1998). Ethical issues must be taken seriously, as in most cases they always involve collecting data from people to gain more knowledge about them (Punch, 2005).

The collection of quantitative and qualitative data happened mostly at the time when the COVID-19 pandemic was affecting the global communities, including this study's targeted

population. As indicated in section 4.8 above, the sites where the collection of historical secondary data were collected (schools, FSDoE EMIS offices and the UFS ideas lab offices), including the qualitative part that involved conducting interviews, were all subjected to health and safety protocols. Visitation to all sites required the researchers and participants to always wear masks and sanitize with a prescribed alcohol-based liquid. At all entrances, the researcher was expected to provide his contact details, and his temperature was measured and always recorded. Although most interviews were conducted at the participants' respective workplaces, not all district officials could access their offices, due to the renovations that were taking place. The selected restaurant was deemed suitable, and their interviews were conducted under strict COVID-19 regulations, like the ones mentioned above. In all interactions, the participants were provided with copies of the ethical clearances from FSDoE, UKZN and UFS. If they agreed to participate, they had to read and thereafter sign individual consent forms (see section 9). All interviews were recorded after seeking permission from the respective participants and providing an explanation of the device's role in this study. They seemed to know why data had to be collected in this manner and were comfortable with the researcher's explanation.

Since their participation was voluntary, the participants were reminded that they were free to stop at any time and that their names, and places of work were in no way going to be used in the study and instead pseudonyms would be used. Although the whole study and interactions with targeted participants were to be conducted in English, most African participants preferred code-switching, which was the only option available, even though as the interviews progressed, they would mostly stick to English. The researcher discovered once code-switching was applied, the participants felt comfortable and willing to participate. Therefore, researchers must familiarise themselves with the ethics policies of the relevant institutions that are part of the research process (Maree, 2019:48). Creswell (2014:92) argues that since research involves data collection from different participants, it is always advisable that researchers prioritize their protection. This also means it is incumbent upon researchers to ensure that participants' interests are considered and equally important is always the application of best and humane practices. This is also key, especially in researchers that involve qualitative or mixed methods, since they are likely to affect the researchers' subjective or personal views (Sanjari et al., 2014). In such cases, it is also incumbent upon the researchers to ensure the following: establish trust and rapport with participants, ensure that the research in totality has integrity, give participants assurance about anonymity and privacy, avoid misconduct and impropriety during the research and use data collection instrument in the correct way. Furthermore, they must ensure all

participants receive equal treatment, keep collected data safe, avoid exploitation of participants at all costs and avoid biases. Furthermore, they must give a true reflection of the results and lastly, they must dispose of collected data at the correct time (2014:92).

For this study, the above ethical considerations were always upheld, and both the data collected from databases and planned interviews were treated and kept anonymously and in private.

4.13 Summary

The purpose of this research study was to investigate the impact of the Internet Broadcasting Project (IBP) on the achievement of Grade 12 learners in the Free State Province. This chapter on research methodology represents the selected methodology for this study and the adopted post-positivist paradigm with a combined or mixed methodology consisting of quantitative and qualitative approaches forming an important component. The quasi-experimental and survey research design were also part of this study, and both were aligned to the post-positivist paradigm prescripts. The study also made use of the population drawn from historical Grade 12 secondary data in three subjects: First Additional Language (EFAL), Physical Science (PHYSC) and Mathematics (MATHS) and that spans over a five-year period (2014-2018). The secondary data was from 12 Grade 12 schools that were categorised as six IBP (experimental group) and six non-IBP (control group). This data formed part of the quantitative approach and for the qualitative approach interviews were sought from Grade 12 teachers in three subjects under study - a combination that works well in a study that follows a post-positivist philosophy. In line with UKZN ethical requirements (see section 9), all data collection procedures were followed, including obtaining approval from all stakeholders, including the Free State Department of Education EMIS, FSDoE district and head office officials, as well as selected Grade 12 teachers and selected UFS ideas lab staff. The detailed findings are analysed in the following chapter.

CHAPTER FIVE

DATA ANALYSIS AND PRESENTATION OF FINDINGS

5.1 Introduction and background

The purpose of this study was to ascertain the impact that the integration of the Internet Broadcasting Project (IBP) has on the performance of Grade 12 learners in the Free State Province. The chapter covers the response rate, section A on descriptive statistics, section B on inferential statistics including the responses from that are linked to the selected research questions. The previous chapter presented a detailed account of the research methodology. The results from both the quasi-experiments and the survey designs were presented in descriptive, and inferential data analysis, using tables and statistics respectively - typical of a combined research study (Olasina, 2014:112 and Osayande, 2019:105). The SPSS 29.0 and NVivo data analysis software (discussed briefly in chapter 1 and in detail in chapter 4) were selected to analyse the quantitative and qualitative data respectively.

The results are presented, analyzed and organized around the following research questions:

1. What are the legal and legislative frameworks that support the creation and integration of IBPs at the Grade 12 level?
2. What are the experiences of learners and teachers on the provision of IBP intervention programmes for Grade 12 learners in the Free State?
3. What are the UFS ideas lab-led factors that influence academic achievement by Grade 12 learners in the Free State?

The combined methods' data analysis results were collated from the Free State Department of Education (FSDoE)'s Grade 12 historical database (quantitative part) and interviews (qualitative) from selected participants drawn from selected IBP and non-IBP schools, the district, and head office's Further Education and Training (FET) schools' subject specialists at FSDoE and the University of the Free State (UFS) ideas lab staff. The results from data analysis were also aligned to the Unified Theory of Acceptance and Use of Technology's (UTAUT's) theoretical framework and specific parts drawn from the literature review and methodology. The descriptive statistics of the quantitative data mainly focused the demographic information, whereas the inferential statistics focused on hypothesis testing. The inferential statistics were presented through testing data using the two-way between-groups ANOVA (Pallant, 2016:271). Unlike the one-way design, the two-way design allows researchers to test both the 'interaction effect' and the 'main effect' (see also chapter 4). The output included the

descriptive statistics, Levene's test of equality of error variances and plots (2016:271). The report is separated into three, since it tests the three datasets: English First Additional Language (EFAL), Mathematics (MATHS) and Physical Science (PHYSC). The output drawn from descriptive and inferential statistics is linked to the relevant research questions (RQs). Furthermore, qualitative data (see also chapter 4.11) was collected, using unstructured interview schedules, an audio recorder, and using the NVivo qualitative data analysis software, transcription, and later thematic analyses content (Osayande, 2019:105). All the findings emanating from the qualitative data analysis, play a complementary part to make sense of the analysed historical Grade 12 secondary data that forms part of the quantitative data (Saulus, 2017:102 and Odaro, 2019:105). The results are presented from sections 5.2 and 5.7, as well as the chapter summary in section 5.8., based on the approved data analysis procedures whose full details were discussed in chapter 4. (Eyaufe, 2018:74).

Marshal and Rossman (1995) posit that data analysis brings order, structure and meaning to data. On the other hand, Swift (2006) defines data analysis as transforming raw data into useful information. Creswell (2009) affirms that data analysis is an important part that the researcher uses to draw conclusions and make informed decisions that could be generalized in relation to the stated research questions and problems. This aligned well with this study where only data from a few selected schools was represented to assist to draw conclusion on the impact that IBP integration has on the achievement of Grade 12 learners in the Free State Province. The analysis of data may occur either in a concurrent order, and in some cases, it happens in a sequential order, wherein data analysis of one dataset precedes the other with the initial findings informing the subsequent one or interactively (Onwuegbuzie & Combs, 2011:3). Although prominence tends to be given to the quantitative part of the analysis, the combination and simultaneous analysis of both the quantitative and qualitative data, enhances the understanding of the phenomenon under study (Onwuegbuzie & Combs, 2011:5 in Mutsvunguma, 2019:112). Accordingly, in this study, both the Grade 12 historical secondary data and the interviews were triangulated to make sense of the research problem and questions. The quantitative data was tackled first, followed by the qualitative data. Onwuegbuzie and Combs (2011:1) cautions that data analysis within the combined research may pose a challenge in that it may need a thorough knowledge of analyzing both the quantitative and qualitative data, including the integration of the results from the two analyzed data sources. This process requires "a coherent and meaningful way that yields strong meta-inferences" that form a coherent whole drawn from the analyzed data sources (Tashakkori & Teddlie, 1998 in Onwuegbuzie & Combs, 2011:1).

In summary, the data analysis and interpretation are presented as a series of steps, in Table 24 below, with one step leading to the next for a complete discussion of the data analysis process (Creswell, 2008). The response rate results, for example, Table 24 below, present to the reader detailed information on the data sources (quantitative and qualitative) that were analysed using SPSS 29.0 and NVivo software. Quantitative data was analysed first, followed by the qualitative and triangulation of both methods at the end.

Table 24
Summarised data analysis steps followed within the combined realm

Steps	**Areas to be covered**	**Source/s**	**Research tool/s**
1.	Response rate	Quantitative and qualitative data	SPSS 29.0
2.	Demographic data analysis	Quantitative and qualitative data	SPSS 29.0
3.	Average performance by IBP schools	Quantitative data: 3 selected Grade 12 subjects	SPSS 29.0
4.	Average performance by non-IBP schools	Quantitative data: 3 selected Grade 12 subjects	SPSS 29.0
5.	Inferential statistics	Two-way ANOVA: • Descriptive statistics • Levene's test of equality of error variances • Profile plots	SPSS 29.0
6.	Emerging themes	analysis of the emerging themes	NVivo
7.	Combined data analysis	Interpretation linked to the two data sources	SPSS 29.0 & NVivo
8.	Summary	A comprehensive picture from data interpretation	SPSS 29.0 & NVivo

Source: secondary quantitative and primary qualitative data

The next sub-topic presents data analysed, based on the response rate that was sourced from both the quantitative and qualitative sources of data that form part of this study.

5.2 Response rate

One of the advantages of the application of a response rate is that it eliminates interference, perceptions and experiences that a researcher may be holding (Thorpe et al., 2008 in Mwageni, 2017:91). Saulus (2017:102) noted that some researchers disagree on what constitutes an adequate response rate, because the term "adequate" is very subjective and depends on many factors that include the selected population, envisaged limitations, the topic under study and the type of responses individual researchers prefer. The above steps have been adopted in this study to ascertain the extent to which participants responded by drawing from both the secondary Grade 12 historical secondary data and primary interviews data. The general agreement is that a higher response rate adds more value to the study's credibility (Baruch & Holtom, 2008, Peytchev, 2013, Ewell, & McCormick, 2020). However, there are instances where getting lower responses is inevitable, but still produces credible outcomes that answer both the research problems and questions (Pike, 2012, Massey & Tourangeau, 2013, Fosnacht et al., 2017 in Mwageni, 2017:91). The response rate for the quantitative part of this study may be described as 100%, since the historical Grade 12 secondary data was provided by Free state Department of Education (FSDoE) from its Education Management Information Systems (EMIS) FET schools' database (see section 4.5-4.8). Table 25 below represents the response rate from the interviews administered to the selected Grade 12 teachers from the selected IBP and non-IBP schools, FSDoE district and head office FET schools' subject specialists in three selected Grade 12 subjects and the University of the Free State's (UFS's) ideas lab participants.

Table 25
Responses from teachers, Motheo FET schools' district officials, FSDoE FET schools' officials and the UFS ideas lab (Source: Field data, 2021-2022)

Faculty	Sample size (n)	Frequency	% of responses
Grade 12 English FAL teachers	12	8	66.6
Grade 12 Mathematics teachers	12	6	50
Grade 12 Physical Science teachers	12	7	58.3

FET Schools district: English FAL	1	1	100
FET Schools district: Mathematics	1	1	100
FET Schools district: Physical Sciences	1	1	100
FET Schools Head Office: English FAL	1	1	100
FET Schools Head Office: Mathematics	1	1	100
FET Schools Head Office: Physical Sciences	1	1	100
UFS ideas lab staff	2	2	100
Total	44	29	65.90
Average Responses	4.4	2.9	65.90

Source: Field data, 2021-2022

Out of a total of 44 targeted participants, 29 were interviewed, giving a response rate of 65.90%, which is reasonably acceptable (Fincham, 2008:43). The high response rate was made possible through constant follow-up with participants and the support that the researcher received from the coordinators across all the targeted institutions (Osayande, 2019:105). Table 24 further shows that amongst targeted Grade 12 teachers, an average 58.3% response rate was obtained, a 100% response rate from both the district and head office FET schools' subject specialists and a 100% response rate was obtained from the targeted UFS ideas lab staff. Below is the descriptive part of the study whose composition includes the demographic analysis of the collected data and the distribution of data according to gender.

Sector A: descriptive statistics

The descriptive statistics in relation to this study have been introduced and discussed in chapter 4 (see section 4.11). First to be discussed were the results from demographic data analysis as drawn from both quantitative and qualitative sources of data that formed part of this study. The next data analysis was on the average performance of the twelve selected schools (six IBP and six non-IBP) in three selected Grade 12 subjects (EFAL, MATH and PHYSC). The following data analysis focused on the combined performance of all Grade 12 learners, based on gender

and the average performance of Grade 12 learners (from IBP or non-IBP schools) according to the Department of Education (DBE)'s ratings' scale.

5.3 Demographic data analysis

The demographic profile of respondents' data was drawn from the study's quantitative and qualitative parts. The quantitative part was represented by the Grade 12 historical secondary data that spans over a five-year period (2014-2018) and the only biographical information included was on learners' gender (Saulus, 2017:104). Although the ages were not included, due to the privacy imposed by the FSDoE, the assumption from DBE'S norms and standards on admission is that, on average, Grade 12 learners are 18 years (Cooper & Schindler, 2006 in Mwageni, 2017:91 and Mail and Guardian, 2010). The qualitative part that involved the interviews with selected participants drew from the researcher's observations on the characteristics displayed and shared by participants that include gender distribution, area of specialization and work experience (Mwageni, 2017:91). The demographic characteristics of the participants, as drawn from both quantitative and qualitative data sources, are presented in Tables 26-27.

5.3.1 Distribution of respondents by gender

From the quantitative side of the study, the historical Grade 12 secondary data was analysed to determine gender distribution. The gender distribution of the participants as observed over a five-year period (2014-2018), is presented in Table 26 below. Table indicates that 52,9% of female learners and 47.1 % of male learners were part of this study.

Table 26
Distribution of respondents by gender (n=13,934)

Male	Frequency	6562
	percentage	47.1%
Female	Frequency	7372
	Frequency	52.9%

Source: EMIS-FSDOE Grade 12 data

According to Table 25 above, the gender distribution of participants show that female participants were 5.8 % more than their male counterparts. In addition, Figure 2 below gives another perspective on how gender amongst the participating leaners was distributed (Females:

53% and Males: 47%). The above analysis is presented in a pie chart to confirm the 53% gender distribution for female learners and 47 % for male learners.

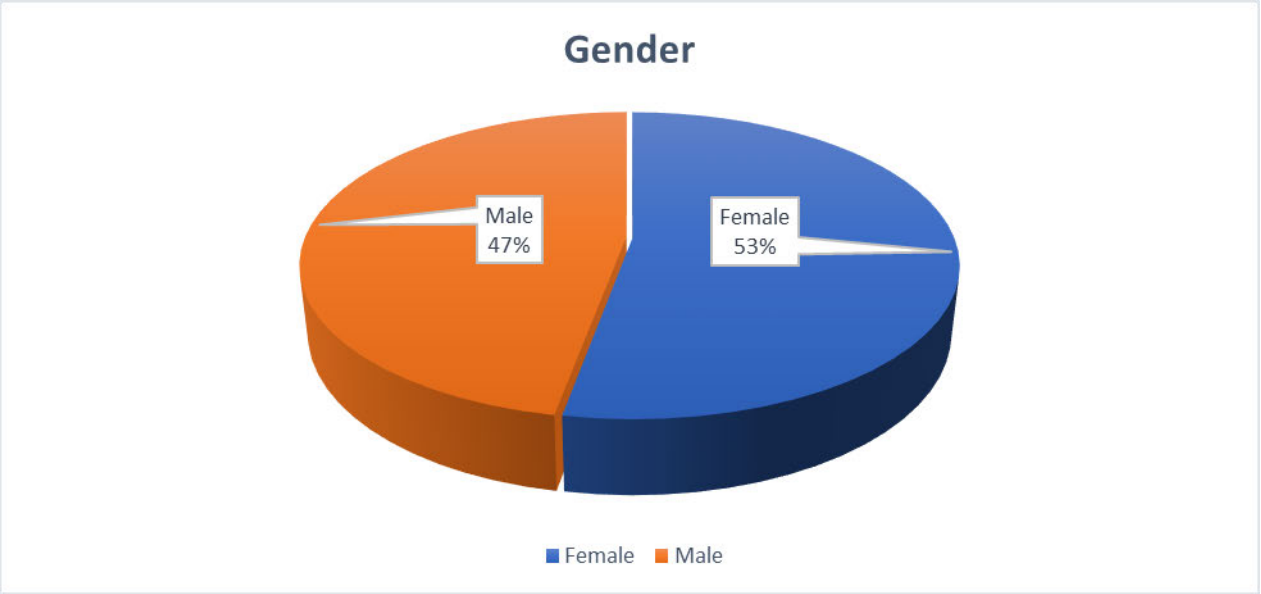

Figure B Distribution of participants by gender

Source: EMIS-FSDOE Grade 12 data

From the qualitative part, which was represented by the interview data obtained from selected participants, the gender distribution, as seen in Table 27 below indicates that 58,6% of the participants were males while 41.4% of the participants were females.

Table 27
Gender of the interviewed participants (n=29)

Male	Frequency	17
	percentage	58.6
Female	Frequency	12
	Frequency	41.4

Source: Field data, 2021-2022

In alignment with the study's focus that sought to ascertain the impact that the IBP has on the achievement of Grade 12 leaners in the Free State Province, the following shows how data analysis was carried out in both IBP and non-IBP schools. The three Grade 12 selected subjects whose secondary data was analysed were English First Additional Language (EFAL), Mathematics (MATH) and Physical Science (PHYSC). The following sub-section presents the distribution of the respondents across the three selected subjects (EFAL, MATH and PHYSC) that formed part of this study.

5.4 Distribution of respondents across three selected subjects

Figure 3 pie chart below shows the distribution of respondents across three selected subjects. The first slice of the pie represents English First Additional or "EFAL" and represents 61% of the analysed data. The second largest slice is Physical Science or "PHYSC" and represents 20% of the analysed data. The third slice is Mathematics or "MATH" and represents 19% of the students. The higher percentage in English First Additional or EFAL is caused by the fact that most Grade 12 learners enroll for EFAL English First Additional across all the academic streams, while the other two subjects (Mathematics and Physical Science) are almost equal and could indicate that they are always taken together by Grade 12 learners.

Figure 3 distribution of respondents across three selected subjects

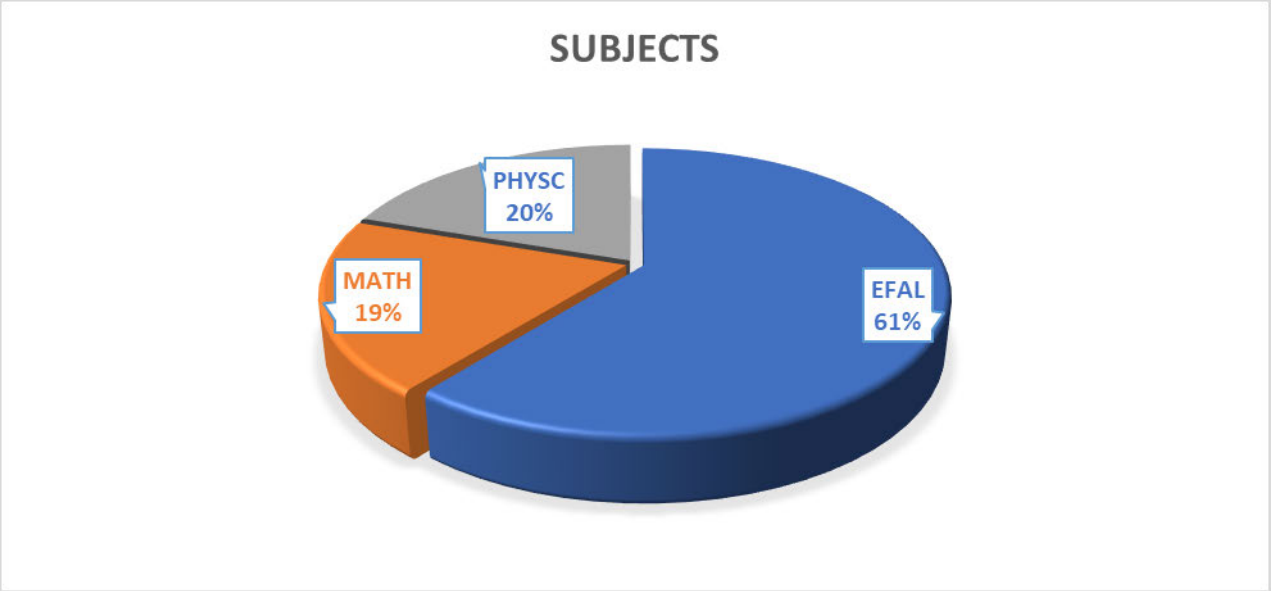

Figure C distribution of respondents across three selected subjects

Source: EMIS-FSDOE Grade 12 data

The following comparative data analysis focuses on the achievement of Grade 12 learners in three selected Grade 12 subjects (EFAL, MATH and PHYSC) at both IBP and non-IBP schools.

5.5 Average performance of IBP schools in three selected Grade 12 subjects over a five year period (2014-2018)

The following data analysis segments the achievement of Grade 12 learners in three selected subjects (EFAL, MATH and PHYSC) at either IBP or non-IBP schools. The first analysis represents the combined achievement of Grade 12 learners in the three selected subjects, as observed over a five-year period (2014-2018). This analysis of data has a link to the Research

Questions (RQs) 1 and 3 that have been introduced above (see section 5.1). The analysis is also aligned with the following Unified Theory of Acceptance and Use of Technology (UTAUT) constructs: Performance Expectancy (PE), Effort Expectancy (EEE), and Facilitating Conditions (FC) that have been introduced and discussed in chapters 1 and 2, respectively. The data analysis was also guided by the quasi-experimental nature of this study (see section 4.4.1), wherein IBP and non-IBP schools were compared in terms of achievement of Grade 12 learners over an observed period under study.

5.5.1 Average performance of IBP schools in three selected Grade 12 subjects (EFAL, MATH AND PHYSC) over a five-year period (2014-2018)

Table 28 below represents the consolidated performance of Grade 12 learners from six IBP schools in three selected Grade 12 subjects (EFAL, MATH and PHYSC), as observed from 2014 to 2018. The table indicates that only Albert Moroka SS and Sethjaba-se-Maketse CS on average, and over the five-year period, obtained 50.6% and 49.8% respectively. According to the DBE's (2021:42) scale of achievement for the National Curriculum Statement, this represents an adequate or level 4 achievement (see section 1.2). The other four: Kgauho SS, Kgorathuto SS, Moroka SS and Strydom SS performed at 41.8%, 42% and 41,6%, respectively. The scale of achievement from the National Curriculum Statement (see section 1.2) categorizes the above as moderate or a level 3 achievement (DBE, 2021:42). The above analysis also indicates that over the five-year period, 33.33% of all IBP schools have been, on average, performing at an adequate level (level 4), while 66.66% of all IBP having been performing at a moderate level (level 3) across all three selected subjects. These schools are receiving the IBP live streaming service and support from both FSDoE and UFS ideas lab.

Table 28 performance of selected IBP schools in three selected subjects over five years period.

	Average final percentage across five years period by schools					Total Average
	2014	2015	2016	2017	2018	
Albert Moroka SS	50	51	54	47	51	50,6
Kgauho SS	41	38	44	40	46	41,8
Kgorathuto SS	38	39	46	48	39	42
Moroka Ss	45	49	50	50	47	48,2
Sethjaba-Se-Maketse CS	46	49	50	53	51	49,8
Strydom SS	42	41	39	42	44	41,6

Source: EMIS-FSDOE Grade 12 data

Below is the average performance of the six selected non-IBP schools in three selected Grade 12 subjects, as observed over a five-year period.

5.5.2 Average performance of non-IBP selected schools in three selected subjects (EFAL, MATH and PHYSC) over a five-year period

According to Table 29 below, the average performance of Grade 12 learners from non-IBP schools in three selected Grade 12 subjects (EFAL, MATH and PHYSC) indicate that the four selected schools: Kopanong SS, Lefikeng SS and Vulamasango and Christian Liphoko achieved 46%, 45.8%, 43.8% and 42.8%, respectively, which is categorized by DBE (see section 1.2) as a moderate or level 3 achievement (2021:42). The other two: Leratong SS and Popano SS, both achieved a 38.2%, which falls under an elementary or level 2 achievement category (see also section 1.2). The above analysis also means, over five years, 66.7% of the selected non-IBP schools have been, on average, performing at a moderate level, while another 33.3% at a lower elementary level across all three selected subjects. These schools have no access to the IBP livestreaming service and hence the categorization 'non-IBP'.

Table 29
Average performance of non-IBP schools in selected Grade 12 subjects over a five-year

	Average final percentage across five years period by schools					Total Average
	2014	2015	2016	2017	2018	
Christian Liphoko IS	44	45	38	45	42	42,8
Kopanong SS	41	42	50	50	47	46
Lefikeng SS	44	39	48	46	52	45,8
Leratong SS	39	34	32	45	41	38,2
Popano SS	36	34	39	42	40	38,2
Vulamasango SS	42	45	46	43	43	43,8

Source: EMIS-FSDOE Grade 12 data

Below is a table representing an average performance by six selected IBP schools in English First Additional Language (EFAL) as observed over a five-year period.

5.5.3 Average performance by selected IBP schools in English First Additional Language (EFAL)

Table 30 below represents the average performance of six IBP schools in English First Additional Language (EFAL) as observed from 2014 to 2018. Three schools: Albert Moroka SS, Moroka SS and Sethjaba-se-Maketse CS, achieved 55%, 55% and 54%, respectively. DBE

(2021:42) ratings (see section 1.2) show their performance is on level 4 or a moderate achievement. The other three schools: Kgorathuto SS, Strydom SS and Kgauho SS performed at 46%, 46% and 45%, respectively. Their performance is on level 3 or adequate achievement (see also section 1.2). The above analysis and Table 30 below also mean that 50% of the selected IBP schools have been, on average, performing at a moderate level, while another 50% has been performing at an adequate level in EFAL. They are all receiving the IBP live streaming from FSDoE and the UFS ideas lab.

Table 30
Average performance by selected IBP schools in EFAL from 2014-2018

Subjects	School Names	Average final percentage across five years period by schools by subjects					Total average
		2014	2015	2016	2017	2018	
ENGFA	Albert Moroka SS	56	54	59	53	53	55
	Kgauho SS	44	41	47	48	47	45
	Kgorathuto SS	41	41	50	52	46	46
	Moroka SS	53	53	58	59	54	55
	Sethjaba-se-Maketse CS	53	54	56	57	52	54
	Strydom SS	47	44	45	45	49	46

Source: EMIS-FSDOE Grade 12 data

Below is a table representing the average performance of six selected non-IBP schools in EFAL as observed over five years.

5.5.4 Performance of non-IBP schools in English First Additional Language (EFAL) from 2014-2018

Table 31 below represents the average performance of six non-IBP schools in English First Additional Language (EFAL), as observed from 2014 to 2018. All six schools: Christian Liphoko SS, Kopanong SS, Lefikeng SS, Leratong, Popano SS and Vulamasango, achieved below 50% at 45%, 49%, 48%, 43%, 41% and 45%, respectively and that is equivalent to a level 3 or moderate achievement (see section 1.2). These schools are not receiving live streaming compared to the IBP schools above. Data analysis also means that 100% of the non-IBP schools have been performing at a moderate level (see also section 1.2) in EFAL. These schools are not receiving the IBP live streaming service.

Table 31
Performance of non-IBP: EFAL schools over five years period from 2014-2018

Subjects ENGFA	School Names	Average final percentage across five years period by schools by subjects					Total average
		2014	2015	2016	2017	2018	
	Christian Liphoko SS	46	44	42	48	46	45
	Kopanong SS	47	45	53	53	47	49
	Lefikeng SS	44	39	53	52	54	48
	Leratong SS	44	38	43	48	41	43
	Popano SS	39	39	44	42	42	41
	Vulamasango SS	46	45	47	46	43	45

Source: EMIS-FSDOE Grade 12 data

Below is the average performance by Grade 12 learners from selected IBP and non-IBP schools in Mathematics over five years.

5.5.5 Performance of IBP schools in Mathematics (MATH) over a five-year period from 2014-2018

Table 32 below, indicates the average performance of Grade 12 learners from six selected IBP schools in Mathematics (MATH) from 2014 to 2018. The table indicates that two schools: Albert Moroka SS and Sethjaba-se-Maketse CS, performed at 48% and 47%, respectively. The DBE (2021:42) ratings (see section 1.2) equate this to level 3 or a moderate achievement. The other four schools: Kgorathuto SS, Moroka SS, Strydom SS and Kgauho SS, achieved at 39%, 39%, 37 % and 35%, respectively. This performance is equivalent to level 2 or an elementary achievement (see also section 1.2). The above analysis also means 33.33% of the schools performed at a moderate level in Mathematics in comparison to 66.67% of the schools, who performed at an elementary level.

Table 32
Performance of IBP: Math schools over a five-year period from 2014-2018

Subjects	School Names	Average final percentage across five years period by schools by subjects						Total averag
		2014	2015	2016	2017	2018		
MATH	Albert Moroka SS	47	51	52	46	44		48
	Kgauho SS	31	32	41	30	44		35
	Kgorathuto SS	36	40	41	43	32		39
	Moroka SS	37	41	39	40	39		39
	Sethjaba-Se-Maketse CS	36	44	48	53	52		47

	Strydom SS	37	42	32	38	38		37

Source: EMIS-FSDOE Grade 12 data

Below is the performance of six selected Grade 12 learners from non-IBP schools in Mathematics over the selected five-year period.

5.5.6 Average performance by non-IBP schools in Mathematics (MATH) over a five-year period

Table 33 below, shows the performance of Grade 12 learners from six non-IBP schools in Mathematics (MATH) as observed from 2014 to 2018. Table 31 indicates that only two schools: Lefikeng SS and Vulamasango SS obtained a 43% and 40% performance, respectively. DBE (2021:42) categorize this achievement (see section 1.2) under level 3 or a moderate achievement. The other four schools: Christian Liphoko SS, Kopanong SS, Leratong SS and Popano SS, achieved an average 38%, 37%, 33% and 34 %, respectively. This performance is equivalent to level 2 or an elementary achievement (see section also 1.2). This analysis also means that on average, 33.3% of all the selected non-IBP schools performed at a moderate level, while 66.7% on an elementary level.

Table 33
Average performance by selected IBP schools in Grade 12 Mathematics over a five- year period

Subjects	School Names	Average final percentage across five years period by schools by subjects					Total average
MATH		2014	2015	2016	2017	2018	
	Christian Liphoko SS	38	44	28	43	36	38
	Kopanong SS	32	32	37	39	46	37
	Lefikeng SS	44	44	41	38	49	43
	Leratong SS	37	27	21	38	42	33
	Popano SS	26	29	34	45	39	34
	Vulamasango SS	35	47	41	37	42	40

Source: EMIS-FSDOE Grade 12 data

Below is the data analysis of Grade 12 learners in Physical Sciences at either IBP or non-IBP schools over five years.

5.5.7 Average performance by IBP schools in Physical Sciences (PHYSC) over a five-year period from 2014-2018

Table 34 below, indicates the performance of Grade 12 learners from six IBP schools in Physical Sciences (PHYSC), as observed from 2014 to 2018. Three schools: Albert Moroka SS, Moroka SS and Sethjaba-se-Maketse SS performed at 46%, 41% and 42%, respectively. According to DBE (2021:42), this achievement is an adequate or level 3 achievement (see section 1.2). The other three schools: Kgauho SS, Kgorathuto SS, and Strydom SS obtained an average achievement at 36%, 34% and 34%, respectively. This performance is equivalent to level 2 or an elementary achievement (see also section 1.2). This analysis also means that 50% of the selected IBP schools performed at an adequate level, while the other 50% performed at an elementary level. These schools are part of the cohort that receives the IBP live streaming services provided by FSDoE and the UFS ideas lab.

Table 34 Average performance by Grade 12 learners from selected IBP school in Physical Science over a five-year period

Subjects	School Names	Average final percentage across five years period by schools by subjects					Total average
		2014	2015	2016	2017	2018	
PHSC	Albert Moroka SS	45	47	47	40	52	46
	Kgauho SS	35	30	37	34	45	36
	Kgorathuto SS	28	29	40	42	31	34
	Moroka SS	34	43	44	43	44	41
	Sethjaba-se-Maketse CS	39	42	39	45	46	42
	Strydom SS	35	35	29	37	35	34

Source: EMIS-FSDOE Grade 12 data

Below are the results from data analysis of the performance by Grade 12 learners from selected non-IBP schools over five years.

5.5.8 Performance of non-IBP schools in Physical Science (PHYSC) over a five-year period from 2014-2018

Table 35 below, indicates the performance of Grade 12 learners from six non-IBP schools in Physical Sciences (PHYSC), as observed from 2014 to 2018. Two schools: Kopanong SS and Lefikeng SS performed at an average 43% and 44%, respectively. This type of achievement (see section 1.2) is equivalent to level 3 or moderate achievement (DBE 2021:42). The other

four schools: Christian Liphoko SS, Leratong SS, and Vulamasango SS performed at an average 39%, 33%, 30% and 38%, respectively. This performance (see also section 1.2) is equivalent to level 2 or an elementary achievement (2021:42). This analysis also means that 33.3% of the selected IBP schools performed at an adequate level, while the other 66.7% performed at an elementary level. These schools do not receive the IBP live streaming services provided by FSDoE and the UFS ideas lab.

Table 35
Performance of non-IBP: Physical Science schools over a five-year period from 2014-2018

Subjects	School Names	Average final percentage across five years period by schools by subjects					Total average
		2014	2015	2016	2017	2018	
PHSC	Christian Liphoko SS	42	48	32	37	35	39
	Kopanong SS	37	39	46	45	48	43
	Lefikeng SS	47	34	43	42	51	44
	Leratong SS	31	22	25	43	42	33
	Popano SS	29	22	26	38	36	30
	Vulamasango SS	26	45	44	31	46	38

Source: EMIS-FSDOE Grade 12 data

Besides the above analysis on individual subjects at both IBP and non-IBP selected Grade 12 schools, analysis was extended to a consolidated achievement report on specific attributes that included gender and rating levels.

5.5.9 Average overall performance of all learners, according to gender

According to Table 36 below, out of the total 13,934 learners that formed part of this historical Grade 12 secondary data analysis, there were 7,372 females and 6562 males. With reference to DBE's 1-7 levels of achievement, Table 34 indicates that 16.4 % of the female learners and 13.6% of male learners performed at 0-29% or at a not achieved (see section 1.2) or failed level. It also indicates that 21.4% of female learners and 22.1% male leaners performed at an elementary level (see section 1.2). Table 5.5.9 also indicates that 30.1% of female learners and 30.7% of male learners performed on level 3 or at a moderate achievement (see also section 1.2). Table 34 also indicates that 21.1% of female learners and 21.1% of male learners performed on level 4 or at a moderate achievement (see section 1.2). It also indicates that when it comes to meritorious and outstanding achievements (see also section 1.2), only 1.8% and 0.5% of female learners in comparison to 2.4% and 0.8% of male learners respectively managed to reach such high levels.

This analysis further indicates that the three levels (elementary, moderate and adequate) account for 72,6% of female learners' achievement and 73,8% of male learners' achievement. This also means only 11% of female learners and 12.5% of male learners achieve at a combined substantial (level 5), meritorious (level 6) or outstanding levels (level 7), respectively. The analysis also shows that the difference between the genders is minimal, at less than 3%, across all performance levels.

Table 36
average overall achievement of all learners, according to gender

Categories of achievement based on final marks	Gender				Total	
	Female		Male			
	N	%	N	%	N	%
Not Achieved	1212	16.4	893	13.6	2105	15.1
Elementary Achievement	1576	21.4	1450	22.1	3026	21.7
Moderate Achievement	2222	30.1	2012	30.7	4234	30.4
Adequate Achievement	1552	21.1	1383	21.1	2935	21.1
Substantial Achievement	640	8.7	553	8.4	1193	8.6
Meritorious Achievement	136	1.8	192	2.9	328	2.4
Outstanding achievement	34	0.5	79	1.2	113	0.8
Total	7372	100	6562	100	13934	100

Source: EMIS-FSDOE Grade 12 data

Below is a data analysis on performance by all Grade 12 learners over the five-year period in all three selected subjects (English First Additional Language, Physical Sciences and Mathematics).

5.5.10 Average performance of all learners, according to the selected subjects, using the ratings scale 1-7

Table 37 below indicates that from the three selected subjects (EFAL, MATH and PHYSC), 3.5%, 30.6% and 35.5% of learners, respectively received a level 1, 0-29% or not achieved rating. This analysis indicates a higher percentage for Mathematics and Physical Sciences (30.6% and 35.5%, respectively) whereas in EFAL it is about 4%. The analysis also shows that 20.1%, 24.2% and 24.2% of learners performed at an elementary level in EFAL, Mathematics and Physical Sciences, respectively (see section 1.2). It further shows that for EFAL, MATH and PHYSC, 37.6%, 20.2% and 18.4% of learners performed moderately. The analysis further indicates that in EFAL, MATH and PHYSC, 27.3%, 12.4% and 10.6% of learners performed at an adequate or level 4, respectively. There was also a 9.7%, 6.6% and 6.9% performance at

substantial level of learners in EFAL, MATH and PHYSC, respectively. At a meritorious level (see also section 1.2) and in EFAL, MATH and PHYSC, there was a 1.7%, 3.8% and 2.9% achievement, respectively. Lastly, at an outstanding level and in EFAL, MATH and PHYSC, there was a 0.1%, 2.1% and 1.7% achievement, respectively. When observing from the polar sides there is a 15% not-achieved rating whereas only a 0.8% outstanding rating, which is a wide gap.

Table 37
Average achievement by all learners across all selected three subjects over the five year-period

Categories of achievement based on final marks	Subject (Alpha)						Total	
	ENGFA		MATH		PHSC			
	N	%	N	%	N	%	N	%
Not Achieved	297	3.5	832	30.6	976	35.5	2105	15.1
Elementary Achievement	1703	20.1	658	24.2	665	24.2	3026	21.7
Moderate Achievement	3179	37.6	548	20.2	507	18.4	4234	30.4
Adequate Achievement	2308	27.3	336	12.4	291	10.6	2935	21.1
Substantial Achievement	824	9.7	180	6.6	189	6.9	1193	8.6
Meritorious Achievement	145	1.7	104	3.8	79	2.9	328	2.4
Outstanding Achievement	9	0.1	58	2.1	46	1.7	113	0.8
Total	8465	100	2716	100.0	2753	100.0	13934	100

Source: EMIS-FSDOE Grade 12 data

The analysis shares the distribution of achievement at either IBP or non-IBP schools, using DBE's levels of achievement 1-7 as observed over a five-year period under study.

5.5.11 Average performance of all IBP schools, using the ratings scale 1-7

According to Table 38 below, there are 968 Grade 12 learners across all IBP schools, who obtained at 0-29% or a not-achieved result (see section 1.2), and they are from Kgauho, Kgorathuto and Moroka at 274, 220 and 161 respectively, while Albert Moroka has the lowest at 59 or 6.1%. At elementary level, the analysis shows that Kgauho SS, Kgorathuto SS and Stardom are leading with 364 (25.8%), 302 (21.3%) and 219 (15.5%), respectively. While, on the same elementary level, the other three schools performed as follows: Moroka SS 198 (13.8%), Albert Moroka 179 (12.6%) and Sethjaba-se-Maketse SS (156 (11%). The analysis also shows that at moderate level (50-59%), Moroka, Albert Moroka and Sethjaba-se-Maketse performed as follows: 217 (27.4%), 204 (25.7%) and 186 (23.5%), respectively. At adequate and substantial levels (see also section 1.2), Albert Moroka SS, Moroka SS and Sethjaba-se-Maketse SS achieved at 408 (23.0%), 367 (20.7%) and 323 (18.2%) respectively, followed by Kgauho SS, Kgorathuto SS and Strydom SS at 254 (14.3%) and 238 (13.4%) and 184 (10.4%),

respectively. At meritorious and outstanding levels, Moroka, achieved 71 (31.1%), 11 (16.2%) respectively, followed by Albert Moroka at 62 (27.2%) and 15 (22.1%), respectively. At third place Sethjaba-se-Maketse achieved a 56 (24.6%) and 19 (27.9%), respectively.

Table 38
Average achievement of IBP schools, according to rating scale

Centre name	Level of achievement based on final scores														Total	
	Not		Elementary		Moderate		Adequate		Substantial		Meritorious		Outstanding			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Albert Moroka SS	59	6.1	179	12.6	302	14.4	408	23.0	204	25.7	62	27.2	15	22.1	1229	16.7
Kgautho SS	274	28.3	364	25.8	521	24.9	254	14.3	84	10.6	16	7.0	13	19.1	1526	20.8
Kgorathuto SS	220	22.7	302	21.3	394	18.8	238	13.4	69	8.7	14	6.1	7	10.3	1244	16.9
Moroka SS	161	16.6	196	13.8	261	12.5	367	20.7	217	27.4	71	31.1	11	16.2	1284	17.5
Sethjaba-Se-Maketse CS	94	9.7	156	11.0	275	13.1	323	18.2	186	23.5	56	24.6	19	27.9	1109	15.1
Strydom SS	160	16.6	219	15.5	341	16.3	184	10.4	33	4.2	9	3.9	3	4.4	949	12.9
Total	968	100	1416	100	2094	100	1774	100	793	100	228	100	68	100	7341	100

Source: EMIS-FSDOE Grade 12 data

Below is the data analysis of all IBP schools, according to the DBE rating scale.

5.5.12 Average performance of all non-IBP schools, using the ratings scale 1-7

Table 39 below, indicates that out of 1137 learners from six selected non-IBP schools, who obtained at 0-29% or not achieved (see section 1.2) the top three schools from the highest to the lowest, are: Leratong SS: 496 (43.6%), Lefikeng SS: 211 (18.6%) and Kopanong SS: 133 (11.7%), respectively. The last three are: Popano SS: 172 (15.1%), Christian Liphoko SS: 61 (5.4%) and Vulamasango SS: 64 (5.6%). At elementary and moderate levels of achievement level, the top three are: Leratong SS, Lefikeng SS and Popano SS at 474 (29.4%), 314 (19.5%), and 241 (15%), while the last three are: Kopanong SS, Vulamasango SS and Christian Liphoko SS at 226 (14%), 194 (12%) and 161 (10%), respectively.

Data analysis also shows the following top three non-IBP schools that achieved at moderate level (50-99%): Leratong 508 (23.7%), Lefikeng SS 465 (21.7%) and Kopanong SS: 417 (19.5%), respectively. They are followed by Vulamasango SS: 298 (13.9%), Christian Liphoko SS: 231 (10.8%) and Popano SS 221 (10.3%), respectively. Data analysis also shows the following the first three non-IBP schools that achieved at adequate level (60-69%): Leratong SS: 508 (23.7%), Lefikeng SS: 465 (21.7%) and Kopanong SS: 417 (19.5%), respectively. Vulamasango SS follows them: 152 (13%), Christian Liphoko SS: 109 (9.4%) and Popano SS: 70 (6%).

The top three schools performing at substantial achievement (70-79%) (see also section 1.2) are: Lefikeng 144 (36 %) Kopanong SS: 139 (34.7%), Vulamasango 46 (11.5%) and Vulamasango SS: 46 (11.5%), respectively. The last three are: Leratong SS: 31 (7.8%), Christian Liphoko 27 (6.7%) and Popano SS: 13 (3.3%). At the meritorious achievement level, the top three are: Lefikeng 41 (41%), Kopanong 29 (29%), and Vulamasango 11 (11%), respectively. Popano SS follows them: 9 (9%), Leratong SS: 7 (7%) and Christian Liphoko SS: 3 (3%), respectively. The top three schools performing outstanding achievements are: Lefikeng 28 (62.2%) Leratong 7 (15.6%) and Popano 4 (8.9%), respectively. They are followed by Vulamasango SS: 3 (6.7%), Christian Liphoko SS: 2 (4.4%) and Kopanong SS: 1 (2.2%).

Table 39
Average achievement of non-IBP schools according to rating scale

Centre name	Level of achievement based on final scores														Total	
	Not		Elementary		Moderate		Adequate		Substantial		Meritorious		Outstanding			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Christian Liphoko IS	61	5.4	161	10	231	10.8	109	9.4	27	6.7	3	3	2	4.4	594	9
Kopanong SS	133	11.7	226	14	417	19.5	328	28.3	139	34.7	29	29	1	2.2	1273	19.3
Lefikeng SS	211	18.6	314	19.5	465	21.7	312	26.9	144	36	41	41	28	62.2	1515	23
Leratong SS	496	43.6	474	29.4	508	23.7	190	16.4	31	7.8	7	7	7	15.6	1713	26
Popano SS	172	15.1	241	15	221	10.3	70	6	13	3.3	9	9	4	8.9	730	11.1
Vulamasango SS	64	5.6	194	12	298	13	152	13	46	11.5	11	11	3	6.7	768	11.6

Total	1137	100	1610	100	2140	100	1161	100	400	100	100	100	45	100	6593	100

Source: EMIS-FSDOE Grade 12 data

This study made use of the quasi-experimental design wherein the IBP (treatment) and non-IBP (control) schools are compared, in terms of achievement over a five-year period, and the inferential statistics (see section 4.4) below, further explored the data under study to make sense of the achievement by Grade 12 learners in the Free State Province. The study below covered the inferential statistics part that adopted a two-way between-groups ANOVA.

SECTION B: INFERENTIAL STATISTICS

5.6 Two-way between-groups ANOVA output

For the inferential part of the study, a two-way between-groups analysis of variance (ANOVA) option was adopted (see sections 4.9 and 4.11). This analysis of data has a link to the Research Questions (RQs) 1, 2 and 3 that have been introduced above (see section 5.1). The analysis is also aligned with the following Unified Theory of Acceptance and Use of Technology (UTAUT) constructs: Performance Expectancy (PE), Effort Expectancy (EEE), and Facilitating Conditions (FC) that have been introduced and discussed in chapters 1 and 2, respectively. The choice was informed by many independent variables and different people in the identified groups (Pallant, 2016:271). In this case, the two independent variables: type of school (non-IBP and IBP) and gender (female and male) were tested against the dependent variable, the final mark. Accordingly, the datasets were separated into three selected subjects: English First Additional Language (EFAL), Mathematics (MATH) and Physical Sciences (PHYSC) to ascertain the extent to which the type of school (IBP or non-IBP) or gender (female or male) has on the achievement (final mark) of Grade 12 learners in the Free State Province. The two-way ANOVA works well in situations where multiple independent (categorical) variables are individually tested against a dependent (continuous) variable (2016:266). It also allows for the testing of both the main and interaction effects (2016:266). Although, for example, the one-way ANOVA allows for the comparison of the learners' (combined genders) performance using the final mark, the two-way takes it further and permits comparison between genders (females and males) on individual marks, across the three selected subjects (2016:271). The outputs from the individual subject's datasets were comprised of the descriptive statistics, Levene's Test of

Equality of Error Variance, main effects, interaction effects and plots. The first output was for English First Additional Language (EFAL).

5.6.1. Univariate Analysis of Variance: Subject (Alpha) = English

The first output, as indicated in Table 40, shows how the two independent variables: type of school and gender are represented from the EFAL dataset. In non-IBP schools, 4291 learners sat for the English (EFAL) examinations, while 4174 learners sat for EFAL examinations in IBP schools. In the same EFAL examinations, 4518 female learners sat for examinations, while 3947 male learners sat for the same examinations. In both school types, female learners are more than their male counterparts. Research questions (RQs)1 and 2 address gender differences from the policy and participants' perspectives. Achievement of learners is linked to the research question 3 that seeks to ascertain the impact that the IBP integration has on achievement of Grade 12 learners.

Table 40
Between-Subjects Factorsa

		Value Label	N	%
Type of school	0	Non-IBP	4291	50.7
	1	IBP	4174	49.3
Gender	0	Female	4518	53.4
	1	Male	3947	42.6

Source: SPSS 29.0 a. Subject (Alpha) = English

The next output, as indicated in Table 41, shows the descriptive statistics for the dependent variable, represented by the final mark (achievement level). When comparing the means in EFAL, according to gender in non-IBP, female learners received 45.46 in comparison to male learners, who received 43.55. In IBP schools, female learners had a 50.20 mean score, compared to male counterparts who received 48.56. The total mean average for both genders in non-IBP schools is 44.55, while in IBP schools it is 49.45. When combined (IBP and non-IBP), females have a 47.84 mean score, while the male learners have a 45.97 means score. In both independent variables, female learners had a higher mean score than their male counterparts. To better understand the mean scores, the same dataset was subjected to Levene's Test of Equality of Error Variance.

Descriptive Statistics[a]

Table 41
Descriptive Statisticsa Dependent Variable: Final Percentage

Type of school	Gender	Mean	Std. Deviation	N
Non-IBP	Female	45.46	9.867	2251
	Male	43.55	9.582	2040
	Total	44.55	9.778	4291
IBP	Female	50.20	10.019	2267
	Male	48.56	99.78	1907
	Total	49.45	10.032	4174
Total	Female	47.84	10.220	4518
	Male	45.97	10.090	3947
	Total	46.97	10.202	8465

Source: SPSS 29.0

The third output is the Levene's Test of Equality of Error Variances that tests the null hypothesis that states that the error of variance of the dependent variable (final mark) is equal across groups (independent variables). A test was run on the EFAL dataset, and the output from Table 42 below indicates that the sig. level (p value) is 0.010 or below the 0.05 threshold and therefore significant. This means that the variance of the dependent variable across the groups is not equal (Pallant, 2016:276). The next output is a stringent test between-subjects effect.

Table 42
Levene's Test of Equality of Error Variancesa,b,c

		Levene Statistic	df1	df2	Sig.
Final Percentage	Based on Mean	3.758	3	8461	.010
	Based on Median	3.792	3	8461	.010
	Based on Median and with adjusted df	3.792	3	8457.873	.010
	Based on trimmed mean	3.787	3	8461	.010

Source: SPSS 29.0

The fourth test is the test of the effects of between subjects, and it involves testing data using the *interaction effect* and the *main effect* functions. Table 43 above had a p-value less than the set 0.05 threshold, and this is common in large datasets, including the one for this study. In such cases, it is therefore allowed to set the threshold below 0.05, which was then set at a stringent 0.01 threshold (Pallant, 2016:276). Table 43 has an output for the independent variables: type of school (IBP or non-IBP), gender (female or male).

The output from the *the interaction effect* indicates the possibility of an interaction effect e.g., the influence of the type of schools on the final mark depends on whether you are male or female (Pallant, 2016:276). The type of school *gender* output has a p-value of 0.525and that is more than the 0.05 set threshold value. This means the interaction is insignificant and indicates no significant difference in the effect of the type of school on the final mark for females or males.

Since there is no significant interaction effect, the next interpretation of *the main effect*

indicates that the p-value for the type of schools' independent variable is <.001 and it is a significant main effect, since it is less than the set 0.05 threshold.

Table 43
Tests of Between-Subjects Effectsa Dependent Variable: Final Mark

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	57449.339[b]	3	19149.780	196.763	<.001	.065
Intercept	18558532.324	1	18558532.324	190687.848	<.001	.958
Typeofschool	50013.895	1	50013.895	513.890	<.001	.057
Gender	6638.566	1	6638.566	68.211	<.001	.008
Typeofschool * Gender	39.307	1	39.307	.404	.525	.000
Error	823459.613	8461	97.324			
Total	19555568.000	8465				
Error	880908.953	8464				

Source: SPSS 29.0

a. Subject (Alpha) = English

b. R Squared = .065 (Adjusted R Squared = .065)

The fifth output is represented in the form of a profile plot graph 1 below, which is for the final scores between females and males across the type of school variable (non-IBP and IBP). The plot allows researchers to inspect visually, the extent of the relationship among the variables

under study (Pallant, 2016:278). For the EFAL subject: in non-IBP schools, there is a difference between female (45.5) and male (43.6) learners, and that difference is 1.9. EFAL scores in IBP schools also differ between female (50.2) learners and male (48.6) learners, and they differ by 1.6. The next analysis is on the mathematics subject.

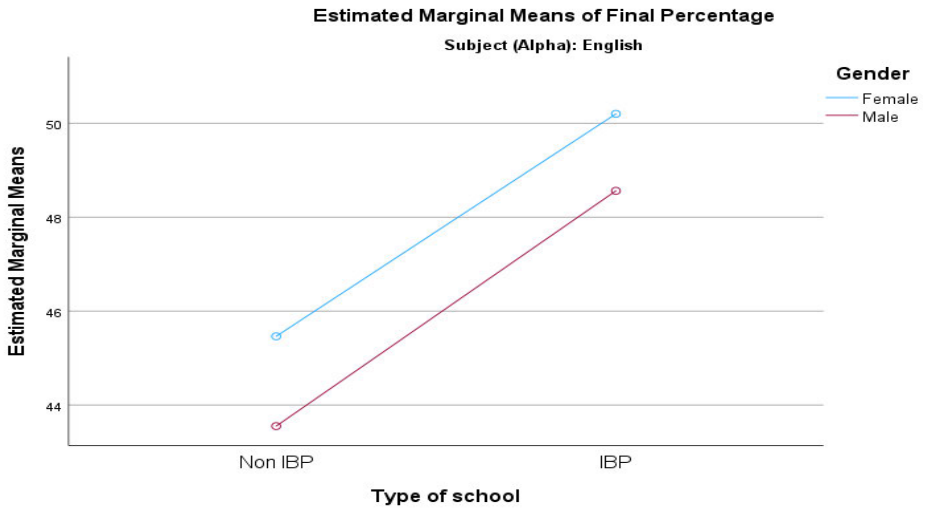

Figure D Profile Plots: EFAL

Source: SPSS 29.0

The following outputs that involve testing the MATH data are also divided into five different steps

5.6.2 Univariate Analysis of Variance: Subject (Alpha) = MATH

The first output is the Univariate Analysis of Variance: Subject (Alpha) = MATH and is represented below in Table 44. It indicates how the two independent variables, type of school and gender are represented from the dataset under study. Dissecting the dataset according to subjects, in non-IBP schools there were 1124 Grade 12 learners who sat for the mathematics examinations, while 1592 Grade 12 learners from IBP schools sat for Mathematics examinations. Furthermore, in the same Mathematics examinations, there were 1402 female learners who sat for examinations, while 1314 male learners sat for the examinations. The type of school and gender have a link to research questions 2 and 3 in the former addresses the variables from the policy level while the latter from the participants points of view. Achievement has a link to research question 3 and seeks to ascertain if the IBP impacts the integration of the technology on teaching and learning.

Table 44
Subject (Alpha) = MATH: Between-Subjects Factorsa

		Value Label	N	%
Type of school	0	Non-IBP	1124	41.4
	1	IBP	1592	58.6
Gender	0	Female	1402	51.6
	1	Male	1314	48.4

Source: SPSS 29.0 a. Subject (Alpha) = MATH

Table 45 shows the second output from the descriptive statistics for the dependent, wherein the variable is represented by the final percentage. When comparing the means in Mathematics, according to gender in non-IBP, Grade 12 female learners received a 33.51 mean score in comparison to male learners who received a 40.30 mean score. In IBP schools, females had a 37.13 mean score, compared to male counterparts who received 45.52. The total mean average for the non-IBP schools is 37.01, while the IBP schools have 40.54. When put together (IBP and non-IBP), females have a 35.73 mean score, while the male learners have a 42.66 mean score.

Table 45
Descriptive Statisticsa Dependent Variable: Final Mark

Type of school	Gender	Mean	Std. Deviation	N
Non-IBP	Female	33.51	15.119	544
	Male	40.30	18.312	580
	Total	37.01	17.173	1124
IBP	Female	37.13	15.099	858
	Male	44.52	18.168	734
	Total	40.54	16.984	1592
TOTAL	Female	35.73	15.204	1402
	Male	42.66	18.346	1314
	Total	39.08	17.148	2716

Source SPSS 29.0 a. Subject (Alpha) = Maths

The third output is the Levene's Test of Equality of Error Variances that tests the null hypothesis that states that the error of variance of the dependent variable (final mark) is equal across groups (independent variables). After running the mathematics dataset, the output in Table 46 below, indicates that the sig. level (p-value) is 0.010 and that is significant, because it is below the set 0.05 threshold. Although the intention is to get a value that is more than the set 0.05 threshold, the output is therefore significant (Pallant, 2026:276). The output indicates that the variance of the dependent variable (final mark), across groups is not equal. The next output is tests between-subjects effects.

Table 46
Levene's Test of Equality of Error Variancesa,b,c

		Levene Static	df1	df2	Sig.
Final Percentage	Based on Mean	20.773	3	2712	<.001
	Based on Median	19.674	3	2712	<.001
	Based on Median with adjusted df	19.674	3	2668.18	<.001
	Based on trimmed Mean		20.525	2712	<.001

Source: SPSS 29.0

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Subject (Alpha) = Maths

b. Dependent variable: Final Percentage

c. Design: Intercept + Type of school + Gender + Type of school * Gender

The fourth test is the test of between-subjects effects, and it involves testing data using the *interaction effect* and the *main effect* functions. This step involves applying and testing data outcomes, using the *interaction effect* and the *main effect* functions. Table 47 represents an output that came after a test was set at a stringent 0.01 threshold (Pallant, 2016:276). The output for the independent variables: type of school (IBP or non-IBP), gender (female or male) starts with an interaction effect and later the main effect follows. The testing of the interaction effect first, is key before the test could proceed to the main effect (Pallant, 2016:277).

The output explores the possibility of *the interaction effect* e.g., the influence of the type of schools on the final mark depends on whether you are male or female (Pallant, 2016:277). The type of school *gender* output has a p-value of 0.643 and that is more than the 0.05 set threshold value. This means the interaction is insignificant and indicates no significant difference in the effect of the type of school on the final mark for females or males.

The next option open for testing is the *the main effect*. It is explored, since there is no significant interaction effect. The next interpretation on the main effect indicates that the p-value for the type of schools' independent variable is <.001 and a significant main effect, since it is less than the set 0.05 threshold. This is also a significant main effect for gender whose p-value is also <.001 and which is less than the set 0.05 threshold. There is a difference in final scores in non-IBP and IBP schools and there is a difference in the final scores for females and males. The next test produced an output in profile plots.

Table 47 Tests of Between-Subjects Effectsa Dependent Variable: Final Mark

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	42725.722[b]	3	14241.907	51.116	<.001	.054
Intercept	3968508.350	1	3968508.350	14243.554	<.001	.840
Typeofschool	10117.185	1	10117.185	36.312	<.001	.013
Gender	32990.433	1	32990.433	118.407	<.001	.042
Typeofschool * Gender	59.823	1	59.823	.215	.643	.000
Error	755611.619	2712	278.618			
Total	4946473.000	2716				
Error	798337.341	2715				

Source: SPSS 29.0

a. Subject (Alpha) = Maths

b. R Squared = .054 (Adjusted R Squared = .052)

The profile plot 2 output below represents the final scores between females and males across the two types of schools. The plot is important in that it allows researchers to inspect visually the extent of the relationship among the variables under study (Pallant, 2016:278). For the Maths subject: in non-IBP schools, there is a difference between female (33.51) and male (40.30) learners, and that difference is 6.8. Maths scores in IBP schools also differ between

female (37.13) learners and male (44.52) learners, and they differ by 7.4. The next analysis is on the physics dataset.

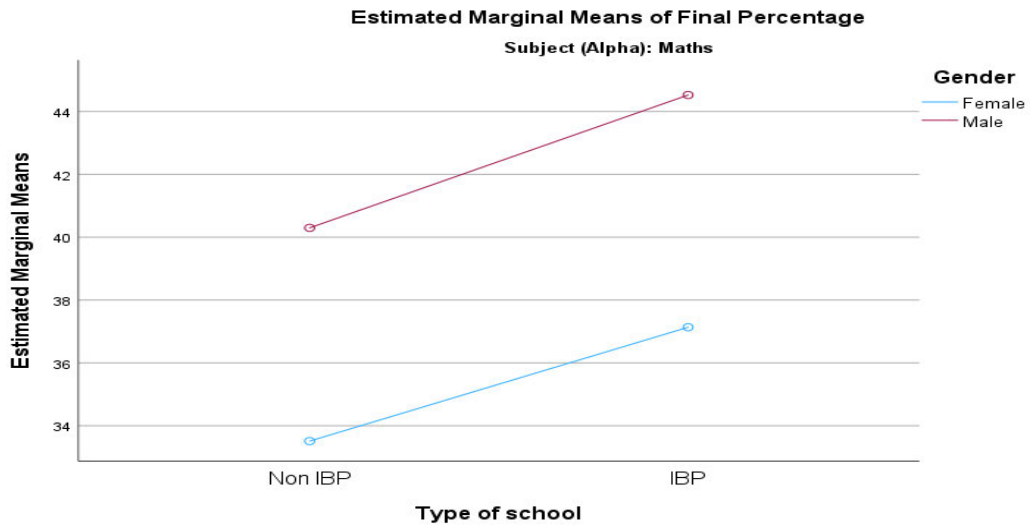

Figure E Profile Plots: MATH

Source: SPSS 29.0

5.6.3 Univariate Analysis of Variance: Subject (Alpha)=PHYSC

Table 48 indicates how the two independent variables, namely type of school and gender, are represented from the dataset under study. Dissecting the dataset according to subjects, in non-IBP schools, there are 1178 learners who sat for the Physical Sciences examinations, while 1575 learners from IBP schools sat for Physical Sciences examinations. When it comes to the same Physical Sciences examinations, there were 1452 Grade 12 female learners, who sat for examinations, while 1301 Grade 12 male learners sat for the same examinations. The type of school and gender variable are linked to the research questions 1 and 3. The achievement dependent variable has a link to the research question 3 in that it assists to determine the impact that the IBP has on Grade 12 learners across the Free State Province.

Table 48
Subject (Alpha) = Physics Between-Subjects Factorsa

		Value Label	N	%
Type of school	0	Non-IBP	1178	42.8
	1	IBP	1575	57.2

Gender	0	Female	1452	52.7
	1	Male	1301	47.3

Source: SPSS 29.0 a. Subject (Alpha) =PHYSC

5.6.3.2 Descriptive statistics dependent variable: final mark

Table 49 shows the descriptive statistics for the dependent where the variable is represented by the final percentage. When comparing the means in Physical Sciences (PHYSC) for gender in non-IBP, Grade 12 female learners received 32.91 in comparison to Grade 12 male learners, who received 38.25. In IBP schools, Grade 12 female learners had a 36.41 mean score in comparison to their Grade 12 male counterparts, who received 42.44 score. The total mean average for the IBP schools is 35.53, while the IBP schools are 39.18. When put together (IBP and non-IBP), females have a 34.96 mean score, while the male learners have a 40.58 means score. The next analysis is Levene's Test of Equality of Error Variances.

Table 49
Descriptive Statistics a Dependent Variable: Final Percentage

Type of school	Gender	Mean	Std. Deviation	N
Non-IBP	Female	32.91	15.179	601
	Male	38.25	18.532	577
	Total	35.53	17.107	1178
IBP	Female	36.41	14.341	851
	Male	42.44	16.987	724
	Total	39.18	15.895	1575
TOTAL	Female	34.96	14.790	1452
	Male	40.58	17.804	1301
	Total	37.62	16.521	2753

Source: SPSS 29.0 a. Subject (Alpha) = Physics

Levene's Test of Equality of Error Variances' a,b,c outcome (see Table 50 below) produced an outcome displayed below in Table 48 below and whose sig. level (p-value) is <.001 and that is significant, because it is below the set 0.05 threshold. The intention is to get a value that is more than 0.05 and therefore the output is not significant (Pallant, 2026:276). This output indicates that the variance of the dependent variable (final mark), across groups is not equal. The next output is tests between-subjects effects.

Table 50
Levene's Test of Equality of Error Variancesa,b,c

		Levene Statistic	df1	df2	Sig.
Final Percentage	Based on Mean	21.224	3	2749	<.001
	Based on Median	18.807	3	2749	<.001
	Based on Median and with adjusted df	18.807	3	2669.561	<.001
	Based on trimmed mean	20.219	3	2749	<.001

Source: SPSS 29.0
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Subject (Alpha) = Physics
b. Dependent variable: Final Percentage
c. Design: Intercept + Typeofschool + Gender + Typeofschool * Gender

The tests of between-subjects effects involve testing data using the *interaction effect* and the *main effect* functions. The produced output from the tests between subjects is shown in Table 50 below with the interaction addressed first, followed by the main effect. The threshold is set at a stringent 0.01 threshold, due to the bigger dataset that this study is dealing with (Pallant, 2016:276). Table 51 has an output for the independent variables: type of school (IBP or non-IBP), gender (female or male) and a combination of type of school and gender.

The application of *the interaction effect* output in this study is important to ascertain the possibility of an interaction effect e.g., the influence of the type of schools on the final mark depends on whether you are male or female (Pallant, 2016:271). The *type of school*gender output has a p-value of 0.581 and that is more than the 0.01 set threshold value. This means the interaction is not significant and it indicates that there is no significant difference in the effect of the type of school on the final mark for females or males.

The next option after the above is the *the main effect* that was explored since there is no significant interaction effect. The next interpretation on the main effect indicates that the p-value for the type of schools' independent variable is <.001 and it is a significant main effect, since it is less than the set 0.05 threshold. There is also a significant main effect for gender whose p-value is also <.001 and less than the set 0.05 threshold. There is a difference in final scores in non-IBP and IBP schools and there is a difference in the final scores for females and males. The next test produced an output in profile plots.

Table 51
Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	31650.117[b]	3	10550.039	40.308	<.001	.042
Intercept	3780315.594	1	3780315.594	14443.346	<.001	.840
Typeofschool	9937.126	1	9937.126	37.966	<.001	.014
Gender	21734.166	1	21734.166	83.039	<.001	.029
Typeofschool * Gender	79.789	1	79.789	.305	.581	.000
Error	719506.935	2749	261.734			
Total	4647240.000	2753				
Error	751157.052	2752				

Source: SPSS 29.0

a. Subject (Alpha) = PHYSC

b. R Squared = .042 (Adjusted R Squared = .041)

The output profile plot 3 below, is for the final scores between female and male Grade 12 learners across the two types of schools. The plot is important in that it gives researchers an opportunity to inspect visually the extent of the relationship among the variables under study (Pallant, 2016:278). For the Physical Sciences output: in non-IBP schools, there is a difference between Grade 12 female learners (32.91) and their male counterparts (38.25) learners, and that the difference is 5.4. PHYSC scores of Grades 12 learners from IBP schools also show some differences between Grade 12 female (36.41) learners and their male counterparts (42.44) learners, and they differ by 8.0.

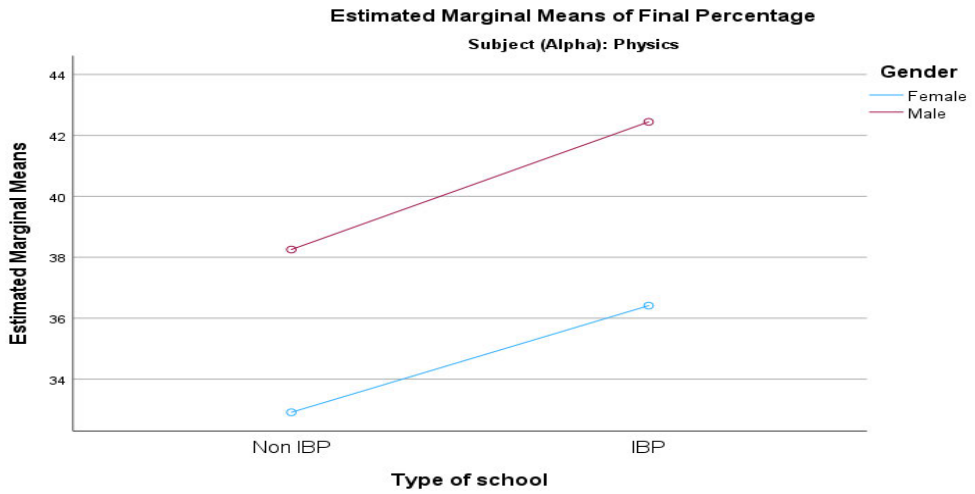

Figure F Profile Plots: PHYSC

Source: SPSS 29.0

The responses from the qualitative part of the study is extensively addressed in the next sub-section with triangulation further down.

5.7 Responses to research questions: qualitative part

Data analysis from the qualitative part has led to the emergence of themes and sub-themes that are linked to the RQ 1 and specific constructs from the selected UTAUT theoretical framework (see section 2.10). As discussed in chapter 4 (see section 4.9), the qualitative part of the study

was guided by the semi-structured interviews with the interview guide (see annexure section 9.15) leading the interaction with the different participants. It was from these interactions with different participants (see also chapter 4) that themes and sub-themes emerged (see Table 52 below). The presentation of the analysed data is aligned to specific Research Questions (RQs) that were listed in the introduction in section 5.1 above, and the relevant Unified Theory of Access and Use of Technology (UTAUT) theoretical framework's constructs and moderators that are discussed in section 2.10. Below is data presentation, linked to RQ 1 and corresponding UTAUT constructs and moderators.

5.7.1 Responses linked to Research Question (RQ) 1

Data analysis from the participants' responses to questions, relating to the legal prescripts that support the introduction of the Internet Broadcasting Project (IBP) in selected schools across the Free State Province, led to the emergence of the following theme: strategic intent to introduce IBP. During the interactions with participants, they referred to the introduction of the IBP as a strategic move that relies and is guided by specific legal policy prescripts. This strategic intent theme has several sub-themes that included: National Intervention Strategy, Provincial Strategy on Learner Attainment (PSLA), Promotion Policy, collaborative effort, and the quintile ranking system (see sections 1.1, 1.2 and 3.2). The theme and the sub-themes are linked to the following Unified Theory of Acceptance and Use of Technology (UTAUT) constructs that are also listed in Table 52 below: PE, EE, SI, FC, moderated by age, gender, experience and voluntariness of use (see also section 2.10).

Table 52
alignment of Research Question 1 (RQ1) with theme, sub-themes and UTAUT constructs

What are the legal and legislative frameworks that support the creation and integration of IBPs at the Grade 12 level?		
Theme	**Sub-theme**	**UTAUT constructs**

Strategic intent to introduce IBP	National Intervention Strategy Provincial Strategy on Learner Attainment (PSLA) Collaborative effort (FSDoE and UFS ideas lab) Promotion Policy Quintile ranking system	PE, EE, SI, FC, moderated by age, gender, experience and voluntariness of use

The first theme to emerge under the research question 1, focuses on the strategic intent to initiate IBP service. From a strategic point of view, the participants shared their perceptions on the reasons behind the establishment of IBP services. There is a general understanding by participants of the strategic intent that led to the collaboration between the Free State Department of Education (FSDoE) and the University of the Free State (UFS) Ideas lab. They appreciated the impact that the IBP has made on the performance of Grade 12 learners in the Free State Province. Participant **PP24** said:

"I was not part of the signing of the contract or an agreement [between FSDoE and UFS ideas lab] …IBP started after it was identified that teachers were experiencing some content gaps and then then the idea of a broadcast was coined. [as time went by], it has now become more of recordings and less of a live broadcast…we were told it's part of our responsibility to also support that program…the initial thinking was most probably twofold. The [first] one would be to have something out there that can help learners perform at higher level, yes and secondly, another reason was for teachers to be upskilled to get some support as well, in terms of the personal development by integrating technology in their teaching activities."

The above sentiments represent the strategic decisions that the FSDoE, through its provincial strategic plan, the PSLA, adopted after they acknowledged that something had to be done to improve the achievement of Grade 12 learners in the Free State Province. The achievement of Grade 12 learners stands out as the main objective that is aligned to both the National Intervention Strategy and the Provincial Strategy on Learner Attainment (PSLA) that were discussed in detail in sections 1.1 and 1.2. For an improvement in the achievement levels of Grade 12 learners in the Free State Province to become a reality, the promotion policy (see

section 1.2) plays a central role in that it serves as a tool to measure the extent to which the achievement of Grade 12 learners happens over time. The introduction of the IBP is further informed by the quintile ranking policy that has also been discussed in detail in section 1.2 and whose aims are to ensure that the under-resourced public high schools were provided with technologies that could be integrated into teaching and learning. Although all the above interventions, strategies and policies are applicable at Free State provincial level, they have a direct impact at national level, since the examinations that Grade 12 write at the end of the year, are monitored and administered as part of the National Senior Certificate (NSC) examinations.

Participants also recognised that there was a need to eliminate the inequalities amongst the schools and the quintile ranking system (section 1.2) was identified as a tool to address such imbalances and the IBP is seen as a suitable intervention tool. The quintile system categorizes schools into non-fee (1-3) and fee paying (4-5) and some of the non-fee-paying schools are IBP beneficiaries. Participant **PP28** confirmed that:

"The IBP implementation was initially focused on non-performing schools throughout the province, your quintiles one, two and three… There are 83 centers, it has been like that since 2011. We're not participating in the identification of such schools."

The above sentiments indicate that the intention of the collaboration between the FSDoE and the UFS ideas lab (see section 1.1), that has been in existence over 13 years, was to uplift and improve performance of Grade 12 learners, who come from 83 non-fee paying or quintile levels 1-3 schools across the Free State Province (see also section 3.1). In a study in South Africa by Ogbonnaya (2019:108), the findings indicate that there is neither limited proof nor a clear relationship between the quintile ranking of the schools and performance in examinations (see also sections 1.1 and 1.4). There was also no evidence between quintile ranking of the schools and the achievement, based on specific parts of the subjects or cognitive levels, but the majority of the consulted 108 studies, concentrated only on overall achievement scores of the learners (Ogbonnaya, 2019:108). This suggests the need to understand the extent to which collaborations that support the integration of technologies have on the achievement of learners. Quintile 1-3 learners' poor performance at Grade 12 often results in a higher dropout rate at tertiary institutions and at times it forces tertiary institutions to introduce extended programmes to accommodate those leaners who obtained average marks at Grade 12 (Mpofu, 2015 in Ogbonnaya, 2019:107). Hence, the need for this study to establish if the strategies adopted by

the FSDoE assist to make sense of the impact that IBP has on the achievement of Grade 12 learners in the Free State Province.

There are international studies that have revealed marked differences in the socioeconomic standards between rural and urban schools and this has an impact on the academic achievement of Grade 12 learners in both Mathematics and Physical Sciences (Saiduddin, 2003: 22, Adell, 2002: 91 in Ramohapi et al., 2015:445). Accordingly, this strategy focused on underprivileged schools, wherein subjects like Mathematics and Physical Sciences produced low results (see also section 1.2). The role played by the policy on the promotion of learners is also linked to the achievement levels experienced across the Free State Province.

The sub-theme (see Table 52) promotion and adjustment policy changes (see section 1.1), including the adjustment of Grade 12 marks across all subjects are, together with the IBP, cited as having positively impacted on achievement of Grade 12 learners in the Free State Province. Such adjustments have also, favoured many learners who would not have passed if the pass rules were not relaxed and thus accommodating those learners who perform at lower levels. For example, one participant expanded on how such changes in the promotion policy produced a national impact.

PP22 confirmed that:

"From 2017, when I started…, the IBP was already there, the analysis of English from 2017 to 2018, to 2019 years, in the districts, yes, on average, marks rose, the pass percentage rose, the number of distinctions rose every year. I know there was an improvement…for English first additional language (EFAL), the pass mark is 30%. For English home language schools, the pass mark is 40%. If they don't pass, they, they fail everything. It's what we call a sine qua non it Latin for, without English, you can't pass. So, English language is ultra-critical and yet, it is one of the least tackled topics on IBP."

According to the promotion of Grade 12 learners' policy, 40% pass in three subjects, including one official home language and 30% in three other subjects offer a guarantee to receiving a National Senior Certificate (NSC) (DBE, 2021). At Grade 12, there has been an improvement in both the pass rate and number of learners passing and many obtaining quality "Bachelor-level" pass marks (DBE 2019:9). The adjustment of pass requirements that have been lowered across all the Grade 12 subjects seem to have contributed to many learners exiting the FET phase with minimum pass levels. Although the strategy was to make it possible for Grade 12 learners to

achieve, the adjusted promotion and adjustment policies have been welcomed with mixed feelings and below is another view shared to confirm the above.

Participant **PP24** added:

"…in the Free State when it comes to Physical Sciences, we are around 83% average pass…it's impossible to get 100% and with Umalusi coming in, changing marks to be in line with your normal curve…to get the same curve, once you reach 83% it's difficult to get to 90% …Last year physics went down in the Free State by, think 8% or so. But if you compare that with the rest of the country where it went down by 15%, our drop is still less than the rest of the country."

The above sentiments (see also section 1.2) indicate that there is a perception that passing Grade 12 is subjected to many policies that sometimes are regarded as have a negative impact on achievement in general. The adjustment of pass requirements, for example, have been cited as not only increasing the number of passes, by compromising on the quality of passes at Grade 12 level. Below are the implications that are associated with the UTAUT theoretical framework when it comes to the above theme.

The Facilitating Conditions (FC) (see section 2.10) is one of the relevant UTAUT constructs that formed part of this theme in that, the FSDoE, together with the UFS ideas lab represent the organizational and technical structures that collaborated to support the implementation of the Internet Broadcasting Project (IBP) (Chatti & Hadoussa, 2021). This strategic move that took place at highest decision-making levels between the two institutions (see section 9: part of the tender agreement) was aimed at mitigating the high failure rate of Grade 12 learners and created a platform that supported the achievement of Grade 12 learners across the Free State Province. Facilitating Conditions (FC) acted as a change agent whose influence positively led to the acceptance and use of the IBP technology within the education sphere (Chatti & Hadoussa, 2021). In addition to the FC, the selected IBP as part of the strategy had to meet the PE, EE and SI constructs to assist in achieving the stated objectives that sought to ascertain the impact that the integration of the IBP has on the achievement of Grade 12 learners in the Free State Province. For FC to thrive, the signed agreement meant that the approved IBP technology had to meet all set criteria that included performing according to expectations, easy to use, produce the desired outcomes and thus leading to the achievement of Grade 12 learners across the Free State Province. Although the promotion and quality assurance policies were cited above as either favouring the pass rate or in some subjects serving as stumbling blocks, the general

sentiments are that there was a general increase in number of Grade 12 learners who passed Matric at the end of each year across the Free State Province. The next sub-section deals with the improvement in performance over the years, including the five years (2014-2018) under study and its association with the developed strategy.

The sub-theme (see Table 52) on improved performance aligned to the strategic shift, emerged from the engagement with different participants who, from policy and strategic level, felt the integration of the IBP and its success would be gauged through full application of the promotion of Grade 12 learners' policy that uses levels to determine the quality of the passes (see section 1.2). In relation to this study, the sub-theme deals with the extent to which the performance of Grade 12 learners happened as observed over a five-year period. The relevant UTAUT constructs linked to this question (see also section 2.10) are PE, EE, SI, FC. DBE (2018) uses learners' average marks and overall pass marks as a barometer to measure levels of performance (Legotlo et al., 2002:113, DBE, 2018, Hunt et al., 2011, Makgato & Mji, 2006, Sasman, 2011 in Zondo et al., 2021:2). Participants were all in agreement that the Free State Province's Grade 12 learners' performance, because of the introduction of the IBP, made a big difference and this was always linked to the Provincial Strategy on Learner Attainment (PSLA) and its national equivalent, the National Intervention Strategy.
According to Participant **PP22: "***...you know every province wants to be first and currently Free State is the number one. We're going to push for numbers, we are trying to get the candidates to get good results. If we get good results, the province gets the spotlight, we are pleased. But that's not the goal, the goal is to produce educated children."*

The above sentiments indicate that the Free State Department of Education (FSDoE) continues to leave a national footprint in terms of pass rate and occupies a leading position in comparison to the other eight provincial education departments. For example, during the 2017 National Matric results announcement, the Minister of Basic Education (DBE), Angie Motshekga, remarked that the Free State Province had two out of five districts in the National top ten (SAnews 2018). On average, the class of 2017 achieved a national pass rate of 75.1%, which was better than the 2016 National pass rate of 72.5% (SAnews 2018). The above assertions affirm that the emphasis by DBE has always been on using the raw marks to gauge Grade 12 learners' performance. The improved Grade 12 pass rate across the Free State Province was, according to all participants from both IBP and non-IBP schools, attributed to the introduction of the IBP at Grade 12 level. Participant **PP27** agreed by saying: "*Yeah, you know, after the*

introduction of IBP, performance increased tremendously…the majority of our learners [from IBP and non-IBP] are in the bracket of 40 to 49 (%), yes. Then you will have those in the 50 to 59 (%) and distinctions are not many…and I believe, as you are even aware, we have been [the Free State Province] number one for so many years and, you know, I also attribute that to the introduction of IBP."

The above views were corroborated by most participants, who always referred to the Grade 12 promotion and adjustment policy (see section 1.2) as the relevant document that spells out how learners' levels of performance should be interpreted. There was also a general agreement that most of the Grade 12 learners were achieving 40 to 49% or just above the 50% pass mark in almost all the Grade 12 subjects and according to the DBE, such performance was either moderate or adequate (see also section 1.2). In a Free State Department of Education (FSDoE) Facebook post (2024/07/09) by the newly elected MEC for education in the Free State Province, she made the following assurances: *"People of the Free State, be assured that our FET machinery [high school operation], is well oiled. We will maintain our number 1 position, but our focus now is on QUALITY results. That is what gives us sleepless nights. We want more bachelor and diploma passes."*

As the political head in the Free State Department of Education (FSDoE) and a Member of the Executive Committee (MEC), Dr Maboya (2024) agrees with participants that performance in terms of numbers was not alignment with quality of passes and promised that, at the strategic level, they were going to turn the situation around. Although the achievements were noticeable at both IBP and non-IBP schools, the former (IBP), on average, were performing better than the latter (non-IBP). Although pass marks seem to be the determining factor as seen in the quantitative data (see section 5.5) and the views shared through qualitative data, unfortunately, such an approach is not always a true reflection of the performance of Grade 12 learners, due to other factors that have an impact the whole examination process for example, how the examination items measure learners' abilities with outmost precision (Embretson & Reise, 2000, Geremew, 2014 in Zondo et al., 2021:2). The link between achievement and the National Senior Certificate (NSC) was mentioned quite often by participants as the main indicator for success at Grade 12 level. Hence, the need to seek relevant legal prescripts that have an impact on the achievement of Grade 12 learners in the Free State Province. In a study by Hillmayr et al. (2017), the results revealed that, despite clear policies on promotion of Grade 12 learners and the curriculum' (CAPS) support for the integration of technology in teaching and learning,

there are instances wherein the use of educational technologies in teaching and learning produced moderate impact on achievement across all learning areas, including languages, Biology, Physics and Mathematics and across all school grades (Hochberg et al., 2020:303). Although policies support the role of educational technologies in teaching and learning, thus assumptions should not be made about their blanket influence across all disciplines, since there are many factors at play (see section 1) that may still need to be tested (Hochberg et al., 2020:303). Below are the participants' responses that are linked to the Research Question (RQ) 2.

5.7.2 Responses linked to Research Question (RQ) 2

Changes in the 21st century knowledge economy continue to transform the teaching and learning landscape with teachers and learners expected to place technology integration at the centre of teaching and learning. (Yurtseven Avci et al., 2020:160 and Chatti & Hadoussa, 2021:6993). Consequently, there is a need to seek teachers and learners' views (see sections1.1, 1.2, 1,4 and 3.2) on the impact that such technologies, including the IBP have on the achievement of Grade 12 learners the Free State Province.

Participants were asked to share their views on their daily interaction (IBP) or its lack thereof (non-IBP) with the IBP during teaching and learning. Since the learners were not directly involved, the participants had to share their experiences on how learners in their respective Grade 12 classes respond to the integration of IBP in teaching and learning (see sections 1.3, 1.4 and 3.5). The data analysis led to the emergence of the themes and sub-themes listed in Table 53 that are further aligned to the study's UTAUT theoretical framework (see also chapter 2).

Table 53
alignment of the research question 2 (RQ1) with theme, sub-themes and UTAUT constructs

1. What are the experiences of learners and teachers on the provision of IBP intervention programme for grade 12 learners in the Free State?		
Themes	**Sub-themes**	**UTAUT constructs**
Blurred lines between IBP and non-IBP schools	• Strong bonds between neighbouring IBP and non-IBP • Thin line between live streaming and video recordings	PE, EE, SI, FC, moderated by age, gender, experience and voluntariness of use

IBP integration during lesson preparations	• Learners as active participants • Targeting specific IBP topics	SI, FC, moderated by experience and voluntariness of use
Teachers accommodating needs of Generation Z	• Teachers embracing Generation Z • Teachers' confidence impacts acceptance and use of IBP by Generation Z • Teachers' continuous guidance of Generation Z • Generation Z selective behaviour	PE, EE, SI, FC, moderated by experience and voluntariness of use
Performance of IBP and non-IBP schools over the years	• Sharing statistics on learners' performance • Subject specific improvements (EFAL, MATH and PHYSC) • Low to medium improvement (EFAL, MATH and PHYSC) • Year-on year fluctuations across all subjects • Improvement does not cut across	SI, FC, moderated by age, experience and voluntariness of use

The first theme (see Table 53) that emerged, highlighted the existence of the blurred lines between IBP and non-IBP schools. Participants shared their views on the presence of a thin line between the schools that were identified as beneficiaries from the IBP live streaming service (IBP) and those that were not (non-IBP) (see sections 1.1 and 3.2). There are identifiable experiences and perceptions between the two groups. Learners who access educational videos, for example from the Internet on their mobile phones, displayed higher learning achievement, compared to those exposed to traditional teaching methods (Hochberg et al., 2020:303). The above sentiments are also aligned to the purpose of this study, which sought to understand the impact that the IBP has on those schools that are exposed to the IBP live streaming, in comparison to those that do not. The identified sub-themes include the strong bonds, and a thin line between live streaming and IBP video recordings (see section 1.1). The relevant UTAUT constructs that are aligned to the identified theme and sub-themes, include PE, EE, SI, FC, moderated by age, gender, experience and voluntariness of use (see section 3.10). The first sub-

theme that emerged from the interaction with different participants deals with the presence of strong bonds between two types of schools under study (IBP and non-IBP).

Another sub-theme that emerged was the existence of strong bonds between the neighbouring IBP and non-IBP schools. The participants gave a true picture in relation to the presence (IBP) or absence (non-IBP) of the IBP live streaming in their schools. They highlighted that even though the Department (FSDoE) and the UFS ideas lab have solid categorization of schools into IBP and non-IBP, there are porous or dotted lines that make the categorization difficult to identify, due to the existential culture that is historical amongst the schools (IBP and non-IBP). Such a culture was made up of strong "neighbourly" bonds, due to strong historical relations between local schools. As neighboring schools, both IBP and non-IBP, find it easier to interact and exchange ideas, knowledge, tools and equipment and the introduction of the IBP in selected schools has not stopped this practice from taking place. Grade 12 teachers from either side (IBP and non-IBP) agreed that it was an acceptable practice to share best practices as neighbouring schools, irrespective of the categorization, but there is still no proof of the extent to which such an exchange between the IBP and non-IBP is taking place. One participant **PP29** highlighted the following: *"…and what also happens, I know you need to be aware of this, although we had several schools, so called IBP schools, there are instances where neighboring schools that are not IBP schools, yes, borrowed materials from the IBP schools. In other words, they got the broadcasts and took them to their schools. So, I'm not sure how many schools made use of the material that was online."*

The lack of fixation with the contents of the legal documents (see section 9: part of the tender document) that led to the collaboration between the FSDoE and UFS ideas lab, opened opportunities for both learners and teachers from either IBP or non-IBP schools (no data to back up the number of such schools), to make use of the technology to improve the achievement of Grade 12 learners in the Free State Province. Participant **PP28** shared the following to back the above-mentioned claim:

"I met this learner from non-IBP school], during one of the well-done functions hosted by FSDoE, she was nationally recognized… I said yes, I'm [XXXX] from IBP. She said, oh, my teacher gets IBP videos from our neighbouring IBP school, our school is not IBP. That told me we have IBP center, yeah, which feeds to the neighboring schools…the IBP school may not be using the live streaming frequently, but they are feeding the neighbouring schools. Unfortunately, we don't have any statistics of how many neighboring schools and how often

they are making use of the shared IBP resources. That's why I propose the use of the Learning Management System (LMS), that will be able to tell the situation at both host and neighbouring schools…through LMS we will have a better understanding in terms of the impact livestreaming has on individual schools."

The above described how this practice takes place in some schools (IBP and non-IBP) and how the established relationships would sometimes lead to the exchange of these technologies (IBP) and thus creating dotted or thin lines between IBP and non-IBP schools. The following sub-theme expands on the shared ideas. The next sub-theme tackles the identified thin line between the two types of schools (IBP and non-IBP).

It also emerged from the following sub-theme (see Table 53) that there was a thin line between the IBP live streaming and video recordings. During the interaction with participants from all levels, it emerged that the IBP schools were not compelled by rules to use either the IBP live streaming or the IBP video recordings. They cited the flexibility and lack of compelling rules to engage one of the tools and this, despite high costs of the IBP infrastructure, the integration process rests with individual teachers or schools (see also section 3.2). Participant **PP18** confirmed the above assertions: *"We make use of IBP live streaming and sometimes it is IBP recorded videos…yes [we have timetable] …the school does accommodate the IBP live streaming…even if I am at home, I usually switch on my data, go to YouTube and watch the IBP recorded videos that I have downloaded on my phone [I do this] after teaching, I can say oh, this is how he the topic is presented or should be approached and then I would go back to my classes [with confidence to teach]."*

The above sentiments were shared by participants from both school types (IBP and non-IBP), who seem to follow the multiple access points to integrate the technology in their respective subject areas (see sections 3.2 and 3.3). All the participants agreed that the technology has made a difference in the way they were presenting the different topics and what they shared and liked is the flexibility that the IBP gives them and that they are able to access it 24/7/365, whenever time allows. Participant **PP6** added**:** *"One thing I like about IBP even if you were in not class and you did not see the live streaming after some time, yeah. and we're able to go and download recordings, and I can later present that lesson to my learners for two, three hours or during the afterschool classes, I would ask learners to just watch the lessons…they [learners] become interested."*

What also confirms the presence the thin or dotted lines when it comes to accessing IBP technology by different teachers, is the free movement of teachers from one school type to the next and thus taking their experience along or being exposed to the new IBP experience. The presence of relaxed rules also means the teachers who move from one (IBP) school to the next (non-IBP), are free to make use of the IBP recordings without restrictions. Participant **PP1** concluded: *"Sometimes it happened [in her previous school] that I was busy at the time it [IBP] was shown live, I would then at a later stage, go back and watch the video recordings. I rely on my previous schools' video recordings [has changed schools]. It saves time. From where the IBP machine is stored, you can move it around. I am new at this school I think theirs is also able to move around."*

The attitude of the teachers and their strong beliefs on the IBP, as confirmed above, play a role when it comes to the times that it takes for the teachers to integrate IBP in their respective Grade 12 teaching and learning activities. The introduction of technology, in a teaching and learning sphere, including the IBP, is directly influenced by the attitude that teachers and learners have towards it and hence its association with the Social Influence (SI) construct from the UTAUT theoretical framework (see chapter 2) (Chatti & Hadoussa, 2021:6997). Most studies (Venkatesh et al., 2003) are in support of SI as having a significant impact on how technologies are accepted and used (2021:6997). Below is a sub-theme on the integration of the IBP during lesson preparations.

The second theme (see Table 53) focused on the IBP integration during lesson preparations. When it comes to specific classroom activities at both IBP and non-IBP schools, participants shared views on its impact or lack thereof in their daily lesson preparations in their respective Grade 12 classes. The participants responded to the question on infusing IBP live streaming, video recordings or traditional ways, during lesson preparation. Although those with exposure have confirmed that they integrate technology, the extent to which such integration takes place, differs from teacher to teacher, school to school and many overt and covert factors at play. Participant **PP4** argued: *"Yes. For lesson preparations it's good. Normally I first consult the diagnostic reports as part of lesson preparation and use IBP. Before teaching each topic, I refer to the IBP…and then for my kids, after teaching the topic I often introduce them to the IBP."*

Participants also shared that besides IBP live streaming or IBP videos that form part of their daily preparations, they sometimes go an extra mile and consult other sources on the Internet to supplement and form part of the teaching and learning activities. Participant **PP7** confirmed: *"For lesson preparations, I do include IBP videos, I also google a lot, and there is this website that I trust, yes, I then share information with my learners via their smartphones or send them soft copies of some of the books. I sometimes come across, for example summaries on the Internet that form part of my planning. Generally, in terms of a computer use, watching IBP videos for lesson preparation, I do that a lot."*

Many studies (Borko et al., 2010; Desimone, 2009, Garet et al., 2001, Patton et al.,2015 and Penuel et al., 2007) consider active participation by teachers as an effective part of the technology integration process in that they are able to observe, raise questions, learn from peers, reflect, as well as create new knowledge that is linked to previous teaching and learning experiences (Desimone, 2009, Garet et al., 2001, Han, 2014, Polly & Hannafin, 2010, Seidel et al., 2011 in Yurtseven Avci et al., 2020:167). These above sentiments were supported by all participants from both IBP and non-IBP, who believe in active participation of their Grade 12 learners across all subjects during technology integration. They seem to support the development of strong bonds between teachers and their learners whom they believe are central in the teaching and learning process whose outcomes lead to the high achievement of Grade 12 learners. The following sub-theme tackles the active role that learners play.

Under the second theme, a sub-theme (see Table 53) on the learners' active participation during IBP integration emerged. There are participants who indicated that they were actively participating and engaging with the IBP daily during teaching and learning activities and that they still believe in it and that it was making a difference in the profession. Participant **PP18** shared the following: *"…I tell my learners in advance that they should set up the IBP…if I have an allocated time from 8 to 12; from eight to 10 I will be teaching the topic and then from 10 to 12 the very same topic that I taught in class will be projected so that they can access it through the IBP technology. They get to hear from another person…especially around this time of the year [September trial exams], it is IBP and the questions papers time all the way once I am done with marking as from next week."*

The views shared above, highlight the importance of sharing ideas with the learners and the importance of letting them hear the same topics being presented by different people through the

IBP presentations. Active learner-participation during the technology integration process (see section 3.5) requires teachers who are well versed with designing technology-related activities that would revolve around the needs and interests of their learners and thus leading to positive changes in attitude by both teachers and learners towards technology integration (Wells, 2007 in Yurtseven Avci et al., 2020:170). Participants from both IBP and non-IBP further shared their views on how they tackle subject specific challenging topics that negatively impact on the achievement of Grade 12 learners in the Free State Province. Below is a data analysis of the participants' assertions across all three selected subjects that form part of this study, on how they empower themselves and become better when it comes to teaching topics that are difficult.

The second sub-theme (see Table 53) to emerge addressed the targeting of specific IBP topics. Participants also mentioned that they had specific topics that they, together with IBP, used as part of the lesson planning process (see also section 3.5). They acknowledged that their lessons preparations sometimes target specific topics that they, together with presented lessons, assist in making sense of the challenging topics. Participant **PP12** agreed: *"Yes, I do... [use videos] as part of lesson planning, especially in chemistry, they talk about, most of the time about chemical reactions, learners don't seem to understand it, it's just an imagination. They can see the reactions in chemistry [unlike in a traditional classroom]. I think it [IBP] is also important in physics. It is important to visualize when another person is telling you and I always hear learners saying but I don't see it [chemical reaction], you want me to pass but I don't see that."*

The above views confirmed that the IBP presentations (live streaming or video recordings) have the power to change the way teachers and learners tackle challenging topics that are sometimes difficult to make sense of, through the traditional teaching methods. In addition, the participants shared how through engaging IBP developed specific techniques and approaches when preparing lessons especially that have involved specific topics in their respective Grade 12 subjects. Participant **PP3** believed: *"…if you have a challenge teaching a specific topic, you can browse, go through it, and see how the other person is presenting it. So, it gives you an overview of how, this topic should be presented and include it as part of lesson planning and presentation."*

There are participants who also confidently indicated that they were copying the styles and techniques from the seasoned IBP presenters on specific topics whom they felt were experts, whose presentations were worth copying and integrating during their individual lessons'

preparation and presentation (see also section 3.5). Participant **PP19** highlighted that: *"…but let's say there's a particular part of the content which I feel like the learners are not doing particularly well I consult them…because it is usually the learning facilitators or subject specialists who present those subjects…I would listen to see if we differ in terms of the strategies that we are using, a couple of times I would use them for my lesson preparations…as teachers we are human beings, and there will always be topics that we find ourselves not comfortable."*

Below is a theme on those deals with the recognition of the role that Generation Z plays during the integration of IBP live streaming or IBP videos in teaching and learning.

The third sub-theme (see Table 53) is on teachers accommodating the needs of Generation Z (Gen Z) learners (see section 3.2). The following responses from participants are based on their perceptions and experiences on how to accommodate the unique needs of Generation Z (see also 3.2.1) and how that impacts teaching and learning. The themes that emerged, include embracing reality, confidence dictates, the need for guidance and being selective in their independence. The above is also linked to UTAUT constructs PE, EE, SI, FC and moderated by experience and voluntariness of use (see also section 2.10). The engagement with Generation Z, using digital platforms, has not been widely welcomed, due to the different strategies and methodologies that are yet to be tested in terms of effectiveness and impact on the achievement of high school learners (Bhamani et al., 2020:15). The role of parents during the introduction, acceptance, and use of intervention programmes to the Generation Z and teachers, enhances bonding between parents and their children and in some instances, they become the source of comfort when their children experience anxiety and coping challenges (Bhamani et al., 2020:12).

The following sub-theme (see Table 53) highlighted teachers' roles in embracing Generation Z. The sub-theme is aligned to a general agreement from participants that Generation Z learners are now an integral part in all schools (IBP and non-IBP) and that include Grade 12 learners (see section 3.2). To highlight their acknowledgement of the Generation Z learners, Participant **PP22** highlighted that: *"Certainly, the new generation has now ceased to be homosapiens and is now homoelectronicus [laughing]…. However, the teacher in a classroom is a key factor during the IBP lessons. We can bend the rules slightly, for example, we're have many instances where the teachers give lessons interactively with information being transmitted from one place to the other using various technologies including IBP."*

The above sentiments confirm that the Generation Z learners are unique and have qualities that are linked to the heavy use of different technologies, because they were born in a world that already embraced these technologies (see also chapter 3). Another participant **PP5** agreed that**:**
"…*these learners are techno savvy…they use those words [to describe Generation Z]…because they were born into it [technology]…it helps because, like we are not the same…it lessens the fear to use technology and then you gain confidence… as I said earlier, there are two groups of people it lessens the fear of using technology."*

The above shared views by participants have also cited the benefits of having such a generation in their respective Grade 12 classrooms, in that they are well informed and are able to assist the teachers with the integration of different technologies with ease (see section 3.2). They complement each other during the technology integration process. When asked about the characteristic features and attitude that the Grade 12 leaners have towards the integration, acceptance and use of technologies including IBP, Participant **PP11** added:
"They [Generation Z] do not have a problem, yes, I think so they are used to these educational technologies like IBP."

From the UTAUT model point of view, the above assertions indicate that Generation Z are au fait with IBPs functions and thus confirming the strength of the following UTAUT constructs: PE, EE and SI (see section 2.10), which makes it easier to integrate it in teaching and learning. In addition, another sub-theme that emerged was that of the teachers' state of mind when it comes to engaging their Grade 12 learners in teaching and learning activities that involve the integration of technologies like IBP (see also section 3.2). All responses across all school types (IBP and non-IBP) mentioned the importance of always displaying confidence and willingness to allow technology integration in Grade 12 classrooms. Below is what was shared and emerged as the confidence dictates sub-theme.

The following sub-theme (see Table 53) is on the impact that teachers' confidence has on the acceptance and use of IBP by Generation Z. The importance of attitude and personal beliefs toward the IBP integration in teaching and learning was also cited by participants who felt a positive state of mind contributes towards adoption and use of the technologies, including the IBP. Like many other participants, who shared their views on the role of confidence, Participant **PP27** believed:

"Handling the Generation Z in EFAL classes depends on the confidence of the teacher. If I am a BBT (Born Before Technology) then I will be saying what you have just said [relating to Generation Z]] because I'm not confident, you will feel like these learners are going to teach you how to use these gadgets [IBP]."

The current of cohort of Grade 12 learners has been cited in many studies (Gawelek et al., 2011a, Gawelek et al., 2011b, Ertmer et al., 2012, Rives, 2012, Barrett-Greenly, 2013 and Mouza, et al., 2015.) as not only knowledgeable about use of new technologies, more than their teachers, but their opinions and suggestions assist to speed up the teaching and learning processes that require acceptance and use of such technologies (Yurtseven Avci et al., 2020:160). Drawing also from the above sentiments, it became apparent that participants are aware of the knowledge possessed by their learners and had no choice but to adapt to the new challenges that was inevitable and promise to be in their spaces forever (see section 3.2). The participants' positive responses and their attitude towards the recognition of the role that Generation Z is playing, and as observed by the researcher, indicate that they were prepared to adjust themselves and mentally prepare themselves to jointly integrate technologies, including IBP into teaching and learning. The following sub-theme that is presented below, emerged from the interaction with participants who identified the need for continuous guidance to be offered to Generation Z throughout the integration processes.

Another emerging sub-theme (see Table 53) highlighted the teachers' continuous guidance of Generation Z. The participants were in unison that although Grade 12 learners are totally embracing technology including the IBP and are willing to be taught, using different technologies, they still believe in the presence of the teacher during the integration process. They argue that teachers have a responsibility to ensure that introduced technologies are not left in the hands of the unattended learners and that they must always be there to integrate the technologies in a correct and beneficial way. In agreement with the above sentiments, Participant **PP4** emphasised that: *"No, those ones [Generation Z] need you [as a teacher] yes, sometimes even if they're using their phones, you cannot be 100% sure that they are doing or following your instruction in class."*

In addition to the above emphasis on the teachers' role, Participant **PP18** insisted that: *"I can't leave my learners alone watching the IBP [livestreaming]. We have three types of learners, the lowest, average, and then the ones doing very well. The level 7 [excelling group] tends to get*

bored so, if you are not there when the presenter is presenting the topic, they start to distract other learners and mostly, the lowest performing. You need to be in class all the time to supervise and assess if the learners are performing or not."

Drawing from his experience in a specific subject**,** Participant **PP11** concluded: *"…for my subject [Mathematics], I cannot just leave them use technology on their own, maybe yes, when it comes to social networks or media".*

Participants further added that the reasons why they felt there was a need to be in their Grade 12 learners' spaces and supervise them, while they were using the different technologies, is their selectiveness when engaged in learning (see also section 3.2). The selective behaviour sub-theme that emerged is discussed below. Generation Z' selective behaviour sub-theme that focused on the learners' searching skills was not up-to-date and since many were still young, they needed supervision. Participant **PP17** warned: *"You will be surprised that, even though they can use technology, they are very selective and tend to run away or avoid education related ones."*

Although the above views were shared by many participants from both school types (IBP and non-IBP), the general agreement was that at this stage, there is still more that needs to be researched to show how independent engagement with different technologies can take place in the classrooms. Participant **PP21** added: *"…I disagree that technology create learners who can learn independently from teachers, today's learners need to constant supervision, they cannot do things on their own, really! Not the kids that we are having!"*

It is also confirmed that successful integration of technologies (see sections 1.1, 3.2 and 3.5) depends on the willingness and positive attitude of learners to accept and use it, while failure to adopt it may hinder integration initiatives and thus lead to a waste of finance that would have been budgeted for the intervention (Chatti & Hadoussa, 2021:6993). The advantage that technology has when introduced to teaching and learning (see also section 3.4), is that it breaks down physical and distance barriers and thus exposes learners, mostly from under-resourced and far-flung rural areas to quality education that is presented by the best and experienced teachers through virtual platforms (Carew, 2023). Such interventions, when successfully implemented (see also section 1.1), level the playing field and thus accommodate the needs of Generation Z across the socioeconomic divide (see section 3.4). The following UTAUT constructs (see section 2.10): PE, EE, SI, FC and moderated by experience and voluntariness of

use, align with the above views and need to be taken advantage of. The next themes and sub-themes address the views of the participants on the use of mobile devices to access educational content.

The last theme (see table 53) to emerge, was the performance of IBP and non-IBP schools over the five-year period. The theme and sub-themes that emerged, include performance over a five-year period, use of statistics to back the claim on the achievement of subject specific increases, low to mid-level improvement, and year-on-year fluctuations (see sections 1.1, 1.2 and 3.2). The relevant UTAUT constructs linked to this question are PE, EE, SI, FC. DBE (2018) uses learners' average marks and overall pass marks as a barometer to measure levels of performance (Legotlo et al., 2002:113, DBE, 2018, Hunt et al., 2011, Makgato & Mji, 2006, Sasman, 2011 in Zondo et al., 2021:2). During the 2017 National Matric results announcement, the Minister of Basic Education (DBE), Angie Motshekga, remarked that the Free State Province had two out of five districts in the National top ten. On average, the class of 2017 achieved a national pass rate of 75.1%, which was better than the 2016 National pass rate of 72.5% (SAnews, 2018). The above assertions affirm that the emphasis by DBE has always been on using the raw marks to gauge Grade 12 learners' performance. Unfortunately, such an approach is not always a true reflection of the performance by learners, due to other factors that have an impact on the whole examination process, for example, how the examination items measure leaners' abilities with outmost precision (Embretson & Reise, 2000, Geremew, 2014 in Zondo et al., 2021:2). The link between achievement and the National Senior Certificate (NSC) was mentioned quite often by participants as the main indicator for success at Grade 12 level. Hence the need to seek participants' views on the factors that have an impact on the achievement in the Free State Province. In a study by Hillmayr et al. (2017), the results revealed that the use of educational technologies in teaching and learning have a moderate impact on achievement across all learning areas, including languages, biology, physics and mathematics and across all school grades (Hochberg et al.,2020:303). Although educational technologies have the potential to support effective teaching and learning (see also sections 1.1. and 1.3), assumptions should not be made about their influence across all disciplines since there are many factors at play that may still need to be tested (Hochberg et al., 2020:303). Below are the corroborating sub-themes that are linked to the Research Question (RQ 2).

Under this theme (see Table 53), the following sub-theme, sharing statistics on learners' performance emerged. Responding to the question on how their schools or Grade 12 learners

have been performing in their respective subjects and in unison, participants noted that there was a consistent increase in performance, and they shared statistics to back up their responses. Participant **PP27** said: *"Yeah, you know, after the introduction of IBP, performance increased tremendously…the majority of our learners [from IBP and non-IBP] are in the bracket of 40 to 49 (%), yes. Then you will have those in the 50 to 59 (%) and distinctions are not many…and I believe, as you are even aware, we have been [the Free State Province] number one for so many years and, you know, I also attribute that to the introduction of IBP."*

The above participants' responses highlight a thin line between IBP live streaming or video recordings, hence the interchangeable use of the two, as if they are not separated. They see and attribute an increase in the pass rate from a single lens that involves the integration of the IBP, even though there is a marked dotted or thin line between the IBP and non-IBP schools. Participants have, on many occasions, boasted about the Free State Grade 12 learners' performance that has put the Province on the map and they hoped that the numbers of learners, who pass Grade 12 each year, will continue to increase in comparison to their counterparts from the other eight South Africa's Provinces. Participant **PP22** agreed: *"...you know every province wants to be first and currently Free State (FSDoE) is number one. We're going to push for numbers, we are trying to get the candidates to get good results. If we get good results, the province gets the spotlight, we are pleased. But that's not the goal, the goal is to produce educated children."*

The participants' high satisfaction rate could be linked to the UTAUT's FC construct that ensures that the IBP infrastructure is not only appropriate, but accepted by the beneficiaries, in this case the IBP schools, teachers and learners. The role of the SI construct is also noticeable from the participants' assertions in those neighbouring schoolteachers' and the FSDoE officials' influence, using different advocacy and marketing strategies that made it possible for the IBP to be adopted and used effectively and thus contributing toward an improved pass rate across the Free State Province. The following data presentation is on the improvements in Grade 12 learners' performance that is linked to specific Grade 12 subjects and the sub-theme below confirms this.

The following sub-theme (see Table 53) addresses subject specific increases in pass marks of three selected Grade 12 subjects (EFAL, MATH AND PHYSC). In addition to the above sentiments, participants from both IBP and non-IBP schools went on to cite improvements as

seen from their respective Grade 12 subjects and such achievements have a link on the introduction of the IBP (see also section 5.5 and 5.8). Participants **PP6** highlighted that: *"In terms of the results in the past, we have been performing very well. At some point we got position one, and our school was awarded 12,000 rands, it was three to four successive years … my EFAL learners are getting better levels 4 to 7…these results are because of the IBP, and they encourage each group of learners to improve on their studies…some of our learners are studying medicine at UFS."*

The views seem to permeate across the different Grade 12 subjects and Participant **PP10** added: *"In my subject, Physical Sciences, despite the fact that I use IBP, the majority of my Learners are performing on level 3 while some are around 4 or 5 there are very few who go as far as 6 or seven it is a struggle to get there…I usually get 60, okay, it depends because they're coming from different primary schools because…it depends because they come from different feeder schools."*

A true statistical picture on performance in specific Grade 12 subjects was also shared by Participant **PP13** who highlighted that: *"I can say, since I started teaching Mathematics and using IBP, my Grade 12 learners' performance is always going up, they're always on the 3s, a few on five, but the majority are on three, and a lot on 2. I think it is increasing because of my experience in teaching mathematics. Yeah, so I know what to deal with it. So, I know how to deal them each year. I am becoming an expert on how to simplify the topics for the learners."*

Although participants above cited increases in their respective specific subjects, some, from both IBP and non-IBP, went on to share in terms of the levels of rating, where their learners are likely to be grouped (see also section 5.5 and section 5.8).

Another sub-theme that emerged highlighted low to mid-levels improvement (EFAL, MATH AND PHYSC). Although participants acknowledged the impact of IBP in their teaching activities, they believed that their learners are still performing at minimum level (see sections 1.2 and 1.4). Despite the downward adjustment by the Department of Education, for example to 30%, and standardisation of marks by Umalusi [the quality assurer], many learners from both IBP and non-IBP schools meet only the minimum pass requirements. Participant **PP26** argued that: *"… you can check the type of product that we produce at Grade 12, even though these learners have access to the IBP, they also register for extra classes, weekend, and holidays*

tuition, the majority obtain minimum passes. All the time they are watching the IBP videos and in fact, when they reach tertiary, they struggle because they are used to being spoon-fed. We still have such challenges, and it will take time to be addressed…I suggest that a study by the university should be conducted to check the failure rate and you will see that lots and lots of learners do not do well at first year…they even extend the extended programmes because most learners, although they meet the minimum requirements, struggle when they have to face reality at university."

Although IBP schools are slightly better, in that they have learners who achieve at level 3 (40-49%), many learners across the two groups are performing on level 3 (30-39%) and the promotion policy considers them part of the achievers. Local and international stakeholders with an interest in Mathematics education agree that the state of Mathematics teaching and learning is in dire straits in that there are many learning deficits that have been identified as contributing factors that lead to the poor achievement of Grade 12 learners (Spaull & Kotze, 2015:13). The analysis across IBP and non-IBP schools indicates that the achievement levels for the former (IBP) are better than the latter (non-IBP), even though both school types have Grade 12 learners achieving at a minimum level. Below is a data analysis on the performance of Grade 12 learners in Physical Sciences at both IBP and non-IBP schools.

In addition to the above views, some participants pinpointed the root causes of the minimum passes with some blaming the foundation classes as not preparing learners enough to perform and achieve at higher levels when they reach Grade 12. Participant **PP14** confirmed: *"My learners perform at minimum levels and one is forced to focus more on basics, we always come across learners who are lacking, learners who are average performers, you are forced to focus more on paper 1 & 2…no, no, let me give you an example, between 2018 and 2020, 2018 Grade 12 were much better…it was mostly leaners who were on average, but their performance was better."*

To back the above claims, Participant **PP20** argued that: *"…like last year I had an average of 55 (%) this year my dream… is to move to 60 but now I have two learners who are not a learning material [learning challenges] … we cannot do a thing…they are already at high school you cannot turn them back."*

The above sentiments apply to Grade 12 learners from both IBP and non-IBP schools and the above is aligned to the data analysis in sections 5.5 and 5.8 on the average achievement of

Grade 12 learners over a five-year period under study. In the next section, participants shared their views on the absence of consistent levels of performance over the years.

The year-on-year fluctuation across all subjects is another sub-theme (see Table 51) that emerged under this theme. The general belief from participants is that the pass rate is not stable and changes every year, based on the type of learners that the teachers are dealing with (see sections 1.2, 1.3 and 3.2). Participants cited various attributes and qualities that learners possess that influence the end of the year results at Grade 12 level. Participant **PP1** agreed: *"Yes, it depends on the type of learners that one comes across during that particular year especially their background in this case the foundation that was built in the lower classes all these play a role."*

In agreement with the above shared views, Participant **PP15** confirmed that: *"It's fluctuating because of different learners that we get each and every year. For example, I know there are groups of learners that you can get in a year, who are, technologically active…in another year you would get learners who don't like that."*

Some participants also went as far as sharing the different techniques that they employ to ensure that they face and overcome the challenges**.** Participant **PP14** indicated that: *"…you don't get the same group of learners, you may find that this year they are better and a different story the following year, so your strategy would differ beyond IBP recorded video technology. You are forced to focus more on basics in case you come across learners who are lacking, in case where learners are average, you will be forced to focus more on paper 1 & 2…no, no, let me give you an example, between 2018 and 2020, 2018 Grade 12 were much better…it was mostly leaners who were on average, but their performance was better."*

Although there are marked fluctuations on this level, an increase in black African bachelor passes is seen as a positive shift towards the overall improvement by Grade 12 learners (DBE 2019:9). According to Ramohapi et al. (2015:445), the trend of average to below performance of South African learners, especially in critical subjects, including STEM happens at all grade levels (see also section 1.2). The quantity versus quality is still debatable and the fact that promotion levels were revised downwards as indicated above, requires more research on the state of performance by learners in Grade 12. The above concerns on lack of quality were echoed in a Facebook post by the FSDoE MEC for education, Dr Maboya (see section 5.7.1

above). Although the general agreement was that performance was fluctuating and depended on the type of foundation that learners received in lower classes, there were also other nuances that participants shared and felt needed to be given immediate attention. The imbalanced performance was also cited as influenced by the different contexts at play that produce different success stories across all school types. The next section deals with marked improvement that does not cut across all school types, but is context based (see section 1.3).

The last sub-theme (see Table 53) to emerge, focused on improvements that do not cut across schools. On a minimum scale, there are participants who felt there was little and no improvement due to the natural traits that learners possess that make it difficult for them to achieve at higher levels (see also sections 1.4 and 3.2). Such unique influences that are individualistic in nature were clearly described by Participant **PP19** who said: *"In our case...yho! I think there is no improvement…because our school is central…central means we have a lot of learners who come from neighbouring feeder schools… we have 1500 learners and then we have about 500 learners with learning defects …I always tell people that there are many who are struggling to get to level 2, and you find a lot of them. The level of learners who are not doing well is so high and the presence of IBP may not be of assistance in such cases."*
The above performance indicates that although the performance of IBP schools is better than the non-IBP, there are few learners, irrespective of the intervention, that achieve at higher levels that could guarantee them admission at higher education institutions. Ben Ouahi et al. (2021:1) conducted a comparative study on the impact that computer simulations as an intervention have on the performance by learners during the teaching and learning of Physical Sciences, with specific reference on Ohm's law. The results revealed that although an experimental group performed better than the control group, there was little or no difference in performance between genders and a recommendation was made for the implementation of such technological interventions to improve performance and develop a deep understanding by learners (2021:1). The discussion on teachers tackling specific topics that may be described as challenging is in alignment with section 3.5.6 on page 6 that shares the need for teachers to have a deeper knowledge and confidence on the content that they are teaching including the difficult topics across all subjects (Mishra & Koehler, 2006:1026). To acquire such knowledge is a process that would need time to familiarize with concepts theories and procedures related to the subject matter (Mishra & Koehler, 2006:1026). Below is a data analysis on the average performance of Grade 12 learners from both IBP and non-IBP schools according to gender.

With reference to section 5.6, there were 7,372 female learners and 6,562 male learners who sat for the Grade 12 examinations in three selected subjects. Although female learners had a slight advantage, there has been a minimum difference in achievement at most levels (see also section 3.5). Spaull and Makaluza (2019:11) analysed how gender gaps impact the achievement of leaners across different levels in the South African education sphere, including Grade 12, as observed from 1995 to 2018. Their results indicate that girls consistently achieve better than boys and that was confirmed by the average mean marks across all subjects, including Mathematics and Physical Science up to Matric or Grade 12 (2019:11). In the last 10 years of their study, they observed that there was a significant decline in the number of Grade 12 male learners in comparison to their female counterparts with 2018 recording 80 males for every 100 female learners (Spaull & Makaluza, 2019:12). Letsoalo (2022:103) conducted a comparative quantitative study to compare the level of performance in Mathematics between female and male learners at Grade 12 level in the Gauteng Province. The test revealed both genders had comparable chances of passing, while the adjusted regression placed males ahead of the female counterparts and a recommendation suggested that there was a need for intervention programmes to be introduced at lower grade levels (2022:103). The above affirms that differences in achievement between genders are minimal and with all things being equal, the likelihood is that such differences could be eliminated. Below is a data analysis on the average performance of Grade 12 learners from both IBP and non-IBP schools in three selected subjects, using the rating scale 1-7.

Such sentiments call for a multi-pronged approach when integrating the technologies in teaching and learning. For example, the learners' well-being and state of mind may be hereditary in nature or in need of medical attention and if they are not attended to, may result in technological integration attempts, falling flat on the ground. The mixed views from participants also highlight that performance over the five-year period under study is impacted by many factors, irrespective of whether the learners come from IBP or non-IBP schools. The following UTAUT constructs: PE, EE, SI, FC, link well with the above theme and has a direct impact on the achievement by Grade 12 learners in the Free State Province (see also section 5.5). The sub-topic is linked to the Research Question (RQ) 3 and like above, it is comprised of themes and sub-themes.

5.7.3 Responses linked to Research Question (RQ) 3

The following data presentation is linked to the Research Question (RQ) 3 that sought to highlight the different factors, related to the IBP services that are offered by the University of the Free State (UFS) ideas lab that impact on the achievement of Grade 12 learners in the Free State Province. The following themes, as presented below in Table 54, are also composed of corresponding sub-themes. The first theme deals with the IBP operations that impact integration and the achievement of Grade 12 learners across the Free State Province.

Table 54
themes, sub-themes aligned to the research question 3 and corresponding UTAUT constructs.

What are the UFS ideas lab- led factors that influence academic achievement of Grade 12 learners in the Free State?		
Theme	**Sub-theme**	**UTAUT constructs**
IBP operations factor	• Physical and human resources allocation • Financial resources allocation	SI, FC, moderated by voluntariness of use
Evolving IBP services factor	• Diversification of the IBP portfolio • Seamless navigation	SI, FC, moderated by voluntariness of use
Continuous training, support, and sustainability to the IBP	• Continuous improvement in service delivery • SMT support • District support • Customized training and reporting	SI, FC
Challenge with IBP live broadcast and video recordings	• Biasness towards content subjects • Data conundrum • Contractual obligations • Copyright issues • Absence of mandatory rules	FC

Drawing from Research Question (RQ) 3, one of the themes that emerged from interaction with the participants, is on the IBP intervention operations over the years, including the five years under study (2014-2018). Under this theme, the following sub-themes were identified: physical and human resources allocation, as well as financial resources allocation. Within this theme, the following UTAUT's constructs, including the moderators, were identified and they include SI, FC, and the voluntariness of use moderator.

The first theme to emerge (see Table 54), focused on the IBP operations factor. In this IBP operations theme, participants shared their diverse opinions on the operations of IBP technology from the human resources and financial resources' points of view (see sections 1.1, 1.2 and 1.4). The two factors are relevant in that they contribute towards ensuring that the IBP service is spread to all Free State Province' IBP schools on time and that the right content is delivered.

Under the above theme, emerged the physical and human resources allocation sub-theme (see Table 54). The presence of the staff members with requisite skills was cited by participants as contributing positively to the sustainability of the IBP (see also section 3.5). The IBP services that are offered at the UFS ideas lab premises have the infrastructure that caters for the needs of the IBP schools and the presence of staff members with the requisite skills, make the transmission of the live streaming services and the recording of the videos thereafter to be a seamless exercise. Participant **PP29** shared that: *"…we have three staff members; they're also working as technical staff for the studio. So, what happened was when IBP started, we also saw it as an opportunity to further improve services within the University of the Free State."*

The above shared views indicate that the IBP human resources infrastructure exists and ensures that there is a smooth and seamless provision of the service to all selected schools. The different roles that are performed by the UFS ideas lab staff is clearly described by Participant **PP28,** who said: *"…look, our studio team, they do the editing before the final product goes out or goes onto the catalogue. The selection of schools is out of our scope. There are three different types of broadcasts, one is the curriculum coverage, then there's exam preparation and lastly the memo discussion."*

The UFS ideas lab has, in reference to the above, well-established operational and action plans that are aligned with the criteria set in the tender documents and quality service in the form of live streaming and video recordings of which presentations form part of that service. Besides the presence of skilled human resources that take care of the IBP's daily services that are needed to deliver live streaming to the selected IBP schools, there is equally a need for the budget allocation that can sustain the IBP over the years. The following sub-theme deals with the financial part of the IBP.

The second sub-theme to emerge was the financial resources allocation (see Table 54). Participants cited the financial stability of the IBP as an indicator that is likely to continue to produce the desired results (see sections 1.1 and 1.4). Since the service is a collaborative effort

between the FSDoE and UFS ideas lab, all participants cited the presence of financial stability over the years that has made it possible for the seamless service to be delivered to all IBP schools. Participant **PP29** said: *"…the technical staff members are being paid from the IBP project."*

Besides the budget for staff services, there are also the different types of funds that ensure that all schools and the lab are kept afloat. Participant **PP28** confirmed: *"But, what we do, we have an emergency fund …the ICT team, normally carry out the investigations. For example, there was one school where the IBP equipment was removed not because of negligence, there was little to no usage of the project. So, in terms of the schools carrying the expenses, so it's zero."*

The above theme confirms that the success of the IBP and the achievement of Grade 12 learners, thereafter, depends on human, physical and financial resources that are aligned to the related UTAUT constructs: SI, FC and moderated by voluntariness of use. The next sub-section's theme is on evolving IBP services.

The second theme (see Table 54), that is related to research question 3, is on the evolving IBP services factor. The participants shared how the daily operations are conducted at the UFS ideas lab, including the expansion of the IBP portfolio to accommodate equally important services that benefit schools across the Free State Province (see also section 1.4). The themes emerging from the question, include diversification of the IBP portfolio and instant communication. The UTAUT constructs include SI, FC and moderated by voluntariness of use. Technological advances have directly impacted teaching and learning with many teachers and learner's dependent on these educational devices that are propelled by the Internet. These devices, which are made up of many functions, have proven to be an inevitable and integral part of the teaching and learning activities across all subjects and school grades (Hochberg, 2020:303). The World Bank has identified educational technologies as mentoring and coaching tools that empower teachers to effectively perform their duties, while on the other hand, it expands their knowledge base, since it creates a platform for sharing ideas with fellow teachers as members of the communities of practice (Carew, 2023). Accordingly, the participants shared their experiences and perceptions on the different functions offered by the IBP service. Below are the responses in the form of sub-themes that are linked to the above Research Question (RQ) 3.

The first sub-theme (see Table 54), that was associated with the above theme addressed the diversification of the IBP portfolio. Participants shared that IBP has, over time been evolving and has added more on its portfolio (see section 1.4). This means the IB project now, not only focuses on learners, but also on exposing teachers to important activities that include discussion of the questions papers and the memorandum that are key on the integration of IBP in the Grade 12 classrooms. These services are also directly related to the aim of the study, which was to ascertain the extent to which the IBP integration impacts the achievement of the Grade 12 learners across the Free State Province. The following participants highlighted different parts of this ever-growing IBP portfolio. Participant **PP28** noted: *"…There are three different types of broadcasts, one is the curriculum coverage, then there's exam preparation and lastly the memo discussion."*

The above views were corroborated by Participant **PP22,** who added that: *"IBP live streaming and video recordings occur only when there are changes to the policies, yes, for example, last year they introduced the new examination guidelines and this year there were slight changes to items that could be found in paper three for example, your emails have been brought in. They weren't there before, and there was one other thing that was taken away, but I cannot really remember and then they changed the transactional writing topic slightly, so, it's only when there are those changes that you must change them [live presentations and video recordings]."*

In line with the ever-changing technologies, the IBP services have also evolved to meet the needs of the changing clientele and the outside contexts that are forever being changed by the prevailing circumstances. Participant **PP26** highlighted that: "*Although the initial IBP service targeted learners, we are now able to reach a big number of teachers within a short period of time, even if there are changes in the Mathematics Grade 12 curriculum, we initiate zoom meetings quickly, we chat and it helps a lot, the IBP technology is very much important."*

Besides the diverse services that the IBP portfolio provides, the participants also shared their views on how IBP technology delivers its services to the various selected schools across the Free State Province. The following sub-themes address the seamless service that the IBP portfolio can offer.

The IBP offers seamless navigation, is the next sub-theme to emerge and is linked to Research Question (RQ) 3. The participants have proven to know how the IBP technology workflow operates and that is an indicator that they were informed about it and Participant **PP22** shared

the individual experience below: *"Everything goes out via the internet, it is a direct broadcast, for example, the broadcast I did yesterday was a memo discussion, for English paper one, yes, it was written on the 28th of September 2021 this one went out via YouTube… I think the producer would be the director, he controls all the technical functions, sound, transmission, recording of the video section, he switches on, there's a single camera there focusing on the face of the presenter. Yes, and just before the broadcast starts, a link is sent out to all schools and it's still active if you can click on that [pointing from personal mobile phone] you will be able to see/view it…the link is sent out like 15 minutes before broadcast."*

In agreement with the advanced functions that have been added to the IBP portfolio, many participants cited the individualistic nature of the service in the form of links that are sent directly to teachers and learners, who are able to decide on when to access the service. Participant **PP25** highlighted that: *"Due to the advanced technology, we are now making use of the links…Grade 12 learners are writing Mathematics now [on the day of the interview] and the memo discussion will be presented at 2 pm yes…they [UFS ideas lab] send me a link and I immediately send it to the subject advisors to give it to schools. The live memo discussion presentation is on your phone, you can watch it as an individual from your phone."*
The detailed and easy to understand workflow that forms part of IBP's new services were cited by participants as not eliminating travel costs, but also expanded the number of clients who can access the service at the same time in the comfort of their offices, classrooms or homes.
Participant **PP22** concluded: *"Before memo or question paper discussion, a notification is sent out to teachers a day before, yes, the information is punched into the system from the UFS ideas lab studio. They can see if people are connecting, yes. I did a presentation last week, yeah, 332 teachers, logged in."*

Another sub-theme (see Table 53), linked to RQ 3, are the flexible rules that allow the different clients to decide when to access the IBP services and this means they have the liberty to plan and when time allows, they can access the service.

The last sub-theme highlights the existence of the non-mandatory rules (see Table 54). The absence of the mandatory rules on the use of either livestreaming or recorded videos means that teachers are at liberty to engage or not with the IBP with no consequences for not participating in the project (see sections 1.1, 1.4 and 3.5). Although the collaboration between the FSDoE and UFS ideas lab involves money that is spent to run the project, there are no compelling rules

that force schools, especially the ones that are benefitting from the IBP, to access it every time the presentations are transmitted from the UFS ideas lab offices. The participants shared that they apply flexible rules, based on the need to access the IBP service. For example, Participant **PP20** said: *"That day I told you I watched IBP live streaming; I was just looking exactly for specific things like the technical aspects of EFAL. It is normally literature, especially every time new books are introduced. I felt, after watching what was covered in class, that was enough, and my learners understood my lessons in class. I felt there was no reason to make use of IBP livestreaming or videos anymore."*

In some cases, teachers that have been using the IBP services for some time, seem to be selective and only choose topics or specific times of the year to watch the presentations. Although no one indicated they were no longer in favour, maybe as a way of not jeopardizing access to the service, Participants clearly shared their programmes when it comes to accessing the IBP. Participant **PP14** added: *"My learners normally watch it once a year toward the end of the year. It's pure revision…they would then have a clear picture about the book. They are also allowed to imagine things. e.g., how different parts are portrayed during acting like tone or mood depend on how the actor utters those words including body language, it will affect the mood. So, IBP recorded videos help towards the end of the year they [learners] watch the videos quite often."*

The above theme confirms that technology changes and responds to the demands of the current conditions and that means there must be an improvement of the IBP technology, including the UTAUT constructs: SI, FC and moderated by voluntariness of use. The following theme and sub-themes focus on the type and nature of training, as well as support that are offered to ensure the sustainability of intervention programmes, including IBP.

The third theme to emerge, highlighted the need for continuous training, support and sustainability to the IBP (see Table 54). When the different technologies are introduced by different e-learning companies, they are expected to offer, on a regular basis, training and support to ensure that the implemented projects are sustainable (Yurtseven Avci et al., 2020:160 and Chatti & Hadoussa, 2021:6993). The participants shared that there is ongoing support and training that are offered at different levels to IBP schools who are beneficiaries (see sections 1.4, 3.2 and 3.5). The sub-themes that emerged, include support from the School Management Teams (SMTs), support from the district and head office and customized training and reporting.

The relevant UTAUT constructs include SI and FC. Technology integration, training and support must be content-focused in all subjects, including Mathematics, Languages or Sciences and must further expose teachers to the technical, pedagogical and management tips on relevant content (Curwood, 2011, DeSantis, 2012, Gerard et al., 2011; Polly & Hannafin, 2010, Unger, 2012, Unger & Tracey, 2013 and Barrett-Greenly, 2013 in Yurtseven Avci et al., 2020:162).

Literature review on page 3, section 3.5.9 addresses training that is needed by teachers prior to the integration of ICT and in most cases on-going ones after the integration process Ngqondi and Mauwa (2019:2). Caution is also shared about the service providers that offer only once-off training and support programmes that only become costly after the implementation project was over but also lead to teachers and other stakeholders developing a negative attitude towards the new technology (2019:2). The differences in adoption rates between developed and developing countries were still widening with the latter still left behind and that means there is a lot of training and support programmes to be offered to the developing countries (Alshammari, 2020:112).

In a study by Legotlo, Maaga and Sebego (2002) on a sample from a rural province in South Africa, it was reported that the education districts where schools are located, have a significant effect on learner performance (Zondo et al., 2020:3). The analysis reveals that South Africa has a well-planned decentralized structure to administer education. However, districts have significant human resource constraints. Capacity is often lacking and record-keeping, particularly of financial information, is very poor (Boateng, 2014:1). It was also observed that not all school principals had the requisite management skills, nor the ability to develop clear policies that support instructional programmes, including monitoring classroom activities and proper integration of technologies in teaching and learning, assessment tools and interpretation of final examination data (Legotlo et al., 2002:113). However, learners whose parents are actively involved in their learning, irrespective of their socioeconomic status, tend to achieve at the highest level at Grade 12 (Njoroge & Nyabuto, 2014, in Ogbonnaya, 2019:107). Minister Angie Motshekga, the National Minister of Education, recognised the critical role that districts play in the achievement of the aspirations laid down in the National Development Plan (NDP) (SAnews, 2018).

The support from the School Management Teams (SMT) is the first sub-theme to emerge under the above theme (see Table 54). The support from the school management team was cited as

encouraging by most participants from both IBP and non-IBP schools and this is an indicator that there was a buy-in from the school management (see sections 3.2 and 3.5). The creation of a conducive atmosphere that is created by the schools' management teams makes it easier to filter the support to the teachers and the Grade 12 learners who are the beneficiaries from the IBP service. Participant **PP4** confirmed: *"They are very supportive, more especially my HOD [Head of Department], he normally reminds me…and say: today is IBP [live streaming], call learners, expose them to technology. This includes also the principal, they [school management] fully support it...last time we struggled with Wi-Fi, he [School principal] bought data so that we could have access."*

Although the support was cited by all participants, there is a tendency from some schools, that the researcher could confirm, to give more attention to the so-called content or STEM subjects at the expense, for example, of languages, even though the district and head office officials try to debunk the myth and try and open up all opportunities for all subjects. Participant **PP10** agreed: *"I get a lot of support because of the type of subject that I am teaching in comparison to other subjects."*

The role that the school management, districts and technology-related policies play, is well documented (O'Dwyer et al., 2004, and Whitworth & Chiu, 2015) in that it creates a shared platform that is underpinned by common understanding and appreciation of the need to infuse new teaching practices that are relevant during integration processes (Yurtseven Avci et al., 2020:171). Below is a sub-theme that covers the support that the district and head office FSDoE officials offer to the IBP and non-IBP schools.

The second sub-theme is on the support offered by the district and head office FSDoE officials (see Table 54). The district office was also cited by most participants as supportive throughout the years and they cited the presence of communication tools, like WhatsApp as tools and storage tools, like the USB that ensure that solutions to their challenges are guaranteed and taken care of and thus eliminating challenges that would have impacted access to the IBP services. Participant **PP20** highlighted: "*We communicate a lot with people from the district …they expose us to IBP live streaming, I even presented some of the lessons after they even asked me to be part of the people who are preparing and presenting lessons through IBP. I also make use of additional technologies that they offer us as part of support."*

In addition to the above, some participants were very satisfied with the specific services that they were getting from their respective district and head office FSDoE officials. There seems to be a cordial and positive attitude towards each other and respect for each other's responsibilities that make integration of the IBP a seamless exercise. Participant **PP10** added: *"Yeah, most of the time our LFs [District Learning Facilitators] when they visit us, they bring IBP recorded videos along. They would ask permission to have an interaction with English teachers. Our LFs showed us… IBP video recordings in English and encourage us to use them especially during the revision time e.g. on drama…they either share such information so that we keep it for ourselves, and, in other instances, they would say [make copies because] they were taking them away to use them in another school."*

In a twitter post, dated 9 April 2021 09:40 a.m. 2021, the then MEC for education in the Free State, Tate Makgoe (2021a, 2021b, 2021c, 2021d)), confirmed that as the department they were committed to supporting the districts through analysis of the Grade 12 diagnosis report and thereafter finding solutions that would lead to the sustained achievement of Grade 12 learners across the Free State. Many studies (Davis et al., 2009, Owston et al., 2008, Putnam & Borko, 2000 and Guskey, 2003) encourage school management teams to play a critical role during technology integration processes, but a conscientious inclusion of the district officials with relevant knowledge in content and technology integration, strengthens the collaborative efforts with the service provider and adds a broader perspective and impetus to the set objectives (Yurtseven Avci et al., 2020:160). Below is a presentation of the theme on the customization of the training and support services associated with IBP and the type of reporting that is shared with relevant stakeholders.

The last sub-theme under the above theme focusses on customized training and reporting (see Table 54). What makes IBP service unique, according to participants, is that the service that is provided is unique and customized to meet the unique needs of the schools in the Free State Province (see section 3.5). This is because, by their nature, schools are unique entities that operate in unique contexts and that must be addressed as such. Participant **PP28** explained: *"We have really improved our training in terms of the IBP champs, it's five teachers per school. They must be trained over a period of three years. This SACE or NQF accredited training involves integration of ICT into the classroom. "We also train them to be what we call peer to peer learning. It's PLC (Peer Learning Community), meaning we train the IBP schools to reach out to the next school and form groups. It's a 13 modular training course on ways to integrate*

the ICT. There's also a portfolio of evidence that involves the teachers, learners, and the school management."

In addition, the presence of the technical team means that the schools' IBP-related challenges are addressed within the reasonable time. The reality is that there are schools that have experienced more challenges than the others, for example Participant **PP29** cited: *"…the tech team was on a technical visit to all the schools here and they found a lot of the equipment broken, not working and in bad shape and so on. And that is another nightmare."*

Furthermore, the participants indicated that they report on specific activities and that serve as part of the service the IBP is rendering and also the reporting function forms part of accountability that is expected from the UFS ideas lab. Participant **PP28** highlighted: *"We give a monthly report to the department and one of the reports is on the viewing stats…we can see which school has viewed live, which [school] has viewed off on demand, which [schools viewed] offline, and which one has downloaded how many downloads per school…that is why we are taking further steps, going forward, to do a thorough research because most of our [IBP] budget, goes to the live broadcast. We must make sure that the live broadcast does not coincide with schools' timetable."*

It is important that enough time is set aside for ongoing training and support, with set achievable short-, medium- and long-term goals (Carlson & Gadio, 2002, Lawless & Pellegrino, 2007, in Yurtseven Avci et al., 2020:167). However, it must be noted that even if the allocated time is increased, there is no proof that it would lead to effective technology integration (Guskey, 2003 in Yurtseven Avci et al., 2020:167). Below is a theme on the challenge associated with live streaming services that include the IBP, a technology that is integrated into teaching and learning.

The fourth theme that is linked to the research question 3, addresses the challenge with live IBP broadcast (see Table 54). In response to the question on challenges associated with the Internet Broadcasting Project (IBP), the following themes emerged: biasness towards content subjects, data conundrum, contractual obligations and copyright issues (see sections 1.1, 1.4 and 3.5). The corresponding UTAUT construct includes FC. The introduction of the intervention programmes that are accessed through online digital platforms, is also seen enhancing equality and inclusivity across schools, communities and countries (Bhamani et al., 2020:12). The

impact caused by the Internet broadcasting projects across the globe, the quality of the curriculum offered, and the extent of parental involvement, are yet to be determined (Bhamani et al., 2020:12). Although new interventions are sometimes aimed at assisting the underprivileged learners, they sometimes become part of the Grade 12's poor performance, due to inaccessibility, associated with a lack of suitable tools and this calls for the research on how to mitigate these challenges (Legotlo et al., 2002:113). The following issues form part of the themes:

The sub-theme is on the perceived biasness towards content subjects (see Table 5).4 There was a general agreement by many participants that the introduction of the IBP was initially associated with specific subjects and hence it being associated with content subject (see sections 1.2 and 3.5.6). That belief is still in existence, even though many subjects have been accommodated as part of the project, including English First Additional Language (EFAL). Participant **PP28** argued that: *"When IBP started, it was just for Grade 12s about five subjects…,sciences and Maths, I think accounting and other two subjects that I cannot remember... languages?...no, it was not for languages, then over a period of time, they have moved, now we've got 15 plus subjects…we even have a technical subject…you know, in the past, a culture was created that IBP was a Grade 12 project, [this happened] over the period of years, and the Grade 12 content teachers were owning the project, or owning the IBP device."*

It has also been noted by other participants that the source of the biasness stems from the way the service was initially introduced, and such perceptions are difficult to remove. For example, some participants were even specific when referring to the IBP service beneficiaries. Participant **PP20** noted: *"IBP live streaming service is used mostly if a teacher has a challenge with a specific part of the curriculum /content in different subjects…IBP was initially for physical sciences. I remember here at school it was used mostly by the science teacher; the teacher had a challenge with chemistry so most of the time IBP livestreaming was allocated to the subject."*

In some cases, the participants give detailed explanations on why there were such biasness towards specific Grade 12 subjects, and they tended to understand the rationale behind the initial introduction of the IBP services to the various schools across the Free State Province.

Participant **PP27** added: *"What is funny is that EFAL teachers think this IBP is meant for science, technology and Maths classes and not meant for them. But I'm telling you, gradually,*

there is a buy in from them…You know Meneer, I think we need to be honest. When IBP was introduced, it only focused on key subjects, Mathematics, your Life Sciences, your Physical Sciences, and those were key subjects. Languages were not given space and then at a later stage English was introduced, because remember English is now treated as LOLT, it is the language of learning and teaching and that is why it was brought in. The teachers are right…initially, it was meant for key subjects…everything we do now through IBP, remotely or virtually, we even conduct SMTs (School Management Team) meeting virtually and so teachers and schools are getting used to it."

Furthermore**, PP22** pointed out why the focus was on the specific content or STEM subjects**:** *"I can understand why there's so much pressure on the Maths and Physical Sciences colleagues, and why they've got so many subjects advisors, for few candidates, whereas for English, it is the opposite. We've got few subjects advisors. Think about this, every single learner in every single school is doing English, in one form or another. So, this is why I'm always under pressure running around. But be that as it may, it is part of the job. I am not complaining…but then also the stress of English is more than you think…it was in 2015 and 2016 when we had insta-lessons and that's when English, Maths, science got exactly, the same amount of time. At least, the last six years, especially in the last push programs, English is included in the camps, winter schools and the spring classes."*

These above shared sentiments link well with research questions 1 and 2 (see section 5.1), as well as UTAUT constructs SI and FC (see chapter 2). The next theme addresses the data challenge that impedes access to IBP. Below the presentation covers the challenge with data that some participants shared and its impact on access to the IBP service.

The following sub-theme highlights the data conundrum (see Table 54). The data challenge seemed to be cited quite often by most participants, who felt that accessing educational resources should be free and accessible to all (see sections 1.1, 1.2, 1.4 and 3.2). The inequality amongst the schools was also mentioned as the reasons why IBP live streaming outside of the school, becoming a challenge. There were participants who also felt that unsupervised blanket access to data may also serve as a disruption, since learners and some teachers tend to spend a lot of time on the Internet, accessing personal information that has no relation to teaching and learning. One Participant PP**27** agreed**:** *"Yes, meneer, in many schools' data is one of the challenges that we encounter. The department [FSDoE] has thought of going this route [IBP]*

but forgetting that some schools don't have resources. There are schools that do not have appropriate resources and teachers are expected to use their own data… it is difficult, and it's very expensive."

To confirm the dire situation with some schools when it comes to accessing data, Participant **PP29** added: *"...So, there are schools that cannot afford quality internet. Leaners have to travel long distances from their schools to neighbouring and well-resourced school [to connect to the Wi-Fi], and I think quality internet would be a solution, if I were to be asked to put together a solution, that would be the solution."*
The absence of the Wi-Fi causes disruptions and Participant **PP13** shared the frustration: *"Hey, if you can see these learners, the Grade 12s here at school standing next to Motheo [neighbouring TVET College], they [TVET college] have wifi there, so our learners would go there and stand next to the fence to catch the wifi. Eish! this thing disturbs the school [programme], instead of learners coming to class, they will be standing next to the college's fence."*

The above factor seems not to have negatively affected only schools, but across the country in that a #datamustfall movement was formed to sensitize the policymakers about the data costs that are amongst the highest in the world (Right2know.2017: n.p. and Moyo & Munoriyarwa, 2021:365). Below is data analysis related to the contractual obligation sub-theme.

Another sub-theme to emerge addresses the presence of the contractual obligations (see Table 54). Participants have cited the shaky contractual obligations between the UFS and FSDoE that are caused by parties not sticking to the original terms and conditions (see sections 1., 1.2,1.4. 3,2and 3.5). There seems to be creeping elements of mistrust and not respecting the rules of the game. Participant **PP29** argued**: "***…things didn't always work very well between us [UFS ideas lab] and the department [FSDoE]. There were times when we carried on with broadcasts outside the contract period and the department didn't pay because there was no contract in place. Doing business with the government is not a pleasure because things are always late for payment and there is always scrambling to make an agreement with person (A) who doesn't have the power, or approval rights. Now the IBP stopped because we out of contract… they submitted the tender…they have to go through SITA…that takes four or five times longer to get tenders approved and allocated."*

Participant **PP28** noted: *"Currently access issues makes IBP open to all [YouTube]. We must rectify that going into the new into the new contract, we're going to do away absolutely with YouTube."*

The next sub-theme discusses copyright as one of the factors that participants raised and sought clarity on.

The sub-theme on the nature of the copyright (see Table 54), associated with the IBP, emerged under research question 3. Some participants cited skepticism towards moving the IBP to YouTube, as exposing them to the international community, many of which may have bad intentions (see sections 1.1, 1.4 and 3). They want to know if copyright protects them and the knowledge that they are sharing and that there are rules to prevent people with ulterior motives from exploiting the IBP. Participant **PP28** said: *"Copyright is a point of discussion, a huge challenge and that is why we converted IBP access to YouTube, it's an interim process. The platform that we used to have, was an American platform and we've inherited all that. The founding company, the developers, sold it to another company. And that is the reason why we moved to YouTube. As a service provider, it was challenging for us to protect the intellectual property...it is a huge concern, because we have promised our client that we will protect its IP. But coming back to copyright, we are in talks with the ICT department, our long-term goal is for us to have a YouTube channel, then authentication had to happen, and you know, to protect the content, and not just going openly, but apparently there are costs involved."*

Participant **PP23** concluded: *"…you can ask [XXX] about the process that they followed to put those IBP presentations on YouTube, they are in the open… [in contrast] There are instances when I want to access, for example technology related articles but I cannot, they are expensive [access is blocked]. There is an interesting article I wanted to read but I had to pay 25 USD, it was expensive. I believe academic stuff must be open and free of charge including IBP on YouTube."*

In section 3.5, on page 71, literature review highlighted the absence of technologies that are written in the teachers and learners' mother tongue (UNESCO, 2022). This is seen as a stumbling block that makes it difficult for non-mother tongue speakers to easily integrate such different technologies in teaching and learning (2022). The learners who are exposed to the IBP are speaking English as a First additional subject and that means they must learn and understand

the language used by the technology before they can confidently engage IBP in their daily learning activities (2022).

The last subtheme highlighted the existence of multiple factors that are always at play (see Table 53). Participants have cited different factors at play that, despite the presence of either live streaming or video recordings, impact on achievement by Grade 12 learners (see sections 1.1, 1.2, 1.4 and 3). The type of teachers, their attitude, the type of examination papers, parental influence, and the general conditions both at home and school have been cited as having an impact. Participant **PP23** said: *"That's a difficult one because the learners' response to a question paper is a combination of things, like experience, maybe the learner has looked at IBP livestreaming and YouTube videos for a while, obviously, they must have been taught before. They may have a family member or friend at home who can help them with IBP and IBP influences at that time. So, I'm not, I can't say, it has improved the results or not but theoretically, yes, my feeling is it has helped."*

Participant **PP24** added: *"So, I would say there are many reasons for that…one would be the difficult paper…I think IBP integration had an impact…from my side it's very difficult to measure it. In terms of improvement 10 or 11 years ago, our pass rate and our averages which measure quality were much lower than now. If you look at teachers that in the past would deliver learners with levels 3, 4, or 5, are now starting to deliver learners with level seven…now that the IBP videos are available on YouTube, it will be interesting to know how many of those downloads are from outside the Free State."*

Participant **PP21** concluded: *"Performance is affected by many things. When I started working, I worked in different districts [both IBP and non-IBP] and in those districts, it was going up all the time [what do you think it was the reason for that?], it is because I was teaching from Grades 8 to 12 and I was the only one who was in charge of teaching them from Grade 8 and then I would build those learners from lower grades up. I always tell my subject supervisor what is the use of covering 100% of the work when the learners are unable to go to university because of lack of quality? For as long as I can cover thoroughly 70% of my work that will be more than enough for learners to progress to the next grade., and should there be a problem, I would be the one to blame."*

The presence of many factors outside of the IBP non-IBP have been cited by participants as also playing an influential role many believe could not be ignored. There were also some views from participants, who felt there was no marked increase over the years, citing reasons that are responsible for the absence of an increase in performance by Grade 12 learners during the period under study. It was also cited by some participants that they have moved around over the years - some from IBP high schools to non-IBP schools or vice versa. These changes in human resources means that the teachers may decide to continue integrating the IBP in their new schools and if they are not inducted in the IBP schools, they may continue operating, using the mentality from the non-IBP schools where they previously worked. The triangulated data analysis follows in the next sub-topic.

5.8 Triangulated data analysis

In line with this study's combined research prescripts (see chapter 4) that are aligned to the research questions (see section 5.1) and the underlying UTAUT theoretical framework (see chapter 2), the analysed data from quantitative and qualitative parts are triangulated to make sense of the impact that IBP integration has on achievement of Grade 12 learners in the Free State Province. From the combined quantative and the qualitative data a comparative data analysis is initially done separately according to data types and later then linked to the corresponding themes as drawn from the responses from the selected participants who are drawn from the FSDoE (district and head office), selected Grade 12 teachers from IBP and non-IBP schools who teach three selected subjects and UFS ideas lab staff. The overall average performance of Grade 12 learners across all subjects at both IBP and non-IBP schools, drawn from the quantitative part of the study is first to be aligned with corresponding theme/s from the qualitative part of the study. The main research questions are also highlighted.

5.8.1 Triangulated EFAL data analysis

The average performance in EFAL, Grade 12 by six IBP schools over five years period or 2014-2018 (see sections 5.5.3, 5.5.4 and 5.6.1) indicates that 3 (40-49%) schools performed at level 4 (50-59%) while the other 3 (50%) schools, performed at level 3 (40-49%). When looking at the non-IBP schools, all six (100%) schools, performed at level 3 (40-49%). When

combined, 3 (25%) schools performed at level 4 (50-59%) while nine (75%) schools, performed at level 3 (40-49%). The above is corroborated by participants' perceptions and experiences in sections 5.7.2.1 to 5.7.2.3. There is a general acknowledgement that in EFAL the performance is between levels 3 and 4 with th IBP schools edging lightly ahead of the non-IBP schools despite having the support of the IBP livestreaming technology. The participants have cited other factors that impact the observed performance of Grade 12 learners in the Free State Province.

In research conducted across the African continent, South Africa came fourth out of ten countries, obtaining an average 48.1% in literacy and came in last in numeracy, obtaining an average 30% (Ramohapi et al., 2015:445). The above assertions link with the average performance of Grade 12 EFAL learners that is mostly on level 3 (40-49%). From the above EFAL analysis there are indications that most Grade 12 learners fall within the acceptable levels of promotion (see sections 5.5.3, 5.5.4 and 5.6.1) but the presence of both internal and external factors inside the schools and externally from the FSDoE impact achievement. The following data analysis focuses on the combined average performance by both IBP and non-IBP Grade 12 Mathematics.

5.8.2 Triangulated MATH data analysis

The sub-topic covers an average performance of Grade 12 learners in Mathematics at both IBP and non-IBP schools over five years period or 2014-2018. Sections 5.5.5, 5.5.6, 5.6.2 indicate that from IBP schools, 2 (33.3%) schools performed at level 3 (40-49%) while the other 4 (66.7%) schools, performed at level 2 (30-39%). When it comes to the non-IBP schools, 2 (33.3%) schools performed at level 3 (40-49%) while the other 4 (66.7%) schools, performed at level 2 (30-39%). When combined, 4 (33.3%) schools and 8 (66.7%) schools performed at level 2 (30-39%). The above is corroborated by participants' perceptions and experiences in sections 5.7.2 and 5.7.3.

Although IBP schools are slightly better in that they have learners who achieve at level 3 (40-49%), many learners across the two groups are performing on level 3 (30-39%) and the promotion policy considers them part of the achievers. Local and international stakeholders with an interest in Mathematics education agree that the state of Mathematics teaching and

learning is in dire straits in that there many learning deficits that have been identified as contributing factors that lead to poor achievement of Grade 12 learners (Spaull and Kotze 2015:13). The analysis across IBP and non-IBP schools indicates that the achievement levels for the former (IBP) are better than the latter (non-IBP) even though both school types have Grade 12 learners achieving at a minimum level. Below is a data analysis on the performance of Grade 12 learners in Physical Sciences at both IBP and non-IBP schools.

5.8.3 Triangulated PHYSC data analysis

This section delas with an average performance of Grade 12 learners in Physical Sciences from six IBP and six non-IBP schools from 2014-2018 (see sections 5.5.7, 5.5.8 and 5.6.3) indicate that from IBP schools, 3 (50%) schools performed at level 3 (40-49%) while the other 3 (50%) schools, performed at level 2 (30-39%). When it comes to the non-IBP schools, 2 (33.3%) schools performed at level 3 (40-49%) while the other 4 (66.7%) schools, performed at level 2 (30-39%). When combined, 4 (33.3%) schools performed at level 3 (40-49%) while 8 (66.7%) schools performed at level 2 (30-39%). The above is corroborated by participants' perceptions and experiences in sections 5.7.1 and 5.7.2. The above performance indicates that although the performance of IBP schools is better than the non-IBP, there are few leaners irrespective of the intervention, that achieve at higher levels that could guarantee them admission at higher education institutions. Ben Ouahi et al (2021: 1) conducted a comparative study on the impact that computer simulations as an intervention have on performance by learners during the teaching and learning of Physical Sciences with specific reference on Ohm's law. The results revealed that although an experimental group performed better than the control group, there was little or no difference in performance between genders and a recommendation was made for the implementation of such technological interventions to improve performance and develop a deep understanding by learners (2021:1). Below is a data analysis on average performance of Grade 12 learners from both IBP and non-IBP schools according to gender.

5.8.3 Triangulated Gender data analysis

With reference to section 5.5.9, there were 7372 female learners and 6562 male learners who sat for Grade 12 examinations in three selected subjects. Although female learners had a slight edge, there has been a minimum difference in achievement at most levels. Spaull and Makaluza

(2019:11) analysed how gender gaps impact achievement of leaners across different levels in the South African education sphere including Grade 12 as observed from 1995 to 2018. Their results indicate that girls consistently achieve better than boys and that was confirmed by the average mean marks across all subjects including Mathematics and Physical Science up to Matric or Grade 12 (2019:11). In the last 10 years of their study, they observed that there was a significant decline in the number of Grade 12 male learners in comparison to their female counterparts with 2018 recording 80 males for every 100 female learners (Spaull and Makaluza, 2019:12). Letsoalo (2022:103) conducted a comparative quantitative study to compare the level of performance in Mathematics between female and male learners at Grade 12 level in the Gauteng Province. The test revealed both genders had comparable chances of passing while the adjusted regression placed males ahead of the female counterparts and a recommendation suggested that there was need for intervention programmes to be introduced at lower grade levels (2022:103). The above affirms that differences in achievement between genders is minimal and with all things being equal the likelihood is that such differences could be eliminated. Below is a data analysis on average performance of Grade 12 learners from both IBP and non-IBP schools in three selected subjects. Below is a summary of the data analysis chapter.

5.9 Summary

The results presented in this chapter are based on a combination of the historical Grade 12 secondary data in three selected subjects and a survey to ascertain the impact that the integration of IBP has on the achievement by Grade 12 learners in the Free State Province.

Regarding RQ 1, the PSLA adopted by FSDoE and informed by the National Intervention Strategy, assisted the Department to form a collaboration with the UFS ideas through a legally binding tender document. The two institutions came together with the main aim of improving the performance of Grade 12 learners in the Free State Province that was poor at the time. Guided by the quintile ranking system and the promotions policy, FSDoE identified 83 IBP schools across the Free State that were supported and benefited from the live streaming services that were offered by the UFS ideas lab. Through this pro-poor service that targeted quintile 1-3, it positively impacted the achievement of Grade12 learners, who were exposed to quality lessons streamed live from the UFS ideas lab. Although the focus was on the IBP schools, the recording of the lessons benefited the non-IBP schools in that the UFS ideas lab had to make

access to the videos free, with no legal strings attached. This non-mandatory IBP services went beyond the initially targeted 83 IBP schools. This put the Free State Province on the map in that they consistently climbed to the top of the best performing provinces, regarding the National Senior Examinations (NSC) results administered nationally. The PSLA and the legally binding collaborative effort between the FSDoE and UFS ideas lab continued to bear fruit in that there was an increase in the number of Grade 12 learners from quintile 1-3, who received promotion that allowed them to further their studies in various post-matric institutions.

Drawing from RQ 2, many participants positively corroborated the Grade 12 results, and the 2014-2018 secondary data from both IBP and non-IBP schools. One noticeable view shared, is that the participants agreed that the presence of the relaxed rules, when it comes to accessing the IBP, meant both IBP and non-IBP schools were beneficiaries in that besides the live streaming that was meant for The IBP schools only, the recorded IBP lessons were available for access and integration by teachers from non-IBP schools. The quality lessons empowered Grade 12 teachers from both IBP and non-IBP schools in terms of content knowledge and integrating IBP technology in teaching and learning. Through the introduction of the IBP services, learners were placed at the centre and their advanced knowledge and comfortability with technology acknowledged. From the UTAUT theoretical framework's point of view, the indications are that the PE, EE and SI constructs were strong enough and positively influenced teachers and learners to adopt and use the IBP in teaching and learning. This type of arrangement directly and positively impacted on the achievement of Grade 12 learners in the Free State Province.

Concerning RQ 3, both the quantitative and qualitative data presentation results indicated that the IBP integration tended to benefit IBP more than the non-IBP schools, when it comes to the achievement of Grade 12 learners in the Free State Province. The findings further indicated that an independent variable: type of school was significantly related to the dependent variable, the final mark at $p < 0.001$. Similarly, findings indicated that there was a significant relationship between the gender independent variable and the dependent variable: final mark. However, the results indicated that there was no interaction effect of the type of school by gender on the final mark. Hence, the need for recommendations to improve each of the variables, considering their roles during the integration process of IBP in teaching and learning.

The identified challenges to the full utilization of the IBP, included key areas such as the expensive data, vague policies on the use of supporting tools, like mobile devices, contractual

obligations, quality assurance, copyright issues and lack of mandatory rules that enforce the full utilization and integration of IBP across the CAPS curriculum, all subjects and all levels.

CHAPTER SIX

DISCUSSION OF FINDINGS

6.1. Introduction

In this combined research study, the researcher sought to ascertain the impact that the Internet Broadcasting Project (IBP) has on the achievement of Grade 12 learners in the Free State Province. The purpose of this chapter is to make sense of the analysed data in chapter 5, present the discussion in the same order and align the whole discussion to the research questions and consider the broad and specific objectives of the study (Olasina, 2014:141, Saulus, 2017:182, Odaro, 2019:140 and Mutsvunguma, 2019:150). This discussion chapter also delves into what the analysed data means and how it is aligned to existing studies (Hess, 2004, Partridges & Starfield, 2007, Aitcheson, 2010, Cotterall, 2011 in Odaro, 2019:140). The Unified Theory of Acceptance and Use of Technology (UTAUT) theoretical framework propounded by Venkatesh et al. (2003) underpinned this study.

The primary research question was: *how has the collaboration between the Free State Department of Education and the University of Free State' ideas lab impacted the academic achievement of Grade 12 learners in the Free State Province?*
The secondary research questions were as follows:

1. What are the legal and legislative frameworks that support the creation and integration of IBPs at the Grade 12 level?
2. What are the experiences of learners and teachers on the provision of IBP intervention programmes for Grade 12 learners in the Free State?
3. What are the UFS ideas lab-led factors that influence the academic achievement by Grade 12 learners in the Free State?

In this chapter, the researcher provides a broader and deeper interpretation of the findings and the possible implications they might have for practice, thus giving meaning to what has been found (Kiruki, 2018:171). Kothari (2004:344) defines interpretation as drawing inferences from collected facts after an analytical or experimental study, intending to search for broader meanings from research findings (Saulus, 2017:182). Kothari (2004:344) also highlights that proper interpretation of results determines the usefulness and effectiveness of research findings (Mutsvunguma, 2019:150). However, during this process, the researcher was cautioned about the need to remain focused on the research problem and study results (Hess, 2004:1240 in

Mutsvunguma, 2019:150). According to Patton (2002:434), at this stage, the researcher is expected to attach meaning to the research questions, attach significance to specific results, and note the evolving patterns and the implications thereafter (Polit & Beck, 2004 in Saulus, 2017:182). The first discussion is on the demographic characteristics of the participants.

6.2 Demographic characteristics of respondents

In any research study, researchers are expected to collect and share the demographic features of the section of the population under-study (Connelly, 2013). Wyse (2012) opines that such demographic characteristics are usually the observable or quantifiable data of the population under study. They include the following features related to age, gender, race, ethnicity, marital status, level of education, qualification, profession, etc. (Brink et al., 2012, Bakare, 2018:187, Vogt & Johnson, 2011 in Osayande, 2019:141). In this combined research study, the quantitative part drew the demographic features from the historical secondary data, representing Grade 12 learners from selected schools in the Free State and spanned from 2014 to 2018 (discussed in detail in chapter 4). Discussions based on the analysed secondary data are common internationally and they assist in identifying the demographic features of the sampled population (Davis-Kean & Jager, 2017:2). The qualitative part of this study drew demographic data from the participants whose background varied and included the Grade 12 teachers from the 12 selected schools. It also had the Free State Department of Education' (FSDoE) FET schools, Motheo District and head office subject specialists in three selected Grade 12 subjects. Lastly, the participants were drawn from the University of the Free State (UFS) ideas lab that are responsible for the management and operations of the Internet Broadcasting Project (IBP). The demographic details differ, based on the collected data and the study's objectives.

In some experimental or quasi-experimental studies (Khader, 2016, Li et al., 2018, and Ramadhani et al., 2019), that focused on the impact of various educational technologies on the achievement of learners in different subjects, they share the demographic features differently. For example, Khader's (2016:109) sample consisted of 108 male and female students, who were divided into two groups: experimental and control. Li et al. (2018:501) sampled 928 high school teachers who met the different set criteria. In Ramadhani et al.'s (2019:143) study, there were 62 senior high school learners, aged between 15 and 17 years. Out of the total 62 participants, 33 formed part of the experimental class that was exposed to the problem-based learning model, based on LMS-Google Classroom, and the other 29, who formed the control

class, were only exposed to traditional learning. Sahin-Topalcengiz and Yildirim (2020:564) conducted a study that was made up of 12 teachers (four males and eight females who ages ranged between 21 and 45), who were drawn from public schools. They volunteered to participate and were comfortable and familiar with internet use and how it was integrated into teaching and learning. Another quasi-experimental study that was conducted to determine the impact that computer simulation has on achievement of learners in chemistry, had 78 learners that were divided into 38 experimental group (18 males and 20 females), while the control group was composed of 40 learners (16 males and 24 females), all drawn from two secondary schools (Nkemakolam et al., 2018:284). Gender representation was of particular importance in this study, gender representation, which has been covered extensively in the UTAUT theoretical framework (chapter 2), literature review (chapter 3), methodology (chapter 4) and data analysis (chapter 5).

6.2.1 Distribution of participants by gender

Drawing from the Grade 12 historical secondary data, Table 5.5 in chapter 5 indicated that the gender distribution of the participants was 52,9% female learners and 47.1 % male learners. The qualitative part indicated that the 29 participants' gender distribution, as seen in chapter 5, Table 5.3 was that 58,6% of the participants were males while 41.4% were females. When broken down into different professions, teachers were represented by 12 females and nine male teachers, while both district and head office were represented by six males and from the UFS ideas lab they were represented by two male participants. The researcher could not help but notice that female teachers tended to be more than male teachers in most schools, including the researchers' former schools as learners and teachers. All subjects' specialists were males at both the district and head office (see annexure: list of district officials).

In a quasi-experimental study by Adelabu et al. (2019), on the importance of dynamic geometry computer software on learners' performance in Geometry, a total of 45 (51.7%) females and 42 (48.3%) male learners from two secondary schools in Tshwane South District, Gauteng Province, participated in the study. In another comparative study that examined the effects of the game-challenge strategies on learning achievement of the algebra variable, 86 students (35 females and 51 males) participated (Sun Lin & Chiou, 2017:2632). In a mixed method, quasi-experimental study that investigated the changes brought about through an S4F FM programme in a rural school community in South Africa, the qualitative part of the research, there were

three S4F FM programme staff members, 24 family members, 13 teachers and 36 learners, from three different schools (Beje, 2021:vi). From the quantitative part, the historical secondary data in the form of achievement marks data from 16 schools in the OR Tambo District of the Eastern Cape were used, but did not mention the gender (Beje, 2021:vi). In another quasi-experimental study by Malto et al. (2018:543), 80 high school learners in Manila were grouped into experimental and control groups to ascertain the students' academic achievement. In another study by Nurhikmah et al. (2021:605), to determine the impact of computer-based tests and students' ability in computer self-efficacy on Mathematics learning outcomes, a total sample of 64 learners from two high schools in Indonesia were divided into of 32 students from SMP Negeri 6 Makassar and 32 students from SMP Negeri 19 Makassar. (Nurhikmah et al., 2021:605). In a quasi-experimental study to determine the impact that educational technology has on teaching and learning, a total of 52 Grade 12 learners aged between 16 and 19 participated (Hochberg et al., 2020:303). In both groups, there were more male learners than female learners: 26% of the female learners were in the experimental group, while 7% were in the control group (Hochberg et al., 2020:303). The following section is linked to the previous chapter 5's data analysis in that it gives a detailed discussion, based on the three research questions.

6.3 Discussion aligned with the three research questions

In this study's combined research that drew data from quantitative and qualitative approaches, the analysed data results (see chapter 5) were aligned with both the research questions (see section 5.1) and the underlying UTAUT theoretical framework (see chapter 2), to make sense of the impact that IBP integration has on the achievement of Grade 12 learners in the Free State Province. The discussion follows the same sequence from chapter 5's data analysis. The discussion draws a pattern from chapter 5, wherein the data analysis was firstly, divided into the three Research Questions (RQ) and each RQ's sub-themes (see chapter 4) evolved from the views shared by different participants, who were subjected to semi-structured interviews that made use of the pre-planned interview-guide (see annexure). Both the research questions and the themes and sub-themes were aligned to the relevant construct/s within the selected UTAUT theoretical framework. The first discussion is linked to research question 1.

6.3 Discussion based on research question 1

Research question 1: What are the legal and legislative frameworks that support the creation and integration of IBPs at the Grade 12 level?

The discussion centres on relevant legal prescripts (policies, strategies), norms and standards, aligned to the relevant UTAUT constructs that lead to the achievement of Grade 12 learners in the Free State. The identified theme is the strategic intent that is aligned to the following sub-themes: the Provincial Strategy on Learner Attainment (PSLA) that is informed by the National Intervention Strategy, the second one is the promotion policies, and the last one is the quintile ranking system. The identified UTAUT constructs are PE, EE, SI, and FC, moderated by age, gender, experience and voluntariness of use (see chapter 5.7.1).

During engagements with the participants (see section 5.7.1), they all seemed to be aware of the existence of the Free State Provincial Strategy on Learner Attainment (PSLA) and its link to the National Intervention Strategy for Learner Attainment (NSLA), of which both were discussed in chapter 1 (see section 1.2). The participants were also aware of the collaboration between the Free State Department of Education (FSDoE) and the University of the Free State (UFS) ideas lab, that led to the identification of the Internet Broadcasting Project (IBP), who are seen as strategic partners, as well as the different roles that are played by IBP implementers. They confirmed that the Provincial Strategy on Learner Attainment (PSLA) was established after a pattern of failure rate of Garde 12 learners was observed and an intervention (see section 5.7.1) was sought to bring about continuous improvement in learner achievement in relation to the National Senior Certificate (NSC) examinations (Free State Department of Education, 2012:2). The participants' level of understanding when it comes to the strategy (PSLA), differed depending on the position they were holding, with district, head office and UFS ideas lab participants offering more information in comparison to the participants from either IBP or non-IBP schools. However, this was not surprising, because those at implementation were guided by those closer to policymaking levels. For example, Participant **PP23** highlighted that there was also a general understanding of the targeted schools and why the strategy classified schools into IBP and non-IBP (see annexure: list of IBP schools in the Motheo district). In addition, the participants were aware of the quintile ranking system (see chapter 3) and the reason why schools had to be catergorised into quintiles 1-5 and why the IBP was introduced only to the first three (1-3) quintiles. For example, Participant **PP28** said: *"The IBP implementation was initially focused on non-performing schools throughout the province, your quintiles one, two*

and three… There are 83 centres, it has been like that since 2011. Another salient point from the above participant's view is the year from which the IBP was introduced in 2011, and the researcher had earlier indicated that the study focused on years 2014 to 2018 (see chapter 4), which are the years in which CAPS curriculum was in full implementation. The PSLA that is informed by NSLA, is guided by the government's education policy and planning programmes and interventions that, since 1994, have been proponents for pro-poor intervention programmes, aimed at reducing the inequalities whose source go back to pre-1990 (see also chapter 1.2). The historical imbalances linked to poor performance and tied to the pro-poor policy, led to the establishment of the no-fee schools in 2007 and since then, about two-thirds of South African children of school-going age do not pay a fee (DBE, 2019:10). On an international level, the integration of technology has, for years been part of the departments of education and section 3.2 on page 48 confirms that Indonesia has been integrating technology applications like MejaKita, ICANDO, Ganeca Digital, Kelas Pintar, Quipper School, Ruang Guru, Sekolahmu, Zenius, Cisco Webex, and Pahamify to make online teaching and learning possible (Almanthari, 2020:1-2). The above statement is in alignment with the FSPSLA that acts as a strategy to curb inequality and imbalances in resources sharing. It also highlights the important role that the public-private-partnership plays in enhancing quality of teaching and learning.

To highlight the main goals of the PSLA on targeted public IBP high schools, participants elaborated from the strategic perspective, that the above assertions affirmed the intention to acquire an educational technology infrastructure (IBP) that could serve targeted public high schools and Grade 12 learners across the Free State Province and improve performance. Quantity (having a high number of Grade 12 learners passing matric) seemed to be the focus and little attention was paid to quality (passing matric with Bachelor passes). The above discussion on the strategic intentions is aligned with the Facilitating Conditions (FC) construct of the UTAUT theoretical framework that has been discussed in chapter 1 and in chapter 2. FC, a strong and positive predictor of intention to use, refers to the degree to which an individual believes in the existence of an organizational and technical infrastructure that supports the use of the system (Venkatesh et al., 2003). FC aligns well with the Provincial Strategy on Learner Attainment (PSLA) that sought to establish a comprehensive IBP infrastructure that supports the objectives that encourage Grade 12 learners to perform at the highest level. Performance Expectancy (PE) is another construct that aligns well with the strategic intention of the Free State Department of Education (FSDoE). PE, a strong predictor of use intention in both mandatory and non-mandatory situations, is defined as an individual's belief that by using a

particular technology, his or her performance would change for the better (Venkatesh et al., 2003).

Equally important at strategic level are the Effort Expectancy (EE) and Social Influence (SI) constructs, whose contribution features in the strategic documents that sought to acquire the IBP. The above assertions were also confirmed by participants in this study who have experienced the impact that an IBP intervention plays in supporting Grade 12 learners to achieve during the national senior examinations (Moorthy et al., 2019). The above was confirmed by the participants. Besides the above having a strong link to the FC construct, there is also a link to PE, in that, the service provider (see chapter 1 and 3) was expected to provide quality output that would ensure that the achievement of Grade 12 was not only a reality, but also inclusive. The above sentiments also highlight inclusivity in that even though there were, officially, IBP and non-IBP schools, access to the IBP was not too restrictive. The researcher noted that there was a thin or dotted line that, from the beginning, made it possible for the IBP services that were, in paper, benefitting mostly the IBP schools through the live streaming services to be inclusive and be accessible also to non-IBP schools in the form of recorded videos. The researcher also noticed, during the first visit to the UFS ideas lab that there was a standalone desktop that was loaded with folders of previous years' recordings of IBP presentations that catered for all Grade 12 subjects that is freely accessible to schoolteachers from both IBP and non-IBP schools. This proves that the FSDoE's strategic intention and goal was to see achievement at public high levels across IBP and non-IBP schools.

The strategic intentions mentioned above are not different from what is happening elsewhere in the world, wherein schools are often required to integrate introduced technologies to optimize pedagogical effects, thus leading to achievement of their learners. The nature and strength of the Facilitating Conditions (FC) to integrate are guided by the prevailing policies and guidelines. Singapore, for example, has a policy that directs teachers to implement technologies in teaching and learning, explicitly (Yeung et al., 2012:860). Inherent in such policies are the assumptions that they will, always, voluntarily integrate such technologies in their daily classroom activities (2012:859). Other countries that include New Zealand and the USA have introduced the Strategic Framework for Education (MOE New Zealand, 2006) and the USA's National Education Technology Plan (Department of Education USA, 2010) all aimed at ensuring that there were increasing adoption practices by teachers that would lead to improved performance of learners (2012:860).) The introduction of the Provincial Strategy on Learner Attainment

(PSLA) 2011 as an intervention to improve achievement of Grade 12 learners, it placed the Free State Province ahead of the other countries across the world who were forced by COVID 19 to speed up integration of technology (see section 3 on page 48) in teaching and learning (Zhou et al, 2020:504). A well-crafted policy and its clear intentions open a platform that allows for PE, EE, SI and FC to thrive, and in the end, the learners' achievement serves as desired outcomes. The issue of inequality is also addressed in section 3.2.1 on page 53 as a reality that needed policies that target learners from poor backgrounds who need exposure to different digital technologies that impact positively on their achievement (Atmojo & Nughroho, 2020:72). The same sentiments on section 3.4 on page 55 are shared with caution since policy and the realities tend not to be sync and the results do not reflect on the ground. In the South African situation, the ICT policy goal is a case in point (Ngqondi & Mauwa, 2019:3). Below is a discussion linked to RQ 2.

6.4 Discussion linked to research question 2

This discussion is aligned to the data analysis of the same question (see 5.7.2 above) wherein a theme and sub-theme evolved from the interaction with participants, who formed part of this study. The theme's blurred lines (see 5.7.2) below presented the existence of nuanced differences when it comes to accessing IBP between IBP and non-IBP schools. The following discussion also includes the specific UTAUT constructs and related existing literature.

This discussion on the existence of the blurred lines between IBP and non-IBP schools is linked to the theme that emerged and was identified during the data analysis in chapter 5. The discussion is divided into the following sub-topics that are aligned to the above blurred lines' main topic: cross-pollination between IBP and non-IBP schools and thin lines between live streaming and video recordings.

It emerged in section 5.7.2 that despite the presence of the clear and official demarcation of the schools into IBP and non-IBP, there exists a culture wherein neighbouring schools or teachers exchange the IBP material with the aim of improving the achievement of Grade 12 learners across the Free State Province. This acknowledgement is, as drawn from the participants' views, an acknowledgement that knowledge should be freely available and that solid lines, in legal papers, that separated their schools into IBP and non-IBP, could not stand the power to change their Grade 12 learners' dire situation that required change by exposing them to quality content that was accessible though IBP. This also indicates that the collaborative effort had developed into pollination between IBP and non-IBP with no data to back up the extent to

which this practice is taking place within and across schools within districts and across the Free State Province. For example, participant **PP 28** said*: "According to me, since the IBP schools may not be using the IBP videos as much as the non-IBP schools, they are feeding them, but we don't have any statistics of how many neighboring schools are doing this. We need to do a comparison."* The above is an acknowledgement that certain schools within the two groups (IBP) may be engaging in such practices, whose outcomes could be positive outcomes, traced from the collaboration between the FSDoE and UFS ideas lab. Another notable observation on the impact's point of view, participants shared the views on what the collaboration produced over the years (see section 5 on the results). The researcher's observation on the above is that there is a thin line or dotted line that one can draw when it comes to utilising the IBP at both IBP and non-IBP schools' levels. The above confirms that the collaboration positively impacts the achievement of Grade 12 learners in the Free State, even though there is still room for improvement in data collection, analysis, pattern recognition and sustainability. Another important area linked to research question number 2 is the discussion on the presence of a thin line between IBP live streaming and IBP video recording that is discussed below.

The discussion has its link to section 5.7.2., whose sub-theme carries a similar title and deals with the existence of an imaginary or dotted line that separates the IBP live-streaming and IBP video-recording services. The participants could not indicate the extent to which live streaming services differed from the IBP video-recording services and often used the two interchangeably to acknowledge the equal role they played during technology integration in teaching and learning. The impact that exposure to virtual technology has on achievement is discussed in section 3.2 on page 51 and confirms that such learners achieve at higher levels but for that to happen would require them to be dedicated and set aside time to engage with such technologies (Lacka, et al 2021:163).

Even though the IBP teachers had, from the legal point of view, been benefitting from the IBP infrastructure that was provided by both the FSDoE and UFS ideas lab, teachers did not feel that it was the only and compulsory tool to integrate technology and they always felt the IBP video-recordings were an equal option that they relied on, in case they missed the live streaming. On the other hand, the participants from non-IBP equally regarded the video recordings as providing them with the same experience. Another important issue that was addressed in section 3.2, page 4 in the literature review is the need for teachers to move with

speed when it comes to empowering themselves with the ever-changing technologies that are integrated in the education sphere (Mishra & Koehler, 2006:1016).

The presence of a thin line between IBP and non-IBP means that the categorization could not be clearly cast in stone. The following UTAUT constructs: PE, EE, SI, FC, moderated by age, gender, experience and voluntariness of use (see chapter 2), would be strengthened by full utilization of the IBP. There is also a need to explain the type of categorization that exists between IBP and non-IBP schools. The following discussion is linked to the data analysis theme and sub-themes that focus on the integration of IBP during lesson preparations.

Some participants cited the flexibility of the IBP to accommodate new functions, whenever there is a need. They also indicated that recorded lessons can be watched over and over for a long time and this means each cohort from Grade 11 is guaranteed quality teaching and learning digital resources. The added functions that allow for both live streaming and recording of the IBP lessons make the thin line to be thinner in that the participants use the functions (live streaming and video-recordings) interchangeably and thus expanding options to accessing quality material to be used in teaching and learning. Some participants tended to prefer the video-recording option, due to its cost-effectiveness when compared to the expensive IBP live streaming services that are not always attended by all targeted IBP schools at the same time, due to different reasons that participants cited. The next discussion is on the integration of the IBP services to form part of the lesson preparations.

This discussion is aligned to the data analysis in section 5.7.2's theme on IBP integration, during lesson preparations. The participants from IBP and non-IBP schools have shared how they were integrating the IBP during lesson preparations in their respective Grade 12 subjects. Although the approaches varied, there was an agreement that pre-lesson presentation, using IBP was an integral part of their teaching and learning activities. The participants from IBP schools shared that they usually prepared themselves and their learners with pre-discussion sessions before being exposed to the IBP live streaming. This seemed to work for them, in that it allowed their learners to have an idea of what would be stream lived and thus also allowed them to engage the presenters. On the other hand, the non-IBP participants depended on the recorded IBP videos that they used during lesson preparations, especially the challenging topics. This seems to give them confidence before interacting with their Grade 12 learners during lesson presentation. All participants seemed to believe in putting their Grade 12 learners at the centre of lesson preparation activities, because they regard them as the beneficiaries from the IBP

integration and later achievement at the end of the year. Under the above topic, the sub-topics that emerged are the learners' participation and targeting specific topics, using IBP presentation. Section 3.5.4 on page 64 recognises the role that correct pedagogies that teachers should apply if they want to produce learners who are not only knowledgeable but also critical thinkers (Mishra & Koehler, 2006:1027 and Thalberg, 2019:5 and Li et al., 2019:504).

The discussion is informed by the data analysis presentation in section 5.7.2 above, wherein during IBP integration and lesson preparations, participants recognised the active role that their Grade 12 learners were playing (see section 5.7.2 in Chapter 5 for the full details). The integration of the IBP during lesson preparations is also linked to the specific topics that participants cited as needing special attention, due to them lacking content knowledge, having no confidence in their abilities or not experienced enough to tackle the topics. With reference to section 3.5.2 of the literature review, prominent individuals with an interest in the South African education like the Dr Mlambo-Ngcuka (SABC News 2021) showed concern about the teachers' ability to engage with different technologies and the extent to which they integrate them in teaching and learning (Mncube & Olawale, 2019:36). The sentiments indicate that many teachers lack confidence when it comes to technology integration that may be caused by not being able to catch up and be in line with their counterparts from the developed world (Li et al., 2019:502).

This discussion links to the data analysed in section 5.7.2, whose theme dealt with how participants regarded targeting specific lessons as part of their daily lesson preparation's exercise.

In reference to the above, participants have confessed that they have topics that they find challenging in their respective subjects that, after consulting the IBP (live streaming or video-recordings), they were able to prepare rich IBP enhanced lessons that they were able to present to their learners. The introduction of the IBP seems to have enhanced the participants' teaching skills and boosted their confidence when preparing and later presenting some topics. Some participants have cited that they no longer consult IBP, since it has already served its purpose of empowering them. They seemed confident and ready to be on their own and tackle the subject, using the experience gained from IBP live streaming or recorded videos (see section 5.7.2 where the full details of the significant statements by the participant was provided).

Although the changes in the curriculum that gave birth to the Curriculum and Assessment Policy Statement (CAPS) were meant to improve quality, Further Education and Training (FET) teachers' autonomy has been compromised (Ramatlapana & Makonye, 2012: S7). CAPS' restricting and structured approach accommodates under-achieving learners who are mostly from poor socioeconomic backgrounds. Teachers always find themselves in a tight corner in that they must compromise autonomy, due to CAPS uncompromising obligations (Ramatlapana & Makonye, 2012: S23). It has been reported that Chemical Reaction Rate (CRR) for example, is one of the topics that Grade 12 Physical Sciences learners find challenging and some experimental studies, using Computer Simulation-Based Instruction (CSBI) revealed that after teachers infused them as part of lesson preparations, learners tended to perform better, since they got a better conceptual understanding of CRR than through traditional teaching (Jere, 2020: V). The next sub-topic deals with teachers' views and experiences, when dealing with Generation Z learners in their respective Grade 12 classrooms.

This discussion is informed by data analysis of the theme and sub-themes in section 5.7.2 above, wherein the participants shared their views on the importance of respecting and accepting the role of Generation Z, who are learners in their Grade 12 classroom. The sub-themes include acknowledging and embracing this generation with specific reference to the integration of technology, like IBP in teaching and learning. Another theme for discussion deals with teachers developing confidence to accept and use technology in teaching and learning and how some participants noted that their learners tended to be selective when interacting with different technologies. Section 3.2 on page 51 concurs with the above in that despite the current generation's advanced knowledge familiarity with different technologies, they tend to be selective and if they are not monitored there would be negative consequences (Gómez-García et al. 2020:3).

Participants in section 5.7.2 agreed that the learners they are dealing with are way advanced and knowledgeable about different technologies. Since they were born in the world that already embraces technology, the Grade 12 learners find it easier to seamlessly engage technologies, including the IBP live streaming and video-recordings. Techno-savvy Generation Z has a positive attitude towards technological integration in teaching and learning and this makes it easier for teachers to introduce them to the always welcoming Generation Z Grade 12 learners.
Participants also agreed that their self-confidence is boosted through direct interaction with their respective Grade 12 learners, using different technologies. However, the use of technology

for independent use by the Grade 12 learners remains an elusive point of contention. Many participants believe that learners may be knowledgeable about different technologies but still need the guidance from the teachers. This also means that IBP technology integration, like all other technologies, requires a collaborative effort between teachers and learners. Literature review in section 3.5.1on page 58 agrees with the above sentiments that the learners are well informed and navigate the different technologies with ease (Alfaki et al., 2018:136). As part of the teaching and learning process, learners still need the presence of the teachers to guide them as they integrate technologies in the classroom (Das, 2021:313). In addition, on page 58, section 3.5.1, there is a warning that even though learners may be grouped into a specific generation, they should not be treated in a similar way due to differences in situations where teaching and learning is taking place (Pedro and Piedade, 2019:6). The Thabo Mbeki Foundation (2019:8) in section 3.5.1 on page 59 listed the following 21st century skills: problem-solving, critical-thinking, collaboration and digital literacy as important skills that learners must be empowered with Section 3.5.1 page 59.

The advantage that technology has when introduced to teaching and learning, is that it breaks down physical and distance barriers and thus exposes learners, mostly from under-resourced and far-flung rural areas to quality education presented by the best and experienced teachers through virtual platforms (Carew, 2023). This then levels the playing field and thus accommodates the needs of generation Z across the socioeconomic divide. The following UTAUT constructs: PE, EE, SI, FC and moderated by experience and voluntariness of use, align with the above views and need to be taken advantage of. The next themes and sub-themes address the views of the participants on the use of mobile devices to access educational content.

The following discussion has its links to sub-section 5.7.2 that also addresses the same topic that deals with the performance of IBP and non-IBP schools over the five-year period. Participants seemed to be aware of the top position that the Free State Department of Education (FSDoE) occupies, due to the province's best performance when compared to the rest of the country. They also shared that the performance was not of high quality, because most of the Grade 12 learners who pass receive a bare minimum pass that falls between 40% and 49% with few of the leaners reaching the highest levels of performance from 60% to 100%. This situation is prevalent at both IBP and non-IBP schools with the IBP Grade 12 learners doing a little better when compared to their non-IBP counterpart. The issue of quantity (high number of passes)

versus quality (low Bachelor passes) is a worrying one and participants would like to see it addressed.

Another important point to discuss is the achievement of Grade 12 in their respective subjects and most importantly the three subjects that form part of this study namely: EFAL, MATH and PHYSC. The participants acknowledged that in EFAL, Grade 12 learners were, in majority, passing the subject at a near 50% and a little above 50%, with few passing at the highest levels of performance. Both IBP and non-IBP Grade 12 EFAL learners performed well with the IBP schools outperforming their non-IBP counterparts, but not by a bigger margin, and participants attributed such achievements to the integration of the IBP live streaming in teaching and learning across the Free State Province. The same sentiments were shared by participants on the MATHS and PHYSC Grade 12 learners' performance that indicated that IBP learners were slightly better in the two subjects, in comparison to those Grade 12 learners from non-IBP schools. Another noticeable finding of the two subjects, is that most of them were achieving at a little lower than the 50% pass mark and very few Grade 12 earners were achieving at the highest levels of performance. This was worrying, because that meant there were few Grades 12 learners who were being admitted in post-school institutions to study in STEM-related fields of study.

It was also revealed by participants that most learners were not only achieving low to medium levels, but their performance fluctuated year after year. Even though the curriculum was stable, the participants believed that there was no consistent improvement or upward trajectory when it came to the pass rate of Grade 12 learners. There was an agreement that the fluctuations were caused by the number of factors that included the learners' questionable knowledge and skills from the lower levels that made it difficult for Grade 12 teachers to tackle, due to the limited time. There is a general acknowledgement that in EFAL the performance is between levels 3 and 4 with the IBP schools edging slightly ahead of the non-IBP schools, despite having the support of the IBP livestreaming technology. The participants have cited other factors that impact the observed performance of Grade 12 learners in the Free State Province.

In research conducted across the African continent, South Africa came fourth out of ten countries, obtaining an average of 48.1% in literacy and came in last in numeracy, obtaining an average of 30% (Ramohapi et al., 2015:445). The above assertions link with the average performance of Grade 12 EFAL learners that is mostly on level 3 (40-49%). From the above

EFAL analysis there are indications that most Grade 12 learners fall within the acceptable levels of promotion (see sections 5.5.3, 5.5.4 and 5.6.1), but the presence of both internal and external factors inside the schools and externally from the FSDoE, impact achievement. There was also a belief that the department, district and schools tend to focus more on Grade 12 learners and little attention is placed on learners in lower grades. The absence of suitable resources at the lower levels also meant that the learners were likely to suffer when they reached Grade 12 and hence the fluctuations in the achievement of Grade 12 learners. Many high schools are surrounded by primary schools with varying levels of quality output that always make it difficult for high school teachers to remedy it, since time is not always on their side. The multiple factors at play make it impossible for the Grade 12 learners to achieve at higher levels. The following sub-section covers discussions related to the research question 3.

6.5 Discussion linked to research question 3

This discussion is based on the data analysis presentation in section 5.7.3, whose content was centred on the Research Question (RQ) 3. The discussion focusses on four themes that have sub-themes that are aimed at identifying the IBP-led factors that impact on the achievement of the Grade 12 learners in the Free State Province.

The first discussion deals with the IBP operations and underlying factors that were identified and divided into firstly, the physical and human resources and lastly the financial resources. Concerning physical and human resources allocation, the participants agreed that for the IBP to achieve its stated outcomes, the role of the physical and human resources cannot be overemphasized. The presence of the full-time technical and managerial staff members, who oversee the day-to-day running of the UFS ideas lab, has ensured that the IBP schools are serviced in line with what is stated in the legally binding tender document that was signed between the UFS ideas lab and FSDoE. The technical knowledge that the technical staff possess ensures that there is a seamless transfer of valuable knowledge by the different presenters to the identified IBP schools. UFS ideas staff also ensure that the schools receive quality content that is received through IBP-installed equipment. In addition, constant communication between the UFS ideas lab FSDoE and the schools was identified by participants as the main driver of change in that if all stakeholders are in alignment and can execute their allocated responsibilities in time, IBP services are transmitted without any hindrances.

The participants also highlighted the type of physical resources that is found at both the UFS ideas lab and in selected schools that are the IBP live streaming beneficiaries. There was general satisfaction with the equipment that is provided to the different selected schools, and its portability and ease of use were mentioned as added advantages. The ease of use of the IBP equipment also meant that the teachers and learners were able to navigate and access valuable information with ease. This links well with the PE, EE and FC constructs from the UTAUT theoretical framework. The participants were willing to interact with the IBP in their respective schools and thus proved that it was adopted and used effortlessly. The same was mentioned about the IBP studios that were not only user-friendly, but also easy for the different presenters to understand and that also meant comfortability and self-confidence, which aligns with the UTAUT's FC constructs.

Regarding financial resources allocation, the discussion is linked to section 5.7.3 that covered the financial resources that make IBP's daily operations possible. A stable budget allocated and managed by the UFS ideas lab, ensures sustainable delivery of this valuable service to all Grade 12 learners from IBP schools across the Free State Province. The presence of an additional emergency fund is another assurance that unplanned emergencies, that may threaten the transmission of the IBP lessons to IBP schools, are being taken care of and addressed within a short period of time. It has been shared by participants that, even though it is not common, some schools fell victims to crime and the stolen IBP material would require replacement to avoid disturbing the seamless presentation of the IBP lessons that happen online.

This discussion on the evolving IBP services has its links to section 5.7.3 that dealt with the IBP diversification factor that many participants shared during the interaction sessions with the researcher. Even though the initial aim was to offer a service wherein lessons were transmitted from the UFS ideas lab to all the selected IBP schools across the Free State, the IBP evolved with time and added additional services that were deemed suitable within the service delivery realm. A need was identified to add the examinations and memo discussions sessions as part of IBP's wider service delivery to the schools across the Free State Province. The examinations period is seen, in the life of Grade 12 learners, as a critical period wherein learners are provided with all the necessary support and that included identifying specialist teachers in their respective Grade 12 subjects, who would present and oversee the discussion on past examination papers and how Grade 12 learners are expected to tackle such questions during the examination period. In addition, the memo discussions that are also presented through IBP by

Grade 12 teachers and subject advisers, give learners an added advantage in that they can get to know how the examiners and moderators of different Grade 12 final examinations want the papers that they would have set, tackled by the learners. This IBP service ensures that a bigger number of learners are connected at the same time, together with their teachers, who get empowered on how to teach topics, some of which they regard as challenging. The outcome is that Grade 12 learners gain confidence, feel empowered and are not scared to face the final examinations.

The additional services are offered, using improved access points, for example, teachers and learners are now able to access the presentations through the YouTube service, which is a service that has broken down barriers, space and time. The link that the teachers and learners receive is another enhancement that has eliminated the old workflow, wherein they were expected to gather in a dedicated centralized point to access the IBP services. Using their smartphones, they can access the service, save it on their devices, share with fellow counterparts and are able to revisit the presentations and watch them time and again. This expansion of the IBP portfolio happens in an environment that is non-mandatory and that means that the teachers and learners are not compelled to access the above services as they happen. The non-mandatory means that the teachers and learners have a leeway to access the IBP services as and when they find time to watch and integrate it into the teaching and learning experience. The only challenge with a non-mandatory integration of technologies, including the IBP, is that some implementers may not feel obliged to integrate it and thus put the beneficiaries at a disadvantage or deny them access to valuable resources whose information may empower them to achieve at a higher level.

Continuous training, support and sustainability for the IBP are fundamental. The discussion on continuous support, training and sustainability of the IBP is associated with data analysis in section 5.7.3. Training of stakeholders is one of the important elements that form part of the introduction, acceptance and use of new technologies, like IBP. The discussion starts with the support from the SMTs that participants noted as important in that they are the first people to be informed by the FSDoE about their intentions to integrate new technologies and teaching and learning and they are expected to sell a positive message to their respective schools and ensure that they always get a buy-in. If the SMT is well versed and positive about change, this trickles down all staff members and they are always there to offer materials and moral support, which is key to the successful implementation of technologies, like the IBP. Although there was a

noticeable general support from all schools' SMTs, there were a few participants who noted that they are struggling to integrate the IBP, due to the reluctance of some of the members of the SMTs and one of the reasons, was being of an advanced age and thus having a negative attitude towards technology and sometimes thinking it was replacing them. In some cases, the teachers normally develop self confidence that makes them think they can always do better than the other person in their respective subjects, including the IBP presenters.

The district and head office officials were commended by the participants for their unwavering support when it comes to the integration of the IBP services. Their availability through different social platforms and sometimes physical visits to the schools are seen by participants as encouragement and a challenge for them to improve themselves and thus developing a positive attitude towards IBP integration. In a show of support for the contribution that the private sector in making towards quality education in the Free State, MEC Tate Makgoe (2021) tweeted an appreciation of the 100 tablets that were donated by the mobile technology company, MTN, to one of the districts in the Free State Province.

The district officials were also mentioned as practical in their approach in that they would visit their teachers while they were teaching and offer live support and thus making teaching a collaborative effort. The presence of communication tools, like WhatsApp, was also mentioned as one of the tools that the district and head office officials use to interact with their teachers, and this makes them available during and after hours as and when they are needed. Some of the district and head office staff go as far as doing the actual presentation of different IBP lessons and that also builds the teachers' confidence and leads them to adopt the IBP and make it part of their daily teaching and learning activities.

Since training on IBP integration is a continuous process, new ways are being introduced to enhance the way stakeholders are empowered. The in-house identification of IBP champions is one of the strategies used to ensure that any challenges encountered by IBP schools have fellow teachers and learners as first port of call, and this eliminates the time it takes to solve minor challenges. This also assists to empower stakeholders with digital silks that are needed when new technologies are integrated into teaching and learning. The use of locally trained IBP champions also assists in creating awareness and sharing of knowledge with neighbouring skills, and this ensures that more implementers are reached within a short period of time. It is also expected that the IBP staff members will review the training and support in response to the

changes that are happening in the outside world. Since technology is ever-changing, the IBP training is therefore expected to be on par with the rest of the world. The IBP staff also shared that they are legally bound to share and report on a regular basis the type of training that they have offered, including the target audience. As members of the data-driven world, the statistics that are offered on the above activities, are used to make sense of the level of IBP adoption and usage and the development of alternatives if there is a need.

The discussion on the challenges associated with the IBP broadcast times, is in response to the data analysis in the previous chapter (see chapter 5.7.3), which covered the challenges that affect IBP integration and thus negatively affect the achievement of Grade 12 learners in the Free State Province. One of the discussions centred on the participants' views on the perception that it continues in both IBP and non-IBP schools that the IBP services catered only or mostly for the content subjects (for example MATHS and PHYSC) and that excluded or provided little space for the languages (for example EFAL). Even though, over the years, a number of Grade 12 subjects have been accommodated, many participants still think that mentality still exists in many schools and the SMTs have the responsibility to ensure that, for example, languages that include EFAL are promoted and given equal time and most importantly that learners are also encouraged to regard and give languages, like EFAL the same weight as the so-called content subjects (for example MATH and PHYSC).

The success of IBP integration does not only depend on the installation of the infrastructure in IBP, but also on the provision of cheap and accessible data that, now, as it was conveyed by participants, data is still one of the most expensive enablers of IBP integration. It is of use, as some participants shared, to roll-out an excellent IBP service to targeted Grade 12 learners from quintile 1-3 schools, whose parents cannot afford the expensive data that their children need to access IBP 24 hours, 7 days a week and 365 days a year. The contractual obligations between the FSDoE and UFS ideas lab is not always a smooth ride, due to red tape in government and it delays the approval and renewal of the tender that allows for the IBP services to continue uninterrupted. The absence of a legally binding IBP provision service, offered through a collaboration between the FSDoE and UFS ideas lab is seen as threatening the consistent achievement of Grade 12 learners that has placed the Free State Province at the top, compared to their counterparts from the other eight provincial departments. The call from the participants was for these contractual obligations to be always honoured and the lessening of the tight

bureaucratic rules that have an indirect impact on the achievement of Grade 12 learners in the Free State Province.

Another issue that emerged from the interaction with the participants was that of the copyright issue, which was also associated with the new emerging developments that included opening the IBP YouTube channel that is accessed by not only the IBP or non-IBP Grade 12 learners in the Free State but opened to anyone who has access to the Internet. Many participants were cautiously optimistic about the channel and on the other hand questioned if there were copyright laws governing access to IBP lessons through an open internet platform. This issue, as confirmed by the participants from the UFS ideas lab, needed to be investigated further to ensure that there was no copyright infringement and allay the fears of the IBP presenters, who do not want the lessons that they are presenting to be directly and indirectly abused and land in the hands of the people with ulterior motives. However, most of the participants were willing to continue offering their services through IBP, since they were aware that the beneficiaries were Grade 12 learners, who came from 1-3 quintile schools and desperately needed quality education to achieve high levels.

This discussion on multiple factors at play informed by data analysis in section 5.7.3, wherein participants believe that, besides the above and clearly defined factors that either enable or negatively impact on IBP service, there are many overt and covert factors in action, that have an impact on the achievement of Grade 12 learners across the Free State Province. Although these factors may be difficult to pin down, they exist and, as some participants indicated, they must be investigated, identified and dealt with in a way that contributes towards the achievement of Grade 12 learners in the Free State Province. For example, some of these factors are subjective in nature and may revolve around teachers or Grade 12 learners feeling positive towards the content that is offered through IBP integration.

In addition, it was also stated that the achievement of different learners is a combination of many subtle factors at play, for example, the home environment where the learners study and access IBP after school, the presence of data to access such information, parental support and the number of times the different learners access the different IBP videos as a supplement to what has been taught in class by their teachers. There were instances where teachers were just parachuted from lower Grades to Grade 12 and that made them not have enough history of the learners they would be dealing with, unlike the situation where teachers start with their Grade 12 learners from lower grades (Grade 8-Grade 12). This then requires additional research to dig

deeper and uncover these nuanced factors that have an impact on the achievement of Grade 12 learners in the Free State Province.

6.6 Discussion from the triangulated data

The discussion is drawn from the combined data analysis in section 5.8 wherein data from both quantitative and qualitative sources of data from IBP and non-IBP schools are compared and related to the RQs and the constructs from the selected UTAUT theoretical framework. The first discussion is a general comparison between the IBP (treatment) and non-IBP (control), followed by the comparison between IBP and non-IBP schools as seen separately from the three selected Grade 12 subjects (EFAL, MATH and PHYSC) that form part of this study.

To highlight the impact that technology integration has on learner achievement, section 3.2 on page 51 confirms that experimental groups tend to perform better than the control group and the mean scores (Alneyadi et al. 2023:1). The results were from a study conducted in United Arab Emirates (UAE)' city of Al Ain and that is an indicator that technology impacts achievement irrespective of the location of the schools (2023:1).

When it comes to data analysis of Grade 12 data in EFAL, the discussion relies on sections 5.5.3, 5.5.4 and 5.6.1 on the performance between IBP and non-IBP schools. The performance of Grade 12 learners in EFAL, a subject that is taken by all learners indicated that in IBP schools, Grade 12 learners were in the majority achieving between 40% and 59% and on the other hand Grade 12 learners from non-IBP schools performed between 40% and 49%. Further tests on the quantitative data between these two types of schools (IBP and non-IBP) indicate that the better performance in EFAL by IBP Grade 12 learners can only be because of the introduction of the IBP that forms part of teaching and learning in the subject. The qualitative part (see section 5.7.1 and 5.7.2) is drawn from the participants' views that confirmed that EFAL learners were passing in large numbers but were still not producing quality passes that would be linked to Bachelor passes. However, although these levels of performance in EFAL can be considered as a pass as indicated in the promotions policy from DBE, most tertiary institutions have put stringent entry requirements especially on the type of pass that prospective students receive in EFAL while in high school.

The combined data analysis of the performance of Grade 12 learners from both IBP and non-IBP in MATHS (see sections 5.7.1 and 5.7.2), indicate that IBP schools were, in majority, performing between 30% and 49% and these levels of achievement are considered as a pass according to DBE's levels of achievement. It also shows that between these levels stated above, most Grade 12 MATHS learners received 40-49%. On the other hand, the non-IBP schools were also achieving between 30% and 49% with the majority achieving between 30% and 39% and as indicated in the promotions prescripts such learners are considered as achieved. Further testing of data using quantitative data analysis has also confirmed that the difference in achievement in the two types of schools could be attributed to the introduction of the IBP technology in IBP schools wherein Grade 12 teachers and learners were exposed to its integration in teaching and learning. The participants, through the qualitative data analysis (see chapter 5), shared views that are aligned to the above quantitative analysis in that the Grade 12 MATHS learners were not achieving at highest levels of achievement that would open doors for them to enroll for STEM qualifications in different tertiary institutions.

This discussion delves on the combined data analysed from the quantitative part of the study between IBP and non-IBP schools (see sections 5.7.1 and 5.7.2). It is also corroborated with the data from qualitative parts of the study to make sense of the achievement of Grade 12 learners across the Free State Province in PHYSIC. The Grade 12 IBP school learners were achieving between 30% and 49% and this also indicate that they were cut in the middle with 50% in the 30s while the other 50% was achieving in the 40s and both performances according to DBE are considered to be passes, The additional testing of the PHYSC data also revealed better achievement levels of Grade 12 learners from IBP schools in comparison to their counterparts from non-IBP schools and the IBP integration is considered as the only technology that had an impact on achievement of Grade 12 learners in the Free State Province. The above findings are aligned to the qualitative part wherein the participants considered IBP as having made a difference in performance between IBP and non-IBP Grade learners in PHYSC.

The discussion is aligned to the data analysis in section 5.8.4 on overage performance of Grade 12 learners according to gender. It indicates that there were more female learners (7372) who sat for the examinations in the three selected Grade 12 subjects when compared their male counterparts (6562). There was a small difference in performance between the two genders and that corroborated by studies that were shared (Spaull and Makaluza (2019:11and Letsoalo 2022:103).

The 2016 Grade 12 data analysis of performance in Mathematics and Physical Sciences points out that there is an increase in learners who reach critical performance levels between 50 and 70% (levels 3-6) in either subject (DBE 2019:41). In addition, there was also a 65% increase in African black learners achieving 60% (level 5) in mathematics (DBE 2019:41). Unlike this study that concentrated on quintiles 1-3, the above statement may have taken all quintiles into consideration. Many studies (Makwakwa 2012, McCarthy and Oliphant 2013 and Spaull and Kotze 2015) indicate that Grade 12 learners find Mathematics in general, challenging, with specific topics including probability cited quite often (Ogbonnaya et al 2019:107). Some global researchers (Batanero et al 2016) consider probability (Mathematics) and literacy (Languages) as an important part of the curricula at all levels and CAPS is no exception (2019:107). Many participants' views agreed that the subject and specifically probability as a challenging subject (see section 5.7.2.2 above). Ogbonnaya et al (2019:106) conducted a study to ascertain the performance of Grade 12 learners according to quintiles and the results revealed that although quintile 4 performed significantly higher than learners at lower levels, quintile 1 out-performed quintile 2 learners at all cognitive levels. Although many intervention programmes have been introduced to narrow the achievement gap between the quintiles, there is no empirical evidence to prove their effectiveness (2019:106). Accordingly, there is a need to ascertain the extent to which the schools' quintile level impacts levels of achievement.

6.7 Summary of the chapter

The demographic features from the quantitative perspective that are drawn from the Grade 12 historical secondary data, indicate that there are more female learners than male learners, who were part of this study. It also shows that that there were more female teachers than male teachers who participated in this study and this contradicts an all-male district and head office representation. The same was observed at the UFS Ideas Lab, where all male participants, including the observed technicians (even though they did not participate). The development of the Provincial Strategy on Learner Attainment (PSLA) that gave birth to the collaboration between the FSDoE and UFS ideas lab, was an important strategic move whose stated objectives led to the implementation of the IBP. Legally there is a solid line that distinguishes between the IBP and non-IBP schools and hence the selection of the quasi-experimental study for this study (see chapter 4), to highlight that IBP (experimental) schools receive live streaming services that they integrate into teaching and learning. In contrast, the non-IBP

schools (control) follow the traditional way of teaching. The researcher, after consultation with the participants and from the tests done on the Grade 12 historical secondary data, also established that the three selected subjects showed some improvements in achievement of Grade 12 learners during the five-year period under study. However, there are also factors that pose a threat on the integration service of the IBP. The presence of suitable Facilitating Conditions (FC), the positive Social Influences (SI) that stakeholders used to promote the IBP in terms of how it performs (PE) and produces the desired results (EE), made it possible for the teachers and learners to project an image that indicated positivity (BI) and willingness to accept and use the technology in teaching and learning.

CHAPTER SEVEN

SUMMARY RECOMMENDATIONS AND CONCLUSION

7.1 Introduction

Chapter seven is organized conceptually, based on research questions. The chapter provides the overall summary of the study's findings, conclusion and recommendations. Chapter seven discusses the study's contributions to policy, practice and theory. It also maps out future research directions. The study's objectives sought to: (1) identify the legal and legislative frameworks that support the creation and integration of the Internet Broadcasting Project (IBP) at the Grade 12 level, (2) understand the experiences of learners and teachers after the introduction of the IBP as an intervention for Grade 12 learners in the Free State Province, and (3) investigate the UFS ideas lab-led factors that influence academic achievement of Grade 12 learners in the Free State. The study was based on a post-positivist paradigm and underpinned by the theoretical framework, called the Unified Theory of Acceptance and Use of Technology (UTAUT) that was developed by Venkatesh, Morris, Davis and Davis (2003). This combined research used quantitative and qualitative approaches, together with the quasi-experimental and survey design, respectively. The population included 2014 to 2018 historical Grade 12 secondary data, representing learners' final marks in three selected subjects, Grade 12 teachers from selected 12 quintiles 1-3 high schools (six IBP and six non-IBP) in the Motheo District that forms part of the Mangaung Metropolitan Municipality, Motheo District and FSDoE head office's FET schools' subject specialists in three selected Grade 12 subjects and two UFS ideas lab staff (coordinator and head). Quantitative and qualitative data were analysed, using NVivo and SPSS, to generate descriptive and inferential statistics and narrations.

7.2 Summary of chapters

Chapter one provided the context of the study through the discussion of the following aspects: the impact that the introduction of educational technology, as intervention strategy, has on the achievement of learners and as seen from the following perspectives: intentions of the collaborative effort between the Free State Department of Education (FSDoE) and the University of the Free State (UFS) ideas lab's perspective, a brief literature review on the IBP as an intervention strategy and existing relevant literature studies on the integration of technology within teaching and learning, statement of the problem, research objectives, research

questions and delimitations. Likewise, the chapter briefly discussed the Unified Theory of Access and Use of Technology (UTAUT) theoretical framework, theories and research methods employed in the study, including reliability and validity and ethical considerations. The aim of this introductory chapter was to provide an overview and background of the study and set the stage for formulating the research questions and the organization of the study. The next overview to be discussed below is in chapter 2.

Chapter two delved into the details of the Unified Theory of Acceptance and Use of Technology (UTAUT) theoretical framework that was adopted for this study. The model is a product of eight technology adoption models that had been developed earlier, and they include the Technology Acceptance Model (TAM), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Combined Technology Acceptance Model and Theory of Planned Behaviour (C-TAM-TPB), Motivational Model, PC Utilization Model, Social Cognitive Theory and Innovation Diffusion Theory (IDT). The discussion focused on how they were developed, how they relate to other models and were applied by researchers, such as Zhang, Li and Sun (2006), Wang and Yang (2005), Engebretsen (2005), Cody-Allen and Kishore (2006). The chapter delved deeper into the UTAUT model and how, in literature, it has been applied in different situations with a particular focus on education in local and international contexts. It further provided reasons why it was selected as an appropriate theoretical framework for this study, taking into consideration technology adoption literature studies that have identified inadequacies within the popular and commonly used TAM and UTAUT models in explaining technology adoption in non-Western cultures, such as South Africa (Bagozzi, 2007). Accordingly, a detailed linkage between the research questions and the UTAUT model was mapped out to highlight the relationships among the variables of the study.

Chapter three focused on literature studies that linked to the study's title, research problems and questions. Many literature review sources used in this study agree that the introduction of the ICTs in education, transformed the teaching and learning sphere and consequently, an Internet Broadcasting Project (IBP) was conceived (Kocaleva et al., 2015:23, Tan, 2019:2 and Scherer & Brito, 2020:3). The study's argument was premised on the adopted literature view approach, as well as on the concept-centric approach, that is centred on the impact that the Internet Broadcasting Project (IBP) has on the achievement of Grade 12 learners in the Free State Province (Creswell, 2014:30, Watson & Webster, 2020:130 and Ocholla, 2021:1). Different sub-topics that formed part of this study have been selected to make sense of both the

research problem and questions. Equally important is the on-going evolution of education-related legislations, policies and the curriculum (CAPS), whose prescripts promote the integration of ICTs that include the IBP that, when successfully integrated, lead to the improved achievement of Grade 12 learners in the Free State (Behr, 1988:9, Nekhwevha, 2002:135, Nkomo et al., 2004:1, Rakometsi, 2008:1 and Alfaki & Khamis, 2018:136). Different literature review sources on the prolonged segregated system (overt and covert) and the unequal allocation of both physical and human resources, impacting the achievement of learners of the same school-going ages was also covered to support the need to level the educational playing field (Ogbonnaya & Awuah, 2019:107). To establish the impact that the integration of the IBP has on the achievement of Grade 12 learners in the Free State, as cited in the literature review chapter, is a linkage to the political landscape that forms the foundation for the development of the segregated system, DBE's evolution over the years and the introduction of intervention strategies to address inequalities and the achievement of Grade 12 learners in the Free State.

Chapter four gave a detailed outline of this study's research methodology and design. The chapter presented the research paradigm, research approach, selected research designs, population, sampling procedure, data collection, data collection procedures, administration of research instrument, validity and reliability, data analysis and ethical considerations for this research. This combined research study adopted a post-positivism paradigm aligned to studies on technology integration in educational settings (Klein & Lyytinen, 1984, Livari, 1991 and Kaur, 2020). This chapter also highlighted the reasons for selecting the post-positivist paradigm, its strengths, as well as its application in different contexts. It also gave an overview of the selected combined research approach, including quantitative and qualitative approaches. In line with the combined research studies, the quasi-experimental and survey designs that formed part of this study, aligned with the selected post-positivism paradigm. Within the quasi-experimental design realm, a non-equivalent control group post-test design or comparison group design was selected, while the semi-structured interviews formed part of the survey design part of this study. It is from this study that the two selected software, SPSS 29.0 and NVivo, were selected to analyse both the quantitative and qualitative data, respectively. The overall purpose of this chapter was to describe the study's research methodology, explain the sample selection, describe the procedure used in designing the instrument and collecting the data and lastly to explain the statistical procedures used to analyze the data.

Chapter five dealt with data analysis and the presentation of findings from the results emanating from analyzing data from the historical FSDoE Grade 12 secondary data and the semi-structured interviews. A response rate of participants was recorded at 65.90% and when broken down, it showed that the number of EFAL teachers at 66.6%, the number of Mathematics teachers at 50%, the number of Physical Science teachers at 58.3%, the number of Motheo District FET schools subject officials at 100%, the number of FSDoE head office FET schools subject officials at 100% and the number of UFS ideas lab officials at 100 %. Finally, demographic analysis was conducted on the historical FSDoE Grade 12 secondary data in terms of gender, with an average age of 18 being an assumption linked to the DBE's policies on the admission of learners (for ethical reasons learners' identification numbers were not shared). The findings revealed that out of all three Grade 12 subjects' under-study (EFAL, MATHS and PHYSC), the achievement of learners was directly linked to whether they were exposed to IBP or not (non-IBP). The average mean scores that learners received across all three subjects were better for those from IBP than those from non-IBP schools. No link indicates that the learners' gender had an influential role in their final marks or achievement at Grade 12 level. Chapter five provided an overview of the data collected within the combined research prescripts and how it was transformed to make sense of the stated research objectives, following the acceptable data presentation standards.

Chapter six discussed the research findings and provided an interpretation of the results in relationship to the existing and relevant information in the literature. The discussion revealed significant relationships between the variables of UTAUT and variables such as PE, EE and FC (including age, gender, experience and voluntariness) and the achievement of Grade 12 learners in the Free State Province.

7.3 Summary of findings

This summary is informed by the findings that are linked to the research questions that sought to make sense of the impact that the IBP has on the achievement of Grade 12 learners across the Free State Province.

The first findings that are linked to RQ 1 indicate that the development and the implementation of the Provincial Strategy on Learner Attainment (PSLA) produced the desired outcomes in that there was a noticeable increase in the number of Grade 12 learners who were passing the National Senior Certificate (NSC) examinations. Tied to the above are the relaxed promotions

policy that made it easier for many learners to exit the Further Education and Training (FET) schools' band. Since the IBP integration targeted the learners who come from quintile 1-3 schools, the strategy seems to have yielded positive results in that these non-fee schools were now producing good results with some learners getting admissions in many tertiary institutions. The IBP technology infrastructure was not only user-friendly, easy to operate, but it also accommodated the different needs of the different users and thus aligned well with the selected UTAUT theoretical model. The legally binding collaborative effort between the FSDoE and UFS ideas lab and the corresponding policies have left a national footprint in that the Grade 12 learners across the Free State continue to perform better than their counterparts from the other eight provincial departments.

The following findings that are linked to RQ 2, indicate that both Grade 12 teachers and learners were positively prepared to embrace the integration of the IBP in teaching and learning. The teachers discovered various ways of integrating IBP technology to be part of teaching and learning. They identified it as an important part of their lessons' preparations, and they also made use of the technology during school revisions or when preparing for tests and examinations. The IBP technology allows for both teachers and learners to engage and discuss challenging topics, using the live streaming or video-recording services. It has also been confirmed by teachers that their learners have improved in terms of the marks that they were receiving, even though they tended to receive minimum marks, while a few were receiving the highest levels of performance. In all the three Grade 12 subjects (EFAL, MATH and PHYSC) under study, the IBP learners tended to perform better than their counterparts from non-IBP schools and the tests reveal that the success can only be attributed to exposure to the IBP technology. This means that the presence of a conducive platform (FC) for the integration of the IBP, its performance (PE), ease of use (EE) and the positive reviews (SI) from all the interaction with the IBP, confirm that there is a positive alignment with the selected UTAUT theoretical framework. Another finding is that there was an agreement that even though Generation Z learners are familiar with different technologies, they still need guidance, since they are not matured enough to navigate the IBP integration process on their own.

The last finding is linked to the RQ 3 and it reveals that the success of the IBP integration in schools across the Free State, is attributed to the presence of a well-established infrastructure, including human and physical resources that ensure that there is a seamless transmission of the services to all affected schools. The expansion of the IBP portfolio and its flexible nature that

accommodates the ever-changing needs of the clients, is another positive finding that led to the success of the technology. The above also means that the stronger FC construct from the UTAUT theoretical framework ensures that there is a stronger possibility to adopt and use the technology in teaching and learning. The presence of a continuous support and training ensures that there is a seamless and uninterrupted service delivery and thus guarantees access to quality teaching and continuous learning. There is also an acknowledgement that the service is not always prefect and that means there is a need to address any challenges that may arise, for example the ever-increasing data costs and misalignment between the schools' timetable and the IBP live streaming timetable. Both the quantitative (Grade 12 marks) and qualitative (interviews) data, when combined, corroborated that the IBP has made a difference and there is always more room for improvement.

7.4 Conclusion

This conclusion is based on the key findings of each of the research questions. The first research question highlighted the legal and legislative frameworks that support the creation and integration of IBPs at the Grade 12 level. The findings revealed the development of the Provincial Strategy on Learner Attainment (PSLA) and its link to the National Strategy on Learner attainment (NSLA), of which both are discussed in detail in chapter 1 (see section 6.3.1.1), whose intention was to address the high failure rate of Grade 12 learners in the Free State Province. The presence of the tender document that legally binds and ensures that the collaboration between the Free State Department of Education (FSDoE) and the University of the Free State (UFS) ideas lab is fully implemented and leading to stated outcomes. The results show alignment with DBE's promotion policies, as the findings reveal a marked improvement in the Grade 12 results, confirmed by both exam data and the participants, who confirmed that the Free State took position one nationally in the National Senior Certificate results.

The findings indicate that the introduction of the IBP services positively affected the NSC pass rate, which is attributed to the schools' and teachers' willingness to accept and use the IBP in teaching and learning. The conclusion that is drawn from the above is that there were Facilitating Conditions (FC) that allowed for the IBP to be used in schools. In addition to the above, the IBP services were met with open arms by schools and teachers, due to its flexibility and ease of use (PE and EE) and that was confirmed by all stakeholders, who described the technology as fit-for-purpose (SI) and the constructs were strong predictors for both willingness to accept (BI) and use the IBP. Working together with the above constructs are the experience

and voluntariness of use moderators, who correspondingly support the above UTAUT constructs. The conclusion reached also indicates the implementation of IBP services had a beneficial impact on student achievement, which was aided by conducive conditions and stakeholders' acceptability and convenience of use, as well as the experience and voluntariness of moderators.

The second research question explored the experiences of learners and teachers on the provision of an IBP intervention programme for Grade 12 learners in the Free State. The key findings are that the EFAL, Mathematics and Physical Sciences teachers, together with FET schools subjects' specialists in the three selected subjects at both FSDoE' district and head office levels, agree that the introduction of the IBP in their respective areas of specialization had a positive impact on the achievement of Grade 12 learners in the Free State Province. The Grade 12 learners who are the beneficiaries were cited by teachers as having a positive attitude and willingness to engage the IBP during teaching and learning. The above links with studies on the unique characteristics possessed by the Generation Z, who are were born into a word of technologies and therefore find them (including the IBP), using their creativity easier to navigate throughout their schooling life with teachers, playing equally influential, guidance and monitoring roles (Hernandez-de-Menendez et al., 2020:847, Szymkowiak et al., 2020:101565, Kirchmayer, 2020:6019, McCoy, 2020:5 and Bereczki, 2021:100791).

Their assertions are corroborated by the findings from the analysed historical Grade 12 secondary data on the three subjects under study that indicated that there was a continuous improvement in results over a marked period that included the years 2014-2018, that formed part of this study. The IBP infrastructure that was provided, in line with the prescripts in the tender document, was cited by all participants as not only easy to use, but also easy to navigate during the integration process in all teaching and learning spheres. That aligns with the UTAUT's PE, EE, SI and FC constructs, in that in their individual ways are strong predictors of intention to use the IBP (represented by UTAUT's BI and use respectively). Some findings that are subject specific have also revealed that the integration of the IBP assisted teachers (EFAL, MATH and PHYSC) to address and tackle some topics that have been difficult to teach or relay the message to their respective Grade 12 learners. EFAL participants cited mostly creative writing, and whenever new literature books were introduced, Maths teachers cited the topic, called probability, while Physical Sciences teachers pointed at the topic on acids and bases, as some of the challenging topics that, through the integration of the IBP, they were able to gain

confidence, experiences and skills to teach them without challenges. The UFS IBP ideas lab's assistance in tackling the above, for example, in the form of expert presenters, quality video-recordings and access, contributed towards the achievement of Grade 12 learners in the Free State Province. The findings lend empirical support to various theoretical constructs in the UTAUT model. The favourable role of IBP intervention programmes on Grade 12 students is consistent with UTAUT's notions of Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). These data support the theory's claims about the impact of perceived utility, ease of use, social variables, and contextual facilitators on people's intention to use and actual usage of technology in educational contexts.

Another notable conclusion is that since this study adopted the UTAUT model in its original format that includes all its constructs, this confirms the framework's relevance in today's studies (Venkatesh et al., 2003, Yee et al., 2021:1). The findings showed that Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI) and Facilitating Conditions (FC) in their individual ways, assisted in making sense of the impact that the IBP has on the achievement of Grade 12 learners in the Free State Province. The participants clearly showed their appreciation of the presence of the IBP in their everyday teaching and learning lives with some even boasting about the Free State occupying the first position on the DBE Grade 12 Matric results lists over a long period, including the years that form part of this study: from 2014 to 2018 with 2014 being the first year of the CAPS-aligned NSC examinations (Department of Basic Education 2024). The consistent higher performance 2014 (82%: 3 nationally), 2015 (81.6%: number 3 nationally), 2016 (88.2%: number 1 nationally), 2017: (86.1%: and 1 nationally) and in 2018 (87.5%: 2 nationally) and the above statistics are a testimony that the Free State Province is on an upward trajectory (Department of Basic Education, 2024). Equally, the moderators individually played an influential role on the key independent variables, leading to behaviour intention, acceptance and use (Venkatesh et al., 2003, Yee et al., 2021:1). The issue of gender, for example, was clearly demarcated from the historical data and from the qualitative part gender was not set as a criterion but evolved from the interactions with various participants. Another important finding is that although IBP's integration in teaching and learning is not forced upon teachers, the levels of interaction with the technology featured strongly and thus indicated dominance of voluntariness and positivity towards acceptance and use of the IBP (Venkatesh et al., 2003, Yee et al., 2021:1). This means that from the theoretical point of view, there is an alignment with this study's findings with context sometimes separating the IBP from the non-IBP schools.

The third research question explored the UFS ideas lab-led factors that influence the academic achievement by Grade 12 learners in the Free State. The research finding shared in section 6.3.2.3 that deals with IBP acceptance and use, indicated that the IBP was well received and participants cited the performance and ease of use and that there also were elements of influence by neighbouring schools and these assertions link with PE, EE, and SI in that the technology was meeting the needs and the UTAUT constructs indicated that there was general Behavioural Intention (BI) by all stakeholders to adopt the IBP and integrate it in teaching and learning. In addition, the general feeling of the participants is that the Facilitating Conditions (FC) governing the operations and IBP infrastructure provision, are fertile enough for the acceptance and use of the technology by all Grade 12 learners and teachers across Free State Province. The conclusion reached, including the researcher's observations, is that the IBP services served the purpose and responded positively towards the realization of the objectives listed in the strategic plan whose intention was to improve learners' achievement in the Free State Province. Regarding section 6.3.2.3.2 that covers diversification of the IBP portfolio, it was revealed that the IBP had undergone metamorphosis over the years. These changes indicated that the technology was maturing and adding more functions to meet the ever-growing needs of its targeted clientele, which was consistent with components from the Unified Theory of adoption and usage of Technology (UTAUT), such as Performance Expectancy (PE), Effort Expectancy (EE), and Social Influence (SI). Furthermore, the diversity of the IBP portfolio, which included features, such as debating prior exam papers and utilising platforms like YouTube, helped to increase the quality of teaching and learning, resulting in higher academic accomplishment among Free State Grade 12 students.

The issue of mandatory or non-mandatory use and integration of IBP (see section 6.5) states that IBP usage by teachers was not mandatory but seen as an additional tool that improves teaching and learning. The presence of relaxed rules meant that the teachers were at liberty to access the IBP and integrate it into teaching and learning. The flexibility offered by the IBP service that includes accessing video recordings means that teachers have an additional advantage that allows them to repeatedly access the quality presentations later or during their spare time. The absence of an aligned timetable (schools and IBP) means that the utilization of the IBP would always be below expectations in that, as shared by some participants, they sometimes lose the rare real-time engagement with presenters during the IBP live streaming. The conclusion reached is that in as much as the flexibility and autonomy of the schools are

respected, a common ground would need to be created wherein teachers and learners are able to contact the presenters, using various platforms to enhance the quality of the presentations. There was also a need to ensure that the copyright issues are addressed, since the technology world meant that the content that is presented on the YouTube platform is open to access and scrutiny by people outside the Free State Province. The provision of access credentials may assist in ensuring that the information is not subjected to abuse and manipulation by outside forces. The unravelling of the UFS ideas lab-led factors demonstrates the importance of collaborative efforts between academic institutions, like the University of the Free State and educational authorities, like the Free State Department of Education in improving the academic achievement among Grade 12 students. It emphasises the necessity of using creative ways and partnerships to improve educational outcomes and student success.

7.5 Recommendations

The study has identified a variety of issues related to the phenomenon under study. It has presented the recommendations of the study, based on each of the research questions and the findings, where applicable. The first research question identified the legal and legislative frameworks that support the creation and integration of IBPs at the Grade 12 level. The findings reveal that the aims and objectives laid down in the Provincial Strategy on Learner Attainment (PSLA) and whose link is the National Strategy on Learner attainment (NSLA), (see chapter 1 and 6.3), have been achieved through the results that not only left a provincial, but a national footprint as well. Participants and literature confirmed that the FSDoE's Grade 12 results have been on national discourse over the past years and that is an acknowledgement that the IBP contributed towards an improved achievement of Grade 12 learners in the Free State Province. Since this collaborative effort is guided and depends on legal prescripts in the form of a tender, the recommendation is that there is a need to continuously strengthen the legal and legislative frameworks that will lead to a seamless application, in the case of this study, the integration of IBP in schools and later realisation of the outcomes in the form of achievement of Grade 12 learners across the Free State Province. The tender committees should be established that will be comprised of the members from both UFS and FSDoE with the Vice Chancellor and the MEC for education or their representatives driving the approval and implementation of the IBP.

Another recommendation to consider, is the implementation of an ongoing capacity-building programme that will empower and assist the overburdened teachers to increase the percentage pass rate to the highest level when compared to the rest of the country. The Grade 12 teachers

are expected, within the short period of time, through an IBP integration, to produce a high number of passes with quality being compromised. Although the IBP intervention strategy has a direct link to the promotion policies that contribute towards a higher number of passes at Grade 12 level, there are inevitable factors that include progression of learners that seem to put more pressure on schools, who are forced to produce miracles and convert progressed learners who did not meet the promotion rules at Grade 11, to be achievers. It is therefore important that continuous support structures and capacity-building are put into place to ensure that Grade 12 teachers balance quantity and quality of passes successfully. A policy needs to be refined, revised, or undergo a complete overhaul from time-to-time, such an e-education policy was established in 2004, and it should open multiple platforms for critical-thinking, creativity and expansion of the IBP portfolio to be on par with the rest of the world and to have equal access to resources being prioritised. This recommendation, when successfully implemented, will assist to sustain the achievement of Grade 12 learners over the years. The head of Department t the Free State Department of education or his/her representative and the Chief Director for curriculum development have the responsibility to ensure that quality assurance is always maintained.

In addition, since the introduction of the IBP in 2011, that is 13 years later, the schools that have been selected to benefit from IBP live streaming seem to have reached a saturation point, especially those whose teachers have been there from the beginning. They seem to have "gotten used" to the technology and no longer take it seriously, due to familiarity and a long-held belief that it has served its empowerment purpose. This perception also denies the new teachers who are fresh from the university or non-IBP schools' exposure to the IBP live streaming, since none has an interest in it anymore. The recommendation is for the continuous upgrading of the technology to keep up with the needs of the younger and digitally savvy Grade 12 students and ensure the technology used for integration, is on par with the rest of the world. Another recommendation is for the old IBP presentations to be updated on a regular basis, because new teachers and learners may find the old ones not appealing. It may also be advisable that challenging topics be presented by two to three top teachers and or subject specialists on a regular and rotational basis to make sure that teachers and learners are given diverse choices that would entice them to keep on accessing the IBP and thus enhancing their skills and knowledge that are needed to improve learner achievement. Although learner progression has good intentions, there is no panacea for a good foundation and exposure to the IBP with a shaky foundation, may not guarantee achieving at a higher level. Alternatively, new IBP presentations

that go a step or two back may serve as a solution to cover the lost ground by progressed learners in the lower levels. In alignment with the above, establishing a research and development unit whose focus will be on improving IBP integration at Grade 12 level. is another recommendation to consider. The above responsibilities would be handled by the Chief Directors curriculum, districts, district directors, Chief Education specialists at both head office and districts, Circuit managers, school principals, school management teams and teachers.

The second research question explored the experiences of learners and teachers on the provision of an IBP intervention programme for Grade 12 learners in the Free State. All participants across all subject areas commended IBP services (live streaming and video-recordings) for making a difference in teaching and learning and thus leading to the achievement of Grade 12 learners in the Free State Province. When dissected to the three selected subjects, there were commonalities and subject specific issues that were shared by the participants and therefore recommendations will either cut across or be narrowed to subjects. It has also been uncovered from the core findings of the study, that, despite the categorisation of schools into IBP and non-IBP, there is an informal exchange and sharing of the IBP lessons, especially the recordings between the schools. The recommendation is that this cross-pollination and sharing of ideas or between schools through IBP, should be encouraged. It is possible to continue with this practice, since neighbouring schools have shown that dotted lines between IBP and non-IBP schools can be useful catalysts that speed up and eliminate inequalities amongst the under-resourced schools. Another recommendation tied to the above, calls for the creation of intervention strategies that promote mutual and sustainable partnerships and collaborations amongst schools, irrespective of whether they are IBP or non-IBP. The District Directors, district subject specialists, head office subject specialists, circuit managers, school principals, school management teams, UFS ideas lab staff and champion learners would be responsible for the above recommendations.

Another important finding was the lack or consistencies when it comes to monitoring and evaluation of the integration of the IBP live streaming and later the recorded lessons. Although the programme has been running since 2011, the findings indicate weak monitoring tools in place to produce tangible and well-researched evidence on the impact that the IBP integration has on schools that are receiving live streaming and those that are not. This should be conducted across all Grade 12 subjects, otherwise the FSDoE will continue to lead in quantities and lack the important element of good and quality output of Grade 12 learners that is the requirement

for further studies. It is also important that that fair allocation of time and equal attention must be paid to all subjects, including the EFAL that was cited as one of the neglected subjects in comparison to the so-called STEM subjects that include MATHS and PHYSC. The support that is given to Grade 12 MATHS and PHYSC teachers was acknowledged, and the IBP tools seem to have made a difference, but since, by its nature, STEM subjects rely heavily on prior knowledge, there is a recommendation for similar support to be relegated to the lower levels. The belief is that if such intervention is strengthened at lower grades, the Grade 12 learners will achieve at higher levels and thus improve their chances of enrolling in STEM qualifications. There is also a need to ensure that the quality of the content that is presented is kept in check, considering that the new teachers and learners that enter Grade 12 will always be different from the previous cohorts and thus their needs may need to be modified to suit their ever-changing needs. The above also means the resource allocation strategy should be balanced across all subjects and not be biased towards specific subjects. Equally important is the issue of continuous feedback and improvement and that is a responsibility of the schools, district office, head office and UFS ideas lab. Although the absence of mandatory rules to force schools and teachers to implement IBP fully and due to the unique contexts that individual schools operate under, there is a need to continuously emphasise in various internal multi-stakeholder meetings, the importance to integrate the IBP across the schools without always fail and with guaranteed support. The relevant people would include the FSDoE chief director curriculum and all district directors, director quality assurance subject specialist at district and head office, circuit managers and schools' management teams.

The third research question explored the UFS ideas lab-led factors that influence the academic achievement of Grade 12 learners in the Free State. It has been clearly established that the introduction of the IBP services in IBP schools that include live streaming and video-recordings, met the set aims and objectives and that was confirmed in sections 6.3, 6.4 and 6.5 on IBP acceptance and use. The schools that are the main beneficiaries embraced the technology for its ease of use, user-friendliness and its ability to impact across neighbouring schools. The PE, EE and SI constructs that form part of the UTAUT theoretical framework link well with the above assertions whose foundations lead to BI and the ultimate use and acceptance of the IBP. The created positive environment that allows for the IBP platform to thrive, is linked to the UTAUT's FC construct that makes it easier for the adoption of the technology. The recommendation is that, since the adoption process does not take place as a once-off, it must be a process of introducing it to the "late bloomers" and the new teachers, who

are fresh from the university and those who had been transferred from non-IBP to IBP schools. The strengthening of the IBP adoption culture, its sustainability, and relevance require constant improvements and not resting on the laurels and being blinded by a "it is not broken, why fix it" way of thinking. Unfortunately, technologies evolve at a faster rate and their survival and appeal depend on constant improvement and creating a platform for the beneficiaries to voice their satisfaction and dissatisfaction. The success of the IBP is well documented, but there seems to be a repetition of the lessons or the presentation in a similar way when in fact teaching should be an evolving practice where one concept can be presented from different angles. There is a recommendation that teachers who are experts in specific parts of the Grade 12 lessons be identified and offered training on how to interact with the IBP, using various technical skills. This will enhance their presenting skills and boost their motivation. This will not happen overnight and would need continuous training and from relevant stakeholders, including the subject specialists from both district and head office. Such training should also be linked to assessment and evaluation of the processes involved in integrating the IBP to ensure that the outcomes from such exercises are attended to, irrespective of whether they are positive or negative. Hence, the need to apply a learning organisation approach wherein strengths and weaknesses are welcomed as part of service enhancements. The responsible persons would include the UFS ideas lab staff, Chief directors' curriculum and districts, quality assurance, research and development sections, district directors, circuit managers, school management teams, teachers and Grade 12 learners.

The other section that was discussed, is section 5.7.3 that focuses on the relaxation of the IBP rules when it comes to accessing IBP live streaming, absence of mandatory rules to integrating IBP and the misaligned schools and IBP technology. There is a general acknowledgement that the schools are autonomous and that teachers are independent and have rights to decide on whether to access the IBP or integrate it into their classroom activities. The recommendation is that awareness campaigns be continuously held to entice teachers and learners to make use of the IBP services in teaching and learning. That decision should be matched by the quality and up-to-date IBP service for both live-streaming and video-recorded services that will provide value for money. The misaligned timetables are an indication that schools are autonomous entities, and they should be left as is. The only recommendation is for the live streaming to be conducted outside of the school hours or peak times and shifted to afternoons or after school with guarantees to access the video-recordings at a later stage. If YouTube is still going to be used, it is also advisable that data services or Wi-Fi (see section 6.5) be provided for teachers

and learners with a long-term engagement with network providers to either zero-rate access to IBP and similar educational websites or provide substantial discounts that should be linked to tax rebates. In general, access to the IBP and use of its services should be as seamless as possible to make sure that it continues to offer quality education that has, for years, placed the FSDoE's NSC results ahead of the other provinces. The responsible people would be drawn from UFS ideas lab staff, FSDoE ICT head and staff, head office and district subject specialists, district directors, circuit managers, school management teams and Grade 12 teachers.

7.6 Contributions and originality of the study

The findings from the study contribute towards creating an awareness about policy, practical and theoretical interventions, that recognize the impact that technology has on the achievement of Grade 12 learners in the Free State. The study was premised on and sought to expand knowledge based on amongst other key elements, on the policy, practice, theory and society. The Free State Department of Education (FSDoE) and the University of the Free State (UFS) ideas lab operate in spaces that are governed by legal prescripts in the form of Acts, policies, strategies, and procedures that are forever changing in response to the inside and outside challenges. The proliferation of technology in the teaching and learning space and its impact on the achievement of learners continue to draw researchers' attention, and that interest must be met by sound and implementable policies. The rate at which educational technologies evolve means that such policies must also be equally responsive and continuously revised and remodeled to suit the prevailing conditions. Although the e-Education Policy, introduced in 2004 (20 years ago), laid a solid foundation for integrating technology in South African classrooms, its success relies on many factors that must be realistically addressed. The strategy to introduce the IBP has attracted provincial and national attention, because its original intentions and positive outcomes are seen as game-changers. Although the strategy was applied at provincial level, the implications open a platform for research on the achievement of Grade 12 learners from other provinces, nationally, continentally, and globally.

Another noticeable contribution this study makes, is how theory and practice can be aligned through integrating educational technologies, such as IBP. Since this study was based on the UTAUT theoretical framework and had limited focus areas, there are opportunities to apply modified or extended models to address different areas, for example, the achievement of Grade 12 learners across the Free State Province. In addition, although this study uncovered the impact of the IBP integration on the achievement of Grade 12, there is also room to research the

impact that technology has on other Grade 12 subjects that were not part of the study. The study introduced an important element of collaborative efforts between public schools and academic institutions, who are indirectly affected by the outcomes of Grade 12 examinations. Through the UFS ideas lab's social responsibility programme, the schools are empowered with new ideas and knowledge necessary to navigate the integration puzzle of technology in schools that are under-resources and where learners are taught in English, a second language that is the language of learning and teaching. This means that pedagogical practices to be employed that would lead to the achievement of Grade 12 learners, must intentionally consider context. Although the schools are categorized under quintile 1-3, they have unique attributes that may be regarded as individual schools' DNA. Through interaction with participants and personal visits to the schools, the researcher had a rare opportunity to observe the similarities and differences. The study has also uncovered the important role that the IBP technology plays during technology integration in mostly under-resourced schools, in South African. It also assisted in making sense of technology's role in transforming society to become informed and digitally literate.

7.7. Areas of further research

There are some gaps in the empirical literature from previous studies done in technology adoption studies that were not addressed in this study. Although the study delved into the importance of applying policies and strategies to address the achievement of Grade 12 learners, there is still room to explore how strategies that are anchored on mutual collaboration, produce the desired results. The study challenges further research on how the e-Education Policy implementation impacts sound theory and practice alignment and how that leads to educational reforms that are balanced and inclusive in nature. The findings in this study explored teachers' and learners' perceptions and experiences of integrating IBP in teaching and learning. Although the learners' views were not directly sought through their marks from the historical secondary data, it would be advisable to get their views in future. The study covered a five-year period (2014-2018) and since then, a lot has happened, including the changes in technology, teachers coming and going (exiting the system, new entrants and some transferring to other schools), cohort of learners with different outlooks, due to changing contexts (home and school) and the ever-changing technologies that make it difficult to compare evolution over a five-year period. There is still a need to conduct comparative studies of the same topic with what is happening in other provinces. In addition, there is a need to conduct an in-depth analysis of impact of IBP

Schools to non-IBP schools, given that there seems unsubstantiated claim that the IBP schools are having positive impact to non-IBP Schools.

There is also still room to explore teacher-student dynamics, while integrating technology serves as a tool to enhance teaching and learning. This can also be expanded to different contexts and specific subjects at the Grade 12 level. This is critical, because cultural and contextual factors cannot be ignored whenever technologies are introduced, since the teachers and learners are products of communities anchored and driven by cultural practices. Equally important is research on digital literacy and access disparity that is still lingering large and impacting negatively on learners' achievement in mostly third world countries. The above calls for the continuous introduction and evaluation of innovative pedagogical approaches that seek to level the playing field, thus making it easier for technological integration to flourish in the teaching and learning spaces. Other important factors that need further exploration, include technological adoption and use and how that is affected by ever-evolving technologies and theoretical models. Integrating artificial intelligence, deep learning, machine learning, and big data analytics into IBP ideas lab and video intervention in high schools, require investigation, given the current breakthroughs in Generative AI. Finally, there is a need for further exploration and research on policies on technology integration at the school level that are not only sustainable but informed by sound and relevant theoretical frameworks.

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9. LIST OF APPENDICES

Appendix 1 UKZN Approved ethical clearance

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

Mr Aubrey Monde Madiba (218038562)
School Of Social Sciences
Pietermaritzburg

Dear Mr Aubrey Monde Madiba,

Protocol reference number: 00011508
Project title:

Exemption from Ethics Review

In response to your application received on , your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Y [redacted]

Prof Uma Mahesvari Naidu
Academic Leader Research

School Of Social Sciences

UKZN Research Ethics Office
Westville Campus, Govan Mbeki Building

Appendix 2 UFS Approval General/Human Research Ethics Committee (GHREC)

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

24-Oct-2019

Dear Mr Madiba, Aubrey AM
Application Approved

Research Project Title:
The impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on academic achievement by Grade 12 learners.

Ethical Clearance number:
UFS-HSD2019/1225

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

Prof Derek Litthauer
Chairperson: General/Human Research Ethics Committee

[redacted]

Digitally signed by Derek Litthauer
Date: 2019.10.24
21:45:21 +02'00'

205 Nelson Mandela Drive
Park West Bloemfontein 9301 South Africa

P.O. Box 339
Bloemfontein 9300
Tel: 051 401 9398 /
7619 / 3682
[redacted]a
www.ufs.ac.za

Appendix 3 Gatekeeper: UFS Authorities Approval

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

Office of the Vice-Rector: Research and Internationalisation
Kantoor van die Viserektor: Navorsing en Internasionalisering

14-Oct-2019

Dear Mr Aubrey Madiba

UFS AUTHORITIES APPROVAL

Research Project Title:

The impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on academic achievement by Grade 12 learners.

This letter serves as confirmation that your request to collect data from students and/or staff members at the University of the Free State for your research project has been approved provided that you also have ethical clearance for the research from the ethics committee at the University of the Free State.

Please make sure that you also obtain your ethics clearance letter containing your reference number from the ethics committee after you have received this letter before you conduct your research.

Kind Regards

[redacted]

PROF RC WITTHUHN

VICE-RECTOR: RESEARCH & INTERNATIONALISATION CHAIR: SENATE RESEARCH ETHICS COMMITTEE

205 Nelson Mandela Drive/Rylaan
Park West/Parkwes
Bloemfontein 9301
South Africa/Suid-Afrika

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Appendix 4 Approval to conduct research in the Free State Department of Education

Education

Departmen1 of Education

FREE STATE PROVINCE

Enquiries: KK Motshumi

Ref: Research Permission: AM MADIBA

Tel. 051 404 9283 / 9221 /[redacted]

Email: [redacted]

Departmen1 of Education FREE STATE PROVINCE

AM MADIBA

27181 De Waal Street Vista Park **BLOEMFONTEIN, 9300**

Dear Mr Madiba

APPROVAL TO CONDUCT RESEARCH IN THE FREE STATE DEPARTMENT OF EDUCATION

This letter serves as an acknowledgement of receipt of your request to conduct research in the Free State Department of Education.

- **Research Topic:** The impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on academic achievement of grade 12 learners.

  Schools involved: Albert Moroka, Christiaan Liphoko, Kgauho, Kgorathuto, Kopanong, Lefikeng, Leratong, Moroka, Popano, Setshaba se Maketse, Strydom and Vulamasango Secondary Schools in Motheo District.

  Target Population: Grade 12 data for English, Mathematics and Physical Science. 8 Grade 12 teachers teaching English, 8 Grade 12 teachers teaching Mathematics and 8 Grade 12 teachers teaching Physical Sciences. 3 officials at the level of CES/DCES at Provincial Office responsible for English, Mathematics and Physical Science in Grade 12. 3 officials at the level of DCES/SES at Motheo District Office responsible for English, Mathematics and Physical Science in Grade 12

- **Period of research:** From 27 January 2020 until 30 September 2020 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.

- 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 approval is subject to the following conditions:
  - .1 The collection of data should not interfere with the normal tuition time or teaching process.
  - .2 A bound copy of the research document or a CD, should be submitted to the Free State Department of Education, Room 319, 3rd Floor, Old CNA Building, Charlotte Maxeke Street, Bloemfontein.
  - .3 You will be expected, on completion of your research study to make a presentation to the relevant stakeholders in the Department.
  - .4 The attached ethics documents must be adhered to in the discourse of your study in our department.

6. Please note that costs relating to all the conditions mentioned above are your own responsibility. Yours sincerely

Yours sincerely

[redacted]

2019/12/13.
DATE:

CHIEF **FINANCIAL** OFFICER

Research application MA Madiba permission edited 13 Dec 2019

Strategic Planning, Policy & Research Directorate Private Bag X20565, Bloemfontein, 9300

Tel: (051) 404 9283 *f* 9221

Appendix 5 Approval to conduct research in the Free State Department of Education

Education

Departmen1 of Education

FREE STATE PROVINCE

Enquiries: KK Motshumi

Ref: Research Permission: AM MADIBA

Tel. 051 404 9283 / 9221 / [redacted]

Email: [redacted]

Departmen1 of Education

FREE STATE PROVINCE

The District Director Motheo District

Dear Mr Moloi

NOTIFICATION TO CONDUCT A RESEARCH PROJECT IN YOUR DISTRICTS BY AM MADIBA

The above-mentioned candidate was granted permission to conduct research in your district as follows:

1. **Research Topic:** The impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on academic achievement of grade 12 learners.

   Schools involved: Albert Moroka, Christiaan Liphoko, Kgauho, Kgorathuto, Kopanong, Lefikeng, Leratong, Moroka, Popano, Setshaba se Maketse, Strydom and Vulamasango Secondary Schools.

   Target Population: Grade 12 data for English, Mathematics and Physical Science. 8 Grade 12 teachers teaching English, 8 Grade 12 teachers teaching Mathematics and 8 Grade 12 teachers teaching Physical Sciences. 3 officials at the level of CES/DCES at Provincial Office responsible for English, Mathematics and Physical Science in Grade 12. 3 officials at the level of DCES/SES at Motheo District Office responsible for English, Mathematics and Physical Science in Grade 12

2. **Period of research:** From 27 January 2020 until 30 September 2020, Please note the department does not allow any research to be conducted during the fourth term (quarter) of the academic year.

3. **Research benefits:** The study will assist to determine the impact of the collaboration for grade 12 learners in going beyond the traditional textbook, to be empowered in computer technology, critical thinking and information seeking strategies.
4. Logistical procedures were met, in particular ethical considerations for conducting research in the Free State Department of Education.
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 district.

Yours sincerely

DR JEM SEKOLANYANE

CHIEF FINANCIAL OFFICER

2019/12/13.

DATE:

Research application MA Madiba notification edited 13 Dec 2019 Motheo District Strategic Planning, Policy & Research Directorate Private Bag X20565, Bloemfontein, 9300 **Tel:** (051) 404 9283 / 9221

Appendix 6 Approval extension to conduct research in the Free State Department of Education

education

Dc.•parlmcnt o;
Educ.at.on
FREE STATE PROVINCE

Enquiries: MZ Thango
Ref; Research Permission: AM Madiba
Tel. [redacted]
Email: [redacted]

27181 De Waal Street Vista Park Bloemfontein 9300

Dear Mr. A.M. Madiba

APPROVAL FOR AN EXTENSION TO CONDUCT RESEARCH IN THE FREE STATE DEPARTMENT OF EDUCATION

This letter serves as an acknowledgement of receipt of your request to conduct research in the Free State Department of Education.

Topic: The impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on academic achievement of grade 12 learners.

1. **List of schools involved:** Albert Moroka, Christiaan Liphoko, Khauho, Kgorathuto, Kopanong, Lefikeng, Leratong, Moroka, Popano, Setshaba se Maketse, Strydom and Vulamasango Secondary Schools.

2. **Target Population:** Grade 12 data for English, Mathematics and Physical Sciences. Eight Grade 12 teachers teaching English, Eight Grade 12 teachers teaching Mathematics and Eight Grade 12 teachers teaching Physical Sciences at the selected Secondary schools. Three officials at the level of CES/DCES at the Provincial Office responsible for English, Mathematics and Physical Sciences in Grade 12. Three officials at the level of DCES/SES at Motheo District Office responsible for English. Mathematics and Physical Sciences in Grade 12.

3. **Period of research:** From the 17th February 2021 until 30 September 2021. 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.

4. The approval is subject to the following conditions:

4.1 The collection of data should not interfere with the normal tuition time or teaching process.

4.2 A bound copy of the research document or a CD, should be submitted to the Free State Department of Education, Room 101. 1st Floor, Thuto House, St Andrew Street, Bloemfontein.

4.3 You will be expected, on completion of your research study to make a presentation to the relevant stakeholders in the Department.

4.4 The ethics documents must be adhered to in the discourse of your study in our department.

5. Please note that costs relating to all the conditions mentioned above are your own responsibility.

Yours sincerely

Mr. J.S. Tladi
Acting DOG: Corporate Services

08/02/2021
DATE:

RESEARCH APPLICATION FOR EXTENSION BY **AM** MAOIBA, PERMISSION LETTER 03 FEBRUARY 2021. MOTitl:O DISTRICT

Stnltegle Planning, Researdl II< Polley Directorate Private **8ag** X20565, Bloemfontein, 9300 • TllrJto House, Room 101, l" Floor, St Andrew Street, Bloemfontein

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Appendix 7 General/Human Research Ethics Committee (GHREC)

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

24-Oct-2019

Dear Mr Madiba, Aubrey AM

Application Approved

Research Project Title:
The impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on academic achievement by Grade 12 learners.

Ethical Clearance number:
UFS-HSD2019/1225

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

Prof Derek Litthauer
Chairperson: General/Human Research Ethics Committee

[redacted]

Digitally signed by Derek Litthauer
Date: 2019.10.24
21:45:21 +02'00'

205 Nelson Mandela Drive

Park West Bloemfontein 9301 South Africa

P.O. Box 339
Bloemfontein 9300
Tel: 051 401 9398 /
7619 / 3682
[redacted]
www.ufs.ac.za

Appendix 8 Communication with FSDOE: EMIS

From: Jacoba M. Coetzee <j[redacted]a>
Sent: Monday, 15 October 2018 1:48 PM
To: Aubrey Madiba <[redacted]>; Frans H. Kok <F[redacted]za>
Subject: RE: Request to access Grade 12 statistics
Good day
EMIS refered your request to Me Kitching.
The requested data is available on EMIS Portal: www.fsdoe.fs.gov.za/emisportal

Public Reports
Motheo
Gr 12 Exams
File: Motheo_Gr12_Pass%_SchoolAvg%_SubjectAvg%_Levels_2007-2017
Yours truly
Mrs Jacoba Coetzee
SES: EMIS
For any School information, go to:
School Portal: http://www.fsdoe.fs.gov.za
Public Reports and Statistics: http://www.fsdoe.fs.gov.za/documents/reports/
Departmental Reports and
Statistics:
http://www.fsdoe.fs.gov.za/EMISPortal/Account/Login.aspx?ReturnUrl=%2femisportal%2fInternalReports%2f
If you are a departmental official and require a user, please contact
EMIS: emis@fseducation.gov.za

Appendix 9 Communication with UFS ideas lab

From: Aubrey Madiba

Sent: Monday, 08 October 2018 16:05

To: Eugene Van Wyk <[redacted]>

Subject: Request for a meeting on the Preliminary information:

collaboration between FSDoE and

UFS IDEAS Lab

Dear Eugene

I hope this email finds you well.

I would make an appointment with you regarding a proposed study on the impact brought about by

the collaboration between FSDoE and UFS ideas lab at Grade 12 level.

I will be on leave and available to meet you between the 11th to the 16th of October 2018.

As the proposed study it still at a preliminary stages, I am still collecting information- I hope when

available the meeting will not be longer than 30 minutes.

I look forward to hearing from you.

Kind Regards

Aubrey Madiba

Appendix 10 Communication with FSDOE: Research Office

From: Bertha Kitching <[redacted]l.com>
Sent: Wednesday, 21 February 2018 12:45 PM
To: Aubrey Madiba <[redacted]a>
Subject: Research Application A Madiba
Dear Mr Madiba
Please find attached an application form to be completed, signed in two places and submitted with
the supporting documents to [redacted]
Kind regards
Bertha Kitching
Director Strategic Planning, Policy and Research
Free State Department of Education
082 454 1519 / 051 404 9221
21 Feb 2018
From: Aubrey Madiba [mailto:[redacted]a]
Sent: 21 February 2018 08:41 AM
To: [redacted]
Subject: Request to do research in the department: FSDoE
Dear Ms Kitching
I hope this email finds you well.
I am PHD student at UKZN. My research preliminary topic is titled:
The impact of the collaboration between the University of the Free State IDEAS LAB and the Free State Department of Education on academic achievement by Grade 12 learners.
I am completing my proposal and will then ask for ethical clearance which involve indicating the type of participants to be included in the study.
They include the following:
 Grade 12 teachers who have participated in the UFS ideas LAB initiative.
 Grade 12 learners who have are taught in the blended learning that includes the UFS IDEAS lab initiative.
 District and Head office officials responsible for examinations.
 Requesting examinations data from EMIS (excluding the personal data).
I am aware that interacting with students and teachers should be done outside of the examination period. I am looking forward to hearing from you.
Kind Regards
Aubrey Madiba

Appendix 11 Communication with UFS Ideas Lab

From: Eugene Van Wyk <VanWykEP@ufs.ac.za> **Sent:** Thursday, 17 January 2019 3:52 PM
To: Aubrey Madiba <MadibaAM@ufs.ac.za> **Cc:** Johannes Möller <MollerJJ@ufs.ac.za>
Subject: RE: Request to access Grade 12 statistics **Importance:** High

Best Aubrey,

Attached please find the list of all IBP Schools in Motheo with contact numbers as requested.

Kind and Warm Regards, **Eugene van Wyk**
Coordinator: IBP: IDEAS LAB Koordineerder: IBP: IDEAS LAB
Faculty / Fakulteit: South Campus / Suidkampus PO Box / Posbus
339, Bloemfontein 9300, Republic of South Africa / Republiek
van Suid-Afrika (+27 (0)51 505 1308) 2[redacted]
VanWykEP@ufs.ac.za

From: Aubrey Madiba <MadibaAM@ufs.ac.za> **Sent:** Tuesday, 15 January 2019 08:00 **To:** Eugene Van Wyk <VanWykEP@ufs.ac.za> **Subject:** FW: Request to access Grade 12 statistics

Dear Eugene

Compliments of the new year.

I am preparing my proposal and my target is Motheo district (Mangaung, Botshabelo and Thaba Nchu) schools that are taking part in the UFS IDEAS LAB project.

Will it be possible to give me the number of those schools. I tried EMIS from FSDoE and they do not have the specific list (please see their response below)

I look forward to your response.

Kind Regards

Aubrey Madiba

Appendix 12 Annexure: Interview guide: Semi-Structured Interview Questions

Welcoming and familiarizing with the content of the consent form

Research Question 1:
What are the legal and legislative frameworks that support the creation and integration of IBPs at the Grade 12 level?

- What is the Internet Broadcasting Project (IBP)? (**IBP/non-IBP participants**)

- Do you know if it is present/absent in your (some) schools and why was it installed or not installed? (**All participants**)
- What are your views about the collaboration between the IBP/ University of the Free State (UFS) ideas lab and the Free State Department of Education (FSDoE)? (**All participants**)

- Are you aware of the Free State Provincial Strategy on Learner Attainment (FSPSLA) and its relation achievement of Grade 12 learners across the Fraee State Province? (**All participants**)

- In terms of achievement of Grade 12 learners have you noticed changes after the introduction of the IBP in your school? (**IBP participants**)

- What challenges has is the absence of the IBP having on achievement of your Grade 12 learners? (**Non-IBP participants**)

- Since your schools falls under the quintile 1-3, would you say the IBP integration is making a difference in how you are teaching your Grade 12 learners. (**Non-IBP participants**)

- Your school falls under quintile level 1-3 and yet you are not receiving the IBP livestreaming, how do you feel about being left out and what are the implications on achievement of grade 12 learners in the Free State Province? (**Non-IBP participants**) (**All participants**)

  - Would you say that a quintile ranking systems a necessary intervention tool that has an impact in addressing the imbalances of the past? (**All participants**)

- In terms of the pass rate in the Free State Province and your Grade 12 subject in particular would you say the promotions policy makes it easier for your learners to exit the FET schools band? (**All participants**) and how much of an impact is the presence/absence of the IBP having on learner achievement.
- Do you think the Curriculum Assessment Policy Statement (CAPS) clearly stipulates how technology can be integrated in subjects like yours to improve achievement by learners? (**All participants**)

Research Question 2: What are the experiences of Grade learners and teachers on the provision of IBP intervention programme for grade 12 learners in the Free State?

- Since you are/not receiving the IBP live streaming how often do you make use of the IBP and its services/alternatives? (**All participants**)
- How difficulty or easy do you find navigating the IBP with your learners in teaching and learning? / or is its absence posing challenges in your teaching and learning activities? (**All participants**)
- What has the use of the IBP in your Grade 12 classroom done on achievement of Grade 12 learners. (**All participants**)
- At what stage do you usually integrate the IBP services during the teaching and learning cycle? (**All participants**)
- Are there topics within your subject that you had found to be challenging and found solutions from after consulting the IBP, give examples? (**All participants**)
- The IBP also makes use of the video recordings, do you also make use of them and when do you find them useful? (**All participants**)
- How are your Learners attitude towards the integration of the IBP in teaching and learning and do you find them displaying the Generation Z characteristics that indicate that they are madly in love with technologies? (**All participants**)
- Are your learners independent enough to integrate technologies like IBP without your assistance? (**All participants**)
- Looking at the location/position of the school would you say the IBP has motivated both your fellow teachers and learners to perform differently? (**All participants**)

- How has the introduction of the IBP in your school affected the Grade 12 results in comparison to those from neighbouring schools (both IBP and non-IBP Schools)? (**All participants**)

- Are there areas of strength/weaknesses that, since the introduction of the IBP in your school, have improved or hindered performance by learners in your subject area?
- Has the IBP provided you with adequate digital resources that you need for teaching and learning? Explain. (**All participants**)
- Has the introduction of IBP for use in your subject area impacted on how your students respond to you teaching of the content in your subject area? (**All participants**)
- Would you say the introduction of the IBP in teaching and learning within your subject area has made you more professional in how you approach/transfer the subject matter? (**All participants**)
- How has your interaction with IBP over the last 5 years impacted positively/negatively on your learners' performance? In what way, please explain.
- Was there a resistance by either teachers or learners towards the introduction of IBP in teaching and learning? What seems to have been their concerns? (**All participants**)
- What are the views of teachers from your neighbouring schools that they have voiced out about the introduction of IBP in the classroom? (**All participants**)
- How has the community where the school is located viewed the role that IBP is playing on performance by Grade 12 learners? (**All participants**)
- How has the confidence/trust levels been from the school community (teachers, learners, School Governing Body) over the last 5 years towards the IBP integration in teaching and learning? (**All participants**)

What are the UFS ideas lab- led factors that influence academic achievement by Grade 12 learners in the Free State?

- What are the features of the IBP that hold potentials for academic achievement of grade 12 learners? Or what aspects of the IBP best motivate grade 12 learners? (**All participants**)

- Would you say the introduction of the IBP to your schools was properly explained to you as a subject matter specialist? (**All participants**)
- Did you receive enough training that would make you to navigate the IBP with ease during teaching? (**All participants**)
- Are you confident enough to use the IBP and the digital resources that you need during teaching of various topics within your subject area? (**All participants**)
- Is there a seamless integration of the IBP with the different lessons that are presented in your classroom? How does it accommodate the needs of these different topics within your subject? (**All participants**)
- Are your learners finding easier or do they respond positively when they must transition from one tool to the next that is provided by the IBP? (**All participants**)
- How comfortable are you now when comparing to your first interaction with the IBP in the last five years? Has that also affected the way you teaching the subject matter in your classroom? (**All participants**)
- What are the challenges that you can identify that affect the speedy and equal implementation of IBP in schools? (**All participants**)
- Was the introduction of the IBP a seamless exercise with all tools provided from the begin? (**All participants**)
- Would you say the whole IBP infrastructure meets the standards that could be equated to its current performance? (**All participants**)
- Did you receive enough support from both the district and Head office? How was this initiative introduced into the school? (**All participants**)
- Have you all been provided with enough ICT training that assist you to interact with IBP during the teaching and learning exercise? (**All participants**)
- Have you undergone any voluntary training to expand your knowledge towards the integration of IBP into your subject matter? (**All participants**)
- What additional skills would you like to learn that will have an impact on how you use IBP in your daily teaching and learning activities? (**All participants**)
- Do you feel you receive enough ICT assistance in this school when there is a hardware or software breakdown? Explain (**All participants**)
- Have you been exposed to the policy/guidelines from the CAPS that assist you to integrate IBP into the teaching activities within your subject matter? (**All participants**)

- What are the challenges that you have come across since the IBP was introduced in your school/or its absence in your school. (**All participants**)
- What can be done to ensure that the IBP services benefit all for the longest of times? (**All participants**)

Closure and thanking the participants

Appendix 13 List of Motheo District Officials

Enquiries: Tell: E-mail: **Ms S.M.A** Motaung DCES: Curriculum : FET 051-404-4616/7 s[redacted] *I* s[redacted]m

education

OFFICE OF THE DIRECTOR: MOTHEO EDUCATION DISTRICT

'TIILDJGTRJCTON TB RJGL1TJ GR:ZA.1ZN£GA'

TO: Mr. **AM MADIBA**
UNIVERSITY OF THE FREE STATE

Dear Sir/Madam

RE: RESEARCH PROJECT (UOFS - IBP IN MOTHEO EDUCATION DISTRICT SCHOOLS)

Please find the list of Subject Advisors to be interviewed for your research project in Motheo Education District:

No.	SUBJECTS	NAME OF OFFICIAL	CONTACT	EMAIL ADDRESS
1.	Afrikaans	Mrs Zwiegers E	[redacted]	e[redacted]
2.	Physical Science	Mr Kleinhans M	[redacted]	P[redacted]
3.	Life Science	Mr Chaka DL	[redacted]	[redacted]
4.	Accounting	Mrs Andrews L	[redacted]	[redacted]
5.	English	Mr Osborne T	[redacted]	[redacted]
6.	Sesotho	Mr Maile W	[redacted]	[redacted]
7.	Maths Literacy	Mrs Nethe NC	[redacted]	[redacted]
8.	Mathematics	Mr Mohapi W	[redacted]	[redacted]a
9.	Economics	Mr Msimanga MA	[redacted]	[redacted]m
10.	Business Studies	Mrs Mehle NC	[redacted]	[redacted]

11.	History	Mr Masooa ME	[redacted]	[redacted]

We hope you find the above in order.

Kind Regards

[redacted]

DIRECTOR: MOTHEO EDUCATION DISTRICT
DATE: 18/08/2021

Appendix 14 List of IBP Schools

2017 - 2020 MOTHEO Schools participating in the IBP

Number	District	Town	School	Contact details	Principals
1	Motheo	Thaba Nchu	Albert Moroka Ordinary Secondary	051 873 0074	Mr Mompati
2	Motheo	BLOEMFONTEIN	ATLEHANG SS	081 435 8011	Mr Thibinyane
3	Motheo	BLOEMFONTEIN	BLOEMFONTEIN SOUTH HIGH SS	051 522 9112	Mr Hugo
4	Motheo	BOTSHABELO	KGAUHO SS	051 532 3156	Mr Tsie Thaele
5	**Motheo**	Botshabelo	Kgorathuto S/S	051 532 3156	Mr Rakako
6	Motheo	BLOEMFONTEIN	KOPANONG SENIOR SECONDARY	079 103 6276	Mr Melesi Johannes
7	Motheo	Mangaung	Lekhulong School	051 435 2365	Mr Mash Mawasha
8	Motheo	Botshabelo	Lenyora-la-Thuto	051 534 1697	Mr Modupi
9	Motheo	BLOEMFONTEIN	LEREKO SS	051 435 6412	Mr M. Mokate
10	Motheo	Ladybrand	Lereng Secondary	051 924 2885	Mr Kingsley Ramosena Ramosena
11	Motheo	TWEESPRUIT	MARIASDAL SS	051 963 0902	Mr L.T Mabindisa
12	Motheo	BLOEMFONTEIN	MOEMEDI SS	051 434 1825	Mr M.J Thekiso
13	Motheo	Thaba Nchu	Moroka Senior Secondary	051 873 2245	Mr Motlogelwa Motsepe
14	Motheo	Wepener	Qibing Secondary School	051 583 1905	Mr S.A Kompi
15	**Motheo**	Botshabelo	Reamohetse S/S	051 532 0216	Mr Mohai
16	Motheo	Thaba Nchu	RT Mokgopa Senior Secondary	051 876 1220	Mrs Vinger
17	Motheo	Botshabelo	Seemahale senior Secondary	051 534 7190	Mr Nkokoto
18	Motheo	LADYBRAND	SEHLABENG SS	051 924 0200	Mr KKE Qhojeng
19	Motheo	Mangaung	Sehunelo Secondary	051 432 9565	Mr Motlhoioa
20	Motheo	Botshabelo	Setjhaba-se-Maketse Combined	051 534 3153	Mr Tshepo Ralepeli
21	Motheo	THABA-NCHU	STRYDOM SS	081 747 0785	Mr Lepolesa Maseloa
22	Motheo	Mangaung	Tsoseletso Secondary School	051 435 2485	Mr R.M Litabe
23	Motheo	Tweespruit	Unicom Agricultural School	051 963 0013	Mr F. Hattingh

Appendix 15 Communication with targeted participants

From: Monde Madiba
Sent: Thursday, 20 May 2021 11:45 AM
To: [redacted]; [redacted]
Subject: FW: Request to conduct research in your school: Kgauho Secondary School

Dear Sir/Madam

I am a UKZN student doing research titled: **The impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on achievement by Grade 12 earners.**

As part of the study, I am expected to collect historical data on performance by Grade 12 learners in your school. The focus is on English, Mathematics and Physical Sciences and the data spans over a five year period (2014-2018).

In addition to the historical data, I am also required to interview educators in your school who are responsible for the above three subjects at Grade 12 level (the times will be flexible and dependent on their availability).

The collection of data is informed by the approved ethical clearances from FSDoE, UFS and UKZN that instructs that privacy of all individuals should be protected at all times only. This mean no personal information (including name, surname or ID) will be part of the research. Attached are approved ethical clearance letters from FSDoE, UKZN and UFS.

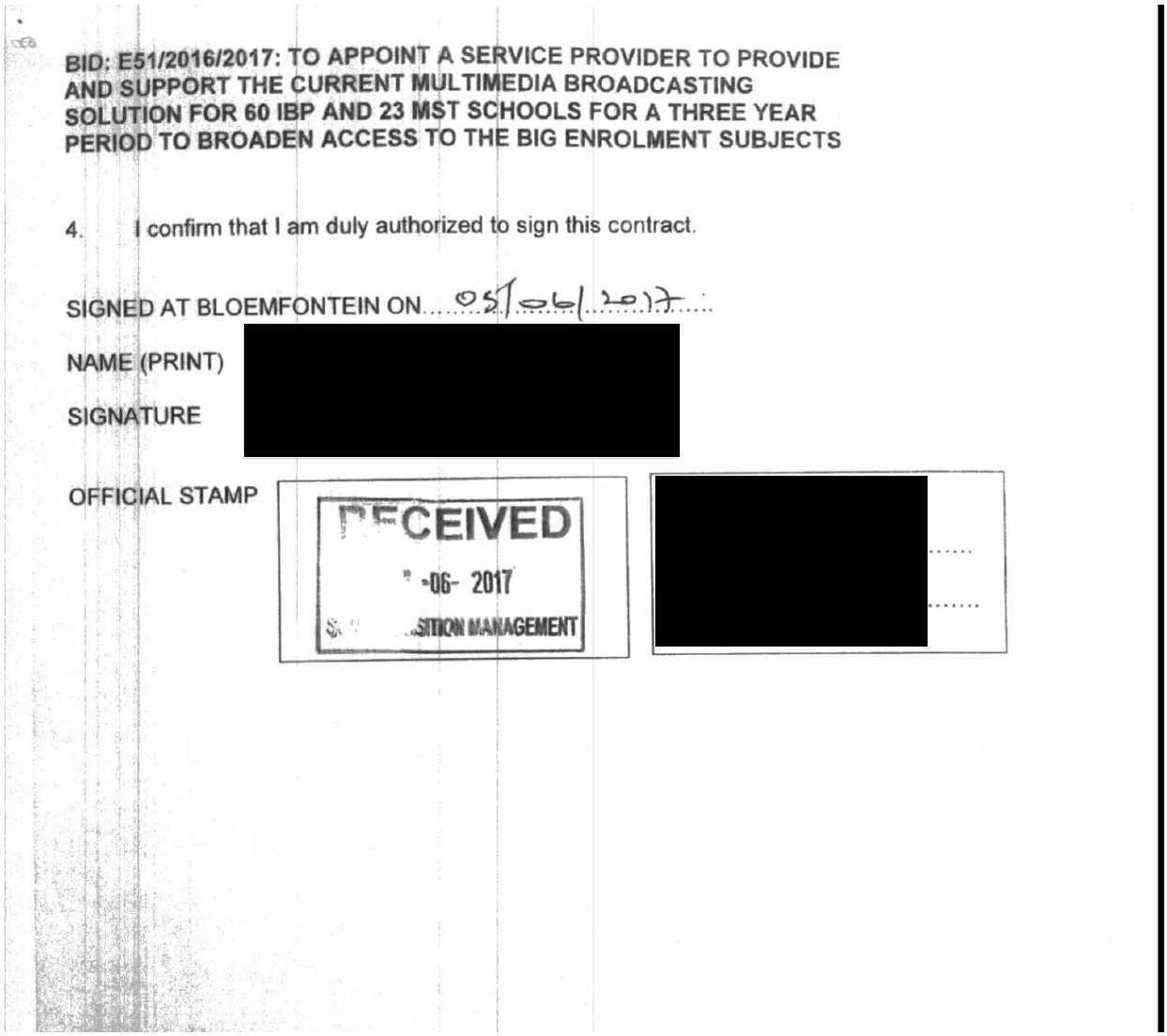
Furthermore, I promise to share the findings once the whole analysis has been finalised. I look forward to engaging with all relevant colleagues in your school.

I hope you will find this in order.

Kind Regards

Monde Madiba

Appendix 16 Sample of the Tender document between FSDoE And UFS Ideas Lab



BID: E51/2016/2017: TO APPOINT A SERVICE PROVIDER TO PROVIDE AND SUPPORT THE CURRENT MULTIMEDIA BROADCASTING SOLUTION FOR 60 IBP AND 23 MST SCHOOLS FOR A THREE YEAR PERIOD TO BROADEN ACCESS TO THE BIG ENROLMENT SUBJECTS

4. I confirm that I am duly authorized to sign this contract.

SIGNED AT BLOEMFONTEIN ON 05/06/2017

NAME (PRINT) [redacted]

SIGNATURE

OFFICIAL STAMP

RECEIVED
-06- 2017
SITION MANAGEMENT

[redacted]

Appendix 17 Informed consent document

Informed Consent Document

Dear participant,

My name is Aubrey Monde Madiba. I am a PhD (Information Studies) candidate studying at the University of KwaZulu-Natal, Howard College Campus. The title of the research is: The impact of the collaboration between the University of the Free State ideas lab and the Free State Department of Education on academic achievement by Grade 12 learners. The aim of the study is to understand and explore the impact brought about by the collaboration between FSDoE and UFS ideas lab on achievement by the grade 12 learners in the Free State. I am interested in interviewing you so as to share your experiences and observations on the subject matter. The coselected schools are both IBP and non-IBP, for comparative purposes.

Please note that:

- The information that you provide will be used for scholarly research only.
- Your participation is entirely voluntary. You have a choice to participate, not to participate or stop participating in the research. You will not be penalized for taking such an action.
- Your views in this interview will be presented anonymously. Neither your name nor identity will be disclosed in any form in the study.
- The interview will take about one hour.
- The record as well as other items associated with the interview will be held in a password-protected file accessible only to myself and my supervisors. After a period of 5 years, in line with the rules of the university, it will be disposed by shredding and burning.
- If you agree to participate please sign the declaration attached to this statement (a separate sheet will be provided for signatures)
- Audio-recording: YES / NO

I can be contacted at: School of Social Sciences, University of KwaZulu-Natal, Pietermaritzburg Campus, Scottsville, Pietermaritzburg. Email: 218038562@stuukznac.onmicrosoft.com;

Cell: [redacted]

My supervisor is Dr. Gbolahan Olasina who is located at the School of Social Sciences, Pietermaritzburg Campus of the University of KwaZulu-Natal. Contact details: email olasinag@ukzn.ac.za Phone number: 033 260 5285

My co-supervisor is …N/A…….. who is located at the School of Social Sciences, Howard College Campus of the University of KwaZulu-Natal. Contact details: email …N/A……. Phone number: ……N/A……..

The HSSREC contact details are as follows:
Tel: 031- 260 8350/4557/3587
Email: hssrec@UKZN.ac.za

Thank you for your contribution to this research.

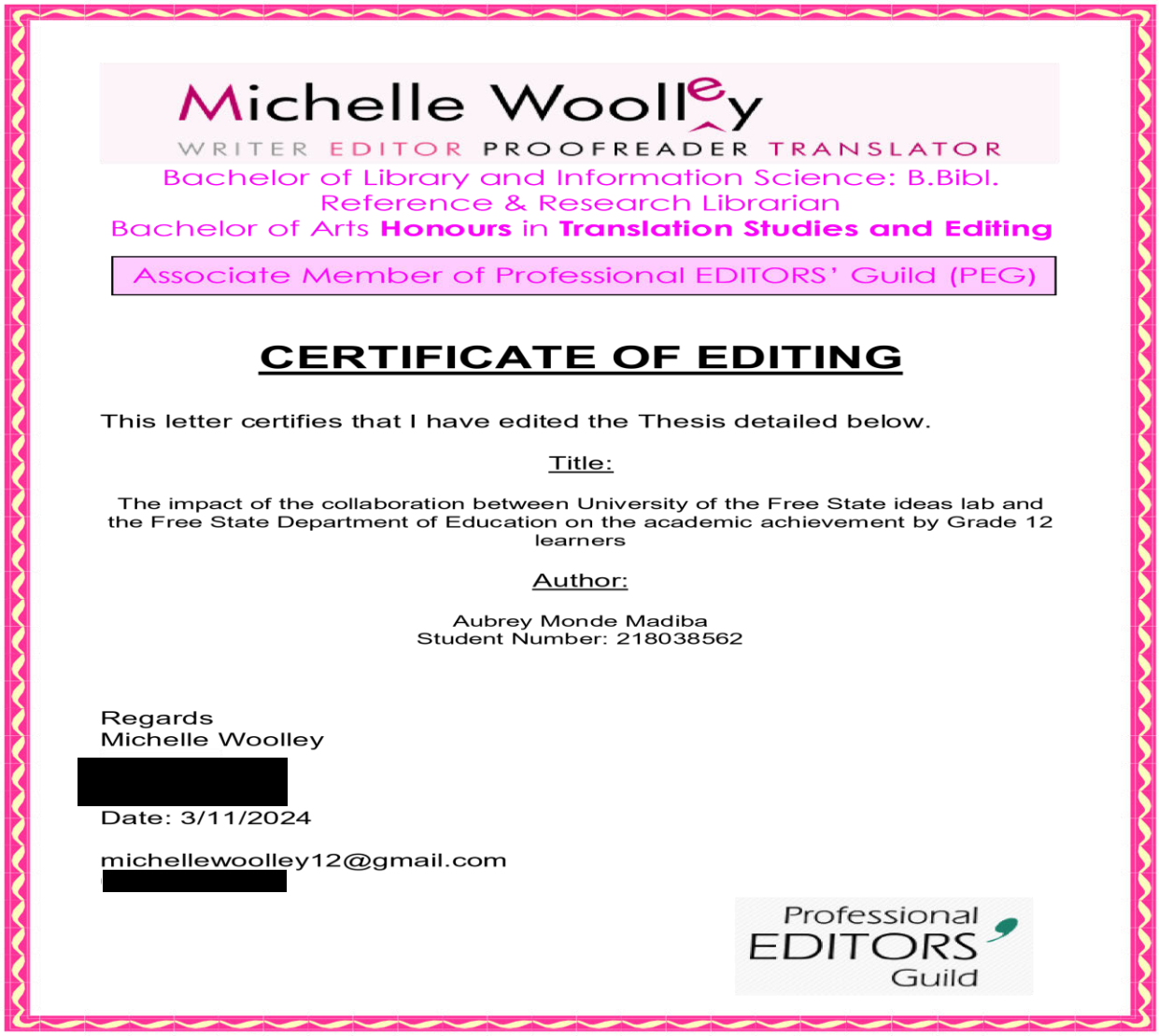
DECLARATION

I …… (full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire. I understand the intention of the research. I hereby agree to participate.

SIGNATURE OF PARTICIPANT …….
DATE……

Appendix 18 Certificate of editing



Michelle Woolley

WRITER EDITOR PROOFREADER TRANSLATOR

Bachelor of Library and Information Science: B.Bibl.
Reference & Research Librarian
Bachelor of Arts **Honours** in **Translation Studies and Editing**

Associate Member of Professional EDITORS' Guild (PEG)

CERTIFICATE OF EDITING

This letter certifies that I have edited the Thesis detailed below.

Title:

The impact of the collaboration between University of the Free State ideas lab and the Free State Department of Education on the academic achievement by Grade 12 learners

Author:

Aubrey Monde Madiba
Student Number: 218038562

Regards
Michelle Woolley
[redacted]
Date: 3/11/2024

michellewoolley12@gmail.com
[redacted]

Professional EDITORS Guild

Appendix 19 Turnitin Original Report

2024 A M Madiba consolidated chapters for turnitin 27 11 2024a.docx

ORIGINALITY REPORT

SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
13%	12%	7%	0%

PRIMARY SOURCES

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2	researchspace.ukzn.ac.za Internet Source	2%
3	uir.unisa.ac.za Internet Source	<1%
4	www.researchgate.net Internet Source	<1%
5	nect.org.za Internet Source	<1%
6	www.coursehero.com Internet Source	<1%