Using blended mentoring approach to support novice science teachers in under-resourced schools in Ekurhuleni South District

by

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ABSTRACT

Induction and mentoring of novice teachers are globally regarded as an important process in enabling the transition of pre-service teachers to become independent professional teachers.

This exploratory study sought to uncover if induction and mentoring experiences or a lack thereof in South Africa's under-resourced schools could be associated with the high attrition rate as highly qualified beginner science teachers consider leaving the teaching profession for greener pastures. Previous research has it that novice teachers experience shock as a result of the gap between university or college pre-service training theory and reality of practice in the classrooms, leading to frustration and burnout. Botha and Rens (2018) ascertain that this gap is a defining point in a teaching career as it determines whether one stays in the teaching profession or tenders a resignation.

To investigate induction and mentoring experiences of novice science teachers in this study, the researcher employed a mixed methods approach. Quantitative data was obtained through a web-based survey with respondents based in the provinces of South Africa. Qualitative data was obtained in a focus group discussion with novice science teachers based in Ekurhuleni South District. This study found out that there is a patchy and uncoordinated provision of induction and mentoring experiences for novice science teachers in South Africa's under-resourced schools. A policy deficit by the Department of Basic Education was a cause for concern. However, the researcher recommended blended mentoring as an alternative strategy to enhance induction and mentoring practices in 21st century under-resourced schools.

KEY WORDS

Asynchronous, blended/hybrid mentoring, e-mentoring, induction and mentoring, novice science teachers, novice teacher attrition, protégé, tele-mentoring, under-resourced schools, zone of proximal teacher development

ACRONYMS

CAQDAS: Computer-assisted qualitative data analysis software

CMC: Computer-mediated communication

DBE: Department of Basic Education

DoE: Department of Education

ECDoE: Eastern Cape Department of Education

F2F: Face-to-face

FET: Further Education and Training

GDE: Gauteng Department of Education

ICT: Information and Communication Technology

I&M: Induction and mentoring

MM: Mixed model

MMR: Mixed methods research

NTI: New Teacher Induction

oTPD: Online teacher professional development

PAM: Personnel Administrative Measures

PEDs: Provincial Education Departments

PC: Personal computer

VVOB: The Flemish Association for Development Cooperation and Technical Assistance

SPSS: Statistical Package for the Social Sciences

ZPTD: Zone of Proximal Teacher Development

DECLARATION

I, Misheck Semu, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Magister Educationis at the University of South Africa, Pretoria. It has not been submitted before for any degree or examination in this or any other university.

Misheck Semu
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Signed at …Germiston……

On the ..12th .. day of …December… 2023..

DEDICATION

I dedicate my dissertation to my late parents for their endless love, support and encouragement throughout my pursuit for education. I trust that this achievement fulfils all the dreams that they envisioned for me from a tender age.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

The purpose of this study or research (terms used interchangeably) was to explore blended mentoring as an alternative strategy to enhance induction and mentoring (I&M) programmes for novice science teachers in South Africa. The research focused on under-resourced schools that seemingly rely mainly on poorly established traditional face-to-face mentoring strategies, if any at all. This study sought to inform education stakeholders about the feasibility of blended mentoring as a novice science teacher induction and support strategy with the intention to gradually reduce the high novice teacher attrition rate in South Africa.

1.2 Context of the study

Education, particularly science teaching, is often regarded as a challenging and demanding profession. In South Africa, as in many parts of the world, science teachers must deal with a myriad of challenges in their daily work, including classroom management, individual student support, planning and designing learning activities, adopting and implementing various pedagogical approaches, curriculum reforms, and managing relationships with administrators, colleagues, and parents. Spanorriga, Tsiotakis, and Jimoyiannis (2018) claim that these concerns are particularly urgent for teachers in their early years of teaching. The transition from initial teacher education to the classroom seems to be one of the most crucial phases in a teacher's career and also appears to be one of the most difficult due to several reasons. Botha and Rens (2018) point out that novice teachers referred to an extensive workload and a lack of support as contributing factors, including their experiences of high stress levels and pressured working environments inside and outside of the classroom. Notably, novice science teachers experience immense challenges on their transition from pre-service to post-qualification teachers. Spanorriga et al. (2018) assert that the transition can lead to teacher stress, exhaustion, and dropout. Janik and Rothmann (2016) quote other previous researchers stating that in the United States of America, 25% to 50% of new teachers resign during the first three years of teaching, owing to their inability to handle the high levels of distress associated with the profession.

Some researchers in South Africa such as Botha and Hugo (2021), concur that many teachers listed lack of job satisfaction as a reason for leaving the education profession, while citing the lack of mentoring as a main cause of job dissatisfaction. The same was reiterated by Janik and Rothmann (2016), who identified concerns of the Namibian government with regard to escalating teacher turnover rates, high stress levels and limited teacher resources to curb the high demands of the profession, and claim these problems are shared worldwide. Further support of this notion is expounded by Paula and Grinfelde (2018) who claim that the first years of teaching can influence the length of career, effectiveness of work and job satisfaction among new teachers. Dyosini (2022) says that research shows a low retention of novice teachers in the teaching profession; novices tend to leave the teaching profession in their first five years in South Africa.

Further support came from Jan (2017) who noted that in the first five years, almost half of all teachers leave their profession in India, and recommended that special care must be taken to make them available early, satisfactory assistance, and encouragement to a great extent when they are being assigned to demanding school environments. Steynberg (2021) claims that South African teachers are becoming more susceptible to burnout development as a result of the multitude of challenges they face. This should be true especially for teachers based in under-resourced schools situated in the Ekurhuleni South District, as explored in this study. Shibiti (2019) supports the claim that teacher turnover is substantial in South Africa, with many teachers departing the profession in their early years.

In different parts of the world, on-going mentorship is advocated as an alternative to assist teachers' professional growth and prevent attrition from the field. In light of this, the establishment of various mentoring programmes to assist teachers in their early career phases is a viable remedy to this problem on a global scale (Kemmis, Heikkinen, Hannu & Edwards-Groves, 2014). In cognisance of these assertions, one can be tempted to ask if South Africa happens to have any novice teacher mentoring programmes, let alone in under-resourced schools such as those that are situated in the Ekurhuleni South District and many other disadvantaged communities. To show the gravity of the need for mentoring, Botha and Hugo (2021) indicated that mentoring is a tool used to bridge the training gap at universities and in practice. The researcher questioned if mentoring was being effectively and efficiently used to help novice science teachers especially those who find themselves in under-resourced schools such as in Ekurhuleni South District to bridge the said gap. From the researcher’s personal experience as a teacher and the literature reviewed in this study, the assumption is that mentoring is scarcely used as a bridging tool to assist new teachers to acclimatise in their new environments.

Botha and Hugo (2021) reiterate that the first year of teaching is usually described as a highly stressful period for beginner teachers who report lower teacher efficacy and perceive higher levels of occupational stress and emotional exhaustion. A similar claim is made by Nixon, Luft and Ross (2017) who argue that new teachers are going through a period of major growth and development accompanied by many challenges as they transition from preparation programmes to full responsibility for a classroom and student learning. This is a true reflection of novice science teachers, especially in under-resourced schools in South Africa. Teachers in under-resourced schools such as those in the Ekurhuleni South District are exposed to work-related problems that exacerbate their experiences such as lack of resources, poor infrastructure, high learner-teacher ratios, learner indiscipline and high work volumes, among many other challenges. Research on South African education contexts and situativity shows that previously disadvantaged schools in rural and township areas are lagging regarding school facilities such as computers, data projectors, libraries, and electricity, compared to their urban counterparts (Ntshangase & Nkosi, 2022). This study explored the experiences of novice science teachers in under-resourced contexts and established if blended mentoring can alleviate their I&M challenges.

In general, mentoring a protégé (mentee) entails a variety of activities, including career path support, direction, encouragement, emotional support, and role modelling. Existing research suggests that mentoring programmes help new teachers advance their professional development, improve their ability to design and implement effective instructional practices that improve student learning, increase job satisfaction, and reduce new teacher attrition (Spanorriga et al., 2018). Mentoring is traditionally perceived as an intense interpersonal relationship and a process that brings together a senior individual (mentor) and a younger, less experienced person (mentee or protégé) to share experiences and assist the latter in achieving specific goals and successfully navigating a new occupation (Spanorriga et al., 2018). If mentoring can bring about all these advantages identified above, it shows how important a tool it can be in bridging the gap through effective I&M programmes especially in South Africa's under-resourced schools that tend to be the most challenged.

Furthermore, Botha and Hugo (2021) found that mentoring improves a mentee's support system by providing them with an experienced person who guides them throughout the beginning stages of their teaching career, which will ultimately promote greater productivity and job satisfaction. In support of mentoring, Hobson and Malderez (2013) argue that teacher mentoring is traditionally perceived as a one-on-one relationship and developmental activity in which a mentor may take on a variety of supportive roles to empower a novice teacher (protégé) and support them in several ways such as professional learning and development as a teacher, their wellbeing, and integration into and acceptance by the cultures of both the organisation in which they work and the wider profession. The researcher personally believes that the merits of mentoring are what every beginner teacher envisages if they were to enjoy their teaching career from the first day in the classroom. This necessitates exploring how I&M (if it exists at all) of scarce resources such as novice science teachers is done in South Africa's under-resourced schools.

Since mentoring comes in different forms, traditional face-to-face (F2F) mentoring has been seen to have its own set of constraints in the literature reviewed in this study. The shortcomings of traditional mentoring prompted the development of an alternative technology-driven strategy called electronic mentoring (e-mentoring). E-mentoring enabled mentoring to take place between educators in various geographical places at a time and place that is convenient for both parties, thanks to the advancement of Web-based technologies. E-mentoring creates a communication and interaction channel between mentors and protégés by combining synchronous (video conferencing, instant messaging, tele-mentoring) and asynchronous (e-mail, discussion forums and blogging) technologies (Spanorriga et al., 2018). E-mentoring has several advantages, including providing access to up-to-date material, new methods of assistance, online training and support, more opportunity to form teacher networks, and the development of a new pattern of personal interactions among peer teachers.

Furthermore, e-mentoring broadens access to mentoring by removing barriers of place and time, such as the requirement that mentors and protégés be in the same physical area at the same time (Spanorriga et al., 2018). E-mentoring allows mentors and mentees to communicate and interact across a country, regardless of whether they are in urban or remote places. Due to its many advantages, the researchers questioned whether e-mentoring cannot be useful in enhancing I&M programmes for novice science teachers in South Africa. If its merits are well harnessed, it is evident that e-mentoring can be an effective way for novice science teachers to interact with, request and receive guidance and support from colleagues and mentors. One wonders if e-mentoring could be implemented for all novice science teachers including those in disadvantaged communities such as the Ekurhuleni South District. However, it can be noted in this report that even e-mentoring on its own is not rosy. E-mentoring has its own limitations if used in isolation to replace traditional mentoring as discussed in Chapter 2 of this research.

Mentorship models in teacher education have been inconsistent and haphazard in South Africa, with no clear criteria guidelines in higher education and in public schooling (The Bridge Resource, 2016). This assertion implies that there is a general lack of proper I&M programmes for novice teachers in South Africa's education system. The researcher doubts if higher education institutions that train teachers prepare exiting student teachers for deployment in schools, just to make them ready for the new environment. Spanorriga et al. (2015) ascertain that it is commonly agreed that current-conventional teacher education and preparation programmes are not responsive to the demands of teaching in 21^{st} century schools. The 21^{st} century teachers need teaching skills, content mastery as well as integrating teaching with technology; as such, teacher development programmes are highly important (Jan, 2017). As a result, effective and efficient induction and support programmes for beginner science teachers are critical, particularly in under-resourced schools where difficulties are significantly more as compared to resourced schools.

Research shows that other current approaches to professional development have generally failed to provide the much-needed day-to-day professional support and mentoring for entry- level science teachers, and thus contribute as a major underlying factor in the resignation rate among new teachers within the first five years in the classroom (Spanorriga et al., 2018). In support of this notion, Luft, Navy, Wong and Hill (2020) argue that the early years of teaching are important for science teachers, but little is known on how science teachers develop professionally in their early years of teaching. No other programmes, according some researchers can provide on-going assistance for novice science teachers as they attempt to adopt learned pedagogies and new methods in new, hostile situations such as under-resourced schools. Traditional teacher professional development programmes sometimes disappoint novice science teachers because they are not only ineffective but also require a substantial investment of time that they do not have. In light of these challenges alluded to in this section, an alternate and effective solution for improving the I&M experiences of newly trained science teachers in South Africa is not only necessary but overdue. The introduction of blended mentoring is vital as it combines the benefits of both traditional and electronic mentoring to provide far more efficient and effective induction and support needed by 21^{st} century novice science teachers.

1.3 Problem statement

1.3.1 Main problem

The main problem is the high attrition rate of novice science teachers in South Africa mainly due to the absence, inadequacy and inefficient I&M programmes especially in under-resourced schools. The Department of Basic Education (2019) admits that there is considerable 'churning' in the teaching force as teachers continually move in and out of the system with many qualified teachers leaving and fewer returning. With the department trying to stabilise teacher demand and supply in South Africa, the system resembles a leaking bucket with a net drain of qualified teachers. As fast as new qualified teachers enter the system, experienced qualified teachers are leaving it in net terms (Simkins, 2015).

Previous research point to the above identified main problem as a cause for concern in South Africa's education system. Jan (2017) points out that there is inadequate and uneven support, assistance and encouragement for new teachers. He further claims that many times new teachers are allotted most challenging classes in schools with little or no support. In the same vein, Mlambo and Adetiba (2020) claim that South Africa's basic educational system is experiencing a severe shortage of qualified teachers, especially in mathematics and science due to emigration. Science and mathematics teachers emigrate to greener pastures when opportunities arise. This calls for thorough research on how lack of I&M contributes in the attrition of scarce science teachers in South Africa as they head for greener pastures in developed countries.

1.3.2 Sub-problems

The first sub-problem is the non-existence and non-adherence to I&M programmes as expected by provincial and district education officials in most under-resourced schools. The researcher personally experienced non-existence of and non-adherence to novice science teacher mentoring in four under-resourced schools in which he taught between 2009 and 2018 in Ekurhuleni South District. Other related issues where mentoring seems to exist include but are not limited to mentor – mentee mismatching, lack of resources, inadequate or zero mentor-teacher training and unavailability of experienced mentors who can contribute to quality induction and support for novice science teachers.

There is a lack of the all-important day-to-day professional support needed by entry-level teachers because current approaches to professional development in South Africa's under-resourced schools generally fail to provide such assistance. Entry-level science teachers in South Africa's under-resourced schools are either left to "sink" or "float" in their new science classrooms. Literature has it that there is a support and professional development gap for new science teachers, which often lead to frustration, underperformance, and burnout.

The second sub-problem is the lack of a clear policies by the Department of Basic Education (DBE) on I&M of novice teachers in South Africa. Literature reviewed has shown that while the DBE (2019) in conjunction with other stakeholders in 2020, have launched a field test of a New Teacher Induction (NTI) programme, nothing tangible has come out of that and policies that relate to compulsory I&M experiences for novice teachers are still to be realised. In another recent research conducted by Mamba (2020), it was found that all principals from the schools that he sampled did not have any documentation or any supporting policy to induct new teachers. This means that as far as the researcher knows, there are no clear guidelines, monitoring and control procedures of I&M in schools. Such a status quo breeds confusion when it comes to I&M programmes for novice science teachers in South Africa.

The researcher suggests that complementing current traditional mentoring approaches (if any) with the introduction of a South African tailor-made efficient blended mentoring models can improve new science teachers' professional development and retain them in the education system for long.

1.3.3 Research question 1

What are the novice science teachers' induction and mentoring experiences during their initial years of teaching in under-resourced schools?

1.3.4 Research question 2

Why incorporating blended mentoring can serve as an intervention strategy to enhance mentoring programmes for novice science teachers in under-resourced schools in South Africa?

1.4 Significance of the study

The study fills a gap in that it explores blended mentoring as an alternative strategy for I&M of novice science teachers in South Africa. Blended mentoring is a relatively new concept in South Africa and the researcher did not come across any local literature that relates to it. Despite this drawback, the researcher remained resolute to become the first one to make a unique contribution to the body of knowledge on formalised blended mentoring in South Africa. In India, Pervaan (2021) cites that only two studies were located that focused on the use of blended learning in preservice courses and those focused on its effects on secondary teachers, specifically on their level of academic achievement and the level of peer-to-peer cooperation. Literature from developed countries such as the United States, gave direction to this study. Most of the local literature reviewed is based on traditional F2F mentoring practices such as one-on-one, group and peer mentoring that is also considered sporadic in many South African schools.

The focus on under-resourced schools that seemingly rely mainly on poorly established traditional mentoring strategies contributes new knowledge to fill a theory gap that exists in literature on enhanced methods of reforming mentoring experiences for novice science teachers. This study will make an innovative contribution to a better understanding of blended mentoring practices in light of challenges that traditional F2F and virtual mentoring practices have if implemented in isolation. For example, the prevalence of Covid-19 pandemic in 2020-2021 made it impossible for traditional F2F education practices to be implemented as teachers and learners were locked down in their respective areas of residence. Parveen (2021) reiterates that the Covid-19 pandemic led to intensive disruptions and traditional teaching learning system is one that was disrupted. To counter the disruptions in several schools across the globe, blended learning was introduced and it encouraged learner-centred approach in which teacher and learners interacted with each other in flexible and conducive environments. Tsegay, Ashraf, Perveen, and Zegergish (2022) point out that when countries implemented lockdown to contain the spread of Covid-19, higher education institutions were the first to replace their face-to-face classes with online learning, transforming their learning environment so that digitalisation expanded and complemented student-teacher and other relationships. One wonders how novice science teachers who needed induction and mentorship navigated the Covid-19 pandemic without mentors physically present to induct and professionally support their mentees. Thus, this study is significant because it recommends an alternative strategy for use to induct and continue to support novice science teachers under any circumstances in the future.

This study provides guidance to the much-needed reformation of novice science teacher mentoring practices in South Africa that are primarily based on traditional F2F practices. The study informs education stakeholders about the feasibility of blended mentoring as a beginner science teacher induction and support strategy with the intention to gradually reduce the high novice teacher attrition rate in South Africa. This study benefits many stakeholders in education such as universities, teacher-training institutions, schools, DBE, provincial and district education officials, school management teams (SMTs), mentees (novice science teachers), mentors and most importantly by learners. Universities and teacher-training institutions will benefit from a new mentoring strategy that may be useful in supporting student teachers during Work Integrated Learning (WIL) widely known as teaching practice. Parveen (2021) advocates the use of blended learning within the context of teacher education, focusing much attention on educational technology, general preservice teaching skills, in-service teachers, educational leadership and general courses.

Hence, this study contributes towards a growing body of knowledge on beginner science teachers by focusing on how blended mentoring can facilitate the smooth transitioning of novice science teachers into the teaching profession, thus addressing the global problem of teacher attrition. To form the basis for potentially high-class mentoring experiences for novice science teachers, this study recommends the development and implementation of an efficient blended mentoring programme for use by all education stakeholders in South Africa.

1.5 Delimitations of the study

The researcher selected to explore the problem “Using blended mentoring approach to support novice science teachers in Ekurhuleni South District” despite the multiplicity of scientific problems that required research. In order to entirely explore the chosen topic, a mixed-methods approach was selected and implemented to accomplish set research objectives.

This study is limited to I&M of novice science teachers with five years or less of science teaching experience at either primary or high school level and does not refer to teachers in general. In the quantitative portion of this study which comprised an online questionnaire, novice science teachers from four provinces that granted permission in time for this study to be conducted, namely the Eastern Cape, Gauteng, Limpopo and Mpumalanga provinces, were surveyed. In the same vein, the qualitative part of this study addresses mentoring experiences by beginner science teachers who are mainly based in under-resourced schools with specific reference to schools in the Ekurhuleni South District in the Gauteng Province for the researcher’s convenience.

Under-resourced schools are characterised by lack of resources (both human and material), poor infrastructure, overcrowded classrooms, a general lack of discipline among learners and usually serve learners from low socio-economic backgrounds. In line with the scope of this study, generalisation and transferability of the research findings may only be limited to schools that have the same or similar settings and to teachers that had similar experiences or that find themselves within the same context as those of participants in this study. This means that the study is applicable since qualitative data was used to corroborate quantitative data. Noble and Smith (2015) note that applicability consideration is given to whether findings can be applied to other contexts, settings or groups, which is true for this study.

1.6 Definition of terms

This study employs several essential terms that have to be understood as used in the context of this study. The following are definitions of important terms as they apply in this study:

Asynchronous: This refers to the exchange of messages that occur by reading and responding as schedules permit rather than according to some clock that is synchronised for both the sender and receiver or in real time (Keengwe, 2019).

ATLAS.ti: This is a qualitative research tool or software that can be used for coding and analysing transcripts and field notes, building literature reviews, creating network diagrams, and data visualisation.

Beginner teacher/instructor: This is a teacher who has started a new teaching career after graduating from a training programme. In this study, this term is used interchangeably with beginner teacher (2017-2019) (Nantanga, 2014).

Blended mentoring: Buatip, Chaivisuthangkura and Khumwong (2019) define blended mentoring as a blend of face-to-face and online mentoring approaches. This takes advantage of information-technology solutions available online to assist the communication, such as instant messaging, web board, blogging, e-mail, searching, and Facebook. It is a kind of mentoring that indicates more than one means of communication are occurring between a mentor and protégé. These means of communication include face-to-face mentoring sessions in conjunction with either an electronic form of communication, phone communication, or both (Keengwe, 2019).

Digital natives/savvies: This refers to someone who was born or raised during the digital technology era and has grown up with computers and the internet.

Efficacy: This is the ability to achieve the desired or anticipated consequences. It refers to one's capacity to complete a work to a satisfactory and expected standard.

E-mentoring: E-mentoring is defined by an unknown writer as a computer-mediated mutually beneficial relationship between a mentor and a protégé that provides learning, advising, encouraging, promoting, and modelling and is often more boundary-less, egalitarian, and qualitatively different than traditional face-to-face mentoring.

Experienced/veteran teacher: This word refers to a senior teacher who has been in the profession for more than ten years (Jones, 2016). Veteran teachers, according to Nantanga (2014), are those who have obtained substantial knowledge and abilities in many pedagogical and professional elements of teaching and learning as a result of their long tenure in the profession.

Induction: Induction is the process of presenting, situating, assisting, supporting, and directing a newly appointed employee in a new position in order to aid his transition to his new employment (Draper, 2010). In this study, induction refers to a procedure of assisting, encouraging, and observing newly certified teachers who have taken positions in schools in order to help them develop the expert knowledge and skills needed to direct their new employment (Nantanga, 2014).

Formal mentoring: This involves a format that is more structured and has specified objectives and goals.

Mentee/protégé: A mentor is a person who receives support, advice and guidance from an experienced or knowledgeable person about their job.

Mentor: A mentor, according to the Cambridge English Dictionary, is someone who helps and advises a less experienced person over time at work. As a result, a mentor can influence another person's personal and professional development. According to Keengwe (2019), a mentor is a trusted counsellor and guide who, when paired with an individual, offers advice and support, either in an academic setting or in the workforce.

Mentoring: Mentoring is defined as a process of assisting novice instructors in becoming experienced teachers under the supervision of an experienced teacher (Nantanga, 2014)

Podcast: This is a digital audio recording made available on the Internet for download to a computer or mobile device, usually in the form of a series with new instalments delivered automatically to subscribers.

Professional development: Professional development, according to Owusu-Mensah (2013), refers to all actions, structured or unstructured, formal or informal, aimed at improving a teacher's abilities, knowledge, competence, and other attributes. Professional development can refer to a wide range of specialised training, formal or informal education, or advanced professional learning aimed at helping administrators, teachers, and other educators improve their professional knowledge, competence, skill, and effectiveness in the learning context.

Tele-mentoring: According to Lewis (n.d.), Tele-mentoring is a naturally occurring paired relationship between a more senior individual (mentor) and a lesser skilled or experienced individual (protégé), primarily using electronic communications, and is intended to develop and grow the skills, knowledge, confidence, and cultural understandings of the lesser skilled individual to help them succeed. Mentoring via telecommunication and computer networks is referred to as tele-mentoring.

Traditional mentoring: Mentoring takes place in traditional, face-to-face meetings in which mentors and protégés are physically present and interact synchronously (Neely et al., 2017).

Under-resourced school: Under-resourced schools are defined by Karlsson (1998) as a teaching and learning context that is exposed to a critical lack and insufficiency in resources. Under-resourced schools tend to serve large numbers of disadvantaged and mostly low-income students.

Virtual/online mentoring: According to Alex (2015), virtual mentoring is any mentoring activity that is not conducted face-to-face (physically). With modern-day technology, this type of mentorship can use a variety of communication tools such as Skype, phone, e-mail, and messaging. According to Neely et al. (2017), virtual e-mentoring occurs when technology totally mediates the mentor-protégé interaction.

Synchronous: Real-time communication between a minimum of two people.

1.7 Assumptions

During the course of this study, several assumptions were made. Firstly, it was assumed that people who participated in this study were novice science teachers with five years or less of teaching experience after their graduation from a teacher-training institution. Responses are assumed to be only from novice science teachers who graduated and not student teachers who are on teaching practice or experienced teachers who may have qualified more than five years ago. Precautionary steps such as sampling and cleaning of data were taken to ensure that data used in this study emanated from the rightful respondents to avoid any unexpected compromise to the validity and reliability of this study.

The second assumption was that all respondents came from under-resourced schools as defined in the context of this study. Although it was not possible for the researcher to ascertain that all online-based survey responses originated only from envisaged respondents, every effort was taken to track, screen and clean quantitative data to avoid any response in error that could affect the validity of this report.

The researcher also assumed that all participants in this study were honest and factual in their responses to all survey and focus group discussion questions explored in this study. The researcher may have taken considerable time and effort to review and validate responses from each participant but it was assumed that all responses were honest and to the best of each participant's knowledge and experiences. This was enhanced through the concealment of participant identities by way of coding and preserving participant confidentiality throughout this study.

Lastly, it was the researcher's assumption that the entire research process went well in accordance with the research plan. Thus, it is assumed that the instruments used to collect data were relevant and appropriate, the methodology selected was appropriate to the problem being explored and fulfilled the purpose for this study, the sample was appropriate and representative enough and that all data collected and used was assumed to be of good quality. The researcher, to the best of his knowledge researched on the merits of the research instruments and the methodology employed to consider them fit-for-purpose for this study.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Teaching in the 21st century, particularly science teaching, is inextricably linked to technological solutions. Literature reviewed especially from developed countries which supports the necessity for and use of technology in science teacher education, induction, and support in the form of blended mentoring is becoming increasingly important. It was noted that as new teachers begin their teaching career, they frequently go through critical stages in their career, which necessitates support for their professional development.

In a comprehensive study about the preparedness of novice teachers to enter the teaching profession, Esau and Maarman (2021) bemoans the weak disciplinary knowledge resources held by the majority of South African teachers. The writers argue that in general, this is a period in which young professionals appear to suffer from a form of “myopia” as they try to focus on their teaching abilities and the most pressing classroom demands. Esau and Maarman (2021) argue that even though the debate continues as to which organ in the education landscape is actually responsible for ill-preparedness of teachers, the question remains whether the support that teachers receive on entering the teaching profession is adequate to sustain their growth and development to meet the growing needs of the diverse learning community.

As soon as they walk into their new schools and classrooms, novice science teachers are frequently met with a slew of challenges. Robinson (2015) points out that research shows that the first year at work is the toughest for novice teachers. Some novice teachers may be barely older than their learners, daunted by having to manage large classroom groups and some may feel intimidated that they have to master enough content knowledge to teach all the subjects in the school curriculum while some may feel overwhelmed by the social problems in the community surrounding the school. Other challenges identified in various literature searched include but are not limited to failure to put theory to practice, increased workload, lack of resources, poor classroom management, deteriorating learner discipline, policies and procedures and assessment.

All the above are basic skills and knowledge that the researcher considers prerequisite for any novice teacher to survive in the classroom. Unfortunately, novice teachers in South Africa are left to either "swim or sink" (Smit & du Toit, 2016) in such environments. Smit and du Toit (2016) expose that as a beginner teacher and researcher at a primary school in South Africa, the authors never received any support from a mentor. He had difficulty in maintaining the quality of facilitating of learning, and wanted to promote quality learning in his teaching practice. In light of all these critical issues that novice science teachers face, it is clear that there is great need to induct and mentor them during their first years of their teaching practice. Robinson (2015) asks how best the education system can support these new teachers in such a way that they become competent and confident while also retaining their passion, enthusiasm and idealism. Robinson (2015) further suggests that one possible intervention is induction, where novice teachers receive structured mentoring and support by more experienced teachers in their first year or two at work. Thus, this study recommends that the intervention to induct and support novice science teachers should come in the form of blended mentorship.

2.2 Background discussion

For the purpose of this study, mentoring is defined as a process of assisting novice teachers in becoming experienced teachers under the supervision of an experienced teacher (Nantanga, 2014). Various research has shown that mentoring is essential in teacher training, induction, and continued professional teacher development programmes and has vast benefits that are discussed later in this research report.

This study sought to add a voice to a growing body of literature on an alternative mentoring strategy and suggests further exploration of this new medium for mentoring which is widely used in developed countries but is still new in South Africa and Africa at a large scale. It is important to understand what blended mentoring means in the context of this study from the onset. Buatip, Chaivisuthangkura and Khumwong (2019) define blended mentoring as a blend of face-to-face and online mentoring approaches, which takes advantage of information-technology solutions available online to assist the communication, such as instant messaging, web board, blogging, e-mail, searching, and Facebook. From this definition, it shows that blended mentoring is a kind of mentoring that involves more than one channel of communication occurring between a mentor and protégé. These means of communication include face-to-face mentoring sessions in conjunction with either an electronic form of communication or phone communication, or both (Keengwe, 2019).

It is evident in several literature consulted in this study that in South Africa's under-resourced schools, there is general inadequacy and inefficient mentoring practices for novice teachers. Jan (2017) points out that there is inadequate and uneven support, assistance, encouragement for new teachers. He further claims that often, new teachers are allotted to the most challenging classes and schools with little or no support and supervision. This is true for both traditional F2F or e-mentoring as long as it is conducted in isolation.

Literature reviewed identified other mentoring problems such as the non-existence of and non-adherence to mentoring programmes in under-resourced schools. This happens even when provincial and district education officials expect I&M programmes to be implemented despite these programmes only existing on paper but lack strong policy backing for compulsory implementation. A study conducted by Mamba (2020) found out that all principals from sampled schools did not have documentation or any supporting policy to induct new teachers. Mamba's (2020) findings confirmed what Ntsoane (2017) also uncovered that in South Africa, there is no formal policy or framework for the I&M of novice teachers. The DBE (2016) only has a sweeping statement in the Personnel Administrative Measures (PAM) document which determines the terms and conditions for the employment of educators where it is stated that senior and master teachers are to act as mentor and coach for less experienced teachers.

Despite the researcher learning from VVOB (2020) that a national framework for induction of teachers was developed in 2018-2019 by the DBE in a consultative way with other stakeholders such as JET Education Services and commissioned by the VVOB, there is no clarity on DBE policies on I&M programmes to date. VVOB (2020) claim that based on the national framework, the DBE in consultation with Dr Tanya Bekker from the Witwatersrand University developed induction materials for novice teachers. The VVOB website continues to state that in collaboration with a team from North-West University led by Prof. Carisma Nel, the DBE developed appropriate mentor-training materials. However, the researcher remains doubtful if the developed material were usable since they sound like a mere research report and the results for the field test of the NTI programme that was launched in 2020 could not be established to answer questions in the researcher's mind.

The lack of a strong policy position by the DBE and clear, formal guidelines on I&M practices is exacerbated by mentor-mentee mismatching, inadequate mentor training and unavailability of proper mentors, among many other factors that can contribute to a lack of quality induction and support for novice science teachers. Previous research argues that a lack of day-to-day professional support and mentoring for entry-level science teachers, which assistance current approaches to professional development generally fail to provide, can be an underlying contributing factor to the high science teacher attrition rate in South Africa. Howard (2016) argues that about a quarter of new teachers entering public schools in the United States leave within the first three years. Arguably, this can be true for South Africa's entry level science teachers who are left to "sink" or "float" in their new science classrooms.

This study identifies a very dangerous support and professional development gap for novice science teachers due to lack of I&M especially in South Africa's under-resourced schools. The researcher attributed frustration, underperformance, burnout and consequential high attrition rate to the lack of induction and support of these new science teachers. To improve novice science teacher induction, support and professional development, complementing current traditional mentoring approaches through the introduction and implementation of a South African tailor-made efficient blended mentoring model is a necessity and the sole aim of this study.

2.2.1 The emergence and value of e-mentoring in teacher professional development

Since blended mentoring is a combination of e-mentoring, and traditional F2F mentoring, the researcher decided to split the two for a better understanding. E-mentoring which might be new to the reader is explained first and face-to-face mentoring is explained next.

What exactly is electronic mentoring?

It is necessary to define e-mentoring in its entirety in order to comprehend it. According to the limited literature researched, e-mentoring has a variety of meanings based on the electronic nature of the interaction and whether it is a structured formal relationship or an unstructured informal relationship. The prefix "e-" refers to any formal electronic mentoring technique that can be used in a mentoring connection in this study.

E-mentoring, according to de Janasz and Godshalk (2013), is a process of employing computer-mediated communication (CMC) technology as the major means of communication between mentors and protégés. By CMC, de Janasz and Goldshalk (2013) are referring to the internet, e-mails, instant messaging services like WhatsApp, and other modern technologies that have transformed the way we interact. CMC may also include the use of computer-mediated communications such as e-mails, discussion boards, chat rooms, blogs, web conferencing, and other rapidly emerging internet-based solutions to change the way mentors and mentees interact. In other words, e-mentoring, according to the above definition, refers to any computer-based solutions to mentoring practices whose focus is to improve the mentoring process and subsequent outcomes.

In the field of teacher education, one can consider e-mentoring as a professional development relationship between a more experienced individual (mentor) and a less experienced individual (mentee) that is intended to develop and improve the mentee's skills; knowledge; confidence and professional understanding, primarily through computer-mediated communications. Novice teacher induction and support is a broad concept because it covers various aspects in respect to professional teacher development.

In this study, the e-mentoring process entails any computer-mediated relationship between a mentor and a novice science teacher where the mentor acts as the guide and role model to develop some skills and knowledge in order to enable the novice science teacher to fully operate alone in his/her classroom one day. E-mentoring is therefore a mutually beneficial relationship between a mentor and a protégé that provides learning, advising, encouraging, promoting, and modelling which is not bound by any geographical limitations as in face-to-face mentoring. This emphasises the importance of computer-based e-mentoring as a form of alternative professional development for science teachers who live in areas where face-to- face mentoring is limited or impossible.

Other literature perused do not provide a definition of e-mentoring, but rather describe it as an evolutionary path toward delivering real-time, continuing, work-embedded support in the form of online teacher professional development (oTPD). Many oTDP programmes in other countries, such as the United States of America, are realising the potential benefits of online communities of practice among teachers, such as the opportunities for reflection offered by asynchronous interaction; the contributions of teachers who are usually silent in face-to- face settings but find their voice in mediated interaction. In an unpublished article, Michau and Louw (2014) argue that e-mentoring follows the same principles as traditional mentoring, with the exception of how they interact. According to Michau and Louw (2014), e-mentoring relies on communication channels afforded by modern technologies such as e-mails, faxes, phone conversations, teleconferences, and other virtual simulations, rather than leveraging the entire spectrum and dynamics of a face-to-face encounter. In conclusion, e-mentoring is a symbiotic professional development relationship between the mentor and the mentee in which electronic communication, digital tools and computer-based technological solutions are used to strengthen the mentoring relationship in real-time.

Limitations of e-mentoring done in isolation

Despite its utility as an alternative teacher induction and support technique, e-mentoring has its own drawbacks. According to Kaufman (2017), e-mentoring requires access to Information and Communication Technology (ICT), such as

PCs or mobile devices (such as smartphones or tablets), as well as technical assistance for the technology and digital platform. In South Africa, under-resourced schools may lack the ICTs and technical support needed to host digital platforms. According to Kaufman (2017), the chosen technology must also be accessible to all mentors and mentees, which can be difficult when working with certain populations like inexperienced educators, especially those with disabilities. The participants in this study are beginner teachers from under-resourced schools who represent a large population of such teachers in South Africa. From the above quotations, the adoption of e-mentoring in under-resourced schools may be hampered by a lack of the necessary technology, such as computers, stable Wi-Fi connection, and internet access. This may be attributable in part to the location of such disadvantaged schools, such as in rural and township communities in South Africa.

Mentors and mentees in an e-mentoring programme must be technologically savvy as well. This is a particular challenge in South Africa’s most under-resourced schools, where experienced teachers are often computer illiterate. As a result, experienced teachers who can serve as e-mentors in online environments can be lost. According to Kaufman (2017), if a mentor is unfamiliar with social media sites, such as Facebook, using them to develop a mentoring connection may be ineffective without adequate training. Mentors and mentees must also have enough ICT communication abilities, such as reading comprehension and the capacity to express oneself adequately through text and/or emojis – digital graphics used to communicate an idea or emotion in digital communication (Kaufman, 2017).

E-mentoring may be less likely than traditional mentoring interactions to catch the interest of protégés. Furthermore, protégés may be less likely to understand material, have less opportunity to clarify, and be less open to information and advice provided by mentors via electronic media than when communicating face-to-face (Neely et al., 2017). Therefore, if protégés' attention is not captivated, e-mentoring will be ineffective. Some researchers support this notion by arguing that because e-mail and certain virtual communication techniques lack a complete spectrum of visual and aural clues that individuals rely on in face-to-face discussion, they can also be rendered ineffective. Thus, e-mentoring requires different interaction tactics as compared to face-to-face mentoring for it to gain maximum educational benefit. Incorporating what is known as good mentoring and induction techniques into online environments is also a significant problem for e-mentoring programmes.

Furthermore, in contexts where e-mentoring only takes place, the introduction of strangers makes it impossible to form a mutual relationship between the mentor and the mentee. Ateş, Çobanoğlu, Yücel, Uzunboylar and Ceylan (2017) point out that especially in e-mentoring relationships which hold virtual relations developed by a weak faith, misunderstandings occur. This can result in trust concerns which can have a negative impact on the mentor-protégé relationship. Even though there is a growing body of research on effective mentoring practices, some researchers believe that little is written about what effective mentoring looks like in an online setting. As a result, many e-mentoring programmes are created, evaluated, and then redesigned based on trial and error. These are some of the drawbacks that make e-mentoring an ineffective technique for induction and beginner science teacher support on its own, necessitating the search for a more effective method of induction and professional support for novice science teachers.

2.2.2 Face-to-face mentoring

In this section, a summarised version of traditional or F2F mentoring is given. The researcher assumes that the reader might be aware of this common type of mentoring which dates back to time immemorial.

In its traditional view, mentoring is considered as an intense interpersonal, face-to-face relationship and a process that brings together a senior individual (mentor) and a younger, less experienced person (mentee or protégé), by sharing experiences and helping the latter to achieve a specific goal for effective entry into a new occupation (Spanorriga et al., 2018). In the classical sense, mentoring entails a mentor-protégé pair physically meeting on a regular basis to discuss various concerns and share experiences. The mentor is an experienced teacher who helps the protégé to grow their skills, whereas the protégé is a new science teacher who benefits from the mentor's knowledge. The mentor supports and guides protégés as they transition from inexperienced to experienced science teachers, influencing their personal, professional growth and development.

In a traditional mentorship setting, the mentor and mentee usually share the same geographic location and meet physically (F2F). A.R. Neely, Cotton and A.D. Neely (2017) argue that mentoring takes place in traditional meetings in which mentors and protégés are physically present and interact synchronously. In some schools, the mentor and mentee share the same classroom or the mentor pays several visits to the mentee’s classroom to offer mentorship services.

Limitations of face-to-face mentoring

Despite the importance of conventional face-to-face mentoring, there is evidence in literature that this technique, which is often employed to help inexperienced science teachers during induction, has underlying risks and so limitations.

Face-to-face communication is not always the richest medium, and richer is not always better (Neely et al., 2017). This assertion indicates that there can be critical issues with a face-to-face I&M relationship if it is used as the sole strategy in the induction and support of novice science teachers. For example, during F2F mentoring, negative connections between the mentor and the mentee may form, which can disrupt the entire beginner teacher induction and support process. Although F2F communication benefits mentee-protégé relationships for a variety of reasons such as equivocality, synchronicity, and role clarity, Neely et al. (2017) argue that other mediums, such as email, can promote frequent contact while also allowing each individual the time to read, process, and reflect before responding. Face-to-face mentoring also has a disadvantage in terms of the pool of skilled mentors available in a school's science department. As a result, the beginner science teacher may not have a mentor who possesses the best attributes that a mentor should possess if there is no such a mentor in their new school. More so, unlike in virtual mentoring, which can occur at any time, F2F mentoring is constrained by geographical factors such as time and location. F2F mentoring can only take place in circumstances where both the mentor and the mentee are physically present. With the busy schedules that most mentors who happen to be HODs have, this means they may have little or no time at their disposal for I&M programmes.

2.2.3 The need for mentoring novice science teachers

Mentoring is essential in teacher training, induction, and continued professional teacher development programmes, according to the data evaluated in literature. In the United States of America, research has supported the importance of I&M), particularly for science teachers, with content-specific I&M found to increase new science teachers' implementation of inquiry-based practices (Wong, Firestone, Weeks & Luft 2017). Globally, including in South Africa, the demands on teaching as a dynamic profession have risen dramatically. The novice teacher's schedule is demanding and includes dealing with classroom discipline issues, completing paperwork, meeting the principal's expectations, managing their time, and planning for daily instruction, among many other things. Such first-year science teacher experiences necessitate effective, high-quality mentoring and teacher professional development programmes that support novice science teachers for remarkable success in their careers.

Understanding the growth cycle of science teachers is essential for understanding the necessity for mentoring them as they get classroom experience. Wong et al. (2017) claim that beginning science teachers progress through a series of developmental stages as they gain experience in the classroom as follows: Stage one is when the teacher is more teacher-centred, focusing on pertinent issues and attempting to keep up with the primary tasks of teaching in the classroom. The teacher's concentration shifts to instruction in the second stage. During this stage, the teacher gains the essential direct teaching experience, as well as enhanced knowledge and the capacity to adapt teachings and ideas to the needs of learners. In stage three, the teacher's thoughts and practice become more student-centred. At this point, the instructor focuses on student learning and involves students in classroom decision-making. Quality

I&M best practices in teacher professional development are pre-requisites for the phases indicated above to be successful.

There are five key types of assistance that novice science teachers seek during their early years, as cited in Wong (2017). These are:

1. Logistical support – identifying and locating accessible resources.
2. Instructional support – identifying and executing effective techniques and pedagogies.
3. Conceptual support – understanding and increasing knowledge of subject matter.
4. Psychological support – emotional support in dealing with challenges with instruction, students, other teachers, administrators, and parents.
5. Philosophical support – relating to science teaching standards and acceptable best practices.

In South Africa, as in many other countries, newly qualified science teachers graduate from various teacher education institutions at various phases of their careers, hence the need for I&M programmes for them to experience the five types of support identified by Wong (2017). In his research, Van Heerden (2019) reiterate that the reality of the classroom can still vastly differ from that of teaching practice no matter how successful the teacher education programme was in preparing their students for their future profession. Numerous beginner teachers feel overwhelmed by the transition from student teacher to full time teaching. Reality shock, however, often quickly sets in for most of them; beginner teachers find themselves to be directly confronted with the gap between theory and practice (Botha & Rens, 2018). This calls for nothing but a quality induction and support programme that will facilitate a smooth transition by novice science teachers.

As previously stated, beginner science teachers in their initial years of teaching require a great deal of assistance that is tailored-made for, and must meet their developmental needs. In the researcher’s personal experience as a science teacher, he noted with great concern that many schools in South Africa tend to have isolationist tendencies, with teachers working in separate classrooms and minding their own business. Teamwork and sharing of ideas seemed to be taboo in those schools. With the various methodologies employed by different institutions in South Africa for teacher training that are mostly remote-based and according to the researcher's standards, somewhat inadequate, it is critical for beginner science teachers to be inducted and seriously mentored in order for them to be retained in the education system.

Literature concurs that a typical traditional mentoring relationship is one in which a veteran teacher is paired with a novice teacher in teacher training, and the former works as a role model, coach, and advisor. Novice science teacher professional development and reflective practices are regarded as important outcomes of pre-service teacher education, with which the field practicum component is supposed to help. Due to the nature of science as a subject, beginner science teachers tend to face more complex obstacles in planning and teaching each day as compared to teachers in other disciplines. For beginner science teachers, teaching assignments frequently require them to create and improvise curriculum for most science concepts at the same time, including decisions on what to teach, how to teach it, audio-visuals, plus the what and how to grade it. This is especially true for new science teachers in South Africa's underprivileged schools where resources are scarce and quality science teaching tend to be determined by the teacher's initiative. Botha and Rens (2018) argue that the other reason for the early attrition of novice teachers is the overwhelming amount of administrative work that has to be done, including being responsible for a register class, financial administrative tasks, keeping a well-organised and up-to-date filing system, and recording and reporting on assessment. Blended mentoring by experienced science teachers can effectively assist novice science teachers to improve classroom management, reduce stress, make them feel welcome, improve their ability to plan properly in accordance with expected curriculum standards, and devise appropriate teaching methods for learners, allowing them to feel at ease in the schools where they work.

Successful teacher mentoring experiences can lead to improved happiness and proficiency in teaching among novice science teachers; as a result, mentored novices' professional development is more visible than their unmentored peers. Botha and Hugo (2021) claim that a mentoring programme contributes to beginner teachers' professional development and helps them to develop their full potential. By promoting professional development among newly qualified teachers, mentors enable these beginner teachers to acquire certain skills, which make them more effective in their new work environment (Botha & Hugo, 2021). It is true that mentoring, in its various forms, positively improved teacher effectiveness in the past. Mentoring programmes can also be described as a procedure that can help mitigate teacher isolation and leads to the establishment and understanding of consensual norms in a school, science department, grade and science team. According to Botha and Hugo (2021: 67), “Mentoring is a two-way process and provides a career path growth and enrichment for the advancement of knowledge to each individual of their respective deficient areas.” Moreover, when newly qualified teachers are supported by a mentor who guides and outlines all the requirements in an educational setting, the new teachers will develop into a confident and committed workforce that experiences a sense of empowerment within their new work environment (Botha & Hugo, 2021).

Mentoring in learning communities aids in the exchange of information and planning of careers. Teachers in a learning community, according to Flores, Hernández, García and Claeys (2011), transform their own knowledge into a collectively developed, widely shared, and unified professional knowledge base. Thus, mentorship connections can help create professional communities of learning (PLCs) that can greatly benefit novice science teachers in South Africa. This minimises chances of solitary teaching in isolated classrooms, which no longer satisfy the needs of today’s dynamic teachers and learners. A supportive community fosters quality support by providing chances for learning, reflection, and development (Flores et al., 2011).

Vygostky in his theory, states that learning takes place in the zone of proximal development (ZPD), which is the area between actualised and prospective developmental levels (Flores et al., 2011). As learners, novice science teachers require guidance from competent others through their ZPD to gain the confidence they need to successfully teach their classes, such effective guidance can only come through a quality blended mentorship programme. The ZPD concept was extended by Fani and Ghaemi (2011) who describe the zone of proximal teacher development (ZPTD) as the distance between what teaching candidates can do on their own without assistance and a proximal level they might attain through strategically mediated assistance from more capable others.

Mentoring new science teachers provides the additional benefit of inspiring and helping them to think critically. When a mentor is supportive, caring, and motivating, the mentee develops what is referred to as “relaxed alertness,” in which experience alters the growth and reorganisation of neural structures in the mentee, promotes higher order and abstract thinking, and encourages reflective activity (Michau & Louw, 2014). This idea is reinforced by literature that states that mentors contribute to the growth and development of mentees’ brains through social interaction and discourse. Fani and Ghaemi (2011) hold that the increased collaboration with either supportive colleague and coaches can support teachers when they seem to lose their self-confidence due to a lack of experience and self-efficacy. An integration principle was discovered by other researchers in which mentees connect what they know with new knowledge through reflection and dialogue with a trusted mentor, and this integration leads to the application of the two. As a result, mentoring novice science teachers allows them to combine what they learned during teacher training with new experiences they gain from others and in their daily routine, hence improving the quality of science teaching.

The importance of mentoring beginner science teachers can be summarised in this section. The induction and support of new teachers assist them build competence and confidence which is crucial for improving student learning outcomes. It should be highlighted that mentoring is helpful not only to the mentee but also to the mentor. The opportunity to mentor a new teacher, according to various literature sourced, solves two fundamental challenges in teaching: the abrupt and unsupported entry of novices into the field and the difficulty of retaining good, experienced teachers in the classroom. Mentoring, thus does not only alleviate the traditional “sink” or “swim” experience of many new teachers by providing social support, but also contributes to experienced teachers’ (mentors) dedication to developing agreed standards and good practice. The numerous advantages of mentoring practices demonstrate that it is a valuable and important strategy for teacher professional development. Esau and Maarman (2017) confirm that the acquisition of skills and knowledge is inadvertently brought about by the recurrent and continuous nature of induction. It does not only guide novices to become part of the competent and experienced teacher corps but it also socialises them more quickly into the culture of the school as a learning community.

2.3 The high attrition rate of novice science teachers in South Africa

The main problem identified by the researcher is the high attrition rate of novice science teachers in South Africa. The researcher attributed this attrition rate to the absence, inadequacy and inefficient I&M programmes especially in under-resourced schools.

Mlambo and Adetiba (2020) claim that South Africa’s basic educational system is experiencing a severe shortage of qualified teachers, especially in mathematics and science due to emigration. Science and mathematics teachers emigrate to greener pastures such as Canada, the United Kingdom, the United States of America, Australia and recently New Zealand and Asian countries where lucrative opportunities arise. Maphalala and Mpofu (2019) found out that between 18,000 and 22,000 teachers leave the profession every year in South Africa, and among them, mainly science and mathematics teachers. They claim that this figure is higher than teachers who join the profession every year. In a report produced by the South African Council for Educators (SACE) in 2011, South Africans made up close to thirty percent (30%) of teaching permit holders and was the largest foreign provider of teaching staff in the United Kingdom at that time. According to the same SACE report, about 48% of practising teachers in South Africa intended to migrate and 27% of student teachers were considering migrating upon graduation. This implies that in South Africa, the rate of teacher attrition currently exceeds the rate at which newly trained teachers join the system. Of particular concern is the fact that there is evidence of higher rates of international recruitment of teachers specialising in subjects that are considered to be scarce subjects, notably, the sciences (SACE, 2011).

In the same vein, Maphalala and Mpofu (2019) argue that South Africa is particularly lagging in producing teachers in science, technology, engineering and mathematics which results in scarcity. In some cases, though rare, teachers are not willing to teach in resource-constrained schools because their teacher education and training did not prepare them on how to facilitate teaching and learning in rural environments. All these challenges call for research on the factors that may result in the country's scarcity of science teachers as they have the potential to leave their schools in South Africa and head for greener pastures in other countries.

2.3.1 Why introduce a blended mentoring model?

The constraints and limitations for both traditional face-to-face and e-mentoring practices used in isolation have been clearly spelt out in this proposal. This results in a big gap in the field of mentoring and professional teacher development, hence the question: What alternative strategy can then be employed to induct and support beginner science teachers efficiently and effectively? The suggested solution proposed in this study is to merge traditional face-to-face and e-mentoring in order to form and implement a blended mentoring model.

Ateş et al. (2017) agree that integrating e-mentoring techniques with a face-to-face communication element can make the process more effective. Mentoring techniques where mentor and mentee communicate not just electronically but also face-to-face, are referred to as blended mentoring practices. Most, if not all, of the issues that arise when face-to-face or e-mentoring approaches are implemented in isolation, can be addressed by blended mentoring. Hassan (2022) holds that while there are benefits to both approaches (e-mentoring and

F2F), there are also drawbacks. For organisations to get the most out of the mentorship, embracing a mixed approach that includes both e-mentoring and face-to-face mentoring is essential. In her blog, Hassan (2022) reiterates that virtual mentoring is a great option for those who cannot meet in person, but it should never replace the importance of meeting in person. The personal connection of meeting in person is unlike any other. She points out that much is lost when we try to connect virtually. Non-verbal communication is a large part of how we interact with others.

Research was conducted with students and graduates of business administration via emails, telephone calls, and face-to-face meetings as an example of blended mentoring. According to the findings, both mentors and mentees benefited from blended mentoring. Mentors became more content as a result of having the opportunity to do more consulting, mentees were able to receive more support in both professional and psychosocial terms, they were able to better plan their career path, and they wanted to continue their relationships with their mentors, according to the study, (Ateş et al., 2017). If blended mentoring has been tried and tested in the business administration field and proved to be effective, the researcher believes it can also be effective in the induction and support of novice science teachers in the education sector, as the two mentoring strategies can supplement and complement one another.

Kizildag and Adnan (2017) argue that limitations of face-to-face mentoring activities such as lack of time, balance between life and academia or logistics-led institutions to offer e- mentoring or blended mentoring programmes through the use of online technologies. Other literature reviewed claim that technology has proved to serve as a reliable source of electronic scaffolding and, thus, a positive change in teacher's professional development. This is true as the Internet, computer and associated software known as technological artefacts have proven to mediate teacher's learning in many developed countries. Since mentors and mentees feel more confident in face-to-face interactions and the use of technology is considered a critical factor to improve their ZPTD, blended mentoring can be considered as the best and more efficient solution for teacher novice science teacher development.

2.4 Summary

From the literature consulted in this study, there is evidence that South Africa faces a high attrition rate of its scarce resources in the form of science, engineering and mathematics teachers as they seek lucrative opportunities in developed countries. This is as a result of burnout, with the absence and inadequacy of professional support in the form of mentoring programmes being a major contributing factor. Literature reviewed maintains that the importance of mentoring novice science teachers cannot be overemphasised. Despite the patchy prevalence of face-to-face I&M in some schools, districts and provinces in South Africa, the limitations of using one mentoring approach have been clearly outlined in literature.

This calls for alternative strategies to mentoring and novice teacher support, hence the introduction of blended mentoring as envisaged in this study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This study employed mixed methods research (MMR) which has rapidly become popular in the social and behavioural sciences (Timans, Wouters & Heilbron, 2019). Tashakkori and Teddlie (2010) argue that the term “mixed model” (MM) is more appropriate than “mixed methods” for research in which different approaches are applied at any or all of a number of stages throughout the research; thus, mixing often extends beyond just the methods used in the research. Mixed model is true for this study as the “mixing” was not limited to research methods only but included different approaches done at different stages to enhance the understanding of the topic and get the much-needed answers to research questions. The terms MMR and MM are used interchangeably and are considered to carry the same meaning throughout this study.

Creswell (2015) defines MMR as an approach to research in the social, behavioural and health sciences in which the investigator gathers both quantitative (closed-ended) and qualitative (open-ended) data, integrates the two, and then draws interpretations based on the strengths of both sets of data to understand research problems. As expounded in this definition, the use of MMR was chosen due to its clear potential quality enhancement of this study. MMR covered both quantitative and qualitative aspects of my study as the researcher endeavoured to gain in-depth understanding of the novice science teachers’ lived I&M experiences in the different provinces where they are deployed. A number of advantages of using MMR of which the researcher took advantage are summarised by Tashakkori and Teddlie (2010, p272-273):

> A fundamental assumption about mixed methods research in the social, behavioural, and health sciences is that it might potentially provide a better (broader, more credible)

> understanding of the phenomena under investigation than a dichotomous qualitative/quantitative approach. This is certainly assumed for complex questions that may not readily be answered by either qualitative or quantitative approaches alone. As a consequence, it is also assumed that, because of its potential for broader understanding of social issues, mixed methods provide more robust opportunities for devising policies and practices to implement positive change.

It was in the best interests of the researcher that this study came out among other qualities being broad, understandable, credible, and robust because the researcher intended to contribute to a vital body of knowledge and practice: I&M of novice science teachers in South Africa. The researcher therefore doubted the use of either a qualitative or quantitative method in isolation as that could have been counterproductive to the understanding of this wide-ranged topic. This could also have limited the credibility of an important phenomenon that was investigated in this project. Tashakkori and Teddlie (2010) believe MM is solidly based on a rejection of the dichotomy between the qualitative or quantitative approaches and enjoys a distinct nomenclature, methodology, and utilisation potential. It is these distinct qualities of MM that the researcher took advantage of and tapped into the strengths of both qualitative and quantitative methods to better understand the research problem that either research approach alone cannot solve.

In this study, the researcher believed the research questions could not be sufficiently answered by employing only one research method. Cohen, Manion and Morrison (2018) argue that in part, because research problems are not exclusively quantitative or qualitative, hence using only one kind of data (quantitative or qualitative), one methodology, one paradigm, one way of looking at the problem or one way of conducting the research, may not do justice to the issue in question. The same sentiment is echoed by Tashakkori and Teddlie (2010) who claim that research questions are often multifaceted in the human sciences since the phenomena of interest are highly complex and intertwined with one other. Such is the nature of this study which the researcher regarded as highly complex and demanded to be approached from different angles, quantitatively – to cover a wide range of novice science teacher population in South Africa and qualitatively – to provide lived experiences and therefore enhance this study.

Tashakkori and Teddlie (2010) argue that the multidimensional nature of many, if not most, social and behavioural phenomena is the reason why MM are often required in research to address those phenomena. The research topic in this study on I&M is of a multifaceted and multidimensional nature, hence the researcher considered the need to obtain balanced research through the use of MM as supported by literature. MMR was also employed in order for the researcher to do justice through having in-depth understanding rather than scratching at the surface of this widely researched area which has seen minimal improvements over the years. Thus, both quantitative and qualitative data obtained at a relatively large scale in this study can provide considerable impact to the body of knowledge on I&M in South Africa. Data collection methods were mixed in this study, that is, through the use of a web-based survey conducted to collect quantitative data from the sampled population and a focus group was conducted to gain in-depth understanding of the topic. Mixing was also done in the way data was interpreted, that is, statistical analysis of quantitative data with thematic analysis being applied to qualitative data.

Selecting MM for this study was in line with Cohen et al. (2018) who set out four different realms of MMR addressing what can be mixed as the methods; methodologies; paradigms and the practice. By mixing methods, Cohen et al. (2018) refer to the use of both quantitative and qualitative methods for the research and different data types. Mixing methods was applied in this study where an online survey and focus group discussion were used as data collection methods, giving rise to secondary and primary data, respectively. Tashakkori and Teddlie (2010) equate the researcher to an everyday problem solver who, at the stage of intervention, would go ‘‘horizontal’’ seeking the widest variety of interventions that might address the issue at hand, thus substantiating the researcher’s choice of using MMR. Tashakkori and Teddlie (2010) remark that once specific questions have been formulated, a researcher should consider the most diverse array of methodological tools available to answer those questions through a process they call methodological eclecticism. This is defined as a natural extension of pragmatism's rejection of either quantitative or qualitative which is a hallmark of the mixed researcher's approach towards conducting research, replacing it by continua of options that stretch across both methodological and philosophical dimensions (Tashakkori & Teddlie, 2010). This is true for all intentions in this study where the researcher chose both the quantitative and qualitative approach. A wide variety of methodological interventions were considered in a bid to find answers to this study which had multi-dimensional questions. Hence, the researcher believed that using MMR would help in gaining real-life experiences from the esteemed participants.

It is clear that MMR operated at almost all stages of this study. This is considered to be an important step in the processes of the analogical everyday problem solver and the social or behavioural scientist who, alike, is involved in having an iterative, cyclical approach to their work (Tashakkori & Teddlie, 2010). As a problem solver and behavioural scientist, the researcher followed an iterative approach in this study where the content of the discussion, stimulus, and even the methodology was adapted over the course of the study to bring about credibility and validity. Tashakkori and Teddlie (2010) believe there should be a characteristic ''ebb and flow'' to mixed research that exemplifies its constant search for better, however elusive, understandings of social or behavioural phenomena. The researcher was determined to implement a cyclical approach in the search for best answers to research questions and a better understanding of the research topic.

The use of MMR is further supported by Creswell (2015) who claims that a core assumption of MMR approach is that when an investigator combines statistical trends (quantitative data) with stories and personal experiences (qualitative data), this collective strength provides a better understanding of the research problem than either form of data alone. The combined usage of quantitative and qualitative data in this study proved the dynamic power of MMR. Due to the exploratory nature of this investigation and limited availability of literature in the South African context, the researcher believed that using either quantitative or qualitative research methods in isolation would be insufficient to gain a clear understanding of the research problem. The researcher was also aware of the inherent weaknesses of quantitative or qualitative research methods if used in isolation, hence employed MMR in order to arrive at valid conclusions.

Since this study is exploratory in nature, it was founded on a mixed methods approach to gain insight into it. According to Kumar (2019), exploratory research is performed to determine the feasibility of undertaking a study where little or no information exists. It is evident that there is paucity of literature on blended mentoring for novice teachers in South Africa. It was therefore feasible to do exploratory research in this area in order to gain more insight in this field of study, hence contribute to the body of knowledge on this vital topic which can help improve the quality of science teaching and education in South Africa.

In further support for using MMR from the literature reviewed, Kumar (2019) claims that using mixed methods tries to capitalise on the strengths of the other approaches, that is, it employs the best of both paradigms to improve the accuracy, depth, and dependability of the findings. In this study, the researcher's intentions were to produce accurate and in-depth findings that are not only dependable but rather credible with a vision to see considerable improvements done in the I&M of novice science teachers in South Africa. Cohen et al. (2018) further support mixed methods research approach by saying that it enables the researcher to have a more comprehensive and complete understanding of phenomena than single methods approach. Thus, in this study, with the researcher aiming at having complex research questions answered more meaningfully, contextual aspects of novice science teachers were researched through a mixed methods approach.

In conclusion, Creswell and Plano-Clark (2011) point out that mixed methods research can provide insights into and explanations of the processes at work in a phenomenon, as well as multiple perspectives on the phenomenon, thereby increasing the usefulness and credibility of the findings, and even allowing for unexpected outcomes. This was evident in this study where participants provided varied aspects of their lived experiences as novice teachers operating in various provinces. Last but not least, Cohen et al. (2018), claim that mixed methods research improves data accuracy and reliability through triangulation, reduces bias in research, provides a “practical, problem-driven approach to research” and allows compensation between strengths and weaknesses of research strategies. The use of MMR in this study certainly improved data accuracy and reliability, coupled with the reduction of bias as triangulation was employed to enhance validity through converging of information from both quantitative and qualitative standpoints.

3.2 Research methodology

This study is exploratory in nature; hence it was founded on a pragmatist paradigm which played a major role in establishing the structure and basis for this research. Kaushik and Walsh (2019) claim that pragmatism as a research paradigm finds its philosophical foundation in the historical contributions of the philosophy of pragmatism and, as such, embraces plurality of methods. This implies that pragmatism is associated with mixed methods which the researcher preferred to use. Kaushik and Walsh (2019) further affirm that as a research paradigm, pragmatism is based on the proposition that researchers should use the philosophical or methodological approach that works best for the particular research problem that is being investigated. Their assertion resonates well with this study in which pragmatism and MMR were used due to their many known merits in educational research.

Pragmatism as a paradigm was adopted as the most suitable philosophical approach in this study for various reasons identified in reviewed literature. As a research paradigm, pragmatism orients itself towards solving practical problems in the real world. It emerged as a method of inquiry for more practical-minded researchers (Kaushik & Walsh, 2019). The lack of quality mentoring and support strategies for novice science teachers is a real problem that this study seeks to resolve. The researcher is personally pragmatic in nature who wishes to contribute towards quality science teaching in South Africa, hence the selection of this paradigm.

As a pragmatist, the researcher concurs with Kaushik and Walsh (2019) who assert that as a methodological approach to problem solving, pragmatism requires detection of a socially situated problem and adequate action to address the problem. The high attrition rate of science teachers as developed countries that suffered from ‘brain loss’ due to Covid-19 pandemic in 2019-2022 open up to immigrant workers, is a social problem that requires immediate attention in South Africa. Through the use of pragmatic approaches, action suggested in this study is of utmost importance.

Despite its several advantages, pragmatism has several assumptions. As mentioned by Maarouf (2019), pragmatism is the philosophy that permits mixing paradigms, assumptions, approaches and methods of data collection and analysis. This assumption leaves a lot of choices for the researcher to make which widens the possibility of error. However, for the purpose of this study, the researcher took advantage of this assumption and performed the best “mix” which resulted in the successful completion of this study. Another assumption is that pragmatism does not address the issue of the differing assumptions of the quantitative and qualitative paradigms. Maarouf (2019) points out that they believe these assumptions suggest that quantitative and qualitative methods are not studying the same phenomenon, which makes mixing methods for cross-validation not logical. In this study, both quantitative and qualitative methods were craftly used to study the same phenomenon and triangulation was very relevant and logical in corroborating the results. In fact, triangulation increased the robustness, validity and credibility of this study.

3.3 Research design

Cohen et al. (2018) define a research design as a plan for, and foundations of, approaching, operationalising and investigating the research problem. As such, the plan sets several things that includes the approach; the theory and methodology to be employed; the type(s) of data required and how data was collected (instrumentation). It also identifies from whom the data was collected, that is the sample; how the data was analysed, interpreted and reported in order to draw conclusions. Kumar (2011) provides another simple definition of a research design as a plan, structure, and strategy of investigation designed to acquire answers to research questions. In this study, the researcher gave cognisance to this simplified version of a research design and ensured that it was well planned, has a structure and would assist in finding answers to the research questions posed above.

In line with the above definitions which the researcher took as guiding principles, a mixed methods research design was selected and implemented. A mixed methods research design is an approach to collecting and analysing both qualitative and quantitative data in a single study. Literature suggests that by integrating data from both quantitative and qualitative sources, a researcher can gain valuable insights into their research topic. The mixed methods research design was selected due to the demanding nature of the topic where quantitative or qualitative data alone could not sufficiently answer given research questions. The mixed methods research design allowed the researcher to combine the strengths of quantitative and qualitative data by digging deeper to better understand mentoring and support experiences of novice science teachers in different locations. Despite some writers identifying the use of mixed methods design as a source of conflicting results for some researchers, in this particular study, the researcher managed to draw meaningful conclusions that led to more benefits such as applicability, contextualisation, and credibility of the research outcomes.

A convergent parallel design, which is a type of a mixed methods design, was selected and used in this study. Figure 3.1 below shows the convergent parallel design which includes both quantitative (survey) and qualitative (focus group discussion) data collection methods.

The Convergent Parallel Design

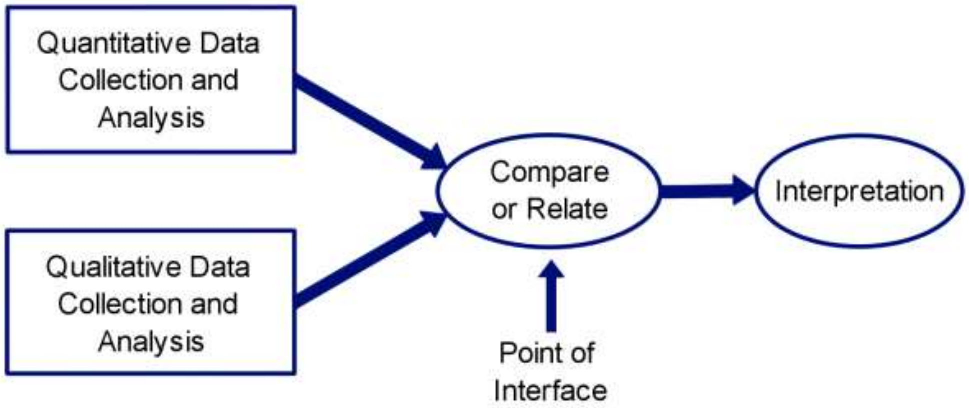


Figure 3.1: Mixed methods typology
[Adapted from http://www.fischlerschool.nova.edu/]

A convergent parallel design entails that the researcher concurrently conducts the quantitative and qualitative elements in the same phase of the research process, weighs the methods equally, analyses the two components independently, and interprets the results together (Demir & Pismek, 2018).

In this study, both quantitative (survey) and qualitative (focus group) data was collected separately but concurrently, analysed separately then interpreted and compared together to allow for validation. As Creswell (2015) suggests, the intent of research in a convergent design is to collect both quantitative and qualitative data, analyse both datasets, merge the results and perform data analyses with the purpose of validation of the results. Comparing and contrasting data was done at the point of interface. This is also supported by Demir and Pismek (2018) who claim that with the purpose of corroboration and validation, the researcher aims to triangulate the methods by directly comparing the quantitative statistical results and qualitative findings. In line with these assertions, data collected in this study was analysed separately, compared for similarities and differences which allowed for triangulation, corroboration and comparing (validation) before conclusions were drawn.

In summary, this study was conducted in such a way that data was collected simultaneously. Quantitative data of numeric form was collected by way of a survey whereas qualitative data was collected through one focus group discussion. Data was analysed independently, compared, and contrasted for similarity, difference, and complementarity before being converged in a triangulation. O'Leary (2017) argues that triangulation studies gather several forms of data to look for corroboration, which improves the overall robustness and credibility of the study. Data was analysed independently in this study, which resulted in it being pooled to provide a unified and validated research report.

3.4 Population and sample

3.4.1 Population

A population is defined as the total membership of a specific class of people, things, or events (O'Leary, 2017). The population in this study consists of novice science teachers with five years or less of teaching experience based in disadvantaged schools in the Eastern Cape, Gauteng, Limpopo and Mpumalanga provinces in South Africa. It is the entire group of prospective participants that the researcher drew conclusions about.

3.4.2 Sample and sampling method

As defined by O'Leary (2017), a sample is just a subset of a population. With a mixed methods research approach employed, two samples were selected from the population for purposes of data collection, that is, a quantitative group for the survey and a qualitative study group for focus group discussions.

In this study, probability sampling of the quantitative study group that was planned during the research proposal could not be implemented because the researcher could not access databases as envisaged for the provinces that granted permission to conduct research, namely, the Eastern Cape, Limpopo, Gauteng, Mpumalanga and Western Cape Provincial Education Departments (PEDs). The permission given was granted to the researcher to directly access schools to conduct research. Instead, non-probability sampling approaches used in selecting the sample for the qualitative phase were employed for the quantitative group. Random purposive sampling was used. In support, Kumar (2017) affirms that the major consideration in purposive sampling is to determine who can supply the greatest information to meet the study's objectives. Prospective participants were invited to participate by sending invitation links through electronic and social media platforms. Stratified random sampling which involved dividing the population into sub-groups was done based on provinces where novice science teachers were based, years in teaching and their support experiences.

The qualitative sample for the focus group consisted of six novice science teachers based at an under-resourced school in Ekurhuleni South District. These were conveniently selected due to their proximity to the researcher for face-to-face focus group discussions that culminated in primary data. As in quantitative sampling, Kumar (2017) agrees that purposive sampling can be done and participants who can supply the greatest information to meet the study's objectives can be chosen. As a result, the researcher contacted under-resourced schools in the Ekurhuleni South District that had novice science teachers to serve as the sample. According to Creswell and Plano Clark (2011), the sequence and design chosen must have a good rationale, and samples and sample sizes may vary depending on the type of data and the stage of the research. Table 3.1 summarises the samples that were used for the quantitative and qualitative phases of the research:

Table 3.1: Profile of respondents

Research method	Description of respondent	Number sampled
Quantitative (survey)	Novice science teachers with five years or less of teaching experience based in under-resourced schools	29
Qualitative (Focus group)	Novice science teachers with less than five year’s teaching experience based in under-resourced schools	6

The numbers suggested and used for samples stated above enabled the researcher to manage the data collection processes as well as analysis and interpretation.

3.5 The research instruments

Data for this mixed methods study was collected using two different research instruments though this was done concurrently. A web-based survey (attached herein as Appendix A) was created and utilised to gather primary data on the induction and support experiences of sampled novice science teachers in an online survey. A self-administered questionnaire was chosen due to its cost-effectiveness, ease of administration to a large group using online channels, anonymity and its standardised nature of questions that were easy to analyse and are self-paced to ensure maximum response rates.

The questionnaire consisted of four sections with the first part of the questionnaire containing introductory remarks and important information that introduced respondents to the reasons for the survey. This part actually encouraged prospective participants to take part in the survey. The respondent's consent to participate in the survey was requested. Section 1 of the questionnaire requested bio-data of the respondents for the researcher to verify the envisaged respondents in the survey for credibility.

Section 2 contained closed questions that asked respondents to share their induction experiences during the first year of their teaching experience. Spaces were provided for further elaboration especially if the respondents select "Other" as an option. Some questions that sought to verify induction experiences of the participants were based on a 5-point Likert scale. A Likert scale is a rating scale that can be used to measure opinions, attitudes and behaviours. A Likert scale was selected for this study due its simplicity and great suitability to capture a certain level of agreement on feelings by respondents regarding the topic in question. Another great strength of a number scale was the ease of conducting statistical analysis since the label for each category reflects its score, hence there was no need to code information before crunching numbers. With the simple numbering of options, each category label could represent the same value as its score. More so, not only did the word scale helped describe each category, but it also allowed the researcher to present findings verbatim to the respondents' opinions using percentages.

Section 3 of the questionnaire sought to find out the mentoring and support experiences of novice science teachers in the different provinces and schools. Questions were designed to give insight into whether there was any school, district or provincial support and teacher development programmes. For example, the researcher wanted to understand if such programmes actually existed, and if so, if they were once-off or continuous experiences as well as the level of satisfaction of beneficiaries of such programmes. This addressed the research questions and helped the researcher to understand the concept under research.

A pre-survey covering letter (see Appendix A) was designed and sent to respondents to, among other things, introduce the researcher, state the goal of the research, acquaint respondents with the study's importance, promise anonymity, and encourage them to participate in the survey. The cover letter might have discouraged prospective participants who do not like to read long texts due to its length. A pilot of the questionnaire was done by sending it out to a small group of people. A pilot served to improve the questionnaire's reliability, validity, and usability (Cohen et al., 2018) as the researcher had to revise some few questions and add the last item in the questionnaire. A completed questionnaire was given to respondents via electronic and social media platforms. Reminders were sent to respondents to encourage them to participate in their numbers in good time allocated for data collection.

The questionnaire was chosen as a data collection tool for several reasons. Cohen et al. (2018) claim that the questionnaire is a frequently used and useful tool for gathering survey data, as it provides structured, often numerical data. The questionnaire has many advantages of which the researcher took advantage in this study. It can be delivered without the researcher's presence, in this case via online or social media platforms. Responses from the questionnaire are comparatively simple to analyse. The questions in this data collection instrument were relevant to the study's aims; concrete; specific; and focused on the target population and research goal. The types of questions utilised were determined by the rule of thumb established by Cohen et al. (2018) who state that the more the questionnaire may need to be organised; closed; and numerical, the greater the sample size, and the lower the sample size, the less structured, open, and word-based the questionnaire can be. Hence, the questionnaire for this research was designed in a way that befits a large sample size to allow for ease of data analysis processes.

The second instrument used for data collection in this study were focus group discussions (see Appendix B herein attached). A focus group consisting of between six novice science teachers from an under-resourced school in the Ekurhuleni South District was selected based on random purposive sampling technique. The researcher got a chance to interact physically with the participants by acting as a moderator during the focus group discussions. The express goal was to collect qualitative data as informants shared their lived experiences in relation to I&M as well as for participants to air their viewpoints on induction, professional support and knowledge of blended mentoring expressed in their own words and non-verbal clues.

Kumar (2019) agrees that in a focus group interview, the researcher explores the perceptions, experiences and understandings of a group of people who have some experience in common with regards to a specific topic. A focus group was selected to tap into the rich strength found in discussions and the opportunity was used to draw out deep-rooted opinions on induction, mentoring experiences and perceptions about blended mentoring that might not arise during the survey. Appendix B contains broad topic areas of discussion that provided a broad frame of discussions followed by specific discussion points that emerged when participants shared their points of view. The researcher ensured that all that was discussed was captured through audio recordings done at the express consent of the participants. Some notes were also taken down and consolidated with the audio recordings. Transcription was done and taken to the focus group for verification, confirmation and corrections before data was analysed and interpreted. The efficiency of focus group interviews and their relative low cost and effectiveness in research were considered as additional merits in the selection of this research tool.

3.6 Procedure for data collection

As stated above, the researcher collected data using two instruments: a survey (quantitative data) and focus group discussion (qualitative data). Data was collected concurrently since this study was based on a convergent parallel design. The procedure for data collection using the two instruments after getting permission to conduct research in the Eastern Cape, Gauteng, Limpopo and Mpumalanga PEDs proceeded as outlined in the subsequent paragraphs.

Firstly, a self-administered questionnaire, a cover letter and consent forms were designed by the researcher using Microsoft Forms which created a link that would enable easy sharing of the web-based survey. A pre-survey covering letter was sent to respondents to, among other things, introduce the researcher, state the research's goal, remind respondents of the study's importance, promise anonymity, and encourage them to participate in the survey. Secondly, links to access a completed questionnaire and consent form was shared with a small group of respondents via electronic and social media platforms such as emails, WhatsApp, Facebook, Telegram and LinkedIn to serve as a pre-survey to confirm the feasibility of the questionnaire. A pilot of the questionnaire was done by taking the first ten respondents as a pre-test group. Thirdly, the researcher used the pre-survey data to rephrase, change and add some questions in order to improve the questionnaire's reliability, validity, and usability (Cohen et al, 2018). The fourth step involved sharing the links of the finalised Microsoft Forms web-based questionnaire, cover letter and consent form to all prospective respondents via the electronic and social media platforms such as emails, WhatsApp, Facebook, Telegram and LinkedIn. In the fifth step, reminders and follow-up electronic communication was sent to prospective respondents in order to encourage them to participate in the survey and improve the number of responses.

In the qualitative data collection phase of this study, data was collected through focus group discussions (see the outline attached as Appendix B). The focus group consisted of 5-12 novice science teachers based in disadvantaged schools in Ekurhuleni South District who voluntarily participated. The researcher got an opportunity to interact physically with the participants by acting as a moderator during the discussions. The researcher's express goal was to learn the informant's viewpoints on induction; professional support and blended mentoring as participants shared their experiences expressed in their own words and non-verbal clues. Kumar (2019) agrees that in a focus group interview, the researcher explores the perceptions, experiences and understandings of a group of people who have some experience in common with regards to a specific topic.

The procedure for conducting focus group discussion involved, firstly, circulating a recruitment flyer in WhatsApp groups for Ekurhuleni South District teachers designed by the district science subject advisors. The flyer was aimed to inform and invite voluntary novice science teachers to participate in the focus group discussion. Secondly, the researcher applied random convenience sampling to select participants who could supply the greatest information that would meet the study's objectives. There was no bias during the process. Thirdly, the researcher shared a link with a consent form for participants to complete anonymously. A weekend date was agreed upon as the best day to conduct the focus group discussion to reduce barriers to attendance and avoid disturbing the day-to-day running of school business. Step five was the actual focus group discussion day which involved arrival at the selected venue about 20 minutes before time to allow for pre-discussion processes such as allocation of pseudonyms, having a bite and settling into the group.

In line with the focus group outline (attached as Appendix B), the researcher, in his new role as the moderator, opened the focus group by welcoming all participants and fully introduced himself and the assistant moderator. The assistant moderator's role was to audio record and take notes. He reminded all participants to feel free and participate in the focus group with full knowledge of confidentiality and anonymity. Ground rules and focus group guidelines were spelt out to pave way for the discussions. An icebreaker was introduced to increase comfort, and level the playing field before the commencement of discussions.

The researcher gave an overview of the topic and facilitated the discussion of all guided questions as provided in the focus group outline. Adequate consideration was given to specific discussion points that emerged where the moderator asked participants to fully explain themselves. The assistant researcher ensured that everything discussed and expressed was captured through audio recordings and few notes that were taken down for consolidation with the audio recordings. In concluding the focus group, the moderator thanked all participants for their time and volunteering to share valuable data that would contribute towards the improvement of mentoring of novice teachers in South Africa. The researcher promised to share with the participants a transcription report of the focus group discussion for corrections, verification and confirmation before data is analysed and interpreted. After-session procedures that included reimbursement of participants' travel expenses. Immediately after all participants left, the moderator and assistant moderator had a debrief session while the recorder was still running and to discuss the notes taking advantage of fresh memory on the part of both moderators. The storage device with the data was safely stored in line with ethical considerations.

3.7 Data analysis and interpretation

Following quantitative and qualitative raw data gathering phases of this study, the researcher proceeded to data analysis and interpretation, employing a reflective analysis approach in the process. Reflective analysis is defined as keeping as near to the data as possible from data collection through drawing to final conclusions (O'Leary, 2017). During data analysis and interpretation, the researcher, to the best of his capabilities, tried to keep close to the data as possible by 'keeping a keen sense on the overall project' (O'Leary, 2017), as much as possible.

Two data analysis software packages were used to analyse data in this study. Statistical Package for the Social Sciences (SPSS) was used to perform statistical data analysis of survey data. SPSS was chosen because of its growing popularity and flexibility in usage by beginners within both academic and business circles, making it the most widely used package of its type (Arkkelin, 2014). As a beginner, the researcher found SPSS easy to understand and used it for this project. SPSS is a versatile package that allows many different types of analyses, data transformations, and forms of output (Arkkelin, 2014). It is for these reasons that the researcher chose SPSS.

On the other hand, computer-assisted qualitative data analysis software (CAQDAS) known as ATLAS.ti was used to organise, manage and analyse qualitative research data obtained through focus group discussions in this study. The software was chosen for use in this study because it was developed with the purpose of managing a large amount of research data. Adelowotan (2021) argues that ATLAS.ti can be used to analyse large qualitative data against manual coding which takes a lot of the researcher's time and resources. Adelowatan (2021) added that it can be cumbersome and time-consuming if the analysis is done manually. The researcher chose to use ATLAS.ti having captured a 24-page transcription of a focus group interview, which was an immense amount of data that demanded proper organisation and analysis. The software proved to be an efficient tool to organise, capture and analyse data; it provided the researcher with an overview of the findings during the analytical process and helped in the optimisation of time (Brito, Caram, Montenegro, Rezende, Rennó & Ramos, 2016). The researcher took advantage of these two computer-aided data analysis software packages to organise and analyse data.

The analysis and interpretation of quantitative raw data in preparation for SPSS analysis was performed in several phases as suggested by O'Leary (2017). Only phases that were relevant for this study were followed. In phase one, survey data was edited and organised by tracking, screening and cleaning it. This is supported by Kumar (2011) who claims that editing entails scrutinising finished research instruments to discover and minimise errors, incompleteness, misclassification, and gaps in the data collected from respondents. This includes data that had errors, for example, data that was not coming from expected provinces where permission was granted to conduct research and incomplete responses were discarded. Editing resulted in proper preparation of the data set, ensuring that data was clean, accurate, consistent and that it followed the rules and conventions of SPSS for analysis and interpretation.

In the second phase, the dependent and independent variables were systematically determined. This led to systematic coding of data through assigning names and labels to variables and use of numeric codes for categorical variables. Arkkelin (2014) supports this by saying one helpful feature of SPSS that reduces confusion and information overload allows the user to provide more descriptive names (labels) for the variables in the file. The labels were allocated taking cognisance of the restrictive nature of SPSS rules that require the use of short abbreviations (Arkkelin, 2014). Data was then entered into the database where a cause-and-effect analysis was performed, avoiding missing or putting any invalid values.

The third phase entailed statistical analysis of a descriptive nature that was used to characterise the basic aspects of the data collected and summarise variables. The goal was to offer quantitative descriptions in a manageable and intelligible way (O'Leary, 2017). Descriptive statistics results were summarised in frequency distributions, customs tables, graphs and percentages that enabled the researcher to determine relationships and to uncover new information. In the final and fifth phase, appropriate conclusions were drawn using inferential statistics, which allowed the researcher to draw some conclusions and generalisation based on the findings. O'Leary (2017) argues that while descriptive statistics aim to explain and summarise the characteristics of a sample, inferential statistics aim to derive inferences that go beyond the immediate data or sample. Despite the data being limited to a sample, O'Leary (2017) still supports generalisations by arguing that inferential statistics does allow one to assess the probability that an observed difference is more than a chance discovery, and is in fact statistically significant. All the above phases were completed while maintaining a broad understanding of the aims of the research project.

Qualitative raw data gathered through focus group discussions on the other hand, was analysed and interpreted using ATLAS.ti version 23.3. After the focus group discussion, the audio recording was initially transcribed using Auris AI software. Transcription refers to the conversion of recorded speech into written text. The researcher carefully went through the transcription and listened to the recording to correct any inaccuracies and produced a standard verbatim transcription of what was discussed. This meant omitting irrelevant details like repeated words, stutters and repetitions in order to produce an accurate yet uncluttered transcript in line with research objectives. The researcher also used field notes to facilitate quality transcription. The transcription was then sent to focus group participants for confirmation before data was analysed and interpreted. Upon confirmation by focus group participants, the researcher went on to analyse and interpret qualitative data as explained below.

In performing qualitative data analysis for this study, the researcher was summarily guided by four processes of qualitative data analysis identified by Kumar (2011), steps that are also in line with the ATLAS.ti programme used. The first step entailed familiarising oneself with the data through repeated reading of the transcripts, a process called content analysis. Content analysis means analysing the contents of interviews to discover the primary themes that emerge from the respondents' responses (Kumar, 2011). Emerging ideas were found by carefully reading respondents' descriptive responses and my field notes to identify and categorise the meanings communicated, thereby laying the groundwork for data analysis using ATLAS.ti. The second step involved the assigning of codes to the main themes. This entailed randomly selecting a few responses to certain open-ended questions, observational and discussion notes to tally the number of times an emerging theme appeared in a focus group interview. The emerging themes were identified until they reached a "saturation threshold," at which point they were assigned codes in the form of keywords. Thirdly, classifying responses to primary themes was done. In this step, thematic analysis was performed which involved looking over all interview and note transcripts to identify overarching themes and assign them to the main topics as defined in step 2 above. As previously mentioned, ATLAS.ti was used to conduct thematic analysis. The fourth and last step involved interpreting and integrating themes and responses into the text of this report. According to Kumar (2011), this is dependent on whether one wishes to incorporate themes verbatim to maintain the feel or by using frequency samples. The integration of themes and responses was done verbatim in this study to avoid any errors and to maintain the feel.

Despite data analysis being performed independently for quantitative and qualitative data in this mixed methods research, interpretation was done after analysed data was compared and contrasted for similarity, differences, and complementarity. The results were converged in a triangulation. O'Leary (2017) argues that triangulation studies gather several forms of data to look for corroboration, which improves the overall robustness and credibility of the study. Data was analysed independently in this study, with results being pooled before drawing of conclusions to provide a unified and validated research report.

3.8 Limitations of the study

This study was mainly limited by time and bureaucratic procedures in seeking permission to conduct research. Even though the researcher wished to collect data from all the nine provinces in South Africa, delays in getting permission to conduct research due to bureaucratic procedures that have to be followed resulted in the researcher proceeding with only four provinces that granted permission for research to be conducted namely: the Eastern Cape, Gauteng, Limpopo and Mpumalanga. The first two provincial departments to grant permission to the researcher to start conducting research on the 31st of July 2023 were Gauteng and the Eastern Cape provinces. This permission came when the researcher had less than two months remaining on the time scheduled for data collection. There was insufficient time to follow-up on other provinces in order to carry out the online survey at a national scale as initially envisaged, with other provinces such as the Western Cape and North West responding when the researcher was about to close the quantitative data collection phase. There was a further delay when the researcher followed procedure to communicate with district offices first before conducting research. Unfortunately, some of the districts never responded to date.

The response rate for the online survey was low, which is one known demerit of online surveys, despite the researcher using various web-based channels of communication and encouraging prospective participants. Initial prospects of having as many as between over 150 novice science teachers participating was limited to only 29 respondents. Seemingly, researchers do not get the support they need when conducting research in South Africa. Moorosi and Bantwini (2016) experienced a low response rate in their research in 2016; they administered questionnaires to five of the 23 districts in the Eastern Cape that could be conveniently reached by the researcher. Each district was given 20 questionnaires (100 in total) to distribute amongst the school principals and 19 completed questionnaires (20%) were collected. This confirms that low response rates should be expected when conducting research and enough time should be given for the data collection phase.

The low response rate contributed to limited generalisations made in this study even though this was done with great caution as qualitative data was used to corroborate online survey findings. Furthermore, the lack of resources to conduct other forms of questionnaire distribution in a larger demographic area within a short space of time can also be listed as a limitation in this study.

3.9 Validity and reliability

Validity is defined by Oluwatayo (2012) as an indication of accuracy in terms of the extent to which a research conclusion corresponds with reality. The writers suggest that validity hinges on the extent to which meaningful and appropriate inferences are made on the basis of scores derived from the instrument used in research. In other words, the validity of a research study refers to how well the results among the study participants represent true findings among similar individuals outside the study (Patino & Ferreira, 2018). Heale and Twycross (2015) simply defined validity as the extent to which a concept is accurately measured in a quantitative study. This implies that it was of crucial importance that I ensured validity throughout the research process.

The validity and reliability of this study was afforded first priority. Various validity-enhancing factors were considered in the selection and usage of data collection instruments to avoid any validity breaches. Despite different types of validity being identified in several literature reviewed, of interest in this educational research were four types of validity that Oluwatayo (2012) identified as face, content, concurrent and construct validity. These types of validity were adhered to as they were deemed necessary for the ultimate enhancement of quality of this research's outcomes.

In designing the instrument used for quantitative data collection in this study, face, content, concurrent, and construct validity were considered and satisfied. Despite Sürücü and Maslakçı (2020) arguing that face validity is a subjective decision on the researcher's feelings, thoughts, and intuition about the functioning of the measuring instrument, Heale and Twycross (2015) argue that face validity is a subset of content validity. Face validity was considered important and was addressed through ensuring that all questions in the questionnaire were logically linked to the study's objectives. In other words, the researcher ensured that the structure of the questionnaire created was attractive, Likert scale statements were clear with the purpose of each statement being appropriate for the measuring instrument. Furthermore, all statements in the questionnaire were readable and clearly understood by the participants because the difficulty of each item was appropriate for the level of the participants.

Sürücü and Maslakçı (2020) defines content validity of a measuring instrument as a validity study that reveals the extent to which each item in the measuring instrument serves the purpose. Content validity of the questionnaire was satisfied by making sure that all items were adequately balanced and covered the entire scope of the subject under investigation. Concurrent validity, which is a form of validity used as a measure of the convergence of the results of an alternative instrument used to measure the same structure or as a measure of the sameness (Sürücü & Maslakçı, 2020) was adhered to. This was addressed through the selection of focus group discussion as another data collection instrument that was used to compare and contrast with survey results. Construct validity, which according to Sürücü and Maslakçı (2020) is concerned with the degree to which the instrument measures the concept, behaviour, idea and quality was also prioritised in this study. This was taken care of through ensuring that only novice science teachers were selected as participants whose contributions were the only ones used to draw conclusions in this study.

3.9.1 External validity

External validity refers to whether the study results apply to similar patients in a different setting or not (Patino & Ferreira, 2018). In this study, similar "patients" refer to novice science teachers who find themselves in different contexts (school environments) in the population throughout South Africa and not just the sampled group. Patino and Ferreira (2018) clarified the major source of external validity, as shown in Figure 3.2 below:

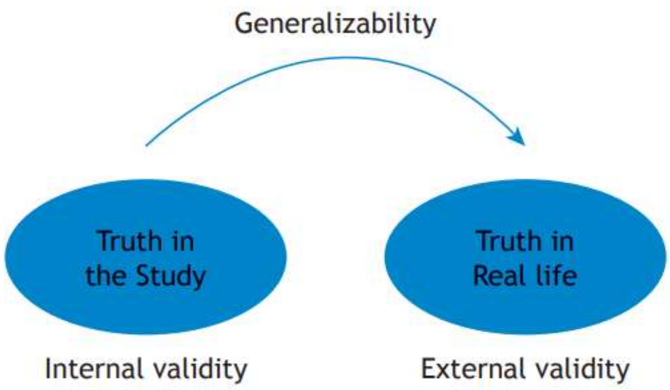


Figure 3.1: Internal and external validity
[Adapted from Patino & Ferreira, 2018]

Figure 3.2 illustrates that external validity is derived from internal validity. To ensure external validity in this study, a broad inclusion criterion that resulted in the selection of a study sample that resembles real-life environments of the population was used. In fact, novice science teachers who have lived experiences of I&M or no I&M experiences and who are based in different under-resourced school environments were sampled across the four provinces for both quantitative and qualitative data collection. This ensured homogeneity and therefore led to the generalisability of this study's findings.

3.9.2 Internal validity

Internal validity is defined as the extent to which the observed results represent the truth in the population we are studying and, thus, are not due to methodological errors (Patino & Ferreira, 2018). The writers went further and identified the following factors as threats to internal validity: errors in measurement or in the selection of participants in the study (Patino & Ferreira, 2018). These threats were avoided in this study at all costs. Internal validity was increased through careful planning and adequate quality control of research processes such as sampling, data collection and data analysis.

3.9.3 Reliability

The term ‘reliability’ seems to carry different meanings in quantitative and qualitative research. In a detailed definition, Oluwatayo (2012) confirms that reliability in quantitative research is synonymous to dependability, consistency, replicability over time, over instruments and over groups of respondents. They further claim that for research to be reliable, it must demonstrate that if it were to be carried out on a similar group of respondents in a similar context, similar results would be obtained. In other words, reliability refers to the stability of the measuring instrument used and its consistency over time (Sürücü & Maslakçı, 2020). Another simplified definition comes from Heale and Twycross (2015) who simply say reliability relates to the consistency of a measure. As stated above, issues of validity and reliability were prioritised in order to obtain credible results in this study. Every effort was put by the researcher who believe that the results of this study can be replicated if the same instruments were going to be used to conduct the same research, with novice science teachers in other provinces in South Africa. The assumption is that the measuring instruments would give similar results when applied even at different times.

In qualitative research, reliability is regarded as a fit between what researchers record as data and what actually occurs in the natural setting that is being researched (Oluwatayo, 2012). Despite the differences in definitions, issues of reliability were valued in this study. The wording of questions was perfected, and physical settings during focus group discussions were well maintained to reduce and entirely eliminate the degree of error, hence boosting reliability. The operating atmosphere for both the researcher and the participants in the focus group discussions as well as the nature of engagement were done in a way that ensured reliability of data collected.

To ensure reliability of the data, the gathering instrument (questionnaire) used in this study was subjected to an internal consistency check. Internal consistency is related to the reliability of expressions contained in the measuring instruments, measures the consistency of the items within it and questions how well the measuring instrument measures a particular behaviour (Sürücü & Maslakçı, 2020). Calculations were done using Statistical Package for the Social Sciences (SPSS) software to find the Cronbach's Alpha Coefficient using the formula:

$$\alpha = \left[\frac{N}{N-1}\right]\left[\frac{S_x^2 - \sum S_I^2}{S_x^2}\right]$$

$N = Number\ of\ items\ in\ the\ measuring\ instrument$

$S_1^2 = variance\ of\ each\ item$

$S_x^2 = sum\ of\ variance\ points\ of\ each\ item\ in\ the\ measuring\ instrument$

[Adapted from Sürücü & Maslakçı, 2020]

These procedures were done in this study to ensure that issues of validity and reliability were fully catered for.

Summary

To conclude this chapter, it can be noted that the researcher elected to use MMR due to its various advantages as supported by literature reviewed and quoted in this chapter. Due to the exploratory nature of this study, a pragmatist approach was adopted as the philosophical paradigm which best suited the objectives for this study. Furthermore, MMR was not only employed as a research methodology, but it was also adopted as a research design best applicable for this exploratory study. A convergent parallel design was also implemented where the researcher concurrently conducted quantitative and qualitative elements of the research process, analysed data obtained from the two components independently, and interpreted the results together in a triangulation before drawing some conclusions.

All novice science teacher with five or less years of teaching experience served as the population for this study. Despite some limitations in sample selection, non-probability sampling procedures (purposive sampling) were followed to select the respondents who met the criteria to participate in the quantitative and qualitative groups. Two research instruments, that is, the questionnaire and focus group (see Appendix A and B) were used during the data collection phase. All preliminary processes for the use of the said research instruments were successfully carried out. The researcher applied a reflective and iterative stance in data analysis and interpretation. Quantitative data was analysed using SPSS software while ATLAS.ti was used to analyse qualitative data. Issues of validity and reliability were given utmost preference. Both internal and external validity factors were considered and satisfied in this study. The Cronbach's Alpha Coefficient was calculated to ensure that the questionnaire that was used to collect quantitative data really met the standard internal consistency threshold. Cronbach's Alpha coefficients for all the constructs tested fell in line with the threshold ranging between zero (α=0) to one (α=1), hence the questionnaire that was used to collect quantitative data for this study was highly reliable. In the qualitative phase, several procedures that ensured the validity and reliability of the focus group data were followed to the letter.

CHAPTER 4:

PRESENTATION OF RESULTS

4.1 Introduction

The results in this mixed methods study were presented for both the quantitative and qualitative phases that were conducted concurrently. Quantitative findings were presented first under 4.2 and 4.3, and separately from qualitative findings that were presented under 4.4 and 4.5 respectively. Section 4.2 constitutes demographic profiles of survey participants while findings that speak to research question 1 were presented under section 4.3. Similarly, qualitative findings were presented under 4.4 and 4.5 respectively.

4.2 Demographic profile of quantitative respondents

Table 4.1 outlines the demographic profiles for participants in the quantitative phase of this study.

Table 4.1: Demographic profile of participants

Variable	Category	Frequency	Valid Percent
Gender	Male	9	31.0
	Female	20	69.0
	Total	**29**	**100.0**
Age group	21-30 years	18	62.1
	31-40 years	9	31.0
	41-50 years	2	6.9
	Total	**29**	**100.0**
Years of teaching experience	Less than 1 year	5	17.2
	2 years	6	20.7
	3 years	5	17.2
	4 years	12	41.4
	5 years	1	3.4
	Total	**29**	**100.0**

Composite Table 4.1 above shows that 69% of the participants were female and 31% were male. There is no difference with what the researcher anticipated since there are more women teachers than males in South Africa to date. These findings are in line with Wills and Böhmer (2023) who claim that 70% of teachers in South Africa are women and Davids and Waghid (2020) who argue that there is feminisation of teaching in the country.

In terms of ages of participants, Table 4.1 shows the age groups of respondents in the quantitative group. It can be noted that the highest percentages of slightly over 62% of the respondents were in the 21-30 age group and 31% were in the 31-40 years age group. Only 6.9% represent participants in the 41-50 years category. However, the total number of only 29 participants in the online survey is different from what the researcher expected during the planning phase. This was caused by delayed granting of research permission by provincial education departments leading to limited time for the researcher to collect online survey data.

Composite Table 4.1 also shows that a 96.6% of the participants were novice science teachers with less than five years of science teaching experience as defined in this study. Only one out of the total of 29 participants who constitute 3.4% of the participants was not a novice science teacher. This was expected by the researcher during the planning phase, hence the affirmation that such data would only be used to enrich this study but never for conclusions and recommendations as that can affect the credibility of these findings.

Since this study expected only novice science teachers to participate despite phases taught, custom Table 4.2 below shows the different science subjects and different phases taught by online survey participants.

Table 4.2: Subjects and phases taught by survey participants

Subjects taught	Category	No	Yes	Total
Natural Sciences	Count	2	27	29
	Row N %	6.9%	93.1%	100.0%
Life Sciences	Count	17	12	29
	Row N %	58.6%	41.4%	100.0%
Physical Sciences	Count	23	6	29
	Row N %	79.3%	20.7%	100.0%
Agricultural Sciences	Count	24	5	29
	Row N %	82.8%	17.2%	100.0%
Other	Count	28	1	29
	Row N %	96.6%	3.4%	100.0%
Phases taught	**Category**	**No**	**Yes**	**Total**
Foundation phase	Count	24	5	29
	Row N %	82.8%	17.2%	100.0%
Intermediate phase	Count	14	15	29
	Row N %	48.3%	51.7%	100.0%
Senior phase	Count	12	17	29
	Row N %	41.4%	58.6%	100.0%
FET phase	Count	14	15	29
	Row N %	48.3%	51.7%	100.0%
Other (please specify)	Count	29	0	29
	Row N %	100.0%	0.0%	100.0%

It can be noted in Table 4.2 that participants taught different science subjects with 93.1% of the participants teaching Natural Sciences only. Combinations of subjects were expected with 41.4% teaching Life Sciences, 20.7% Physical Sciences, 17.2% taught Agricultural Sciences and 3.4% taught other subjects in their schools. The combination of subjects is not something new in South Africa as science teachers are usually expected to teach across a range of science subjects.

Novice science teachers who responded to the web-based survey taught in different phases, and mostly in a combination of phases as shown in Table 4.2 above. The highest number of participants consisting of 58.6% taught in the Senior Phase, followed by a tally with 51.7% who taught in the Intermediate and FET phases with only 17.2% teaching at Foundation Phase. This was not any different from what the researcher expected as science teachers are usually regarded as versatile teachers who can teach across different phases and subjects. Further demographic information on the survey participants is shown in Table 4.3 below:

Table 4.3: More demographic characteristics of survey participants

Variable	Category	Frequency	Valid Percent
Type of schools	Public/Government	26	89.7
	Private/Independent	3	10.3
	Total	**29**	**100.0**
Provinces where based	Eastern Cape	5	17.2
	Gauteng	12	41.4
	Limpopo	3	10.3
	Mpumalanga	9	31.0
	Total	**29**	**100.0**
Novice science teacher or not	I am a novice science teacher and my contributions can be used to draw conclusions	28	96.6
	I am not a novice science teacher and I am enriching this study	1	3.4
	Total	**29**	**100.0**

From composite Table 4.3 above, it can be noted that 89.7% of the total respondents were novice science teachers based in public schools with the remaining 10.3% based in independent or private schools. These are the schools that mainly fall under the armpit of under-resourced which is in line with what the researcher envisaged. These respondents were relevant in this study as they could give a clear picture of their mentoring experiences in under-resourced schools.

The respondents came from schools based in various provinces around South Africa. Table 4.3 illustrates the provinces from which novice science teachers who participated in the online survey were based. Most of the respondents constituting 41.4% were from Gauteng Province, followed by Mpumalanga Province with 31%. The Eastern Cape Province only made 17.2% of the participants with the Limpopo Province being the lowest with only 10.3% of the respondents. The four provinces were the only ones that responded in time for the data collection phase by granting permission to the researcher to conduct research. The provinces granted permission at different times with Gauteng and the Eastern Cape being the first to respond, followed by the Mpumalanga Province. The Limpopo Province responded last and late. The Western Cape Province also responded when there were very few days remaining for the data collection phase to close, hence novice teachers could not participate in this study.

The low response rate by provincial education departments was different from what the researcher had anticipated and planned. The researcher expected all provinces to respond in time for data collection in order to increase the probability of willing novice science teachers to participate in the online survey. This could have resulted in the research reaching the anticipated target of at least 150 or more participants.

Of interest in the demographic profiles of survey respondents is that 96.6% were novice science teachers with less than five years of teaching experience as defined in this study. Only 3.4% of the respondents already had five years of teaching experience which falls outside the scope of this study. The researcher expected this and affirmed in the planning phase that responses from participants who fell outside the definition of a novice teacher as used in this study were for enrichment purposes would never be used in the interpretation of findings and the conclusions reached in this study.

4.3 Results pertaining to research question 1

4.3.1 Introduction

In this section, the researcher presents findings that speak to the first research question, “What are the novice science teachers’ I&M experiences during their initial years of teaching in under-resourced schools?” The research sub-divided this section into two with 4.3.2 dwelling on the I&M experiences while 4.3.3 deals with satisfaction levels of novice science teachers with the I&M programmes, if any.

4.3.2 Induction and mentoring experiences in under-resourced schools

This study aimed at finding I&M experiences of novice science teachers in under-resourced schools. In this section, I present my findings under section 2 of the survey questions. Composite Table 4.4 reflects different novice science teacher induction experiences in their different schools, districts and provinces.

Table 4.4: Novice science teacher induction and mentoring experiences

Variable	Response	Frequency	Valid Percent
Does/Did your school, district or province provide(d) a teacher induction programme for beginning teachers?	Yes	2	6.9
	No	22	75.9
	Not sure	1	3.4
	Sometimes	4	13.8
	Total	**29**	**100.0**
If there is/was any induction programme, what is/was its nature?	Face-to-face	5	17.2
	No induction programmes	21	72.4
	Other, specify	3	10.3
	Total	**29**	**100.0**
What is/was the purpose of the induction programme, if any? Select ALL appropriate responses.	Yes, I am/ I was inducted	4	13.8
	No, I crushed in	18	62.1
	Somewhat inducted	7	24.1
	Total	**29**	**100.0**

Table 4.4 above shows that 75.9% of novice science teachers never experienced I&M programmes in their new schools and only 6.9% of respondents agreed that they experienced some induction. 13.9% said they somewhat experienced mentoring while 3.4% were not sure if what they experienced can fall under the true definition of induction and mentoring. These findings are not in any way different from the patchy and uncoordinated I&M experiences that the researcher envisaged.

In the few schools where I&M were conducted, Table 4.4 above details the nature of the programmes. Face-to-face I&M were prevalent with 17.2% of respondents having undergone some form of induction and support programmes. However, the table depicts that no I&M programmes were done for 72.4% of the respondents, which resonates with what the researcher also had in mind. Only few respondents experienced other forms of induction that are explained in Figure 4.1.

To further elicit respondents to share their personal induction experiences, the researcher asked if they were personally inducted into their new schools during the first years of their science teaching. The results, as shown in Table 4.4 above depicts that a whopping 62.1% of the respondents crushed into their classrooms and started teaching without any support experiences. Only 13.9% were inducted in the process while 24.1% confirmed that they were somewhat inducted and supported. These findings resonated with the researcher's expectations.

Where I&M programmes were done, the researcher found out the duration of the programmes were as shown in the Figure 4.1:

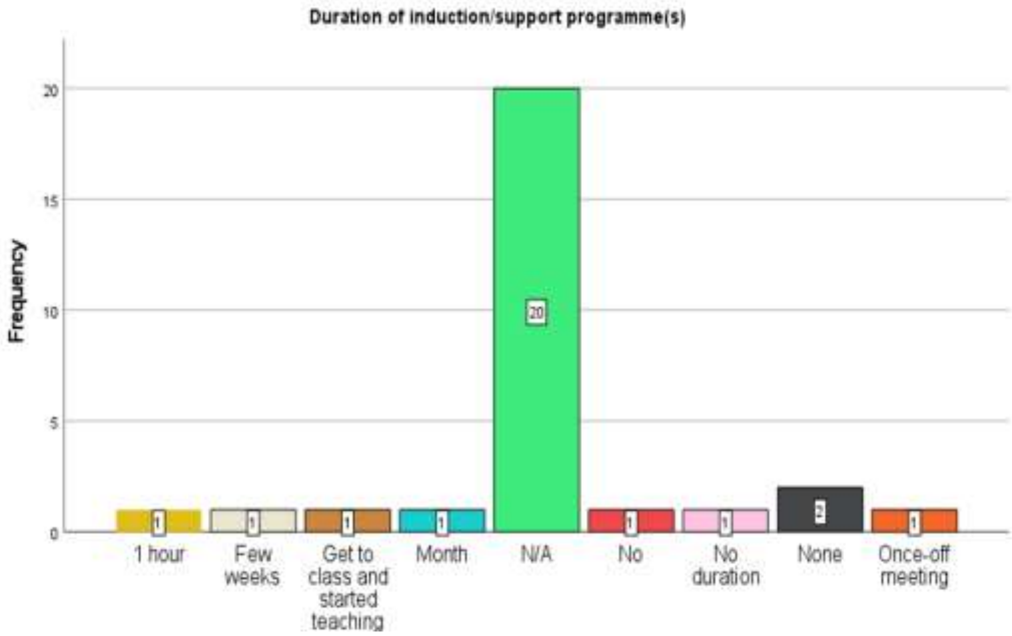


Figure 4.1: Duration of induction and mentoring programme

It can be noted in Figure 4.1 that 20 out of 29 respondents said this was not applicable to them since they were not inducted or mentored. Otherwise, the duration for those who were inducted and mentored lasted from one hour to a month in the main. For one respondent, it was just a once-off meeting. These findings shown in the graph fulfil what the researcher anticipated.

The researcher also sought to know the purpose of any I&M programmes that respondents might have experienced, if any. The results were presented in Table 4.5 below.

Table 4.5: Purpose of induction and mentoring programme(s) where applicable

Purpose of induction programme(s)	Category	No	Yes	Total
General support and guidance for new teachers	Count	21	8	29
	Row N %	72.4%	27.6%	100.0%
Orientation to the school/district or province	Count	20	9	29
	Row N %	69.0%	31.0%	100.0%
Promote high standards in teaching science	Count	27	2	29
	Row N %	93.1%	6.9%	100.0%
Promote practical science teaching	Count	27	2	29
	Row N %	93.1%	6.9%	100.0%
Other (specify): …………………………..	Count	16	13	29
	Row N %	55.2%	44.8%	100.0%

Table 4.5 shows that 44.8% of the participants found the given choices not applicable to them and had "other" reasons apart from the ones provided. 31.0% of respondents said the I&M programmes were aimed at orienting them into the new schools, districts and provinces. About 27.6% argued that I&M programmes were meant for their general support and guidance. The key features of any I&M programme which would touch on the cores of science teaching such as high standards and practical science teaching was received by 6.9% of respondents. This is not different from the researcher's personal experiences in under-resourced schools that tend to be, in the main, characteristic to this scenario.

The researcher went on to find out what respondents who selected "other" had to say in terms of the purpose of support programmes done in their schools. Figure 4.2 shows the results:

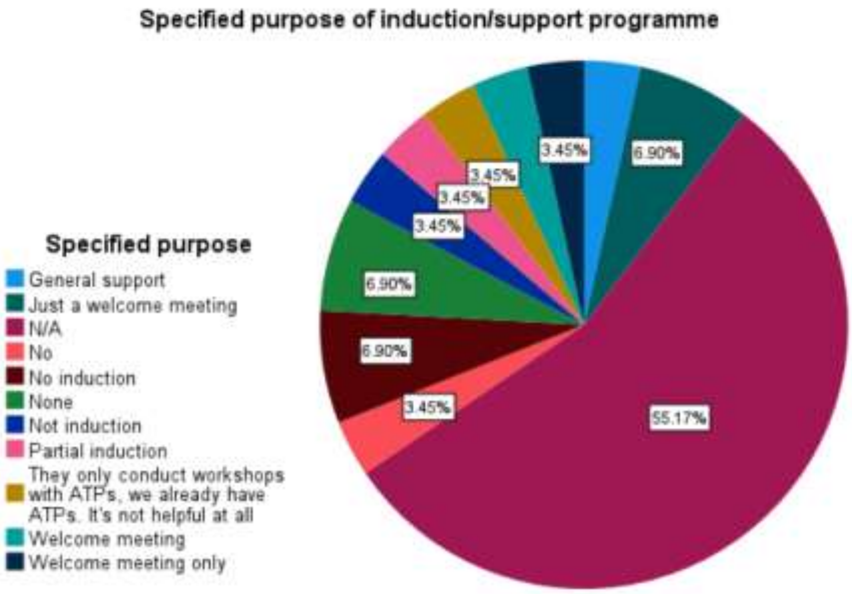


Figure 4.2: Purpose of induction and mentoring programme(s)

The pie chart in Figure 4.2 illustrates that only 3.45% of the respondents experienced general support, another 10.35% attended welcome meetings, 3.45% experienced partial induction and 3.45% attended workshops where annual teaching plans (ATPs) which they already had were shared and discussed. A cumulative 79.3% responded negatively to this question implying that they were neither involved in any induction nor mentoring programme, and whatever they experienced was rather purposeless. The results are congruent to what the researcher anticipated.

Respondents were also engaged to share the rate at which I&M programmes prepared them to transition smoothly into full-fledged science and independent science teachers. Results were presented in Figure 4.3 as follows:

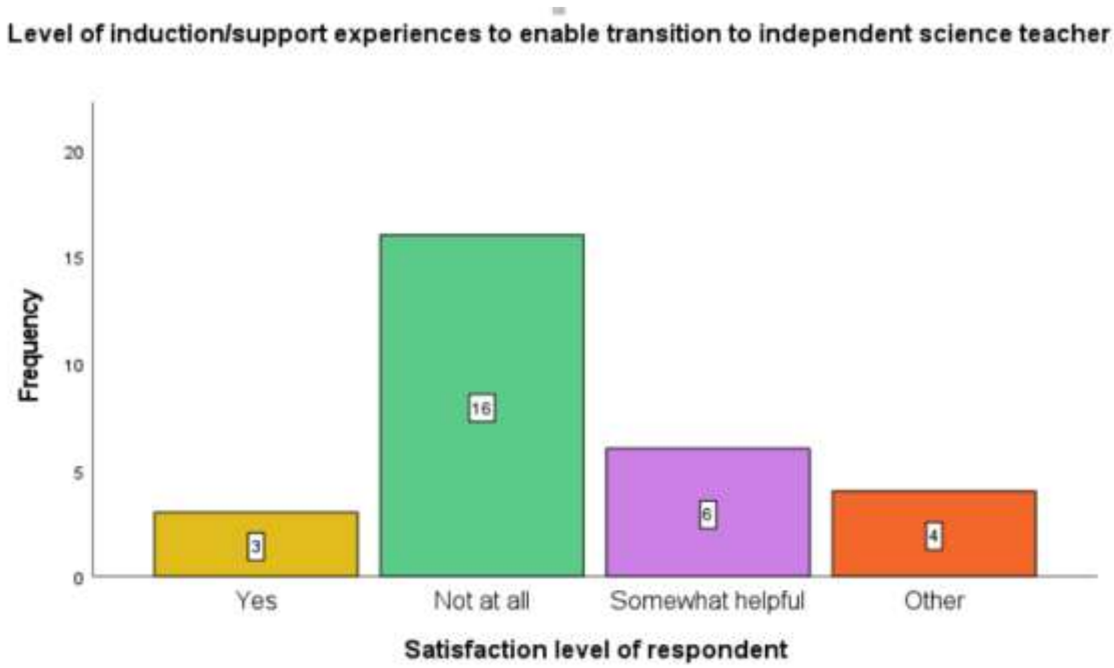


Figure 4.3: Level of satisfaction with induction and mentoring for transition

Figure 4.3 depicts that only three out of the total 29 respondents agreed that the I&M programme met their requirements to nurture and supporting teachers in moving from the graduate to proficient career stage. 16 out of 29 respondents claimed that the so-called I&M programmes were not helpful at all, while six argued that for them it was partially helpful. The remaining four out of 29 respondents had “other” as their response. The results shown in Figure 4.3 painted the same picture as that which was originally in the researcher’s mind.

4.3.3 Satisfaction levels with induction and mentoring programmes

In concluding section 2 of the survey, the researcher requested participants to rate their levels of satisfaction with I&M programmes conducted (if any), on a number of factors. The results were presented in Table 4.6 below which shows that only total 20.6% of the respondents were satisfied/dissatisfied with understanding the school’s culture, policies, and practices. 27.5% of the participants were very dissatisfied/dissatisfied with assistance in completing paperwork or administrative work while only 24.1% were very satisfied/satisfied. Assistance with lesson planning with mentor teachers had 34.4% very dissatisfied/dissatisfied whereas only 20.7% were very satisfied/satisfied.

Table 4.6: Satisfaction levels with induction and mentoring programmes (if any)

Induction experiences on identified pertinent areas for novice teachers	Category	Very dissatisfied/ Dissatisfied	Neither satisfied nor dissatisfied	Satisfied/ Very satisfied	Not applicable	Total
Understanding the school's culture, policies, and practices	Count	3	10	6	10	29
	Row N %	10.3%	34.5%	20.6%	34.5%	100.0%
Completing paperwork or administrative work	Count	8	5	7	9	29
	Row N %	27.5%	17.2%	24.1%	31.0%	100.0%
Working with other teachers to plan instruction	Count	10	3	6	10	29
	Row N %	34.4%	10.3%	20.7%	34.5%	100.0%
Working with other school staff, such as principal, counsellors, disability specialist	Count	6	6	8	9	29
	Row N %	20.6%	20.7%	27.5%	31.0%	100.0%
Communicating with parents	Count	12	1	5	11	29
	Row N %	41.4%	3.4%	17.2%	37.9%	100.0%
Teaching science as a subject	Count	10	0	9	10	29
	Row N %	34.5%	0.0%	31.0%	34.5%	100.0%
Motivating students	Count	11	2	6	10	29
	Row N %	37.9%	6.9%	20.6%	34.5%	100.0%
Using student assessments to inform your teaching	Count	9	1	8	11	29
	Row N %	31.0%	3.4%	25.7%	37.9%	100.0%
Teaching learners with varying levels of achievement/ability	Count	12	0	7	10	29
	Row N %	41.3%	0.0%	24.1%	34.5%	100.0%
Teaching students of varying ethnic/racial and socioeconomic backgrounds	Count	12	1	6	10	29
	Row N %	41.3%	3.4%	20.6%	34.5%	100.0%
Reviewing and assessing student work	Count	11	1	7	10	29
	Row N %	37.9%	3.4%	24.1%	34.5%	100.0%
Managing classroom activities, transitions, and routines	Count	10	2	7	10	29
	Row N %	34.5%	6.9%	24.1%	34.5%	100.0%
Managing student discipline and behaviour	Count	11	1	7	10	29
	Row N %	37.9%	3.4%	24.1%	34.5%	100.0%
Using multiple instructional strategies/techniques to teach science	Count	11	1	7	10	29
	Row N %	37.9%	3.4%	24.1%	34.5%	100.0%
Reflecting on your instructional practices	Count	8	1	9	11	29
	Row N %	27.6%	3.4%	31.0%	37.9%	100.0%
Selecting or adapting science curriculum materials	Count	11	0	8	10	29
	Row N %	37.9%	0.0%	27.6%	34.5%	100.0%
Accessing school, district and community Science resources	Count	10	1	8	10	29
	Row N %	34.3%	3.4%	27.6%	34.5%	100.0%
Teaching Science towards national, provincial or district standards	Count	12	2	6	9	29
	Row N %	41.3%	6.9%	20.7%	31.0%	100.0%

It can also be noted that the variable "working with other school staff, such as principal, counsellors, disability specialist" was emphasised, culminating in a

27.5% being very satisfied/satisfied and 20.6% sharing that they were very dissatisfied/dissatisfied. Table 4.6 generally shows a very interesting trend of high percentages representing high levels of dissatisfaction by respondents on core science teaching factors from the variable “communicating with parents” all the way down to “teaching science towards national, provincial or district standards” as compared to very low percentages for those who claim they were satisfied. This trend is in line with what the researcher expected as most I&M programmes in many under-resourced schools tend to add no value to the core areas of need for most novice science teachers.

4.3.4 Mentoring and professional support experiences

Professional development activities in which novice science teachers could participate to enhance their pedagogical and content knowledge in a variety of areas, such as teaching strategies, education standards, student assessment, applications of technology to instruction, and classroom management were surveyed. These professional development activities included in-service workshops, study groups, seminars and continuing education courses and can include activities other than school or district run programmes. The findings were presented in Table 4.7.

Table 4.7: Mentoring experiences of respondents

Independent variable	Category	Frequency	Valid percentage
Do/did you have/had any mentor(s)?	Yes, only 1	5	17.2
	Yes, more than 1	4	13.8
	No, I do not have, I never had one	19	65.5
	No, but one is being organised	1	3.4
	Total	29	100.0
Overall, how satisfied were you with the mentoring/induction programme/event?	Very satisfied	1	3.6
	Neither satisfied nor dissatisfied	2	7.1
	Dissatisfied	11	39.3
	Very dissatisfied	1	3.6
	Not applicable	13	46.4
	Total	28	100.0
	Missing System	1	
	Total	29	100.0

Table 4.7 clearly shows that 65.5% of the respondents never had or do not have a mentor. 17.2% only had or have one mentor whereas 13.8 percent had or has an unprecedented privilege of having more than one mentor. Another 3.4% of the participants still awaits a mentor who is being organised for them. Time only could

tell if we were going to add the 3.4% to the respondents who never had a mentor or to those who secured a mentor in their novice science teacher years. Further checks on biographical details points out that the respondent awaiting a mentor already has four years of science teaching experience. The results shown above resonate with the researcher's viewpoint on I&M experiences of novice science teachers in under-resourced schools.

For those respondents who had the privilege to have a mentor, the researcher elicited more information about where their mentors are based and presented the findings as follows:

Table 4.8: Information about where mentors were based

Some demographic data of mentors	Category	No	Yes	Total
Full-time/experienced teacher in your school	Count	23	6	29
	Row N %	79.3%	20.7%	100.0%
Part-time teacher in your school	Count	29	0	29
	Row N %	100.0%	0.0%	100.0%
Full-time mentor from your university/college	Count	29	0	29
	Row N %	100.0%	0.0%	100.0%
Experienced teacher from another school	Count	28	1	29
	Row N %	96.6%	3.4%	100.0%
HOD in your subject (Science)	Count	20	9	29
	Row N %	69.0%	31.0%	100.0%
District office-based mentor	Count	27	2	29
	Row N %	93.1%	6.9%	100.0%
Provincial office-based mentor	Count	29	0	29
	Row N %	100.0%	0.0%	100.0%
Other (please specify)	Count	8	21	29
	Row N %	27.6%	72.4%	100.0%

Table 4.8 above portrays that only 20.9% of mentors in under-resourced schools where respondents were based were full-time or experienced teachers in their schools. All respondents never had mentors who served as part-time teachers; full-time mentors from their previous universities or colleges as well as from respective provincial education offices as all these reflect 0.00% under "yes" and 100.0% "no" responses. Of interest is the fact that 31.0% of the respondents had their heads of department (HODs) as their mentors. Mentors from the district offices only constituted 6.9%. Few novice teachers making 3.4% experienced mentoring by experienced teachers from other schools. The bulk of respondents making 72.4% selected "other" as their response and the researcher concluded that it was those respondents who did not receive any mentorship. The findings

outlined in Table 4.8 did not come as a surprise to the researcher. It is common practice in under-resourced schools that HODs tend to be the most available mentors for novice science teachers.

The researcher went on to find out how respondents who were mentored had mentors assigned to them, when mentor-mentee meetings were held as well as when on the school schedule their meetings took place. The outcomes were presented in Table 4.9 below:

Table 4.9: Assignment of mentors and meeting times

Independent variable	Category	Frequency	Valid percent
Was/Were this/these mentor(s) assigned to you?	Yes	5	17.2
	No, they are/were self-imposed	3	10.3
	I organised for myself	4	13.8
	I don't have a mentor/ I never had a mentor	17	58.6
	Total	29	100.0
Is/Was there any set time when you and your mentor(s) meet/met?	Yes	4	13.8
	No	19	65.5
	Sometimes	6	20.7
	Total	29	100.0
When do/did these meetings usually take place?	After school	5	17.2
	During lunch	5	17.2
	During planning period	3	10.3
	Other, please specify:	16	55.2
	Total	29	100.0

Table 4.9 unfolds that only 17.2% of the participants agree that they had mentors assigned to them and 10.3% imposed themselves as mentors on some novice science teachers. Interestingly, 13.8% of the respondents had to organise mentors for themselves, something that the researcher never thought of during the planning phase. Assigning of mentors is regarded as a responsibility of school management. It is also clear that 58.6% of the respondents never had a mentor assigned to them.

In terms of meeting times, Table 4.9 only 13.8% of the participants had pre-set times when they would meet with their mentors. 65.5% did not have the privilege to meet and 20.7% of the participants only met sometimes. This resonates with what the researcher experienced in under-resourced schools where no one seemed to have time to assist the next person. 17.2% of those who met with their mentors used either lunch or after school time to do so. Only 10.3% agreed that they met during the planning period, a period which, generally, is not common to have in under-resourced schools. 52.2% of the respondents selected “other” as their response.

One of the independent variables sought to find the frequency of mentor-mentee meetings. Frequency Table 4.10 below outlines the results:

Table 4.10: Frequency of mentor-mentee meetings

	Category	No	Yes	Total
Daily	Count	28	1	29
	Row N %	96.6%	3.4%	100.0%
2-4 times per week	Count	27	2	29
	Row N %	93.1%	6.9%	100.0%
Once per week	Count	27	2	29
	Row N %	93.1%	6.9%	100.0%
2-4 times per month	Count	29	0	29
	Row N %	100.0%	0.0%	100.0%
Several times per year	Count	26	3	29
	Row N %	89.7%	10.3%	100.0%
Never meet/met	Count	23	6	29
	Row N %	79.3%	20.7%	100.0%
Other (please specify)	Count	10	19	29
	Row N %	34.5%	65.5%	100.0%

Only 3.4% of the respondents in Table 4.10 suggested that mentor-mentee took place on daily basis. In two instances, 6.9% of participants claimed that mentor-mentee meetings took place 2-4 times a week and once per week. No respondents selected that mentor-mentee meetings occurred 2-4 times per month. Only 10.3% responded that such meetings occurred several times per year while 20.7% argued that they never met with their mentors. 65.5% of the respondents selected “other”, showing that they never had mentors to meet with. The frequency of mentor-mentee meetings outlined in Table 4.10 do not pose any significant difference with what was in the researcher’s mind who also experienced the scarcity of mentor-mentee meetings in under-resourced schools.

The duration of I&M meetings between mentors and their mentees were considered as important by the researcher as it contributed towards determining the quality of support given to novice science teachers. Table 4.11 below details the duration of mentor-mentee meetings and rated novice science teacher satisfaction levels in terms of whether the time was adequate or not.

Table 4.11: Average meeting duration and mentee satisfaction levels

Independent variable	Category	Frequency	Valid percent
On average, how long are/were these meetings with your mentor?	1 to 2 hours	2	6.9
	15 to 30 minutes	5	17.2
	30 minutes to 1 hour	16	55.2
	Other	6	20.7
	Total	29	100.0
Do you feel there is/was adequate time scheduled for you to meet with your mentor?	Yes	5	17.2
	No	23	79.3
	Maybe	1	3.4
	Total	29	100.0

As shown in Table 4.11, only 6.9% of the participants held meetings ranging between one to two hours with their mentors. The majority who amounted to 55.2% took between 30 minutes to one hour in their meetings. 17.2% took between 15-30 minutes in their mentor-mentee meetings. 20.7% of the respondents selected "other" as their option.

On rating of satisfaction levels with regards to adequacy of meeting durations, 79.3% of the participants voiced that they were not happy with the time allocated for them to hold meetings with their mentors. However, 17.2% believed the time was adequate while 3.4% were neutral as to whether the duration was adequate or not. These findings are in line with what the researcher thought as he planned for this study.

4.3.5 Conclusion

From the findings presented in this section, it can be noted that novice science teachers in under-resourced schools went through different experiences with regards to their I&M. A few of them were inducted and mentored while the majority never went through any I&M programmes. The researcher found out that there is a patchy and uncoordinated provision of I&M programmes for novice science teachers in different under-resourced schools, districts and provinces.

Moreso, the definition of the terms “induction” and “mentoring” in some under-resourced schools was limited to introductory meetings which could last for less than an hour. Hence, most novice science teachers demonstrated their dissatisfaction with the quality and prevalence of I&M programmes conducted in under-resourced schools. Otherwise, the bulk of the respondents were never inducted or mentored, thus their responses reveal their lack of I&M programmes.

4.4 Results pertaining to research question 2

4.4.1 Introduction

To determine why incorporating blended mentoring can serve as an intervention strategy to enhance I&M programmes for novice science teachers in South Africa, the researcher used this section to present the results on respondents' dissatisfaction levels with the existing modus operandi.

4.4.2 Novice teacher satisfaction

Survey questions sought to determine respondent's satisfaction on pertinent issues in which novice teachers usually require assistance. Custom Table 4.12 below pictures the respondents' satisfaction levels on the quality of assistance received from the mentor(s) on core areas of teaching as novice science teachers.

Table 4.12: Ratings on quality of assistance given by mentors

Quality of assistance on pertinent mentoring issues	Category	Very dissatisfied/ Dissatisfied	Neither satisfied nor dissatisfied	Satisfied/ Very satisfied	N/A	Total
Modelling a lesson	Count	6	4	8	11	29
	Row N %	20.7%	13.8%	27.6%	37.9%	100.0%
Observing you teaching science lesson(s)	Count	9	4	8	8	29
	Row N %	31.0%	13.8%	27.6%	27.6%	100.0%
Co-teaching science lesson(s)	Count	11	1	7	10	29
	Row N %	37.9%	3.4%	24.1%	34.5%	100.0%
Share lesson plans and assessments	Count	10	3	7	9	29
	Row N %	34.4%	10.3%	24.1%	31.0%	100.0%
Assist with lesson-planning/preparation	Count	10	2	8	9	29
	Row N %	34.5%	6.9%	27.5%	31.0%	100.0%
	Count	12	1	7	9	29

Organise practical work or other instructional activities	Row N %	41.4%	3.4%	27.5%	31.0%	100.0%
Meeting with you on a one-on-one basis	Count	13	1	6	9	29
	Row N %	44.8%	3.4%	20.6%	31.0%	100.0%
Meeting with you together with other novice science teachers	Count	12	2	6	9	29
	Row N %	41.3%	6.9%	20.7%	31.0%	100.0%
Give you suggestions to improve your practice	Count	8	4	8	9	29
	Row N %	27.5%	13.8%	27.5%	31.0%	100.0%
Give you encouragement or moral support	Count	10	2	8	9	29
	Row N %	34.5%	6.9%	27.5%	31.0%	100.0%
Provide an opportunity for you to raise issues/discuss your individual concerns	Count	12	1	7	9	29
	Row N %	41.4%	3.4%	24.1%	31.0%	100.0%
Provide guidance/information on administrative or logistical issues	Count	11	3	6	9	29
	Row N %	37.9%	10.3%	20.6%	31.0%	100.0%

Provide guidance on teaching to meet standards	Count	10	2	8	9	29
	Row N %	34.5%	6.9%	27.6%	31.0%	100.0%
Work with you to identify teaching challenges and possible solutions	Count	12	1	7	9	29
	Row N %	41.4%	3.4%	24.1%	31.0%	100.0%
Discuss with you instructional goals and ways to achieve them	Count	7	2	7	10	29
	Row N %	34.4%	6.9%	24.1%	34.5%	100.0%
Provide guidance on how to assess your students	Count	11	3	7	8	29
	Row N %	37.9%	10.3%	24.1%	27.6%	100.0%
Act on something you requested the previous week	Count	14	2	4	9	29
	Row N %	48.3%	6.9%	13.8%	31.0%	100.0%
Applications of technology to instruction	Count	12	3	4	10	29
	Row N %	41.3%	10.3%	13.7%	34.5%	100.0%
Classroom management	Count	12	2	6	9	29
	Row N %	41.3%	6.9%	20.7%	31.0%	100.0%
Overall mentoring experiences	Count	12	1	8	8	29
	Row N %	41.4%	3.4%	27.5%	27.6%	100.0%

Custom Table 4.12 paints a picture on respondents' ratings on the quality of assistance provided to them by their mentor(s) on crucial issues that affect novice science teachers from modelling a lesson to classroom management. A Likert scale ranging from 1-5 with 1 – Very Dissatisfied and 5 – Very Satisfied, percentages for rating 1 and 2, and 4 and 5 respectively were combined to make Table 4.12 easy to understand and interpret. Due to the size of data represented in Table 4.12, the researcher could only summarise the table for a better understanding by the reader(s).

Table 4.12 above generally depicts high percentages of respondents being very dissatisfied or dissatisfied in comparison to those who were very satisfied/satisfied. There are also high percentages of participants who answered that the independent variables were not relevant or rather inapplicable to them. Of interest are the overall mentoring satisfaction levels where 41.4% of the respondents exclaimed that they were very dissatisfied/dissatisfied by the quality of mentoring provided by their mentor(s). 3.4% said they were neither satisfied nor dissatisfied whereas 27.5% of the respondents were very satisfied/satisfied. 27.6% confirmed that this variable was not applicable to them.

Since some of the respondents suggested that they received some professional support from other quarters other than their school-based mentor(s), the researcher asked such respondents to rate the quality of extra assistance that they received. Findings were presented in Custom Table 4.13 below:

Table 4.13: Quality ratings of other forms of professional development

Other forms of professional development	Category	Very dissatisfied/ Dissatisfied	Neither satisfied nor dissatisfied	Satisfied/ Very satisfied	N/A	Total
In-service workshops	Count	1	2	24	2	29
	Row N %	3.4%	6.9%	82.8%	6.9%	100.0%
Study groups	Count	2	4	6	17	29
	Row N %	6.8%	13.8%	20.7%	58.6%	100.0%
Departmental meetings	Count	14	7	8	0	29
	Row N %	48.2%	24.1%	27.6%	0.0%	100.0%
Online or face-to-face seminars	Count	4	5	3	17	29
	Row N %	13.7%	17.2%	10.3%	58.6%	100.0%
Former university or college	Count	2	3	7	17	29
	Row N %	6.9%	10.3%	24.1%	58.6%	100.0%
Colleagues in the school or other schools	Count	1	3	11	14	29
	Row N %	3.4%	10.3%	37.9%	48.3%	100.0%
Continuing education courses	Count	10	7	12	0	29
	Row N %	34.7%	24.1%	41.3%	0.0%	100.0%
District, provincial or national education officials	Count	9	12	8	0	29
	Row N %	31.0%	41.4%	27.6%	0.0%	100.0%

Table 4.13 portrays that 82.8% of the respondents found in-service workshops beneficial as professional support mechanisms. Seemingly, study groups are not commonly used as 58.6% of the respondents claimed that this was not applicable to them, and only 20.7% were satisfied/very satisfied. The quality of departmental meetings as a form of mentee assistance was questionable as 48.2% of participants demonstrated that they were very dissatisfied/dissatisfied with only 27.6% being satisfied/very satisfied. Online or face-to-face seminars also did not seem to be a common source of professional support as 58.6% of respondents regarded this as inapplicable while only 10.3% suggested they benefitted from such.

The table above further illustrates that there was very little or no support for qualified novice science teachers from their former teacher training institutions. This is evidenced by 58.6% of the respondents who claimed this was not applicable to them, whereas there was 24.1% of the respondents who were satisfied/very satisfied with the quality of assistance they received. Colleagues in the school or from other schools assisted 37.9% of the participants despite 48.1% arguing that this never happened to them. 41.3% of the respondents expressed their satisfaction with the quality of professional support that came from continuing education courses despite 37.4% claiming that they did not benefit positively. Professional support from the district, provincial and national education officials came under the spotlight in the table as 41.4% confirmed that they were neither satisfied nor dissatisfied by the level of professional support. Only 27.6% of the respondents confirmed that they were satisfied with a considerable 31.0% expressing that they were very dissatisfied/dissatisfied.

The researcher asked respondents to rate certain crucial aspects of teaching that explore the environment in which novice science teachers operate within the under-resourced schools. The results were presented in custom Table 4.14 that follows:

Table 4.14: Teaching environmental aspects for novice science teachers in under-resourced schools

Aspects of teaching environment for novice science teachers	Category	Very dissatisfied/ Dissatisfied	Neither satisfied nor dissatisfied	Satisfied/ Very satisfied	N/A	Total
Support from administration for beginning teachers	Count	14	6	9	0	29
	Row N %	48.2%	20.7%	31.0%	0.0%	100.0%
Availability of resources and materials or equipment for your classroom	Count	22	1	6	0	29
	Row N %	75.8%	3.4%	20.7%	0.0%	100.0%
Autonomy or control over your own classroom	Count	11	10	7	1	29
	Row N %	37.%	34.5%	24.1%	3.4%	100.0%
Student motivation to learn	Count	23	1	5	0	29
	Row N %	79.3%	3.4%	17.2%	0.0%	100.0%
Student discipline and behaviour	Count	23	1	5	0	29
	Row N %	79.3%	3.4%	17.2%	0.0%	100.0%
Opportunities for professional development	Count	5	15	9	0	29
	Row N %	17.2%	51.7%	31.0%	0.0%	100.0%
Supportive atmosphere among faculty or collaboration with colleagues	Count	17	6	6	0	29
	Row N %	58.6%	20.7%	20.7%	0.0%	100.0%
Professional calibre of colleagues	Count	10	11	7	0	28
	Row N %	35.7%	39.3%	25.0%	0.0%	100.0%

Table 4.14 illustrates that 48.2% of the respondents were not happy with the support they got from administrators within their schools. However, 31.0% claimed that they were satisfied/very satisfied with the support from administrators while the remaining 20.7% of the respondents were neutral. In terms of availability of resources and materials and equipment for their classrooms, 78.8% of the respondents demonstrated that they were very dissatisfied/dissatisfied. This resonates with the researcher's anticipation. Only 20.7% claim that they were satisfied/very satisfied with the availability of resources and materials and equipment for their classrooms, whereas 3.4% remained neutral.

Participants rated autonomy or control over their classrooms as follows: very dissatisfied/dissatisfied (37.0%); neither satisfied nor dissatisfied (34.5%); satisfied/very satisfied (24.1%) and not applicable (3.4%). An equivalent 79.3% of participants demonstrated their dissatisfaction with student motivation to learn as well as student discipline and behaviour. This never came as a surprise to the researcher who was aware of some common student indiscipline and uncontrollable behaviour as well as generally low levels of intrinsic drive to learn.

Table 4.14 also showed that 51.7% of respondents were neither satisfied nor dissatisfied with the opportunities made available for their professional development. However, 31.0% demonstrated that they were happy with opportunities for professional development. In respect of a supportive atmosphere among faculty or collaboration with their colleagues, 58.9% of the respondents showed their disappointment with only 20.7% reflecting that they were happy. These findings were in line with what the researcher envisaged and termed solitarisation of teaching. This is a scenario when each teacher minds their own teaching business as they operate independently and are isolated in their own classrooms. The professional calibre of colleagues was confirmed as generally poor with 35.7% of the respondents demonstrating their dissatisfaction, 39.3% being neutral and only 25.0% confirmed that they were happy.

The final survey question established the overall satisfaction levels of novice science teachers in under-resourced school with regards to mentoring and elicited their thoughts on quitting teaching and the introduction of blended mentoring. The findings are presented in Table 4.15:

Table 4.15: Overall satisfaction levels, desire to quit and introduction of blended mentoring

Final aspects for overall rating on decision to quit and feelings on the introduction of blended mentoring	Category	Very dissatisfied/ dissatisfied	Neither satisfied nor dissatisfied	Satisfied/ Very satisfied	Total
I enjoy teaching science in my grades	Count	1	16	12	29
	Row N %	3.4%	55.2%	41.3%	100.0%
I am confident to teach science on my own	Count	0	19	10	29
	Row N %	0.0%	65.5%	34.5%	100.0%
I feel a can leave science teaching for other subjects	Count	5	2	22	29
	Row N %	17.2%	6.9%	75.8%	100.0%
Science teachers need a lot of support, especially in early years	Count	0	0	29	29
	Row N %	0.0%	0.0%	100.0%	100.0%
I feel I can quit teaching for another profession	Count	5	2	21	28
	Row N %	17.9%	7.1%	75.0%	100.0%
My plans are to improve my science teaching capabilities	Count	0	8	21	29
	Row N %	0.0%	27.6%	71.4%	100.0%
I enjoy attending professional development activities	Count	2	1	26	29
	Row N %	6.8%	3.4%	89.7%	100.0%
Mentoring is useful for me as a science teacher	Count	2	0	26	28
	Row N %	7.1%	0.0%	92.8%	100.0%
Blended mentoring can help to support me as a novice teacher	Count	1	0	27	28
	Row N %	3.6%	0.0%	96.5%	100.0%

Custom Table 4.15 outlined interesting findings for this study. Despite all the challenges that novice science teachers face in under-resourced schools as evidenced in previous tables, 41.3% of respondents enjoyed teaching science in their grades with 55.2% who chose to be neutral. Overall confidence levels to teach science on their own were low at 34.5% of the respondents with a further 65.5% neither satisfied nor dissatisfied. This was confirmed by a further 75.8% of the respondents who felt that they can leave science teaching for other subjects. Only 17.2% of the participants argued that they would not consider leaving science teaching for other subjects while the remaining 6.9% were neutral. 100% of the respondents agreed that science teachers need a lot of support, especially in their early years of teaching.

Table 4.15 further paints an alarming scenario when 75.0% of the respondents threatened they felt that they can quit teaching for other professions. Only 17.9% argued that they did not anticipate to leave science teaching for other subjects with 7.1% remaining neutral. However, some form of relief came as 71.4% of the respondents demonstrated that they planned to improve their science teaching capabilities, with only 27.6% who felt neutral. The relief was further confirmed by 89.7% of participants who enjoyed attending professional development activities as compared to 6.8% who did not. 92.8% of the respondents believed in mentoring as they agreed that it is useful for them as science teachers. On the introduction of blended mentoring, 96.4% of the respondents agreed that this could be a great strategy to enhance mentoring of novice science teachers whereas only 3.6% suggested that blended mentoring could not serve as the solution.

4.4.3 Reliability analysis of the survey instrument

As already mentioned, issues of reliability and consistency of the questionnaire was afforded first priority to ensure the replicability and credibility of this study. Chan and Idris (2017) argue that generally, reliability in quantitative research refers to two situations (i) the consistency of a measure; despite repeated several times and (ii) a measure of stability at all times. In line with the above, the researcher ensured that issues of reliability were tested before analysis, deductions and conclusions were done to cover what Jugessur (2022) refers to as the “research gap”.

Jugessur (2022) demands that irrespective of the outcome of the end research, after collecting data, in quantitative research, the reliability of the questionnaire used and responses obtained needs to be tested. This is where the Cronbach Alpha comes into play, to provide a reference value of whether the questionnaire responses are reliable or not, even before any statistical deduction are drawn from the research (Jugessur, 2022). Cronbach Alpha measures the extent to which item responses (answers to survey questions) correlate with each other. Chan and Idris (2017) state that the reliability index range is between zero (α=0) to one (α=1). High Alpha value means higher reliability, the index Alpha of .7 and above is good for instruments that have 10 or more items.

The reliability of the questionnaire was tested with the Cronbach's Alpha using the SPSS software version 25.0. Table 4.16 below shows the findings:

Table 4.16: Reliability analysis

Construct	Cronbach's Alpha	Number of items
Induction experiences	.992	19
Aspects of teaching	.992	20
Professional support	.707	7
Satisfaction levels as a science teacher	.725	7
Overall satisfaction levels	.992	20

Table 4.16 illustrates that the Cronbach's Alpha coefficients for all the constructs tested were in line with the threshold ranging between zero (α=0) to one (α=1). In fact, the recommended threshold index Alpha of .7 and above was met, indicating my data collection instrument used was highly reliable. Therefore, this suggests that the findings, analysis, deductions and conclusions in this study can be relied on because the research meets set standards.

4.4.4 Conclusion

From the quantitative data obtained and presented mainly in form of custom tables in this section, it can be noted that, generally, novice science teachers have low satisfaction levels with the quality of mentoring that they experienced, if any. The researcher found that a majority of respondents were prepared to either move away from teaching science for other subjects or completely quit the teaching profession. Mentoring remained a core expectation of every novice science teacher, hence their support on the introduction of blended mentoring to enhance mentoring programmes especially in under-resourced schools.

4.5 Qualitative data analysis and results

4.5.1 Introduction

In this section, the researcher presented and analysed qualitative data obtained through focus group discussion with six novice science teachers in Ekurhuleni South District. First, an overview of how qualitative data was prepared was given, followed by the analysis procedures that were done using the selected CAQDAS. Lastly, an affirmation of the reliability and validity of this study was made.

4.5.2 Demographic profile of qualitative respondents

Qualitative data was collected in a focus group discussion conducted with six participants who were based at school X in Ekurhuleni South District. Table 4.17 depicts the demographic profiles of focus group participants.

Table 4.17: Demographic data of focus group participants at school X

Pseudonym	Age	Gender	Phase taught
Lizzy	23	Female	Senior & FET
Miss Black	26	Female	Senior & FET
Miss Purple	24	Female	Senior & FET
Necro	28	Male	Senior and FET
Noxy	24	Female	Senior & FET
Zentia	30	Male	Senior & FET

Table 4.17 above depicts that the focus group was composed of four female and two male participants. Initially, one more male participant attended but had some work-related emergency, leaving only seven minutes into the discussion. The researcher proceeded with the six who still made the minimum planned threshold of between 5-12 focus group participants according to literature reviewed. The male participant’s (with the pseudonym Frank) contribution could not be used in

this research report due to its incompleteness, which formed part of data cleaning.

All six focus group participants each had a pseudonym and their real names were never used in this report for anonymity. The four female pseudonyms as shown in Table 4.17 were Miss Black, Miss Purple, Noxy and Lizzy, and the two male participants were Necro and Zentia. All six focus group participants were in the 21-30 age group and taught science and other subjects at the Senior and Further Education and Training (FET) phases.

The focus group discussion was audio-recorded upon receipt of consent by all participants. The researcher who posed as the moderator throughout the focus group discussions also took some field notes during the discussion, noting some important points including non-verbal cues displayed by the participants.

4.5.3 Overview of data and preparation

After the focus group, data was first transcribed using Auris AI software. Data was personally cleaned by the researcher to avoid any inaccuracies. This was in line with Mattimoe, Hayden, Murphy and Ballantine (2021) who state that as with any qualitative research project, prior to formal data analysis, there is a significant amount of work involved in ‘cleansing’ the interview data collected. The transcription by Auris AI software assisted the researcher, but it was not entirely accurate. Hence for several times and days, the researcher listened to and repeatedly read the transcription, and corrected all inaccuracies.

Field notes and the audio-recording were helpful in this process as the researcher clearly remembered what happened and each participant’s response. Self-transcription, reading and re-reading served as a merit to the researcher who familiarised more with the data for better analysis and interpretation. Individual respondent contributions were made separate to allow for easy comparison, confirmation of information and management across data sets. As discussed in section 3.6 of Chapter 3 in this study, data analysis followed a thematic approach and ATLAS.ti version 23.3 was used.

4.5.4 ATLAS.ti procedures followed

The researcher followed several steps in data analysis as prescribed by Creswell (2009). The process was iterative in nature as summarised in Figure 4.4 below:

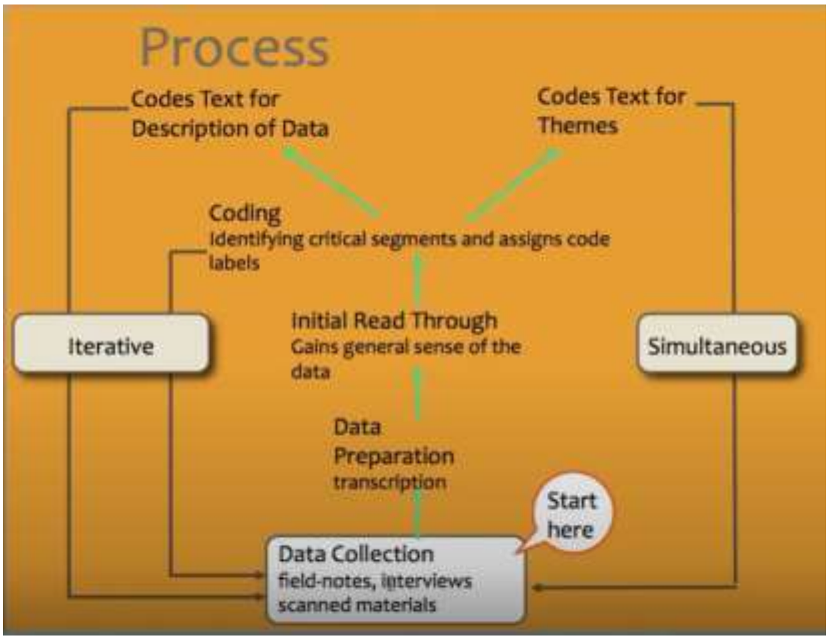


Figure 4.4: An iterative data analysis process done
[Courtesy: Gramenz, 2014]

Figure 4.4 outlines the iterative coding process that was done in qualitative data analysis from data collection through to themes. After data collection, transcription was done followed by initial read throughs where the researcher familiarised with the data. Critical segments were identified and coded but the researcher is expected to restart the process if there is anything wrong with the data and/or transcriptions. Codes are then done for the description of data, that is, as categories or patterns, a process that can be re-done if initial processes were not adequately performed. Lastly, codes are simultaneously turned to themes if they meet all quality requirements and a narrative can be produced.

Step 1: Creating a project and importing data

A project was created using ATLAS.ti v23.3 and the individual transcripts from the six participants were imported into the software. The researcher generated an ATLAS.ti document report as shown in Table 4.18 below.

Table 4.18: ATLAS.ti version 23.3 document report

Project: Mentoring experiences of novice science teachers in Ekurhuleni South district Report created by Misheck Semu on 2023/11/22 **Document Report** All (6) documents **1 Transcription_Lizzy** PDF document, 21 quotations **Created** by Misheck Semu on 2023/11/22 **1 Groups:** Unmentored participants **2 Transcription_Miss Black** PDF document, 13 quotations **Created** by Misheck Semu on 2023/11/22 **1 Groups:** Mentored participants **3 Transcription_Miss Purple** PDF document, 21 quotations **Created** by Misheck Semu on 2023/11/22 **1 Groups:** Unmentored participants **4 Transcription_Necro** PDF document, 18 quotations **Created** by Misheck Semu on 2023/11/22 **1 Groups:** Mentored participants **5 Transcription_Noxy** PDF document, 10 quotations **Created** by Misheck Semu on 2023/11/22 **1 Groups:** Unmentored participants **6 Transcription_Zentia** PDF document, 19 quotations **Created** by Misheck Semu on 2023/11/22 **1 Groups:** Unmentored participants

The report in Table 4.18 which the researcher created depicts that a total of six participants had their PDF documents uploaded on ATLAS.ti v23.3. The six respondents were grouped according to whether they were mentored or not. For each participant, a number of quotations were created from their focus group contributions as the researcher went through the coding process. Coding is defined by Wicks (2017) as the process of attaching meaningful attributes (codes) to qualitative data that allows researchers to engage in a range of analytic processes such as pattern detection, categorisation and theory building. Jones (2023) defines a code as a brief description of what is being said in the interview or focus group extract; it is a description not an interpretation. With this theoretical understanding by the researcher, the use of ATLAS.ti version 23.3 and coding played a major role in the analysis of qualitative data in this study.

Step 2: Reading through the data

The researcher repeatedly read the transcripts in order to further familiarise himself with the data and to make more sense of it despite having gone through it several times during transcription. This resulted in the researcher coming up with some free quotations from the initial ideas that were noted. Mncanca (2022) says free quotations refer to highlighting segments that one considers interesting or important without necessarily coding them. Kalpokaite and Radivojevic (2019) argue that by reading, the researcher searched for the “what’s of the data”. Figure 4.5 illustrates some of the common and main ideas to which participants alluded during the focus group discussions.

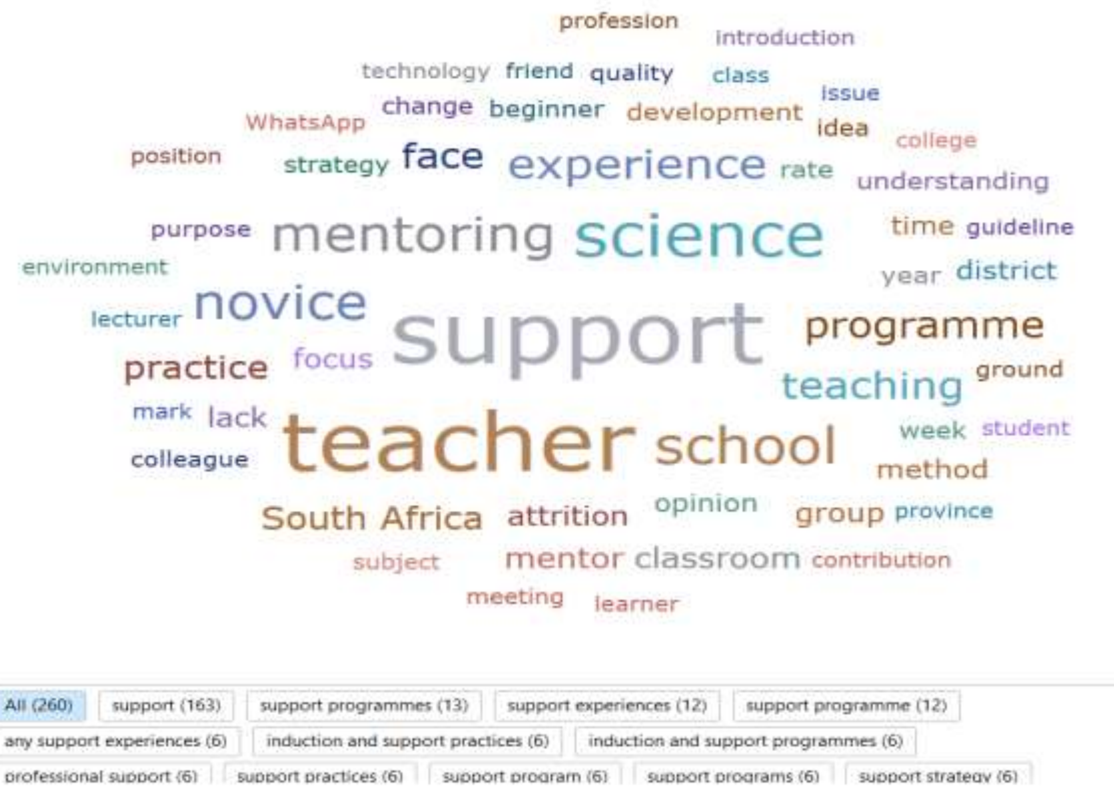


Figure 4.5: ATLAS.ti cloud showing main ideas from transcriptions

For example, Figure 4.5 shows that some of the central points of discussion, “the what’s of the data”, focused on key words such as support, teacher, science, mentoring, experience and programme, with the size of the word in the web reflecting how often the word came out to. Participants raised the need for support of novice science teachers by experienced teachers (mentors) and the need for improving mentoring practices especially in under-resourced schools.

There are so many key ideas that were discussed by the focus group. Figure 4.6 below is another ATLAS.ti cloud showing additional main ideas that were highlighted in the interview.

Figure 4.6: ATLAS.ti cloud on more ideas discussed during the focus group

It can be noted in Figure 4.6 that key to the discussions were terms like induction, teaching, classroom, environment, mentoring and learner among many others. The researcher noted all these initial ideas that turned helpful as the researcher proceeded with the coding process.

Step 3: Coding the data

After generating initial ideas, an inductive, open coding approach was used to code the data. Jones (2023) states that inductive is a method of coding that allows the data to determine your themes. This is an iterative process that involves lots of refinement and multiple rounds of analysis (Jones, 2023). In line with the inductive approach, the researcher employed a line-by-line coding to allow the data to start generating codes that were eventually used to generate themes.

Gibbs (2012) supports line-by-line coding as an approach recommended by many grounded theorists as a first step when coding. This means the researcher had to go through all six transcripts, reading and coding each line of text that was relevant in responding to research questions. The idea was to force analytic thinking while keeping close to the data (Gibbs, 2012). One of the advantages of line-by-line coding is that it forces the researcher to pay close attention to what the respondents actually said and to construct codes that reflected the respondents' experience of the world, not the researcher's or that of any theoretical presupposition the researcher had (Gibbs, 2012). Figure 10 exemplifies line-by-line coding of some participants' transcripts that was done by the researcher during line-by-line coding.

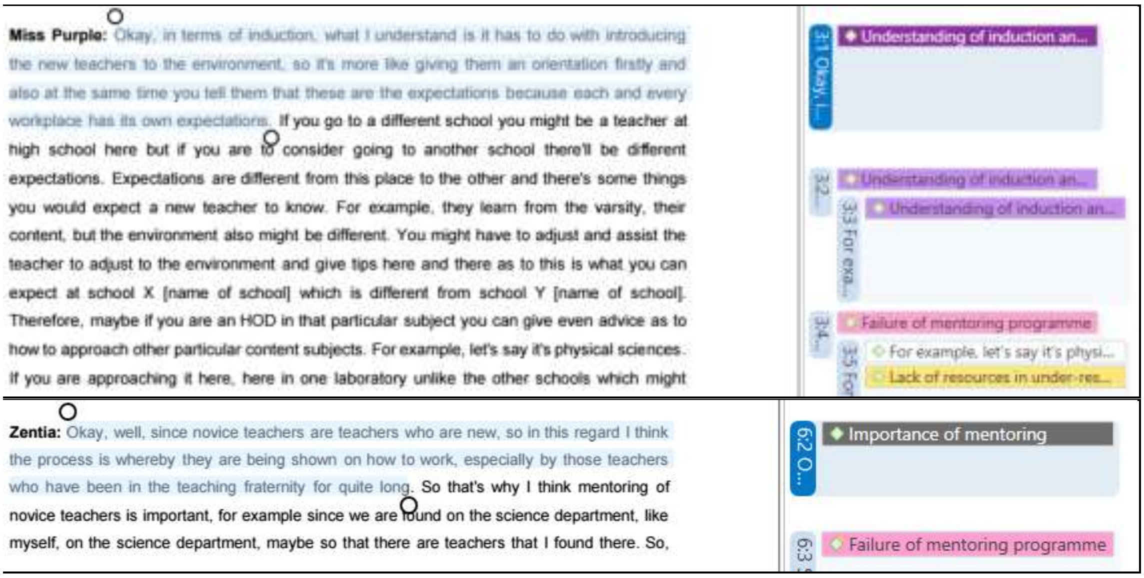


Figure 4.7: Line-by-line coding of respondent's contributions

Figure 4.7 illustrates some of the text segments that were selected by the researcher (highlighted in blue to the left) and codes applied (in different colours to the right) such as "understanding of induction …", "importance of mentoring" and "failure of mentoring programme".

In vivo codes, defined by Wick (2017) as what was derived from the actual language used were also done to produce different yet equally valid insights about my qualitative data. Figure 4.8 displays an example of an in vivo code where the exact words of the participant were used as a code.

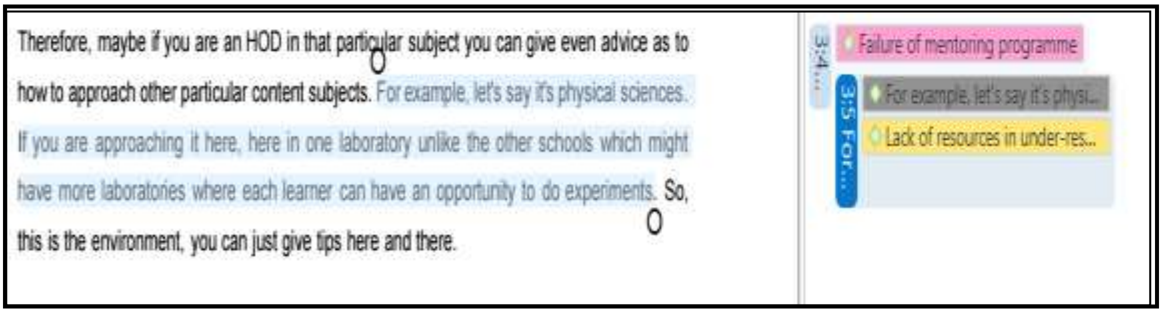


Figure 4.8: In vivo coding from a participant

As shown in Figure 4.8, the participant said, "*For example, if it's physical sciences……",* the exact words were used for the code, hence in vivo coding. The coding process resulted in 27 codes and 102 quotations identified from the focus group data. The researcher diligently performed coding with the full knowledge that it is a crucial first step towards organising qualitative data into meaningful categories. Jones (2020) affirms that it also allows the researcher to discover reoccurring concepts that could be further refined.

Step 4: Clustering similar codes and reverting to data

As the researcher made more sense of the data by returning to it, similar and related codes were merged. Jones (2023) prescribes that in order to prevent a long list of codes, one needs to aggregate those codes from time to time, which means merging and renaming them to reflect the higher abstract level. Hence, the researcher merged all codes that were related and carried the same meaning but for which different codes were initially used. Coding in this exploratory way enabled the researcher to recognise and recontextualise the data to give a fresh perception of what was already visible (Jones, 2020). Table 4.19 shows the 24 codes that the researcher was generated, their groundedness and density that is explained below:

Table 4.19: Excel export of 24 merged codes from the transcripts

A	B	C	D
1	**Code**	**Grounded**	**Density**
2	● Blended mentoring experiences	4	1
3	● Bridging the gap between universities and reality in the classroom	5	1
4	● Demerits of virtual mentoring done in isolation	1	0
5	● Desire to quit science teaching for greener pastures	6	1
6	● Duration of mentoring	5	1
7	● Effectiveness of mentoring strategies	1	2
8	● Envisaged mentoring programme	2	1
9	● Failure of mentoring programme	8	3
10	○ For example, let's say it's physical sciences. If you are approaching	1	0
11	● Importance of mentoring	10	1
12	● Induction a success or not	5	2
13	● Issues novice science teachers need mentoring on	5	1
14	● Lack of resources in under-resourced schools	2	1
15	● Methods of mentoring	2	1
16	● Negative effects of non-mentoring practices	1	1
17	● No induction in under-resourced schools	6	1
18	● Quality of mentor used	3	1
19	● Quality of support from Department of Education	3	2
20	● Rating of quality of mentoring experienced	1	0
21	● Science teacher attrition	13	2
22	● Self professional development	1	1
23	● The need for blended mentoring	13	0
24	● Understanding of induction and professional support	4	1
25	● What education districts should do	1	1

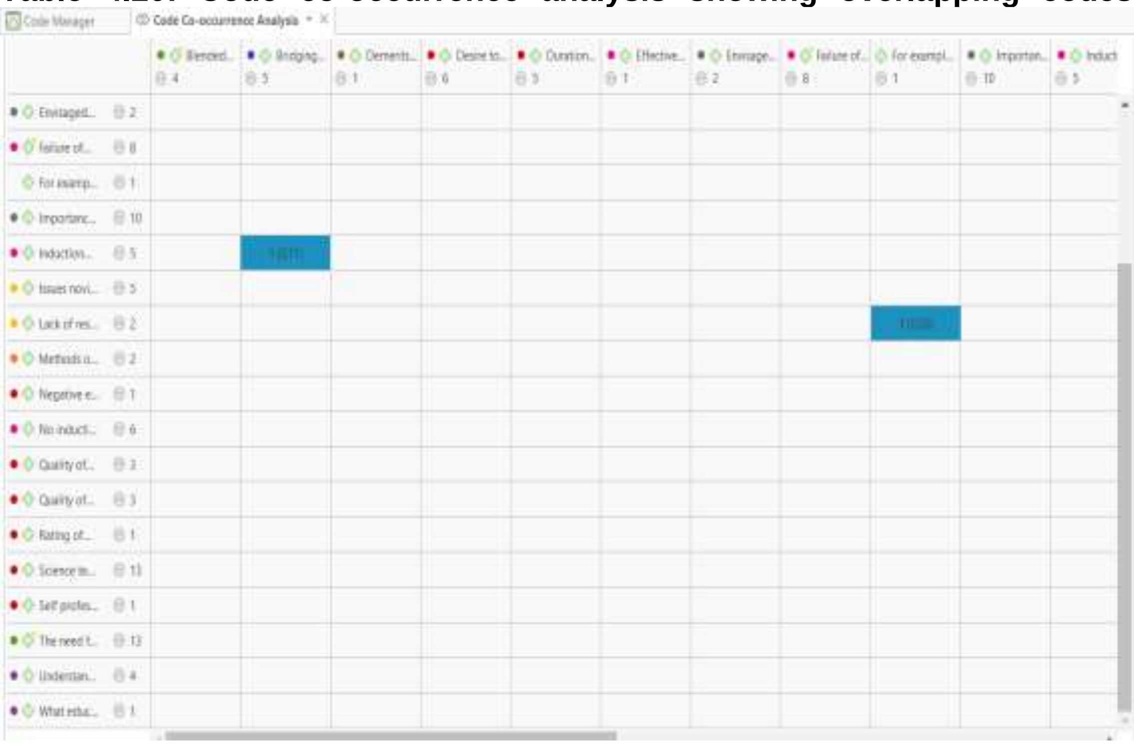
Table 4.19 shows *groundedness* and *density* of some codes. Groundedness shows how many times a code has been applied (Illinois University Library, 2023). For example, the code "the need for blended mentoring" and "Science teacher attrition" shows that 13 quotations were derived from each code. This portrays that some codes had strong *groundedness* while others had a weak *groundedness* of 1. One reason for weak groundedness is that the codes were assigned to critical issues raised by one or few participants (Mncanca, 2022). For example, *Miss Purple* raised an important issue of lack of resources as a major obstacle in the realisation of proper mentoring in under-resourced schools as shown in Figure 4.9 below.

Figure 4.9: Excerpt showing important contribution but low groundedness

Figure 4.9 also raised issues of *density* of the codes. Density shows the number of links between entities (Illinois University Library, 2023). For example, a density of 2 means the code, memo, or quotation is linked to two other codes, memos, or quotations. Using ATLAS.ti software, very few codes were merged on grounds of groundedness and density during analysis as 11 codes were generated from the initial 27 codes as saturation was reached.

Clustering of codes was also done based on overlapping codes. The aim was to relate codes that were applied either to the same quotations or to overlapping quotations that are termed co-occurrences (ATLAS.ti User Manual, 2023). Table 4.20 pictures only two code-co-occurrences that led to clustering.

Table 4.20: Code co-occurrence analysis showing overlapping codes


Code Manager | Code Co-occurrence Analysis

	Blended... 4	Bridging... 5	Dements... 1	Desire to... 6	Duration... 3	Effective... 1	Envisage... 2	Failure of... 8	For exampl... 1	Importan... 10	Induct 5
Envisaged... 2											
Failure of... 8											
For examp... 1											
Importanc... 10											
Induction... 5		[illegible]									
Issues novi... 5											
Lack of res... 2									[illegible]		
Methods o... 2											
Negative e... 1											
No inducti... 6											
Quality of... 3											
Quality of... 3											
Rating of... 1											
Science in... 13											
Self profes... 1											
The need t... 13											
Understan... 4											
What educ... 1											

Table 4.20 outlines that only two pairs of codes had proximity to each other, hence they were clustered. The same codes can be easily identified in the Sankey diagrams in Figure 4.10 that follows. Applicability consideration is given to whether findings can be applied to other contexts, settings or groups.

Figure 4.10: Sankey diagrams showing code co-occurrence

After clustering of codes, the researcher went on to generate code groups. Seven code groups were created and used to sort and organise codes in the code manager and to facilitate the navigation from codes to categories. Below are the seven code groups presented in form of networks in Figures 4.11 to Figure 4.17 to show the emerging themes in their connections.

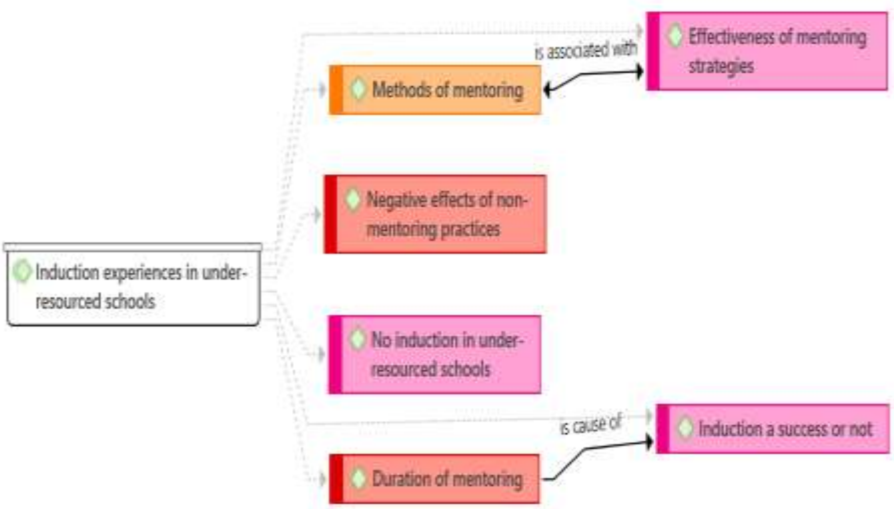


Figure 4.11: Network for code group 1

The network for code group 1 depicts the main issues raised by participants and under I&M experiences in under-resourced schools. Notably, there is no induction taking place in some schools and the methods and duration of I&M has a cause-and-effect relationship with successful induction or not.

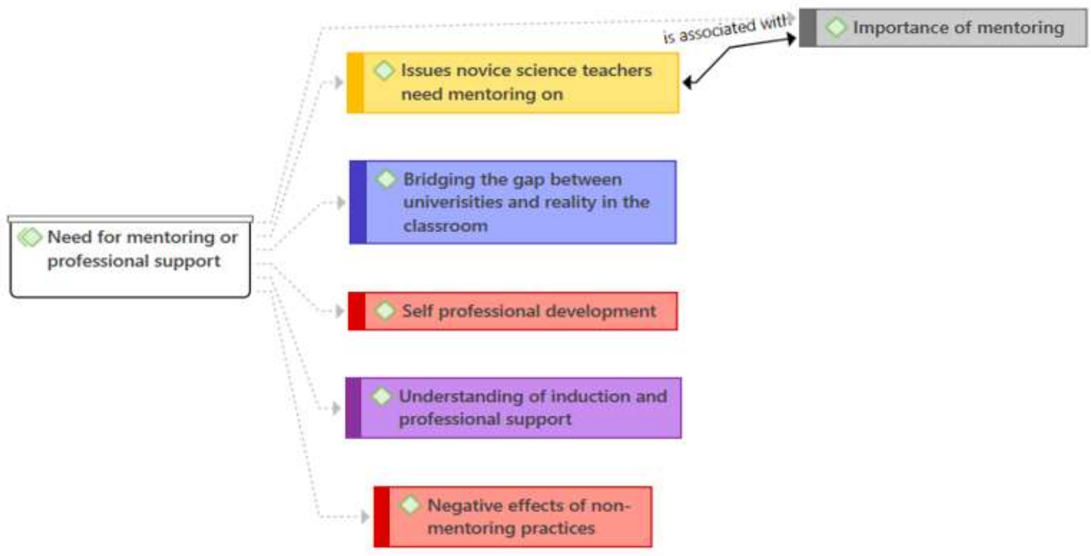


Figure 4.12: Network for code group 2

Network for core group 2 outlines wthat was discussed under the need for mentoring and professional support. Participants showed that they understood induction but failure of mentoring methods to bridge the gap between university work and the real classroom makes them to consider self-professional development.

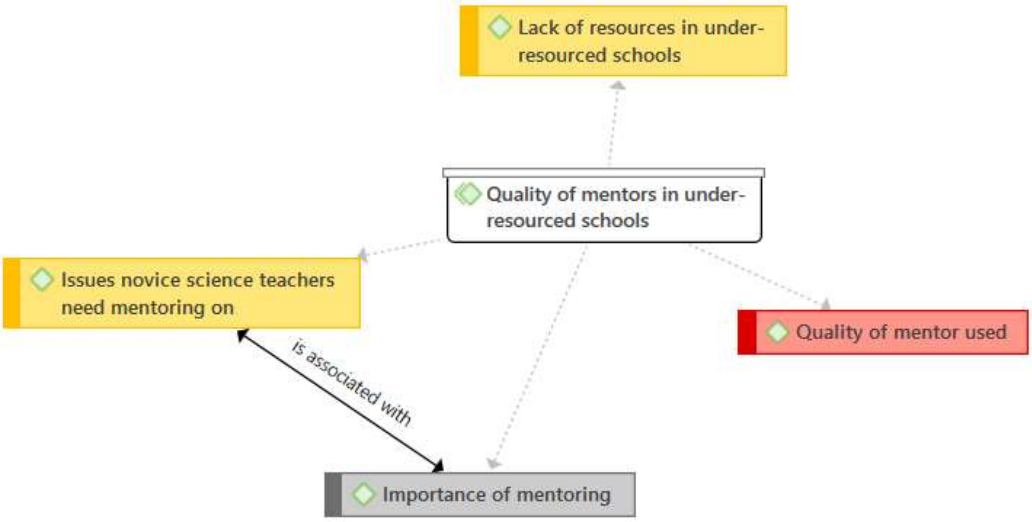


Figure 4.13: Network for code group 3

Network for code group 3 shows that the quality of mentors and lack of resources in under-resourced schools relates to the issues and importance of mentoring.

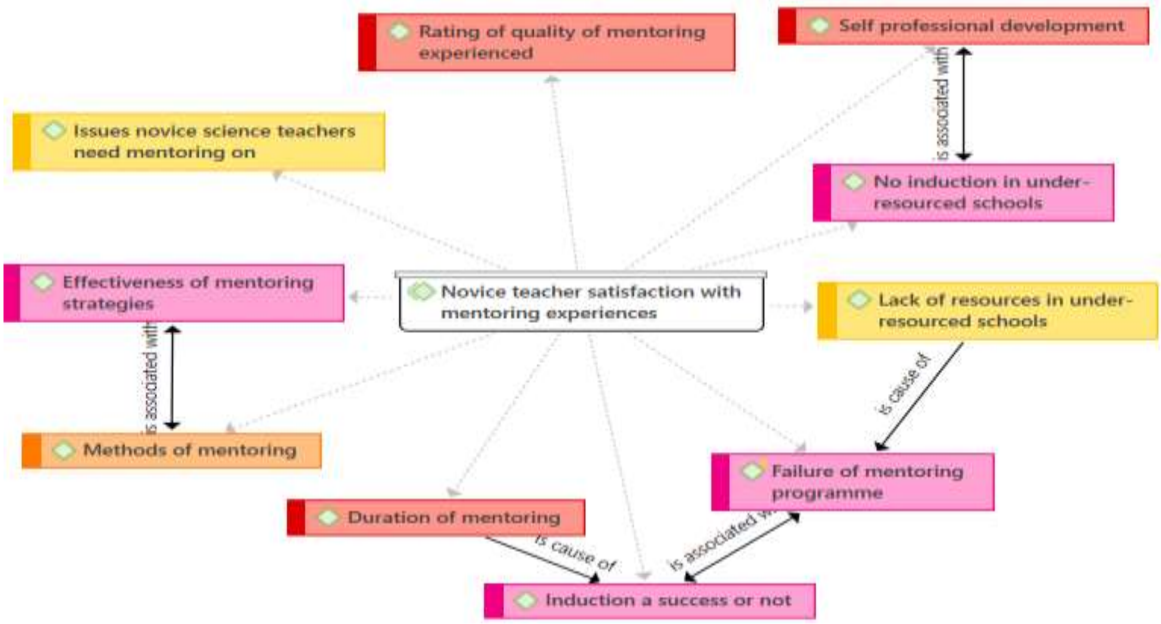


Figure 4.14: Network for code group 4

The network in Figure 4.14 pictures what was coded as participants' contributions towards their satisfaction with mentoring experiences, only for those who were mentored.

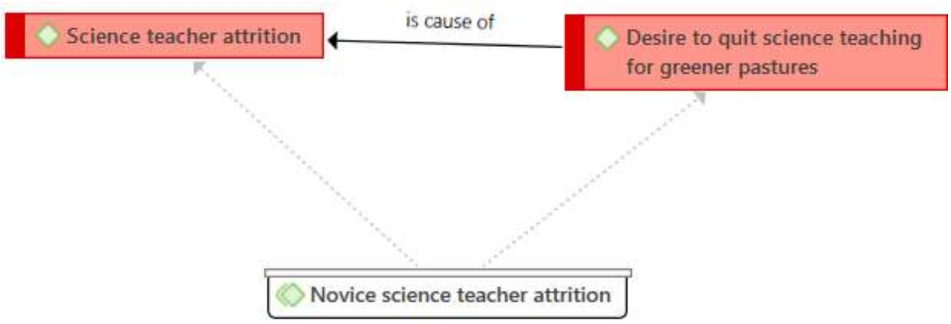


Figure 4.15: Network for code group 5

Network for code group 5 shows grouping of codes that dealt with novice teacher attrition. There is a link between science attrition and the desire to quit and science teaching for greener pastures.

The network below shows the DBE's role in the mentoring of novice science teachers:

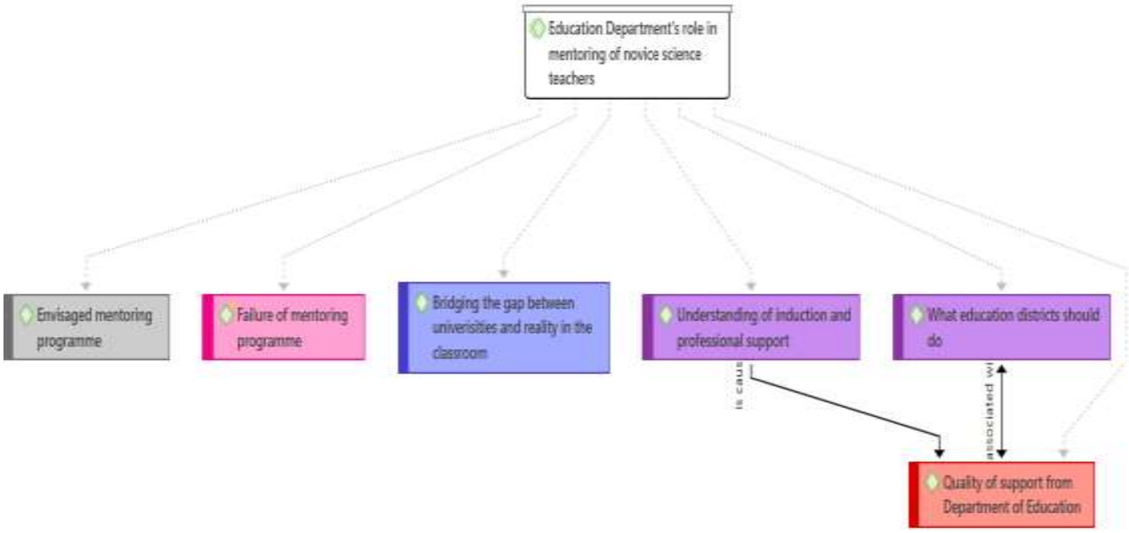


Figure 4.16: Network for code group 6

Figure 4.16 depicts that the role of the Department of Education when it comes to I&M of novice science teachers was questioned and discussed, hence group coded.

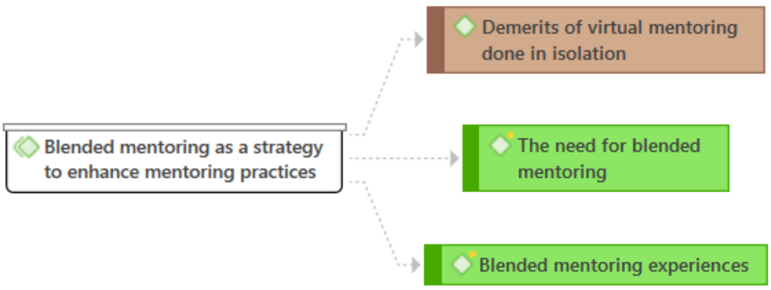


Figure 4.17: Network for code group 7

The network for code group 7 features discussions that were done on blended mentoring as an alternative strategy to enhance mentoring of novice science teachers. Having completed code grouping, the researcher went on to the next step of the data analysis process.

Step 5: Refining code groups to form categories

As was alluded to in step 1 that an inductive approach, which is an iterative process that involves lots of refinement and multiple rounds of analysis was selected and used in analysing data for this project. The researcher went on another round of refinement to ensure that categories were generated from code groups. Bazeley (2013) argues that inevitably, not all codes the researcher produces continue to prove useful. Some of the codes become too general whereas others can become too specific to one or two segments of data with the exception of contextual codes, a category that is so broad or so vaguely defined that it codes a very large number of passages or very lengthy passages is less likely to be useful in analysis (Bazeley, 2013). Table 4.21 sets out the refined categories that emerged and were derived from the code groups and data.

Table 4.21: Refined categories derived from data

Code groups	Refined categories
Induction experiences in under-resourced schools Induction experiences in under-resourced schools	1. Induction experiences in under-resourced schools. 2. Induction and mentoring: a success or not.
Induction experiences in under-resourced schools	3. Poor induction and mentoring experiences.
Novice teacher satisfaction with mentoring experiences Envisaged induction and mentoring Envisaged induction and mentoring Blended mentoring Novice science teacher attrition	4. Novice science teacher satisfaction with induction and mentoring programmes. 5. Quality of support from DBE and district office. 6. Envisaged induction and mentoring of novice science teachers. 7. Blended mentoring as a strategy to enhance mentoring practices. 8. Novice science teacher attrition.

Table 4.21 outlines eight categories that were generated by the researcher from the code groups. Friese (2011) points out that the aim of the above outlined process of developing categories and sub categories is to add structure to the previously loose list of codes, forcing the researcher to rethink the initial codes and to further develop them conceptually. This avoids drowning into the ‘code swamp’, that is, creating too many codes that look like codes in the software but have not yet reached methodological status (Friese, 2011). Hence, the categories generated and the structure created enabled the researcher to see some emerging patterns which are also known as overarching themes.

Step 6: Assemble category data and generating themes

The researcher followed a thematic and inductive approach in the analysis of qualitative data. After generating eight categories from the code groups, the researcher went on to use ATLAS.ti to generate emerging themes. Tracy (2020) says that rather than approaching the data with pre-existing theories and concepts and applying these theories to the data (a deductive or etic approach), researchers instead begin by collecting data, engaging in open line-by-line analysis, creating larger themes from these data, and linking them together to create an emergent explanation or theory.

As the researcher moved from codes to categories, emerging themes in categories were explored until a saturation point was reached. Saturation is considered to be the gold standard, which is the point in data collection and analysis when new information produces little or no change to emerging findings and themes (Tracy 2020). This phase involved reviewing the open coding, merging, re-naming, distilling and collapsing the initial codes into broader categories of codes (Mattimoe et al., 2021). The main reason was to allow the data analysis process to be completed in a manner that enabled the objectives of the research to be fulfilled.

At this stage, the researcher decided on removing some codes that were irrelevant to the study. Some codes were split and others merged by using the relationship manager option in ATLAS.ti. The relation manager function in ATLAS.ti, has descriptors that stipulate, for example, whether a code: is a part of, is a property, is associated with, is a cause of, contradicts, and many other descriptions and is used to link related codes. Some categories were merged to update them and align them with the purpose of the project. The researcher even took some time to reflect on whether there were any missing data. Figure 4.18 below illustrates the iterative data analysis procedure that the researcher followed from codes to themes.

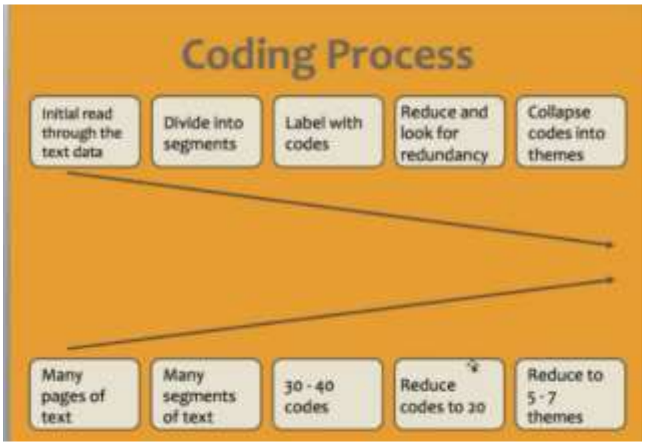


Figure 4.18: Iterative data analysis process from codes to themes
[Courtesy: Grenz, 2014]

The researcher finally generated five overarching themes and several sub-themes by looking at the patterns and connections between categories and segments in the stored data using ATLAS.ti. Literature provides that the general rule of thumb is that each theme should not have more than 4-5 codes. It is also better to have 6-10 broad themes with sub-themes rather than extensive detailed themes (Jones, 2023). However, Saldana (2013) argues that the final number of major themes should be held to a minimum to keep the analysis coherent, but there is no standardised or magic number to achieve. The researcher was satisfied with the five themes and several sub-themes that were generated in this study since they fully answer the two research questions. An ad hoc thematic network was constructed to present the refined themes and sub-themes as shown in Figure 4.19 below:

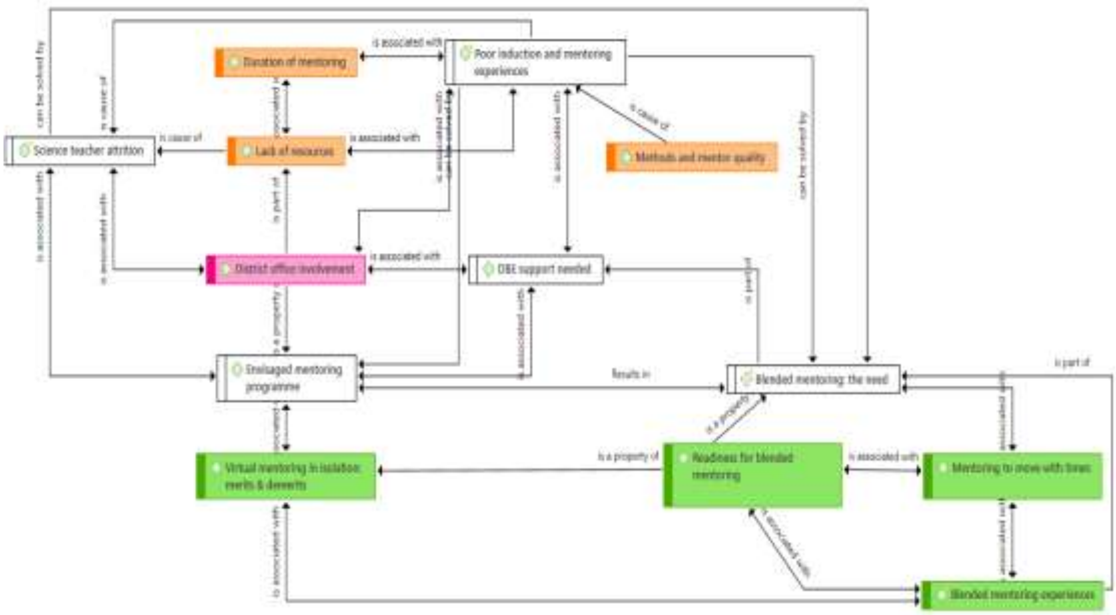


Figure 4.19: Ad hoc network showing overarching themes and sub-themes

Figure 4.19 presents the five themes (white) and several sub-themes (orange, red, green) that emerged from the data. The ad hoc network demonstrates that poor I&M of novice teachers in under-resourced schools is associated with DBE and district office (sub-theme in purple) support which this study considers central to the success of such programmes. Poor I&M practices were the contributing factor to science teacher attrition. Three sub-themes in orange colour were connected to poor I&M. It also emerged that novice science teachers envisaged that I&M must move with the times. This implies that what the researcher terms 21st century I&M strategies should be tried, tested and implemented to enhance I&M programmes.

Summary

Qualitative data was analysed and presented by the researcher in the foregoing section. ATLAS.ti version 23.3. was used to organise, manage and analyse data, the results of which were then presented in different ad hoc networks ranging from codes to themes.

4.5.5 Validity and reliability of qualitative data

Noble and Smith (2015) argue that unlike quantitative researchers who apply statistical methods for establishing validity and reliability of research findings, qualitative researchers aim to design and incorporate methodological strategies to ensure the 'trustworthiness' of the findings. On these bases, the researcher incorporated a number of methodological strategies to ensure validity and reliability of the qualitative part of this mixed methods study.

The following italicised strategies as prescribed by Noble and Smith (2015) were implemented to maintain rigour:

1. *Accounting for personal biases which may have influenced findings* – The researcher used the respondent's view in qualitative data presentation. Any possible biases were avoided by all means, and if any, were accounted for in the report.

2. *Meticulous record keeping, demonstrating a clear decision trail and ensuring interpretations of data are consistent and transparent* – The researcher kept all records secured and presented as well as interpreted data consistently and transparently.

3. *Including rich and thick verbatim descriptions of participants' accounts to support findings* – Respondents' verbatim quotations and in vivo coding were used in qualitative data presentation.

4. *Demonstrating clarity in terms of thought processes during data analysis and subsequent interpretations* – The researcher made a clear presentation with literature, especially in support clarifying ATLAS.ti terminologies that may be new to the reader.

5. *Engaging with other researchers to reduce research bias* – The researcher sought advice from expert researchers throughout this project.

6. *Respondent validation: includes inviting participants to comment on the interview transcript and whether the final themes and concepts created adequately reflect the phenomena being investigated* – The

final focus group transcript was shared with the respondents who were invited to commend. Moreso, the researcher generated themes from the data, themes that adequately reflected the phenomena that was investigated.

7. *Data triangulation, whereby different methods and perspectives help produce a more comprehensive set of findings* – The researcher selected to implement mixed methods research in a concurrent design with the view to triangulate data and increase the applicability of this study.

Among the nine points raised by Noble and Smith (2015), the researcher fulfilled seven of them. This affirms that the researcher designed and incorporated methodological strategies to ensure the trustworthiness of research findings stated in the subsequent chapter.

4.6 Summary of the results

Chapter 4 constituted the analysis and presentation of both quantitative and qualitative data. Quantitative data obtained from an online survey was analysed using SPSS software and presented in this chapter. In section 4.2, demographic profiles of online survey participants were presented. Quantitative data results were sub-divided into sections to respond to research question 1 and research question 2, respectively. Section 4.3.2 presented I&M experiences of novice science teachers in under-resourced schools, if any, while section 4.3.3. demonstrated satisfaction levels of respondents with the said I&M programmes, if any were conducted. Further presentation of results was done in section 4.3.4 that looked at the mentoring and professional support given to respondence, if any. Results pertaining to research question 2 were presented under section 4.4.2 which dwelt on novice teacher satisfaction levels with I&M programmes, if any were conducted in their schools. In all the sections, results were displayed in form of bar graphs, pie charts, custom tables and composite tables that were accompanied by explanations.

In Chapter 4, qualitative data was organised, managed and analysed using CAQDAS ATLAS.ti version 23.3. The data was obtained through a focus group discussion conducted with six novice science teachers at a school in Ekurhuleni South District. Section 4.6.2 provided an overview of how qualitative data was prepared for analysis which included six respondent transcriptions that were done and uploaded to ATLAS.ti for analysis. Thereafter, section 4.6.3 detailed Creswell's (2009) six-step iterative data analysis procedure in ATLAS.ti that were adhered to by the researcher. Initially, about 27 codes and 102 quotations were generated using a line-by-line, iterative and inductive coding approach. The codes were refined into categories that were sequentially refined to generate six themes derived from the data.

The presentation of results was done using various ATLAS.ti visualisations that were generated by the researcher. These visualisations included ATLAS.ti reports, cloud features, excerpts, excel exports, code co-occurrence tables and ad hoc networks, to name but a few. The visualisations were largely based on respondents' viewpoints, meaning that the researcher maintained some close proximity to the data to increase rigour in this study. A trustworthiness check of the qualitative data was done in line with reliability and validity protocols. In Chapter 5, the researcher will discuss, explain and interpret the results in a triangulation.

CHAPTER 5: DISCUSSION OF THE RESULTS

5.1 Introduction

In this mixed methods research, a concurrent parallel design was employed to gain valuable insights into the research topic: Using blended mentoring approach to support novice science teachers in under-resourced schools in the Ekurhuleni South District. The research aimed to answer the two research questions:

1. What are the novice science teachers induction and mentoring experiences during their initial years of teaching in under-resourced schools?

2. Why incorporating blended mentoring can serve as an intervention strategy to enhance mentoring programmes for novice science teachers in under-resourced schools in South Africa?

Both quantitative (survey) and qualitative (focus group) data was collected separately but concurrently, analysed and presented separately in Chapter 4. In this chapter, the results were discussed and explained with specific refence to literature before they were merged in a triangulation where results were related, compared and interpreted to draw conclusions.

This chapter starts with outlining the demographic profiles of both quantitative and qualitative respondents in section 5.2. Separate discussions and explanations of quantitative and qualitative results pertaining to research questions 1 and 2 in relation to literature followed in sections 5.3 and 5.4 respectively. Sub-sections were created under various sections to enable a coherent but organised flow of discussions and explanations. Results were then triangulated and interpreted in section 5.5 of this chapter before conclusions were reached in section 5.6.

5.2 Demographic profile of respondents

5.2.1 Demographic profile of quantitative respondents

As alluded to in Chapter 4 where visualisations can be revisited, a total of 29 novice science teachers based in four provinces responded to the online survey. Of the 29 respondents, 20 of them were female while only nine were males. Eighteen of the respondents were in the 18-30 years age group, nine were between 31 and 40 years of age with the remaining two in the 41-50 age group. The respondents had varying years of teaching experience. Five of them had less than five years' teaching experience, six had two years, another five had six years, 12 had four years and one had five years of teaching experience. The respondents taught different subjects in different phases as presented in Table 4.3 and came from four provinces that granted permission for research to be conducted.

The total number of 29 participants that responded to the online survey was far different from the researcher's expectations of at least 180 respondents from all the provinces in South Africa. The researcher expected at least 20 participants from each of the nine provinces in South Africa. With only four provinces participating, the researcher expected at least 80 participants to respond to the online survey. By calculation, the actual response rate was 36.3%. However, Wu, Zhao and Filse-Aime (2022) argue that questions regarding what constitutes a respectable response rate for online surveys in research remained unanswered though in their meta-analysis studies they prescribed that an average online response rate of 44% is expected in an education-related field. In comparative studies done by Fosnacht, Sarraf, Howe and Peck (2017) who examined data from one of the most widely used higher education assessment instruments, the National Survey of Student Engagement (NSSE), they found that the estimates based on the data remained reliable even with a 5%-10% response rate with a sample size of at least 500. They also found that surveys with a smaller sample size (of less than 500) needed 20%-25% response rates to provide fairly confident estimates. This means despite a low response rate in this study, quantitative data obtained was significant enough to enable analysis through SPSS and was used to draw up conclusions in this study.

Wu et al. (2022) also found out that sending surveys to more participants does not necessarily yield a higher response rate. Despite the researcher sending the survey on platforms such as LinkedIn, Facebook, and to so many science teacher groups on Telegram and WhatsApp and to some crucial contacts like science subject advisors in some provinces, there was no significant increase in the response rate. Wu et al. (2022) cite a number of comparative meta-analyses studies that provide conclusive evidence for them to conclude that in general, online surveys produce an 11%-12% lower response rate than other types of surveys. They further cite several factors that result in positive and negative survey response rates as follows:

> The factors they found that positively impacted the response rates include topic salience, invite personalisation, selectivity, pre-notifications, reminders, and incentives. The factors that had a negative impact on the response rates include the length of the survey, poor visual presentation, and unstable internet coverage. Some factors referred to as "social level factors" (i.e., survey fatigue, public attitudes, and social cohesion) were also related to a decline in response rates worldwide (Wu et al., 2022, p2).

As stated by Wu et al (2022), a low survey response rate in this study may also be attributed to unstable internet, no internet coverage and lack of internet resources for novice science teachers in under-resourced schools. Hence, novice science teachers in remote places may not have received the invitation to participate even they though could have wanted to participate. Survey fatigue may also be another contributing factor.

In this study, there were more female participants mainly because there are more female teachers than male teachers in South Africa. The researcher found no differences in terms of subjects and phases taught by respondents as this study was open to all novice science teachers despite the phases or science subjects taught.

5.2.2 Demographic profile of focus group participants

Qualitative data was collected from six participants who were based at high school X (name withheld for anonymity) in the Ekurhuleni South District in the Gauteng Province. The respondents were conveniently sampled because of their proximity to the researcher. Considering that the respondents were based in one school, this enabled easy arrangements for the focus group session. In the literature reviewed, Kumar (2017) agrees to purposeful sampling stating that the major consideration in purposive sampling is one's judgment of who can supply the greatest information to meet the study's objectives. Thus, the researcher successfully identified seven novice science teachers in high school X in the Ekurhuleni South District. In terms of the age, all the six participants were in the 21-30 age group. The novice science teachers taught at the Senior Phase as well as at FET Phase.

By comparison, the focus group composition was not any different from what the researcher envisaged. The plan was to have between 5-12 focus group participants in line with literature reviewed. Graham (2022) suggests that a focus group can consist of any number that the researcher defines as a group, from three to 12 participants being common. Having some form of homogeneity in the focus group was a strong point for this study. A focus group with both male and female novice science teachers of different ages, teaching science and other subjects at different phases as well as coming from different universities and colleges led to a diverse composition for this study. Graham (2022) concurs that focus groups should balance the need for homogeneity among participants, thus increasing comfort in speaking up within the group.

5.3 Discussion pertaining to research question 1

5.3.1 Discussions based on quantitative findings

Induction and mentoring experiences in under-resourced schools

This study aimed at exploring the I&M experiences of novice science teachers in under-resourced schools. From the results presented in Chapter 4, there is evidence that there are few under-resourced schools that conduct I&M in the four provinces that were surveyed. Results have shown that 75.9% of novice science teachers never experienced any I&M programmes in their new schools. In fact, they confirmed that they crushed into their classrooms as they started teaching without any form of I&M. Only 6.9% of respondents agreed that they experienced some I&M. These findings affirm that there is patchy and uncoordinated I&M programmes in under-resourced schools in South Africa.

For the 6.9% who confirmed that they experienced some form of I&M, the duration of the so-called programmes was not satisfactory. Results set out that only 3.4% of those who were inducted and mentored spent up to a maximum duration of a month. Otherwise, a few others spent some few weeks while the least spent about an hour attending I&M programmes. This was not a satisfactory duration for them since they could not be inducted well enough to fully transition into independent science teachers. With a lot of expectations to bridge the gap between university and reality in the classroom, perhaps the next question would be: How long should I&M programmes be in order for them to be effective? According to the DBE (2019), the DoE (2005B) report entitled *Teachers for the Future: Meeting Teacher Shortages to Achieve Education for All,* every new teacher should be required to participate in a formal induction and mentoring programme for at least two years. The researcher believes one year could be enough if the I&M programmes were to be rich and also continuous life-long collaboration of teachers.

On the purpose of I&M programmes that respondents might have experienced, results presented have shown that the main purpose was just to orient and provide some general guidance for beginner teachers in their new schools, districts and provinces. Ntshangase and Nkosi (2022) argue that there seems to be a gap in mentorship where pre-service teachers feel that they do not get effective mentorship that addresses both the subject content knowledge and the situational issues of the schools where they are placed. This means that the core of the I&M programmes is often missed as mentorship programmes concentrate on irrelevant things instead of pivoting the programmes on key issues that affect the transition of novice teachers to find comfort in the science classrooms. This leads to general dissatisfaction of novice teachers as depicted in the results presented in the previous chapter where more than 60% of the respondents confirmed that the purpose of the I&M problems were not helpful at all.

Satisfaction levels with induction and mentoring programmes

From the results presented in Table 4.6, there were high percentages of dissatisfaction by respondents on core areas related to science teaching. This trend is in line with what the researcher expected as most I&M programmes in several under-resourced schools tend to add no value to the professional development of novice science teachers. Ntshangase and Nkosi (2022) argue that rural and township schools are characterised by complexities, including social ills as disease, isolation, neglect, poverty, low literacy levels, low learner achievement, inadequate facilities and services, unfavourable policies, and low self-esteem of teachers because of marginalisation and misconceptions that they are not good enough compared to their counterparts who teach in the former white only schools in suburban areas. They further remark that:

> When pre-service teachers are confronted by these challenges during their teaching practice in township and rural schools, they become emotionally and psychologically frustrated. They find themselves not knowing what to do. "Literature also demonstrates that teaching in rural [and township] settings ostensibly require relevant knowledge and skills to cope with various eventualities, and complexities in those contexts" (Mukeredzi, 2016, p88). The best way to cope with these difficulties is for experienced in-service teachers and mentor lecturers to work collaboratively in developing their mentees holistically, which involves both academic and personal

> development. If there is a missing link regarding the mentoring offered, the results could be regressive instead of progressive (Ntshangase & Nkosi, 2022, p6-7).

This means that there are several challenges that affect the performance of novice science teachers who find themselves in under-resourced schools. Hence, there is need for comprehensive and satisfying I&M programmes to help them transition well and reduce the attrition rate.

Mentoring and professional support experiences

Results also show that one of the causes of poor I&M experiences of respondents was the absence of mentors assigned to the novice science teachers. 96.6% of the respondents claimed that they never had a mentor as they were deployed in their new schools. This is a dire situation as there was no one to guide the new teachers in the new schools. Ntshangase and Nkosi (2022) identified a similar situation during teaching practice that seemingly, there is a trend that once the pre-service teachers are recruited, the mentor teachers do not offer support to the former. The same scenario happens to novice teachers as they are deployed to their new schools. Novice science teachers are sometimes allocated classes with the most “notorious learners” in the school and because of the lack of mentoring, most of these novice science teachers rely on self or each other for support. If they cannot withstand the pressure involved, then they decide to resign.

Even though results presented in Chapter 4 reflected that most of the mentors who were available for novice science teachers were mainly HODs and full-time or experienced teachers in the same schools as the novice teachers, the confirmed percentage is evidently low. This could be the reason why there is patchy and uncoordinated I&M programmes in under-resourced schools. Mamba (2020) conducted research at some schools in Mpumalanga, and found that first, most school principals did not have a policy or any documentation to induct newly appointed teachers. Secondly, inductors (mentors) were too busy and they did not have time to induct beginning teachers as they had many responsibilities (Mamba, 2020). In the same vein, the Bridge (2016) asked how mentors were going to be prepared for their roles, for example, through the provision of training programmes; resources and guidelines; or allow mentors to develop their own approaches. This shows that several researchers have tried to recommend the improvement of I&M programmes in South Africa but nothing was implemented thus far. In fact, this is not possible as long as the DBE does not take a strong and clear policy stance on I&M of novice teachers, training and supporting mentors, introducing mentor incentives, monitoring and control mechanisms and commitment of school principals to ensure quality I&M programmes are conducted for novice teachers.

From the results presented in the Chapter 4, 13.8% of the respondents had to organise their own mentors. This shows initiative on the part of the novice science teachers but reflects a serious lack of planning of mentoring programmes on the part of school management, PEDs and the DBE. Mamba (2020) confirms that sometimes, novice teachers only receive assistance from mentor HODs once they pose questions. However, the mentors fail to adequately respond to novice teachers' questions and the novice teachers end up finding answers on their own to reach their self-efficacy.

Mentor-mentee meetings were found to be rather patchy and uncoordinated as reported by the respondents. 65.6% of the respondents claimed that they never had meetings with mentors, and 20.7% stated they sometimes had meetings, which shows that in under-resourced schools, novice science teachers do not receive adequate support. Ntshangase and Nkosi (2022) warn that when pre-service teachers are confronted with these challenges during their teaching practice in township and rural schools, they become emotionally and psychologically frustrated. As stated earlier in literature, novice science teachers find themselves either swimming or sinking. The times at which mentor-mentee meetings take place are also uncoordinated. 17.2% of the meetings took place during lunch and after school. Mamba (2022) found out that most beginner teachers and their inductors commuted to and from work using public transport. As such, the mentors and mentees did not have much time to meet as they were busy with their overwhelming timetables during the day. Some mentors and mentees consider their lunch time sacred since it is their time to take a breather, so they cannot schedule meetings during this time. Therefore, there should be time allocated on timetables for mentor-mentee meetings.

From the findings presented in Chapter 4, the frequency of mentor-mentee meetings demonstrated an oblique picture of I&M practices in under-resourced schools. Only 6.9% of the respondents agreed that they met either 2-4 times per month or once per week. This is quite low number compared to the 65.5% who showed that they never had any meetings with their mentors, meaning they were never mentored. Even the duration of the mentor-mentee meetings with those who were mentored were, on average, between 30 minutes to an hour. One wonders if this was sufficient time for I&M considering that the frequency of such meetings was patchy. It is worth mentioning that the mentees hasted to demonstrate their dissatisfaction with the inadequacy of the duration for which they met with 79.3% of the respondents crying foul.

5.3.2 Conclusion regarding research question 1

As demonstrated by the findings made in this study, it can be noted that novice science teachers in under-resourced schools went through different I&M experiences. Only a few respondents were inducted and mentored but their satisfaction levels with quality of I&M programmes remained questionable.

5.4 Discussion pertaining to research question 2

5.4.1 Discussion based on quantitative findings

Novice teacher satisfaction

Research question 2 sought to find why incorporating blended mentoring can serve as an intervention strategy to enhance mentoring programmes for novice science teachers in under-resourced schools in South Africa. From the findings presented in the previous chapter, respondents were asked to rate their satisfaction levels with the current I&M programmes in their schools to see if there is need for intervention. The novice science teachers rated negatively the quality of assistance they received from their mentors on core areas of teaching. Findings revealed high levels of respondent dissatisfaction with the assistance they received in areas in which they mostly require assistance. Literature confirms that novice science teachers are not properly inducted in South Africa. Mamba (2020) claims that novice teachers struggle to deal with meaningful assessments, to establish professional relationships with parents, class management, dealing with large classes, teaching with limited resources and insufficient support. The researcher's lived experiences of poor-quality I&M programmes observed in the Ekurhuleni South District reiterates the same.

On support given from other quarters other than mentors in their schools, results indicated that in-service workshops and continuing education courses served as what the researcher can term "motivators" for some novice science teachers to carry on teaching. However, teacher training institutions; district; provincial and national education officials were put on the spotlight with high percentages of dissatisfaction on the quality of assistance they gave to novice science teachers. Universities actually concentrate on mentoring pre-service teachers, that is, their student teachers on Work Integrated Learning (WIL) commonly known as teaching practice. Sadly, once their students graduate, universities and colleges do not follow up on their graduates in the new schools where they are deployed. Of interest is the low level of online assistance that other novice teachers received. With the advent of Covid-19, teachers developed WhatsApp, Telegram, Facebook groups and other social media platforms where they shared information. Chomunorwa, Mashonganyika and Marevesa (2022) ascertain that educational technology has not been fully adopted in most schools in previously disadvantaged communities in South Africa. As such, stakeholders should encourage digital transformation and technology adoption in education.

In the survey, the researcher asked respondents to rate some crucial aspects of teaching that relate to the environment in which novice science teachers operate in under-resourced schools. The results painted a gloomy picture, thus reflecting high levels of dissatisfaction by the participants in this study. An average 54.3% of the respondents demonstrated their unhappiness with all factors raised except for opportunities for professional development where 51.7% were neither satisfied nor dissatisfied. These findings were in line with what the researcher termed 'solitarisation' of teaching where each teacher minds their own business and is ‘solitarised’ in their classrooms. Ostovar-Nameghi and Sheikhahmadi (2016) claim that teacher isolation depends more on how teachers perceive and experience collegial interaction than it does on the absolute amount of interaction in which they are involved. Three types of isolation were identified, but of interest in this study and related to what other novice teachers experienced is what Ostovar-Nameghi and Sheikhahmadi (2016) termed “egg-crate isolation”. This is the physical separation of classrooms to the school structure where teachers lack contact with each other (Ostovar-Nameghi & Sheikhahmadi, 2016). Results in this study have shown that some novice science teachers experienced this kind of treatment where they keep themselves behind closed classroom doors as they try out things on their own without any mentor available to assist.

The final survey question established the overall satisfaction levels of novice science teachers in under-resourced schools with regards to mentoring and elicited their thoughts on quitting teaching and the introduction of blended mentoring. This study found out that most respondents were still in a state of confusion on whether they were doing the correct things in their science classrooms or not. This is evidenced by 55.2% of respondents who said they were neither satisfied nor dissatisfied when they were asked to rate if they enjoyed teaching science in their grades and 65.5% were not sure if they were confident to teach science on their own. This is a real “time-bomb” in the teaching fraternity where novice science teachers are left with learners to experiment their way in a bid to transition into fully fledged science teachers. Mentoring encompasses various aspects; mentor teachers are critical in the personal and professional growth of mentees, which goes beyond the pedagogical and content knowledge of the subject to include emotional and psychological gains (Ntshangase and Nkosi, 2022). One wonders how novice science teachers fulfil all other aspects of their holistic development if they were not mentored.

Of concern in this study were the following findings that: 1) 75.8% of the respondents confirmed that they felt they can leave science teaching for other subjects, and 2) 75% affirmed that they felt they can quit teaching for another profession. Literature reviewed stated that most of the novice teachers think of leaving the teaching profession once they face challenges due to lack of mentoring and support. Mamba (2020) warns that most teachers who recently joined the teaching profession are ready to leave and many beginner teachers do not stay long in the teaching profession. This may be caused by the lack of assistance beginner teachers receive when they start their career (Mamba, 2020). Results have also shown that 100% of the respondents understand the need for support that science teachers have especially in early years of teaching. To the researcher, this means novice teachers arrive at their schools well prepared for I&M.

The researcher found out that 92.8% of the respondents displayed their love for mentoring as they considered it useful for them as beginner science teachers. This corresponds with their desire to attend. Interestingly, some respondents agreed that they planned to improve in their science teaching capabilities. Such readiness to professional and holistic development by novice science teachers is what authorities should take advantage of when planning for induction and support programmes. In addition, this study also established that the majority of respondents enjoy attending professional development activities. Such a positive attitude by novice science teachers to mentorship makes work easy for mentors and authorities who are supposed to develop an I&M model for use in South Africa.

The final question in the survey sought to elicit respondents to rate whether the introduction of blended mentoring can assist in enhancing novice science teacher I&M programmes. Interestingly, this study found out that 96.5% of the respondents agreed that hybrid mentoring will definitely enhance novice science teacher I&M practices in South Africa. In a similar study conducted by Bang (2013), she found out that beginning elementary science teachers who were involved in the computer-mediated induction models designed more inquiry-based science lessons than the teachers in the general group (GG) model, which endorsed a one-way relationship (F2F mentoring only). Specifically, the mentors with the computer-mediated mentoring models assisted mentees' decision-making and problem solving (Bang, 2013). The researcher believes that if hybrid mentoring was tried and tested in other areas, the same can be done successfully in South Africa. This is despite some few respondents thinking that South Africa is not yet ready for blended mentoring especially in under-resourced schools.

Summary

Findings arising from quantitative data in responding to both research question 1 and 2 have painted a gloomy picture regarding novice science teacher satisfaction with I&M practices in under-resourced schools. The patchy and uncoordinated I&M programmes have resulted in very high dissatisfaction levels with the quality of I&M that novice science teacher have experienced, if any. The researcher found out that in the main, respondents were prepared to either quit teaching or to move away from teaching science for other subjects. Interestingly, respondents have demonstrated their readiness to attend I&M programmes and agreed that the introduction of blended mentoring can come handy to enhance mentoring programmes especially in under-resourced schools.

5.5 Discussion pertaining to research question 1 and 2

5.5.1 Discussions based on qualitative findings

Introduction

In this section, the researcher discusses findings that arose from qualitative data in response to both research questions 1 and 2. The researcher could not separate qualitative data to specifically respond to each question but selected to work with a synergised dataset to enable the findings to connect well in dealing with both research questions. The researcher trusted this synergy would bring a better flow of these discussions and a better understanding to the readers.

From the document report that was created on ATLAS.ti by the researcher, one of the major findings was that the focus group was composed of two types of participants, that is the mentored and the unmentored. Only two participants were mentored and four never experienced any I&M programmes. The focus group was rich in that it had the required homogeneity (Graham, 2022). The results presented also show that the researcher followed an iterative data analysis procedure. After the transcriptions were done and uploaded on ATLAS.ti and reading of the transcriptions, the researcher found a number of key issues that were discussed that were then presented in form of word clouds. The issues discussed were not any different from what the researcher expected the participants to discuss as the researcher was the moderator and channelled participants to discuss those issues in response to research questions 1 and 2.

The keywords in the transcriptions guided the researcher to come up with some free quotations and about 56 codes that were later merged and used to generate categories and themes that demonstrated the findings in this study. After clustering similar codes, what the researcher found through the focus group discussion became clear. An Excel export was presented showing 24 merged codes with their groundedness and density. The codes represented issues that were discussed and coded in vivo from the transcriptions (quotations). Groundedness shows how many times a code was applied and density shows the number of links between entities (Illinois University Library, 2023) and this was useful for the researcher to generate themes.

The researcher also found that sometimes participants would raise pertinent issues that could have low groundedness because one participant would have touched on that issue. An example that was presented in Figure 12 under results in the previous chapter is that of Miss Purple who raised the issue of lack of resources in under-resourced schools as an expectation on which HODs should advise mentees during I&M rather than for novice science teachers to be caught unaware. To show that the researcher coded the transcripts well, only one code co-occurrence showing overlapping codes was displayed in the results chapter.

Findings from qualitative data

After clustering of codes, initially seven code groups were presented in form of networks that show what the researcher found from the participants. Code group 1 displayed in Figure 4.11 shows that the majority of respondents (four out of six) never experienced I&M in the schools in which they were deployed. For the two participants who were somewhat mentored, they were not happy with the methods and duration of I&M as they confirmed they did not fully benefit from the haphazardly organised programmes. Below is proof of what respondents said especially on the quality of support from the district office.

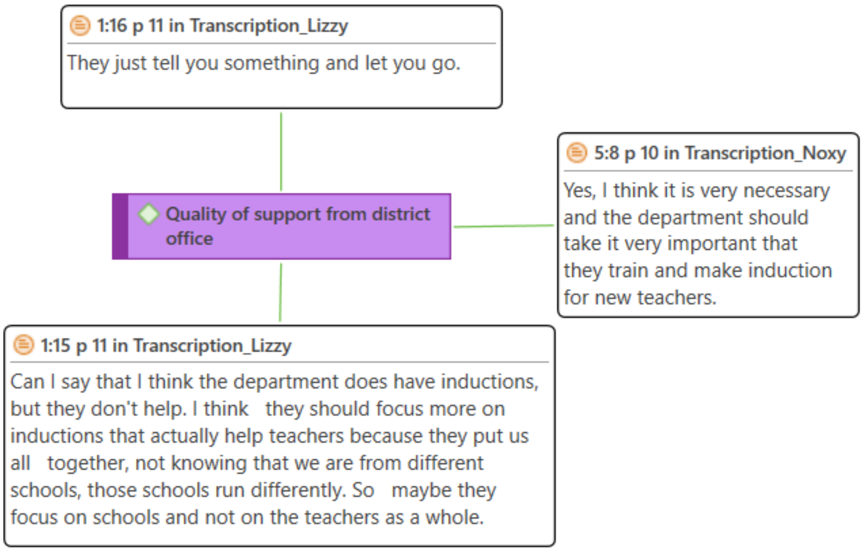


Figure 5.1: Ad hoc network on code group 1

The ad hoc network in Figure 5.1 confirms the findings made in this study that even the district office does not run programmes that can effectively contribute towards successful I&M programmes of novice science teachers in the Ekurhuleni South District. Respondents complained that the one-size-fits-all approach meeting where new teachers from different schools were grouped in a classroom, welcomed to the district and told "something" and let go does not work at all. The researcher also found out that the two participants who claimed they were mentored also suffered from the negative effects of inadequate mentorship because the methods used for mentoring were not effective enough to fulfil their expectations.

Code group 2 was based on the need for mentoring and professional support of novice science teachers. The researcher found out that all participants were aware of I&M since they experienced it during WIL as student teachers in their different universities. However, when they were deployed to their new school, the respondents thought they were going to be inducted to bridge the gap between their university environment and reality in the full-time classroom. Only two participants were fortunate to be inducted even though the whole group knew the importance of mentoring and issues on which they mostly needed help as novice science teachers. To make clear the findings made by the researcher, Figure 5.2 shows verbatim quotations that the respondents made in support of the above findings.

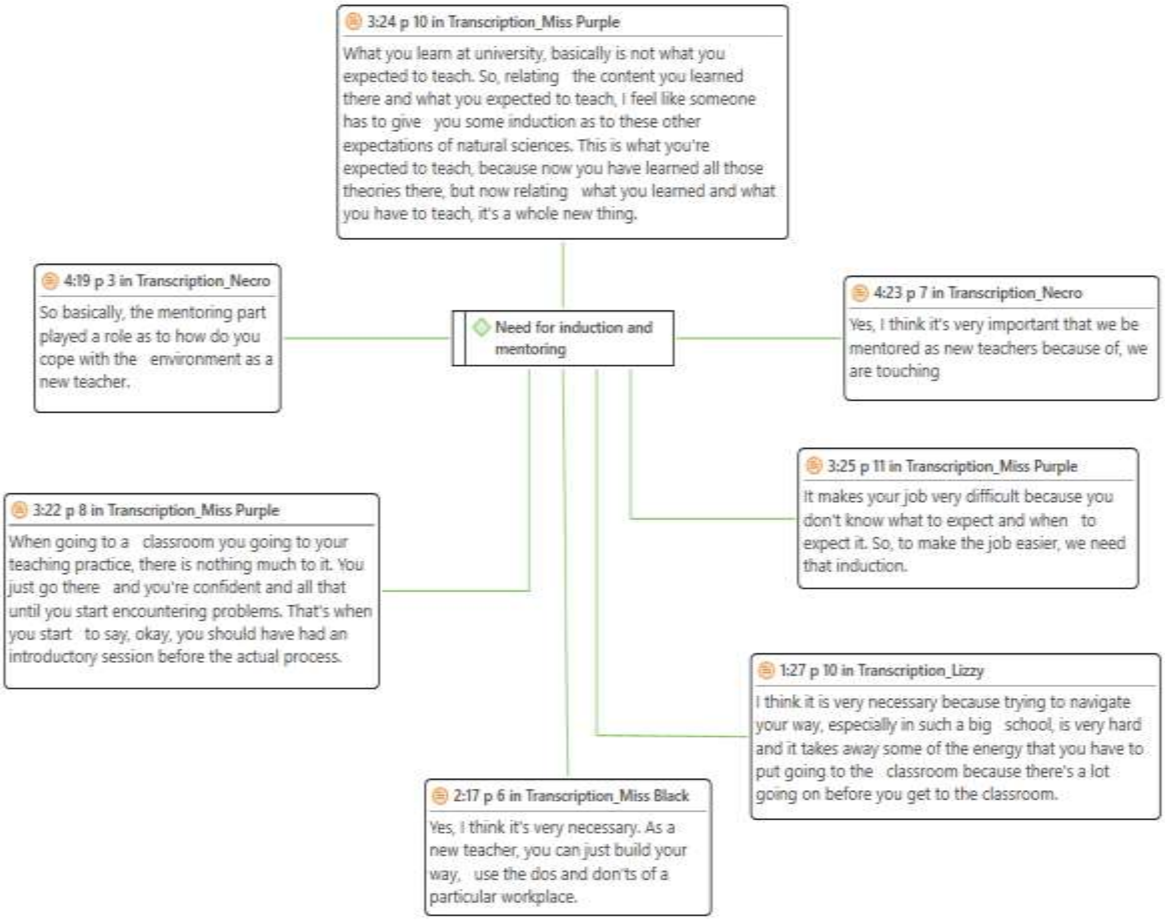


Figure 5.2: Verbatim transcriptions on code group 1

It can be noted from the in vivo quotations that novice teachers expected some form of I&M that they unfortunately could not experience as they were deployed to serve as permanent teachers. Findings in this study resonate with those of Badrudin (2022) who found out that novice teachers attach value to I&M programmes as necessary tool to ease their anxiety and enable the transition from student teacher to professional educator with less challenges or support to deal with those challenges.

The network for code group 3 revealed that the quality of mentors and lack of resources were critical contributing factors to the poor quality of I&M in under-resourced schools. Figure 5.3 below displays quotations of what respondents said about the quality of mentors in under-resourced schools.

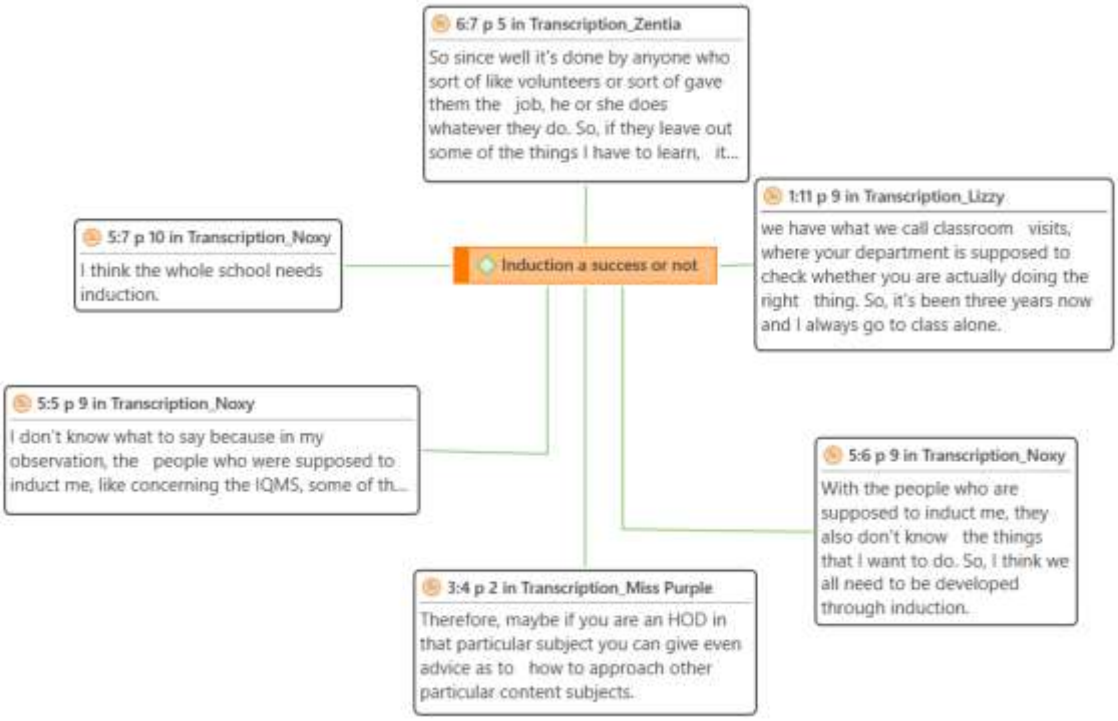


Figure 5.3: Ad hoc network on respondents' comments on quality of mentors

As shown verbatim, this study found that some mentors do not understand what they are expected to do and actually need mentoring themselves. Zentia argued that since mentors do so on voluntary grounds, they choose what they want and leave out pertinent and possibly critical issues on which novice science teachers require assistance. Dyosini (2022) says mentorship opportunities should be available to beginner teachers so that they have a mentor from whom they can learn and lean on for professional and emotional support related to their teaching duties. The researcher questions what novice science teachers should do given the scenario where mentor teachers are as demonstrated in the ad hoc network. Regarding the lack of resources, the findings in this study somewhat resonate with Badrudin (2022) who points out that the practice of mentoring in schools differ based on factors such as context, finances and resources, hence this causes the practice of mentoring not to follow any formal standard.

The ad hoc network in Figure 5.3 reflected findings pertaining to novice science teacher satisfaction levels based on responses from the two mentored participants. This study uncovered that the two participants were not satisfied with the I&M programmes due to several associated factors such ineffective mentoring methods, duration of mentoring lack of resources and poor quality of mentors. This led to their core needs not being met hence their initiative for self-professional development.

The network for code group 5 displays some gloomy findings for this study based on novice teacher attrition. Despite only one participant stating that she knew of one novice science teacher who quit teaching because she needed more mentoring, the rest of the participants answered that they were not aware of such novice teachers. However, this study uncovered that the participants themselves demonstrated absolute desire to quit science teaching and move to greener pastures. Here are some few verbatim quotations in Figure 5.4 to support this finding:

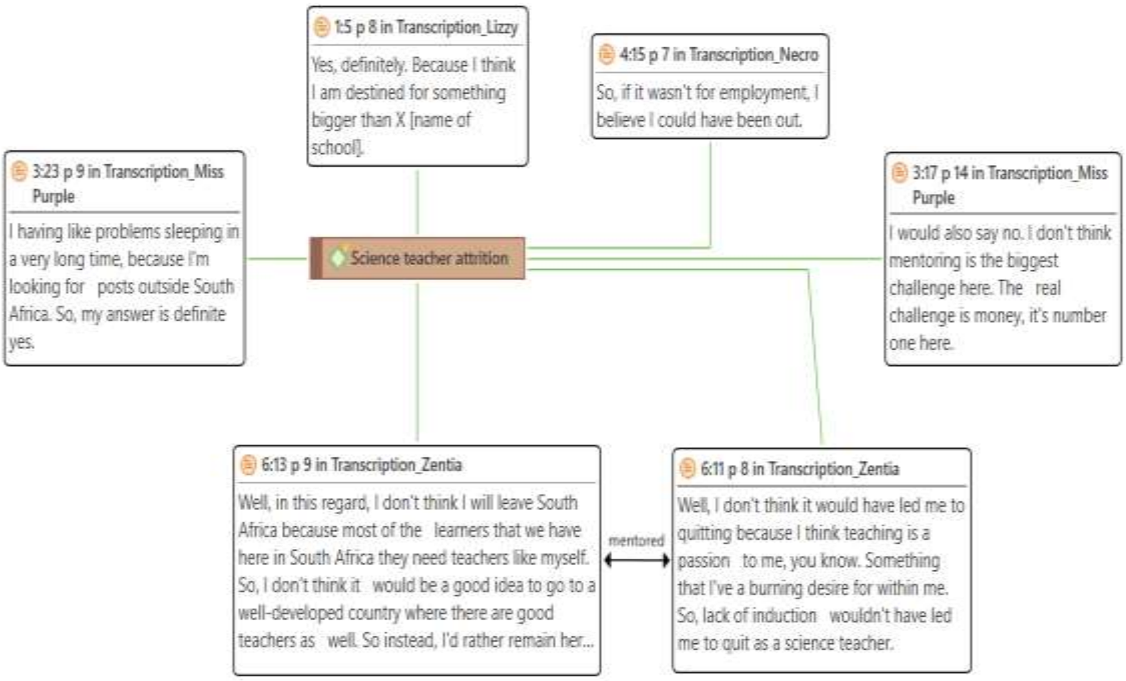


Figure 5.4: Ad hoc network depicting desire to quit teaching

Figure 5.4 portrays that three of the participants were willing to quit teaching. Miss Purple even raised the issue of salaries as a major contributing factor to novice teacher attrition rather than I&M. However, this study found out two participants who were not prepared to quit teaching on grounds of fearing for life out there and some dedicated call of duty to serve learners in South Africa.

On the role of the DBE in the I&M of novice teachers, this study found that the department does not have the necessary policies in place to support the implementation of I&M programmes in schools. The district office somewhat supports all novice teachers in one place and as Lizzy reported: “They just tell you something and let you go”. This assertion means there is no quality in what the researcher termed the one size fits-all approach. The poor quality of support by the DBE on I&M programmes in terms of policy and implementation may have contributed to the failure of the said programmes. Similar findings were made in research by Dyosini (2017) who claims that there is no policy that governs the implementation of induction and mentorship programmes by the South African Department of Basic Education (DBE) for beginner teachers. Having made similar findings, Badrudin (2022) advised that revisions need to be done by the Department of Education in implementing a compulsory and formal mentoring programme for all schools. The researcher herein suggests that this time for someone to offer a tried and tested I&M model for adoption and implementation by the DBE in order to ease challenges faced, and reduce the desire to quit teaching by unmentored novice teachers in South Africa.

Interesting findings were made on the introduction of blended mentoring as a strategy to enhance I&M programmes in South Africa. This study unveiled that participants understand hybrid mentoring, agreed on the need for introducing it and some of them demonstrated that they were experiencing it at the time of this study. It was also uncovered that participants understand the merits and demerits of blended mentoring if it is done in isolation. Figure 5.5 below shows participants’ reactions:

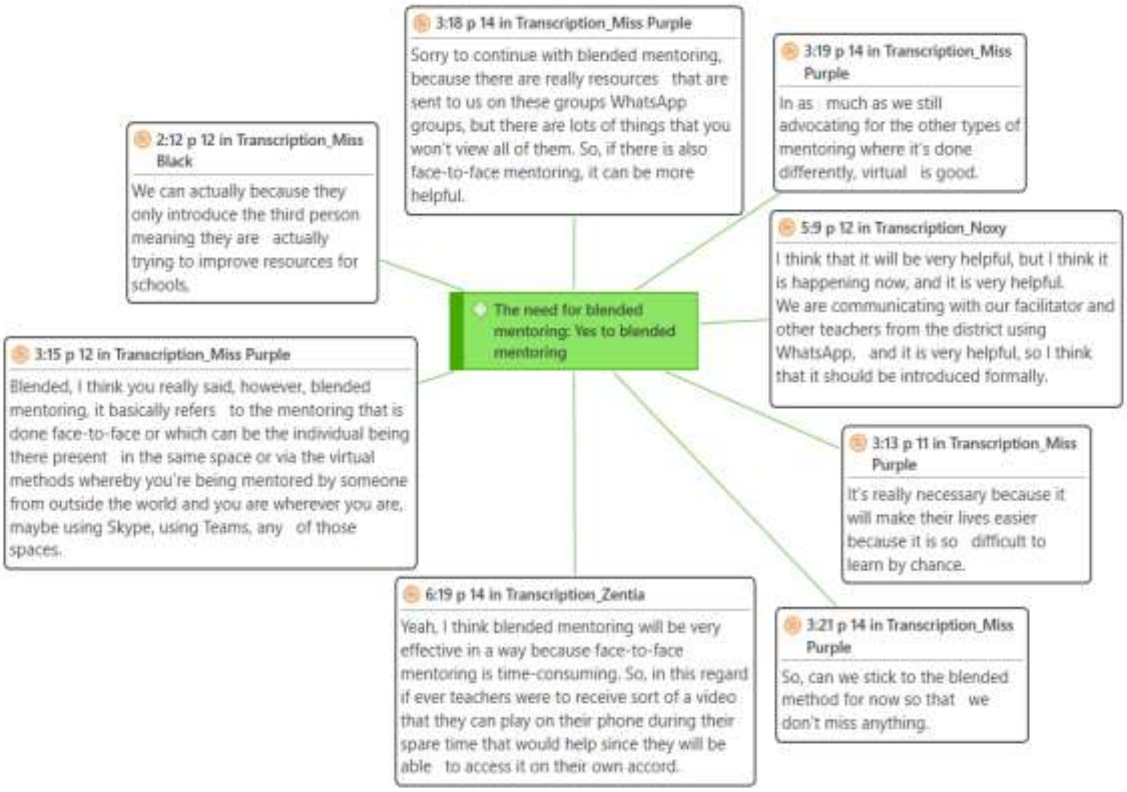


Figure 5.5: Ad hoc network on participants' reactions on blended mentoring

The ad hoc network above reveals positive reactions made by respondents on blended mentoring. However, when it came to readiness to implement blended mentoring in under-resourced schools, this study heard from participants that the country is not ready as shown below.

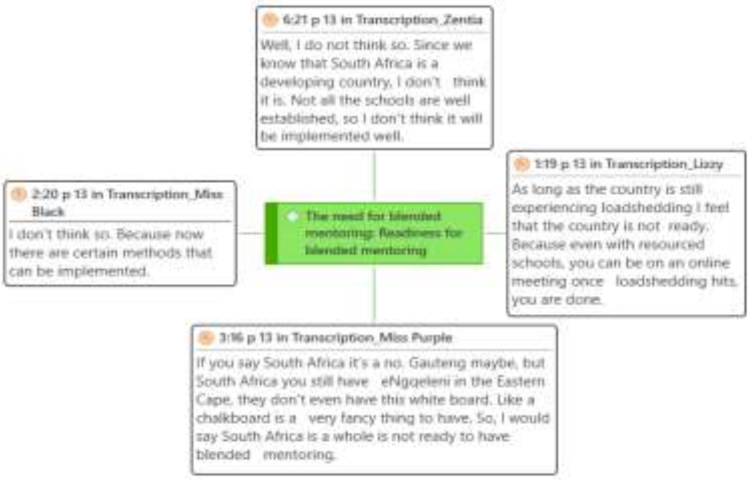


Figure 5.6: Ad hoc network on participants' responses on readiness to implement blended mentoring

Figure 5.6 clarifies that respondents suggested that under-resourced schools in South Africa are not ready to implement blended mentoring. Issues of lack of resources to include infrastructure and equipment, loadshedding and general unpreparedness were raised by the participants. Miss Purple suggested that other well-up provinces such as Gauteng can implement blended mentoring. Similarly, recent research by Dyosini (2022) established that novice teachers who are teaching in different types of schools with varied resources or the lack thereof are disadvantaged from gaining access to quality professional development (Gallo, 2020). The researcher believes as long as novice science teachers can access WhatsApp and other social media platforms, then blended mentoring can be tried. In the next section, the researcher presents findings in the form of themes that emerged from the data during further analysis processes.

From codes to refined categories

In line with the iterative data analysis process, the researcher refined the codes to generate categories. A total of eight categories were found as set out in Table 4.21 in Chapter 4. The categories were generated from the 5 code groups with the research questions and research objectives in mind. Overarching themes started to emerge from the data.

Themes and sub-themes found from qualitative data

As alluded to in Chapter 4, the researcher followed a thematic and inductive approach in the analysis of qualitative data. After generating eight categories from the code groups, the researcher used ATLAS.ti to generate emerging overarching themes and sub-themes that emerged from the categories and the data. Using the ad hoc thematic network (Figure 4.19) that was constructed and presented in Chapter 4, the researcher broke down the ad hoc network for this discussion, explanations and interpretation, and to also facilitate easy understanding by the reader. The researcher numbered the overarching themes from 1-5 just for order and no significance whatsoever should be attached to the numbering.

Table 5.1: Findings – overarching theme 1 and sub-themes

Theme 1: Poor induction and mentoring experiences		
Sub-theme: Lack of resources	**Sub-theme:** Methods and mentor quality	**Sub-theme:** Duration of mentoring

As shown in Table 5.1, the researcher uncovered that respondents had poor I&M experiences in their under-resourced school. Despite two of the respondents having had some form of induction experiences, their satisfaction levels were low. The other four participants were from the unmentored group. The sub-themes that arose during the group discussion verified the likely causes of poor I&M in under-resourced schools. The researcher found out that lack of resources, I&M strategies, mentor quality and duration of the I&M programme were factors that played a major role in the success or failure of I&M practices in under-resourced schools.

Table 5.2: Findings - overarching theme 2 and sub-themes

Theme 2: Department of Basic Education (DBE) support needed	
Sub-theme: Policy changes	**Sub-theme:** District office involvement

This study found out that the DBE is not adequately supporting the I&M practices in schools in South Africa. In fact, there is no formal policy that makes I&M mandatory or compulsory as mentioned in discussions earlier in the previous section. The district office involvement was found to be inadequate when it comes to I&M in under-resourced schools.

Table 5.3: Findings – overarching theme 3 and sub-themes

Theme 3: Envisaged mentoring programmes	
Sub-theme: Understanding I&M programmes	**Sub-theme:** Need for I&M programmes

This finding demonstrated that participants are aware of what they expect in I&M programmes, hence rich programmes must be developed and implemented. What the researcher found is that novice science teachers were ready to be mentored but the system could not avail that opportunity to them. Previous research also found that there is a gap when it comes to the transition of novice teachers to become professional teachers (Badrudin, 2022). It is time that the gap should be closed rather than continue to have recommendations that are never put into practice.

Table 5.4: Findings – overarching theme 4 and sub-themes

Theme 4: Science teacher attrition		
Sub-theme: DBE and district involvement	**Sub-theme:** Lack of resources	**Sub-theme:** Poor I&M experiences

The issue of science teacher attrition came out as a theme during the focus group discussion. Despite only one participant confirming that she knew of only one person who quit teaching because "she needed more mentoring", the majority of participants were not aware of any one who quit the teaching profession due to lack of I&M. The DBE and district involvement, lack of resources and poor I&M experiences surfaced as major factors leading to teacher attrition. One participant added that the issue of low salaries in the teaching profession is another major cause of attrition.

Table 5.5: Findings – overarching theme 5 and sub-themes

Theme 5: Blended mentoring: the need			
Sub-theme: Blended mentoring experiences	**Sub-theme:** Mentoring to move with the times	**Sub-theme:** Readiness for blended mentoring	**Sub-theme:** Virtual mentoring merits and demerits if done in isolation

This findings show that some participants were already benefitting from blended mentoring as they were in WhatsApp and other social media groups where they collaborate in communities of practice. Since the advent of Covid-19, most teachers have shown interest in virtual collaboration. Interestingly, this study found that participants expected I&M programmes to move with the times.

Conclusion

Several findings were made from qualitative data obtained through a focus group discussion that was organised, managed and analysed using ATLAS.ti v23.3 and presented by the researcher in the foregoing chapter. These findings emanated from the data and were demonstrated in form of codes, categories, sub-themes and themes that were discussed and explained in this section. The researcher found interesting connections in quantitative and qualitative findings that are discussed, explained and interpreted in section 5.5 before drawing conclusions in this study.

5.6 Triangulation of quantitative and qualitative findings

In this mixed methods study, a convergent parallel design was implemented. Quantitative data was obtained through a web-based survey and respondents were based in four provinces in South Africa, namely the Eastern Cape, Gauteng, Limpopo and Mpumalanga provinces. Qualitative data was obtained through a focus group discussion with novice science teachers based in the Ekurhuleni South District in the Gauteng Province.

The aim of selecting MMR in this study was to corroborate and validate findings by directly comparing the quantitative statistical results and qualitative findings in a triangulation to increase the overall robustness, validity and credibility of this study. In line with the research objectives and the convergent parallel design, data was collected separately but concurrently, analysed and presented separately. In this section, the researcher triangulated the findings, that is, compared the findings for similarities and differences (corroboration and validation) before conclusions were drawn. At the point of interface, the researcher found that there were more similarities than differences in quantitative and qualitative findings.

5.6.1 Similarities in quantitative and qualitative findings

Interestingly, the researcher found several similarities between quantitative and qualitative findings in this study. To summarise these similarities, the researcher related quantitative findings to the five themes and sub-themes generated in qualitative findings in Table 5.6 as follows:

Table 5.6: Similarities of quantitative and qualitative findings

Qualitative findings	Sub-themes	Quantitative findings
Theme 1: Poor induction and mentoring experiences	Lack of resources	√
	Methods and mentor quality	
	Duration of mentoring	
Theme 2: Department of Basic Education (DBE) support needed	Policy changes	√
	District involvement	
Theme 3: Envisaged mentoring programmes	Understanding I&M programmes	√
	Need for I&M programmes	
Theme 4: Science teacher attrition	DBE and district involvement	√
	Poor I&M experiences	
	Lack of resources	
Theme 5: Blended mentoring: the Need	Blended mentoring experiences	√
	Mentoring to move with the times	
	Virtual mentoring merits and demerits if done in isolation	

Legend: √ [similar to]

As illustrated in Table 5.6, one of the major similarities which served as a response to research question 1 was that the majority of respondents in both the quantitative and qualitative groups never experienced any form of I&M. This means there were zero I&M programmes running in the under-resourced schools in which they were based. For the minority respondents who were lucky to experience some form of I&M, both the quantitative and qualitative respondents demonstrated low or close to zero satisfaction levels with the I&M experiences. Similarly, both quantitative and qualitative respondents associated the same factors such as lack of resources, poor mentor quality, inconsistent and no mentor-mentee meetings as well as short duration of programmes to their poor I&M experiences.

With regards to theme 2, both quantitative and qualitative findings were similar in that respondents raised issues of lack of support by the DBE and its district offices in I&M programmes. Issues of the need for policy change and quality involvement by the district offices were equally raised. Both quantitative and qualitative findings were related in theme 3 in that participants have a vision for better quality I&M programmes. Respondents reflected a very clear understanding of I&M programmes and demonstrated very vividly that they are ready to attend these programmes. to the researcher, this meant the respondents are clear of the benefits that they can derive from quality I&M programmes, hence their call for strong and clear policy intervention by the DBE and education districts.

Similar findings were also made in terms of theme 4. It was clearly articulated in both quantitative and qualitative findings that novice science teacher attrition is a reality and the rate was high especially with the global village opening up vast opportunities for degreed qualified Science, Technology, Engineering and Mathematics (STEM) teachers. Both groups of participants agreed that novice science teachers were leaving South Africa for other countries and for other professions. Akin to qualitative findings, quantitative findings attributed the novice science teacher attrition to lack of support by the DBE and its districts, poor quality I&M programmes and lack of resources. Due to poor quality of I&M programmes, this study found out that most respondents were still in a state of confusion on whether they were doing the correct things in their science classrooms or not. Such ‘swim” or “sink” status quo can result in novice science teacher stress, lack of confidence and eventual burnout, hence attrition.

The final similarity that the researcher identified relates to theme 5 of qualitative findings where all respondents agreed that blended mentoring can be introduced to enhance I&M practices in under-resourced schools in South Africa. Quantitative findings equally proclaim the same need for blended mentoring. In both qualitative and quantitative findings, respondents demonstrated that with the advent of Covid-19, some of the them were connected to other teachers in different areas via WhatsApp, Telegram, Facebook and other social media platforms where they shared information about science teaching. In other words, they experienced and some were still experiencing blended mentoring. Respondents in both groups also demonstrated full knowledge of virtual (in isolation) and hybrid mentoring and their merits and demerits, hence the call to have blended mentoring introduced formally as it is being done informally since Covid-19 lockdowns.

5.6.2 Differences between quantitative and qualitative findings

In further comparison of quantitative and qualitative findings, the researcher found only a single difference between the two. In quantitative findings, respondents claim that blended mentoring can be introduced in under-resourced schools as soon as possible. However, qualitative findings reveal that South Africa is not fully ready for blended mentoring at a large scale. Respondents in the qualitative group argued that with problems such as loadshedding and lack of resources in most under-resourced schools in South Africa, blended mentoring can be piloted in "developed" provinces such as Gauteng while redistribution of resources is done in other previously disadvantaged schools. This was a reflective thought to the researcher who remained with the question "Are novice teachers in provinces that were considered to be under-developed not able to access social media or emails?"

It can be noted that there were several similarities and only one difference between quantitative and qualitative findings in this study. In terms of this validation, it can be concluded that the findings were in more ways than one, the same, hence the results can be generalised and applicable to similar contexts. As previously stated, the aim of employing MMR in this study was to corroborate and validate findings by directly comparing the quantitative statistical results and qualitative findings in a triangulation which has been successfully done in this section.

5.7 Summary

From the quantitative data obtained and presented mainly in form of custom tables in this section, it can be noted that, generally, novice science teachers had low satisfaction levels with the quality of mentoring that they experienced, if any. The researcher found that a majority of respondents were prepared to either move away from teaching science for other subjects or completely quit the teaching profession. Mentoring remained a core expectation of every novice science teacher, hence their support on the introduction of blended mentoring to enhance mentoring programmes especially in under-resourced schools.

Since the two research methods made the same findings, qualitative data also showed that novice science teachers who experienced some form of I&M programmes had low satisfaction levels. The quality of mentoring that they experienced remains questionable as it never satisfied the expectations of novice science teachers.

CHAPTER 6:

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter comprises conclusions that the researcher arrived at in this study. This is followed by some stakeholder-by-stakeholder recommendations that the researcher considers useful to enhance future I&M of novice science teachers specifically, and by default, all novice teachers in South Africa. The researcher concludes this chapter by suggesting grey areas that can serve as topics for further research in the broad area of I&M of novice teachers.

6.2 Conclusions of the study

In concluding this study, the collective effort of literature reviewed, quantitative and qualitative data that was collected, analysed, presented and findings corroborated resulted in a unique, robust, valid and credible study. The purpose of this study was to explore a blended mentoring model as an alternative strategy to enhance I&M programmes for novice science teachers in South Africa. A mixed methods approach was used to research this broad topic with the view to explore novice science teacher I&M experiences during their initial years of teaching in under-resourced schools. Unlike any previous research done on mentoring of novice teachers in South Africa, this study was solution-based as it went on to establish why incorporating blended mentoring can serve as an intervention strategy to enhance mentoring programmes for novice science teachers in under-resourced schools in South Africa.

This study reached five conclusions emanating from the mixed methods approach where quantitative and qualitative data collected, analysed, presented and findings corroborated as explained in the preceding chapters. The five conclusions reached are anchored by, and stem from the triangulation of findings used in this study. Firstly, this study concludes that there is patchy and uncoordinated provision of I&M programmes for novice science teachers in different under-resourced schools, districts and provinces in South Africa. This first conclusion for this study falls in line with what other previous researchers found in the South African context where, generally, novice teachers are left to “sink” or “swim” in their classrooms. Even Mr. Gerrit Coetzee, the director for Initial Teacher Education with the DBE recently agreed that teacher induction in South Africa has happened in different ways and in different schools, but research indicates that it was highly uncoordinated (VVOB, 2020). Positively, some of the novice science teachers successfully managed to swim and such teachers have individually developed survival skills to remain in the system despite the negative experiences suffered due to lack of support. However, some find themselves unable to cope, which results in high teacher attrition rates. For the few who were fortunate to receive some form of I&M experiences, this study found that the I&M programmes did not satisfy the novice science teachers’ expectations, hence their low satisfaction levels, poor confidence in science classrooms and consequential high attrition rate.

The second conclusion for this study is that the I&M policy position of the DBE is still weak and unclear. The DBE (2019) concedes that the policy context of teacher induction is complex, with multiple government departments, statutory bodies and stakeholder groups involved, and many pieces of legislation. While the DBE (2019) claims that there were several policy changes made dating as far back as 2005, and the recent report stating that “every new teacher should be required to participate in a formal induction and/or mentoring programme for at least two years”, the document does not stipulate any clear policy change. This policy deficit results in confusion by stakeholders on I&M programmes in under-resourced schools. Previous research also identified the issue of policy deficit by the DBE and this study further unveiled the inadequacy of support by district officials who are expected to be the change agents for DBE policy implementation, monitoring and control. There is need for the DBE and district officials to work collaboratively with all other interested stakeholders in education to ensure that appropriate policy changes that necessitate the formal incorporation of compulsory blended mentoring in schools is introduced. All district offices must monitor and control the implementation of I&M programmes in schools with principals and HODs ensuring proper implementation at grassroots level.

The third conclusion that was reached in this study is that novice science teachers are aware of I&M, hence have high expectations to be inducted and mentored when they are deployed in their new under-resourced schools. In other words, novice science teachers have envisaged I&M programmes emanating from their university or college WIL experiences, but they find themselves in schools that either do not practice any form of I&M or does so unsatisfactorily. This conclusion alludes to the willingness and readiness of novice science teachers to be assisted through quality I&M practices for them to transition smoothly from novice to quality professional science teachers. Since this study exposed that there is a gap between the theory that novice science teachers learn in university (despite WIL) and the reality in the science classrooms, the involvement of universities and colleges in supporting I&M programmes in bridging the said gap for their newly qualified teachers is of utmost importance.

The fourth conclusion emanating from this study is that the high science teacher attrition rate in South Africa cannot be solely attributed to the lack of I&M programmes. This study found out that there are several factors that contribute to the high attrition rate with poor salaries and working conditions being the most likely factors. Moreso, most experienced teachers have lost interest in serving as mentors for many reasons. Some of the reasons, among many others, could be the lack of training of mentors, busy schedules with their own class(es) and lack of strong DBE policy or documentation on mentoring of novice science teachers. Even though investigating factors leading to the high attrition rate of science teachers in South Africa was not at the core of this study, it suffices to mention these few in support of the fourth conclusion. Further research is therefore necessary if one is interested to understand what really causes teacher attrition in the country.

Finally, this study concludes that blended mentoring of science teachers is an important facet in novice science teacher professional development. Hybrid mentoring is a useful strategy not only for enhancing the quality of science teaching, but can serve as a rubber-stopper to reduce science teacher attrition in

South Africa. It has been noted that with the advent of Covid-19, teachers experienced some form of blended mentoring through WhatsApp, Telegram, Facebook groups and other social media platforms where they shared information with their colleagues, HODs and district officials. This shows that it is possible for educational technology to be fully adopted and utilised in previously disadvantaged communities in South Africa. With the same kind of motivation by all stakeholders, this study further concludes that digital transformation and technology adoption in education should be encouraged by all stakeholders and formalised to enhance I&M programmes in all under-resourced schools in South Africa.

The lack of I&M programmes in under-resourced schools creates a gap which this study sought to close by exploring if the introduction of a blended mentoring model could serve as an intervention strategy to enhance I&M programmes. It is interesting to conclude in this study that novice science teachers have demonstrated a very strong willingness to see the introduction of a formalised blended I&M model to enhance I&M programmes in South Africa. In fact, novice science teachers called for I&M programmes to move with the times, hence the need for aligning such programmes to 21st century mentoring advocated by Janasz (2004). This study attributes the novice science teachers' adaptability to 21st century I&M practices to the fact that on average, novice teachers are generally young people who are technology savvies and have access to social media platforms. Thus, this study concludes that the introduction of blended mentoring to novice science teachers is a worthwhile move to support the development of 21st century classroom skills needed for quality science teaching.

6.3 Recommendations

In this solution-driven study, the researcher has identified quite a number of practicable recommendations for consideration by several stakeholders who were identified in this study. By exploring I&M experiences of novice science teachers in under-resourced schools, this study intended to bring benefits for enjoyment by several stakeholders in education such as the DBE and district education officials, universities and other teacher-training institutions, schools, school management teams (SMTs), mentees (novice science teachers), mentors and most importantly by learners. Such benefits can only be enjoyed if all stakeholders were to consider and take the necessary bold steps to implement their specific recommendations without dilly-dallying.

DBE and district officials' recommendations

It is recommended that the DBE in consultation with its districts must ensure that appropriate policy changes that necessitate the formal incorporation of compulsory blended mentoring in schools are introduced. Since the DBE's vision is that of seeing a South Africa in which all people have access to lifelong learning, education and training opportunities, such a vision can only be realised if appropriate policies are in place to allow for cross-mentoring and all the merits of hybrid mentoring that were highlighted in this study. Despite the DBE publishing and disseminating orientation guidelines new teacher induction, guidelines for the orientation programme in October 2017 which the DBE claims are currently being implemented in schools, this study has demonstrated that I&M programmes are patchy and uncoordinated. In fact, the orientation programme is supposed to be a two-day programme but, as demonstrated in this study, was turned by the districts into a less than two-hour one-size-fits-all meeting just to welcome novice teachers, "tell them something" and bid novice teachers good luck in their teaching endeavours. This study has clearly shown that orientation programmes cannot be relied upon as proper tools to support novice science teachers who are afflicted with so many challenges in their first years of teaching.

Interestingly and in line with the findings of this study, the DBE (2019) has indicated that it envisages a comprehensive induction process composed of two distinct stages, viz: Orientation – a shorter information-sharing process of ensuring that new teachers know and have all the critical information to do their work effectively; and I&M – a year-long learning period with support for new teachers, which should include professional, emotional or social and administrative or operational support. This envisioned position is going hand-in-glove with what the researcher recommended in this study. However, a clear and strong policy position is still required to make this dream come true. Of major concern to the researcher is when this will actually materialise.

Furthermore, the mission of the DBE is to develop, maintain and support a South African school education system for the 21st century (DBE, 2020). In line with this mission, this study recommends blended mentoring as a 21st tool and expect the DBE to craft a compulsory master 21st blended mentoring model which should cover the first year of teaching to ensure quality and adequate I&M of novice teachers. Such quality will also fulfil one of the DBE values of “innovation”, where the DBE seeks to address the training needs for high-quality service with the ultimate goal to improve teacher capacity and practices. As recommended earlier, the DBE must ensure a clear and strong policy position on I&M for them to realise their dreams since they find themselves at the helm of education in South Africa.

This study further recommends that provincial and district education officials can assist with the interpretation and implementation of the master blended mentoring model that can then be customised to suit different contexts in which novice science teachers find themselves. The district officials in close cooperation with school principals and HODs can then lead, monitor, control and evaluate the compulsory implementation of I&M programmes as well as ensuring training of identified mentors. Previous research and this study have shown that the lack of resources in under-resourced schools is still evident almost three decades into post-apartheid South Africa. One can wonder if at all there are any efforts that were done to redress the situation. This study recommends that the DBE should ensure the re-distribution of resources to equip all under-resourced schools with technology-based equipment that can facilitate the introduction of blended mentoring. It should also be the prerogative of the DBE, provincial and its district education officials to ensure the appointment and training of mentors and paying of incentives to mentors if I&M programmes were to be taken seriously in South Africa.

University and college recommendations

Since this study unearthed that there is a huge gap between university or college teacher-training and reality in the science classroom, this study recommends that teacher-training institutions should contribute towards bridging the said gap. It is recommended that universities and colleges should investigate, develop and pilot hybrid mentoring models that can be used to support student teachers during teaching practice. Upon graduation and joining the mainstream teaching profession by their former students, the alumni wing of universities and colleges in conjunction with other stakeholders can provide further support for their former students settle and transition into fully prepared science teachers who can forever enjoy teaching science in their respective schools.

Recommendations for novice science teachers

This researcher recommends that above all, novice science teachers should never allow themselves to "sink" or suffer from depression and potential exit from the education system in this day and age where social media has turned the world into a global village. While the researcher recommended for the formal introduction of blended mentoring by the responsible authorities, novice science teachers who find themselves in precarious situations are encouraged to turn to informal blended mentoring opportunities that are available to them this study found that some participants had to organise their own mentors. Though utmost care and precautions have to be taken especially when selecting and linking with external online mentors, informal hybrid mentoring is the way to go in the meantime.

6.4 Suggestions for further research

Despite this study being broad, solution-based and successfully answering the two research questions that the researcher asked, this very study has created more new questions that can be avenues for further research.

This study found out that the DBE lacks a strong and clear policy stance on I&M in schools. To the researcher, the issue of policy-making on I&M by the DBE is an interesting nut to crack. The document "Towards a South African teacher induction framework" by the DBE (2019) raises a lot of questions on policy-making in the Department of Education (DoE). To the researcher, it sounds as if there is a raging debate on whether I&M programmes should be included in the pre-service training or as an initial post-qualification experience, something that cannot be expected in this year and age when the DBE (2019) claims that the importance of teacher induction in South Africa has been officially recognised at the national level since 2005. The splitting of the DoE in 2009 into two national departments, the DBE and the Department of Higher Education and Training (DHET) resulted in a teacher development and implementation policy split across these two departments. While the DBE is expected to deal with all schools from Grade R to Grade 12, including adult literacy programmes, and is responsible for ensuring an adequate supply of quality teachers, whereas the DHET is responsible for post-school education and training in universities, colleges and adult education centres, the researcher believes the split created a policy gap that should be uncovered through research. As mentioned earlier, the DBE (2019) admitted that the policy context of teacher induction is complex, with multiple government departments, statutory bodies and stakeholder groups involved. Apart from the DBE and DHET, there are other several stakeholders such as South Africa Council of Educators (SACE), the Council on Higher Education (CHE) and the Education Labour Relations Council (ELRC) whose symbiotic relationship has to be unveiled to correct uncover and mend the policy gap in I&M of novice teachers in South Africa.

In the course of this study, the researcher discovered from the DBE website that the DBE promotes the enrolment by principals, HODs and senior teachers for the Advanced Certificate in Education (ACE) and the Advanced Diploma in Education (ADE) qualifications. In these qualifications, the researcher discovered that there is a module “Mentor school managers and manage mentoring programmes in schools” which tackles I&M in schools. Research questions that arose in the researcher’s mind that require further investigation include finding out if school principals were interested in the ACE and ADE programmes in South Africa. If so, one can further investigate if there are any tangible improvements in novice teacher I&M programmes in schools where principals who completed ACE and ADE qualifications were based. It can also be interesting to find out whether these ACE and ADE programmes are regarded as compulsory promotion requirements for school principals in South Africa.

The issues around the re-distribution of resources in schools in South Africa's under-resourced schools is another grey area that can be further researched. As alluded to in this study, it is almost three decades of democracy in South Africa and people still talk of under-resourced schools. Why these resource inequalities were never redressed to date can be a nice can of worms to open in the research realm. The researcher found the following excerpt from the Government Gazette (2013) on regulations relating to minimum uniform norms and standards for public school infrastructure:

Electronic connectivity at a school

16. (1) All schools must have some form of wired or wireless connectivity for purposes of communication, which must be maintained in good working order.

(2) The following communication facilities must be provided:

(a) Telephone facilities;

(b) fax facilities;

(c) Internet facilities; and

(d) an intercom or public address system.

Figure 6.1: South African Schools Act (84/1996)

[Courtesy https://www.education.gov.za]

Figure 6.1 shows that by now, all public schools must have some form of electronic connectivity and under (c), it clearly articulates that internet connectivity should be the found in every public school in South Africa. The fact that what is detailed in the Gazette is still a dream-to-come true warrants research.

Several issues relating to I&M such as mentor quality, mentor allocation and duration of mentor-mentee meetings were identified as factors that negatively affected the quality of I&M programmes in under-resourced schools. This raises further questions such as the willingness of experienced teachers to become mentors as the success or failure of I&M programmes can be attributed to mentor quality. One may be interested to investigate the challenges faced by mentors in mentor-mentee relationships and how these challenges can be addressed to increase the confidence levels of mentors. For instance, recently, novice teachers from teacher-training institutions graduate with degrees to teach in various phases whereas mentors graduated with certificates or diplomas but have considerable years of teaching experience, hence they know the ins and outs of the science classroom. Mentor-mentee relationships in such scenarios are therefore interesting areas for further research.

Last but not least, it can be interesting to investigate the factors that cause the high attrition rate of novice science teachers in South Africa. This study concluded that even though the lack of I&M programmes may contribute to the burnout and exit of novice science teachers, the actual cause of attrition still needs to be investigated. Such an investigation will assist the authorities to curb the high attrition rate for the benefit of the South African education system.

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APPENDIX A

SURVEY QUESTIONNAIRE

INTRODUCTION, AND IMPORTANT INFORMATION

Congratulations for being selected to participate in this survey! You have been selected because you are a novice science teacher with less than five (5) years of teaching experience. This study seeks to explore how blended mentoring can be used in the induction and professional support for novice science teachers. The findings of this survey will be analysed and compared with data found through the focus group before being interpreted and reported from the participating group perspective, and not an individual perspective. As such, the findings will shed light on the effectiveness of current induction and support processes for novice science teachers. Possible recommendations will be done to all relevant stakeholders to implement best mentoring practices in South Africa's education system with the view to lower the attrition rate of newly qualified science teachers who tend to have a greener market elsewhere.

Please note that your participation in this study is entirely voluntary and you will not receive any payment or incentive. If you decide to participate in this survey, you will be required to give your consent. You are at liberty to withdraw from participating in this study for any reason, and without prejudice. Participation will be anonymous and confidential. No respondent will be required to supply information that will identify them personally or put the participant at risk. More so, your participation will not cause harm to your employment or employer-employee relationships. This is because all applicable approvals will be sought from all relevant stakeholders. All information given will be treated as strictly confidential and will only be reported only when collated. The collection and processing of data will be lawfully guided by the Protection to Personal Information Act (POPI Act No 4 of 2013). Data will be password protected and will be stored for 3-5 years for academic purposes, after which it will be permanently deleted.

This study is categorised as low risk and involves participating in an online survey. Therefore, it will not cause any physical, psychological or social harm whatsoever. On agreement to participate in this survey, you will receive a link to the online questionnaire that forms part of this web-based survey. The survey may take between 20-30 minutes only to complete but this might inconvenience your time. There are **FOUR** sections that you are requested to complete in this survey.

SECTION 1: DEMOGRAPHIC QUESTIONS

Please answer the questions below by placing an X or a √ in the appropriate box.

1. What is your gender?

Male	1
Female	2
Binary	3
Prefer not to say	4
Other, please specify………………………………	5

2. In which age group are you?

Below 20 years	1
21-30 years	2
31-40 years	3
41-50 years	4
50+ years	5

3. Years' experience in teaching

Less than 1 year	1
2 years	2
3 years	3
4 years	4
5 years	5
6+ years	6

4. Which subjects do you teach?

Natural Science	1
Life Science	2
Physical Science	3
Agricultural Sciences	4
Other, please specify……………………………	6

5. Phase(s) taught:

Foundation phase	1
Intermediate phase	2
Senior phase	3
FET phase	4
Other, please specify…………………………	5

6. Type of school:

Public/Government	1
Private/Independent	2
Model C	3
Alternative learning (Online)	4
Home school	5
International School	6
Other, please specify……………………………	7

7. In which province are you based?

Eastern Cape	1
Gauteng	2
Limpopo	3
Mpumalanga	4
All provinces (only if Online school)	5

8. If you are not a novice science teacher, you can proceed but your contributions will not be used to determine the conclusion and recommendations.

I am a novice science teacher and my contributions can be used to draw conclusions	1
I am not a novice science teacher and I am enriching this study	2

SECTION 2: INDUCTION EXPERIENCES

Induction refers to a programme of professional development and support for beginning teachers. Teacher induction programmes consist of various components and activities and often include mentoring and professional development workshops.

Please answer the following questions by either filling the square by placing an X or a √ on the response which most clearly represents your answer or by writing your response in the lines provided.

9. Does/Did your school, district or province provide(d) a teacher induction programme for beginning teachers?

Yes	1
No	2
Not sure	3
Sometimes	4

10. If yes to 1 above, state the duration of the induction programme.

Specify here …………………………………………………………………………………

11. If there is/was any induction programme, what is/was its nature?

Face-to-face	1
Online/virtual	2
Blended/ hybrid (both face-to-face and online)	3
No induction programmes	4
Other, specify ………………………………………	5

12. What is/was the purpose of the induction programme, if any? Select **ALL** appropriate responses.

		No	Yes
Q12.1	General support/guidance for new teachers	0	1
Q12.2	Orientation to the school/district/province	0	1
Q12.3	Promote high standards in teaching Science	0	1
Q12.4	Promote practical Science teaching	0	1
Q12.5	Other, specify: ……………………………………	0	1

13. Are/Were you personally inducted into your new school during the first year of your teaching?

Yes, I am/ I was inducted	1
No, I crushed in	2
Somewhat inducted	3

14. If yes to 14 above, does/did the induction programme prepare(d) you fully to transition smoothly into your daily teaching experiences?

Yes	1
Not at all	2
Somewhat helpful	3
Other, please specify:………………………………	4

15. On the following Likert scale of 1-5 with 1 Very Dissatisfied and 5 Very Satisfied, can you rate your induction experiences in the areas stated:

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied	Not applicable
Q15.1	Understanding the school's culture, policies, and practices	1	2	3	4	5	6
Q15.2	Completing paperwork or administrative work	1	2	3	4	5	6
Q15.3	Working with other teachers to plan instruction	1	2	3	4	5	6
Q15.4	Working with other school staff, such as principal, counsellors, disability specialist	1	2	3	4	5	6
Q15.5	Communicating with parents	1	2	3	4	5	6
Q15.6	Teaching Science as a subject	1	2	3	4	5	6
Q15.7	Motivating students	1	2	3	4	5	6
Q15.8	Using student assessments to inform your teaching	1	2	3	4	5	6
Q15.9	Teaching learners with varying levels of achievement/ability	1	2	3	4	5	6
Q15.10	Teaching students of varying ethnic/racial and socioeconomic backgrounds	1	2	3	4	5	6
Q15.11	Reviewing and assessing student work	1	2	3	4	5	6

Q15.12	Managing classroom activities, transitions, and routines	1	2	3	4	5	6
Q15.13	Managing student discipline and behaviour	1	2	3	4	5	6
Q15.14	Using multiple instructional strategies/techniques to teach Science	1	2	3	4	5	6
Q15.15	Reflecting on your instructional practices	1	2	3	4	5	6
Q15.16	Selecting or adapting Science curriculum materials	1	2	3	4	5	6
Q15.17	Accessing school, district and community Science resources	1	2	3	4	5	6
Q15.18	Teaching Science towards national, provincial or district standards	1	2	3	4	5	6

SECTION 3: MENTORING AND PROFESSIONAL SUPPORT EXPERIENCES

Professional development activities are those in which teachers participate to enhance their pedagogical and content knowledge in a variety of areas, such as teaching strategies, education standards, student assessment, applications of technology to instruction, and classroom management. Professional development activities include in-service workshops, study groups, seminars and continuing education courses and can include activities other than school or district offerings.

16. Do/did you have/had any mentor(s)?

Yes, only 1	1
Yes, more than 1	2
No, I do not have, I never had one	3
No, but one is being organised	4

17. Overall, how satisfied were you with the mentoring with the induction/ mentoring programme/event?

Very satisfied	1
Satisfied	2

Neither satisfied nor dissatisfied	3
Dissatisfied	4
Very dissatisfied	5
Not applicable	6

18. If you have/had a mentor(s), please provide the following information about your mentor(s):

Full-time/experienced teacher in your school	1
Part-time teacher in your school	2
Full-time mentor from your university/college	3
Experienced teacher from another school	4
HOD in your subject (Science)	5
District office-based mentor	6
Provincial office-based mentor	7
Other, please specify: ………………………………………………	8

19. Was/Were this/these mentor(s) assigned to you?

Yes	1
No, they are/were self-imposed	2
I organised for myself	3
I don’t have a mentor/ I never had a mentor	4

20. Is/Was there any set time when you and your mentor(s) meet/met?

Yes	1

No	2
Sometimes	3

21. When do/did these meetings usually take place?

Before school	1
After school	2
During lunch	3
During planning period	4
Other, please specify: ……………………………	5

22. How often do/did these meetings usually occur? Please select **ALL** the applicable.

		No	Yes
Q22.1	Daily	0	1
Q22.2	2-4 times per week	0	1
Q22.3	Once per week	0	1
Q22.4	2-4 times per month	0	1
Q22.5	Several times per year	0	1
Q22.6	Never meet/met	0	1
Q22.7	Other, please specify: ………………………………..	0	1

23. On average, how long are/were these meetings with your mentor?

Less than 15 minutes	1

15 to 30 minutes	2
30 minutes to 1 hour	3
1 to 2 hours	4
More than 2 hours	5
Other, please specify: ……………………	6

SECTION 4: TEACHER SATISFACTION

As we draw towards the end of this survey/questionnaire, please share your satisfaction levels.

24. On a Likert scale of 1-5 with 1 Very Dissatisfied and 5 Very Satisfied, please rate the quality of assistance that you receive/received from your mentor in the following areas of your practice as a novice science teacher.

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied	Not applicable
Q24.1	Modelling a lesson	1	2	3	4	5	6
Q24.2	Observing you teaching science lesson(s)	1	2	3	4	5	6
Q24.3	Co-teaching science lesson(s)	1	2	3	4	5	6
Q24.4	Share lesson plans and assessments	1	2	3	4	5	6
Q24.5	Assist with lesson-planning/preparation	1	2	3	4	5	6
Q24.6	Organise practical work or other instructional activities	1	2	3	4	5	6
Q24.7	Meeting with you on a one-on-one basis	1	2	3	4	5	6
Q24.8	Meeting with you together with other novice Science teachers	1	2	3	4	5	6
Q24.9	Give you suggestions to improve your practice	1	2	3	4	5	6
Q24.10	Give you encouragement or moral support	1	2	3	4	5	6

Q24.11	Provide an opportunity for you to raise issues/discuss your individual concerns	1	2	3	4	5	6
Q24.12	Provide guidance/information on administrative/logistical issues	1	2	3	4	5	6
Q24.13	Provide guidance on teaching to meet standards	1	2	3	4	5	6
Q24.14	Work with you to identify teaching challenges and possible solutions	1	2	3	4	5	6
Q24.15	Discuss with you instructional goals and ways to achieve them	1	2	3	4	5	6
Q24.16	Provide guidance on how to assess your students	1	2	3	4	5	6
Q24.17	Act on something you requested the previous week	1	2	3	4	5	6
Q24.18	Applications of technology to instruction	1	2	3	4	5	6
Q24.19	Classroom management	1	2	3	4	5	6
Q24.20	Overall mentoring experiences	1	2	3	4	5	6
Q24.21	Other, please specify: …………………………………………………	1	2	3	4	5	6

25. Do you feel there is/was adequate time scheduled for you to meet with your mentor?

Yes	1
No	2
Mayb e	3

26. Apart from the assistance that you receive(d) from your mentor, please rate any other form of professional support that may mentored or supported you in your first year of teaching on a scale of 1-5 with 1 Very Dissatisfied and 5 Very Satisfied.

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied	Not applicable
Q26.1	In-service workshops	1	2	3	4	5	6

Q26.2	Study groups	1	2	3	4	5	6
Q26.3	Departmental meetings	1	2	3	4	5	6
Q26.4	Online or face-to-face seminars	1	2	3	4	5	6
Q26.5	Former university or college	1	2	3	4	5	6
Q26.6	Continuing education courses	1	2	3	4	5	6
Q26.7	Colleagues in the school or other schools	1	2	3	4	5	6
Q26.8	District, provincial or national education officials	1	2	3	4	5	6

27. At this point, how satisfied are you with EACH of the following aspects of teaching at your school? Use the Likert scale of 1-5 below with 1 Very Dissatisfied and 5 Very Satisfied to rate your satisfaction levels.

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied	Not applicable
Q27.1	Support from administration for beginning teachers	1	2	3	4	5	6
Q27.2	Availability of resources and materials or equipment for your classroom	1	2	3	4	5	6
Q27.3	Autonomy or control over your own classroom	1	2	3	4	5	6
Q27.4	Student motivation to learn	1	2	3	4	5	6
Q27.5	Student discipline and behaviour	1	2	3	4	5	6
Q27.6	Opportunities for professional development	1	2	3	4	5	6
Q27.7	Supportive atmosphere among faculty or collaboration with colleagues	1	2	3	4	5	6
Q27.8	Professional calibre of colleagues	1	2	3	4	5	6

28. Overall, rate yourself on the below statements with regards to your satisfaction as a science teacher in your school. Use the Likert scale of 1-5 below with 1 Strongly Disagree and 5 Strongly Agree to show your satisfaction levels.

		Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied	Not applicable
Q28.1	I enjoy teaching science in my grades	1	2	3	4	5	6
Q28.2	I am confident to teach science on my own	1	2	3	4	5	6
Q28.3	I feel a can leave science teaching for other subjects	1	2	3	4	5	6
Q28.4	Science teachers need a lot of support, especially in early years	1	2	3	4	5	6
Q28.5	I feel I can quit teaching for another profession	1	2	3	4	5	6
Q28.6	My plans are to improve my science teaching capabilities	1	2	3	4	5	6
Q28.7	I enjoy attending professional development activities	1	2	3	4	5	6
Q28.8	Mentoring is useful for me as a science teacher	1	2	3	4	5	6
Q28.9	Blended mentoring can help to support me as a novice teacher	1	2	3	4	5	6

29. In conclusion, if an opportunity to teach science in greener pastures such as in developed countries arise, would you consider leaving South Africa?

Yes	1
No	2
May be	3

Thank you for taking part in this survey.

APPENDIX B

FOCUS GROUP OUTLINE

Section 1: Opening and welcome

Greetings and welcome to our focus group session. Thank you for taking the time to join us in this very important focus group discussion. You were invited because you are novice science teachers with less than five years of science teaching experience in your schools and you are based in Ekurhuleni South district.

My name is Misheck Semu, a Master of Education student with the University of South Africa. I am going to be the moderator in these discussions. Please feel free to take part throughout these focus group discussions. With me is Ms Ntshiwa Sikonyela who is my assistant moderator and will assist with audio recording of our discussion so that we capture everything and avoid losing any data.

Section 2: Topic overview

Our topic for discussion today is induction and support practices (mentoring) for novice Science teachers in South Africa, especially in under-resourced schools. We will also talk about blended mentoring as an alternative practice to face-to-face mentoring that can be useful in enhancing induction and support programmes for novice Science teachers to reduce attrition. The results of these discussions will be used to compare and contrast with the results of a survey that will be done on the same topic to validate the two. This will lead to triangulation and drawing of conclusions on whether blended mentoring can be implemented to enhance induction and support programmes for our beginner science teachers in South Africa.

Section 3: Guidelines and ground rules

You will realise that our session is going to be audio-recorded in line with your consent. I requested to record the session because I don't want to miss any of your comments. I know you are going to raise very helpful points in these discussions and I cannot write fast enough to get them all down. I have placed your selected pseudonym cards on the table and note that at no point will any of your real names be used in my reports. Hence, be assured of complete confidentiality.

Here are some few ground rules that will guide our focus group discussion:

- We can only have one person speaking at a time.
- Everyone is encouraged to participate.
- The person to speak is on a first hand-up basis. However, I may call on you if I haven’t heard from you in a while.
- Only the pseudonyms on the table should be used to call one another for anonymity.
- You don't need to agree with others, but you must listen respectfully as others share their views.
- Every person’s experience and opinion are important.
- Note that there are no right or wrong answers but only differing points of view.
- You are requested to turn off your phones or put them on silent.
- If you must respond to an urgent call, please do so outside and re-join us as quickly as you can.
- My role as moderator will be to guide the discussion and give you turns to speak.
- Let’s avoid talking to the next person since your maximum contributions to these discussions will be greatly appreciated.
- What is said here should remain here or be kept confidential.
- The recorded focus group will be transcribed and the transcription will be brought to your attention for verification before.

Section 4: Guided Questions

1. General/introductory questions

What is your understanding of?

1.1 Induction of beginner teachers?

1.2 Mentoring of novice teachers?

1.3 Professional support for beginner teachers?

2. Induction and support experiences (to be discussed only by those who were mentored – if any. If not, go to 3)

2.1 Have you been inducted and supported as novice teachers into your new schools on deployment? If so, tell us more about your induction and support experiences.

2.1.1 What was the purpose of the induction programme?

2.1.2 How long was the induction and support programme?

2.1.3 Do you think the duration was good enough for quality induction and support?

2.1.4 Was the purpose of the induction and support programme achieved or not? Explain the aspects that were achieved or not achieved.

2.1.5 How well did you benefitted from the induction and support programme for total readiness to start Science teaching in your classes?

2.1.6 Who inducted and supported you?

2.1.7 In what ways were your mentor qualified to induct and support you?

2.1.8 Was the induction and support done face-to-face, online or through blended methods?

2.1.9 What is your feeling about the effectiveness of the method used for your induction and support?

2.1.10 How was the quality of the induction and support programme you participated in?

2.1.11 Suppose you were in charge of mentoring practices in schools in your district. What changes would you make to improve novice science teacher induction and support experiences?

2.2 From your induction and support experiences, do you think mentoring of novice science teachers is really necessary? If yes, please explain your answer.

2.3 Do you think your satisfaction with induction and support programmes contributed to your decision to remain a science teacher in your school?

2.3.1 Can you please explain your levels of satisfaction.

2.3.2 So, what is motivation you to continue teaching in your school?

2.4 Suppose you were in charge of mentoring practices in schools in your district. What changes would you make to improve novice science teacher induction and support experiences?

2.5 Is there anything that you feel we might have left out in these discussions?

3. No induction and support experiences (to be discussed only by those who were never mentored)

If you were not inducted or supported in the first year of teaching:

3.1 Explain how it feels to find oneself in a science classroom without any induction and/or support.

3.2 Did you ever feel like quitting teaching due to lack of induction and support during your first years of science teaching?

3.3 Are there any friends or colleagues that might have left teaching due to lack of induction and support?

3.4 If you were to find a teaching post in developed countries, would you consider quitting teaching and leave South Africa?

3.5 Which areas do you feel you needed induction or support on during the first year(s) of your teaching?

3.6 How did the lack of induction and support have affected you negatively in your professional development?

3.7 In your opinion, is induction and support for novice science teachers really necessary?

3.8 Is there anything that we might have missed in these discussions?

4. **Blended mentoring to enhance induction and support practices** (to be discussed by all)

4.1 What is your understanding of blended mentoring?

4.2 Do you exhibit any blended mentoring practices in your science classrooms?

4.3 In your opinion, do you think introducing blended mentoring might be helpful to enhance induction and support programmes for beginner science teachers?

4.4 Comment if South Africa is ready to implement blended mentoring, especially in under-resourced schools.

4.5 Do you think the introduction of blended mentoring in induction and support for novice science teachers can help to reduce the high attrition rate of science teachers from South Africa?

4.6 What concluding comments can you make on blended mentoring as an induction and support strategy?

4.7 Is there anything that we might have missed in our discussions on induction and support of novice science teachers as well as blended mentoring?

Conclusion

I would like to thank you very much for sharing your ideas, knowledge, and time with me to discuss issues pertaining to novice science teacher induction and support in South Africa. Note that the information gained during these discussions will be compared with information gained through a web-based survey that I conducted. The data you provided will help in the development of a better mentoring model that will improve induction and support experiences for novice science teachers, hence helping to reduce teacher attrition.

I hope that you will be able to join me to hear the results of the survey and focus group in a meeting to be advised. In the meantime, if you think of anything we did not discuss that would be helpful, please feel free to call me on 063 226 4213. I appreciate your on-going interest and hope you will continue to take part in these important discussions in the future.

Thank you again for your willingness to participate and interest in helping to make our novice teachers feel at home in their new schools after being formally inducted and supported during the first years of their practice.

APPENDIX C

COVER LETTER TO AN ONLINE ANONYMOUS WEB-BASED SURVEY

Faculty of Education
Department of Science and Technology Education
University of South Africa (UNISA)
Preller Street, Muckleneuk Ridge, City of Tshwane

Mr Misheck Semu
3 Trio Court, King Street
Germiston 1401
Contacts; +27 63 226 4213
Email: 45032106@mylife.unisa.ac.za

31 March 2023

RE: COVER LETTER TO AN ONLINE ANONYMOUS WEB-BASED SURVEY

Dear Prospective participant,

You are invited to participate in a survey conducted by Misheck Semu under the supervision of Prof Mokiwa an Associate Professor in the Department of Science and Technology Education towards a Masters in Education degree at the University of South Africa.

The survey you have received has been designed to study the mentoring experiences of beginner science teachers in South Africa. You were selected to participate in this survey because you are a novice/beginner science teacher in an under-resourced school in South Africa. By completing this survey, you agree that the information you provide may be used for research purposes, including dissemination through peer-reviewed publications and conference proceedings.

It is anticipated that the information we gain from this survey will help us to determine the need for introducing blended/hybrid mentoring as an alternative teacher professional development strategy. You are, however, under no obligation to complete the survey and you can withdraw from the study prior to submitting the survey. The survey is developed to be anonymous, meaning that we will have no way of connecting the information that you provide to you personally. Consequently, you will not be able to withdraw from the study once you have clicked the send button based on the anonymous nature of the survey. Any identifying information that is obtained in connection with this survey will remain confidential and will be disclosed only with your permission or as required by law. If you choose to participate in this survey it will take up no more than 25 minutes of your time. You may benefit from your participation as an individual and it is envisioned that the findings of this study may help to enhance mentoring programmes for novice teachers, hence reduce the attrition/turnover rate of qualified science teachers in South Africa. We do not foresee that you will experience any negative consequences by completing the survey. The researcher undertakes to keep any information provided herein confidential, not to let it out of his possession and to report on the findings from the perspective of the participating group and not from the perspective of an individual.

The records will be kept for five years for audit purposes where after it will be permanently destroyed. Electronic versions will be permanently deleted from the hard drive of the computer. You will not be reimbursed or receive any incentives for your participation in the survey.

The research was reviewed and approved by the CEDU Research Ethics Review Committee. The primary researcher, Misheck Semu, can be contacted on 063 226 4213 or email to 45032106@myunisa.ac.za. The study leader, Professor H.O Mokiwa can be contacted on 066 082 1524 or email: mokiwho@unisa.ac.za and during office hours at 012 429 6562. Should you have any questions regarding the ethical aspects of the study, you can contact the chairperson of the CEDU Research Ethics Committee Prof A.T Motlhabane on 012 429 2840 or email motlhat@unisa.ac.za. Alternatively, you can report any serious unethical behaviour at the University's Toll Free Hotline 0800 86 96 93.

You are making a decision whether or not to participate by continuing to the next page. You are free to withdraw from the study at any time prior to clicking the send button.

Looking forward to your participation

Yours faithfully,

Misheck Semu
(Masters candidate and Researcher)

APPENDIX D

LETTER TO REQUEST CONSENT FOR SURVEY AND FOCUS GROUP PARTICIPATION AND INFORMATION SHEET

Faculty of Education
Department of Science and Technology Education
University of South Africa (UNISA)
Preller Street, Muckleneuk Ridge, City of Tshwane
P O Box 392 UNISA 0003 South Africa
Tel: 0861670411

Email: mand@unisa.ac.za

Mr Misheck Semu
31 Trio Court, King Street
Germiston 1401
Contacts; +27 63 226 4213
Email: 45032106@mylife.unisa.ac.za

31 March 2023

RE: REQUEST FOR CONSENT TO PARTICIPATE IN AN ONLINE SURVEY, FOCUS GROUP INTERVIEW AND INFORMATION SHEET

Research title: Using blended mentoring approach to support novice science teachers in under-resourced schools in Ekurhuleni South District.

Dear Prospective Participant,

My name is Misheck Semu I am doing research under the supervision of Prof Mokiwa, an Associate Professor in the Department of Science and Technology Education towards a Master of Science degree at the University of South Africa. We are inviting you to participate in a study entitled: “Using Blended Mentoring approach to support novice Science teachers in under-resourced schools in Ekurhuleni South District”.

INFORMATION SHEET

WHAT IS THE PURPOSE OF THE STUDY?

This study is expected to collect important information about the mentoring experiences that you got during the first years of your deployment as a qualified teacher. You are invited because you are a beginner science teacher with five years or less of teaching experience. You are therefore qualified to give us the much-needed reliable data of your lived mentoring experiences (induction and support) in the different schools in which you were deployed. Such quality data will help me as a researcher to make valid conclusions and recommendations at the end of this study. I obtained your contact details from the Basic Education Department (DBE), Provincial Education Department and/or the South African Council of Educators (SACE) databases. In line with the Protection of Personal Information Act, number 4 of 2013, I was authorized to access your details on request and would like to assure you that your personal information is only used for this research and is adequately protected to prevent possible loss, damage and/or unauthorised access. For me to come up with valid conclusions, a lot of quantitative data is required for this research. The approximate number of participants expected is 150-200 participants for the online survey and between 5-12 for the online focus group interview.

The study involves responding to online survey questions in the first phase of a mixed methods approach. Biographical and questions based on your mentoring experiences will be asked in an online survey (questionnaire) that will be posted on internet and/or social media platforms. Completing the survey questionnaire might take you between 15-20 minutes only. In the second phase, an online focus group interview will be done either on Zoom/teams. The focus group will discuss in detail mentoring experiences of participants and how blended mentoring can enhance mentoring practices in South Africa. The focus group interview may take between 45-90 minutes to give all participants the opportunity to contribute.

WHY AM I BEING INVITED TO PARTICIPATE?

Participating in this study is voluntary and you are under no obligation to consent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time during the course of this study without giving a reason. Please note that when participating in a survey, you may not be able to withdraw your questionnaire once you click the submission/send button.

This study will contribute to the professional development of novice science teachers through considering blended mentoring as an alternative support strategy for novice teachers in South Africa. If you elect to participate in this survey, you stand to benefit from this research through sharing information about blended mentoring which is a relatively new concept in teacher professional development in the country. Consequently, you can improve your confidence levels to serve as future mentors in your schools and contribute towards quality induction experiences of future graduate teachers thereby contributing to improving the quality of science teaching/learning in your schools. The wider scientific community and society stand to benefit from learners with excellent science pass rates who can serve as responsible citizens who can bring solutions to scientific problems that bedevil society. Hybrid mentoring experience to be dealt with in this research will ultimately help to reduce attrition rate of science teachers from South Africa and increase professional performance levels.

The nature of my study is rated low risk potential. This means there are no negative consequences expected if you participate in this study. Every effort will be made to ensure avoidance of any form of harm in accordance with Unisa's Code of Research Ethics. However, your participation may inconvenience your time that you may spend completing the questionnaire and/or to attend the online focus group interview. It is regrettable that you need to use your resources such as your data and gadgets to participate in this research. The other foreseeable risk of harm may come from others identifying you as a participant especially in the online focus group phase of this research. Be assured that issues of anonymity and confidentiality will be discussed with all participants and pseudonyms will be used in focus group interviews. To increase privacy and confidentiality, no cameras will be allowed during Zoom/Teams focus group interviews. In the unfortunate event of any harm being caused as you participate in this study, it shall be dealt with in accordance with the relevant policy and/or legislative frameworks.

To enhance confidentiality levels, you have the right to insist that your name will not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about your involvement in this research. Furthermore, your answers will be given a code number or a pseudonym and you will be referred to in this way in the data, any publications, or other research reporting methods such as conference proceedings Provision has been made to increase anonymity by ensuring that your name will not be recorded anywhere and no one will be able to connect you to the answers you give in this research. Please note that other stakeholders who will assist me in this research such as the transcriber, external data coder, assistant moderator and/or the Research Ethics Committee may have access to your data. These are the people who will help me to review your answers and make sure that research is done properly. However, they have signed confidentiality agreements and they are expected to maintain confidentiality in the same way as the researcher. Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

Take notice that your anonymous data may be used for other purposes, such as a research report, journal articles and/or conference proceedings. To protect your privacy and confidentiality, individual participants will not be identifiable in such a report. However, be advised it is impossible for me to make an absolute guarantee of confidentiality or anonymity considering that focus group interviews will be used as a data collection method. A focus group discussion is a qualitative research method and data collection technique in which a selected group of people discusses a given topic or issue in-depth, facilitated by a professional, external moderator. While every effort will be made by the researcher to ensure that you will not be connected to the information that you share during the focus group, I cannot guarantee that other participants in the focus group will treat information confidentially. I shall, however, encourage all participants to do so. For this reason, I advise you not to disclose personally sensitive information in the focus group.

Electronic copies of your answers will be stored by the researcher for a period of five years on a password protected computer at the researcher’s residence in

Germiston for future research or academic purposes. Future use of the stored data will be subject to further Research Ethics Review. All electronic copies of information obtained during data collection will be permanently deleted from the hard drive of the said computer through the use of relevant a software programme.

Please be informed that no incentives or financial benefits will be paid for participation in this study. In view of travelling expenses that will be incurred by participants from Ekurhuleni South district who are required to attend face-to-face focus group interviews at a predetermined venue, only equal reimbursements for travelling and meal expenses will be made with the view to re-compensate them. This will help to alleviate a participation barrier to those who would volunteer to take part but may not afford to incur expenses outside their budgets.

This study has received written approval from Unisa's Research Ethics Review Committee. A copy of the approval letter can be obtained from me as the researcher, if you so wish.

If you would like to be informed of the final research findings, please contact Misheck Semu on 063 226 4213 or email to 45032106@myunisa.ac.za. The findings are accessible for a period of a year from the time this study is completed.

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Misheck Semu on 063 226 4213 or email to 45032106@myunisa.ac.za.

Should you have concerns about the way in which the research has been conducted, you may contact my supervisor Professor H.O Mokiwa on 066 082 1524 (email: mokiwho@unisa.ac.za).

Thank you for taking time to read this information sheet and for participating in this study.

Thank you.

Misheck Semu
(Masters candidate and Researcher)

APPENDIX E

APPENDIX E: CONSENT TO PARTICIPATE (RETURN SLIP)

RE: CONSENT TO PARTICIPATE IN THIS STUDY (Return slip)

I, ____ (participant names), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the focus group interviews.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname (please print)___________________________

Participant Signature :__________________ **Date:**________________

Researcher's Name & Surname (please print): _________________________

Researcher's signature: _____________________ **Date:**___________

Facebook Cover note

Dear Prospective Participant,

My name is Misheck Semu and I am conducting online research in the Department of Science and Technology Education at the University of South Africa.

I am inviting all Science teachers with less than 5 years of teaching experience based in the Eastern Cape, Gauteng, Limpopo and Mpumalanga provinces to participate in a web-based survey that seek to improve mentoring and support programmes for newly qualified teachers in South Africa.

Kindly follow the link https://forms.office.com/r/D2kRVkzsp2 to read the Cover Letter for this anonymous web-based survey and complete it to consent to participate.

Thereafter, you can follow this link https://forms.office.com/r/i9Yx700R8C to access the survey (questionnaire).

Note that this is an anonymous survey where confidentiality and all ethical considerations will be respected.

Your participation is greatly appreciated.

Survey Link and bar code

APPENDIX F

REQUEST TO CONDUCT RESEARCH IN PROVINCES (Sample for Gauteng Province)

Faculty of Education
Department of Science and Technology Education
University of South Africa (UNISA)
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Tel: 0861670411

Mr Misheck Semu
3 Trio Court, King Street
Germiston 1401
Contacts; +27 63 226 4213
Email: 45032106@mylife.unisa.ac.za

31 March 2023

The Head of Department
Gauteng Department of Education
17 Simmonds Street
Johannesburg

Dear Mr Mosuwe,

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN SOME OF YOUR SCHOOLS IN EKURHULENI SOUTH

I am Misheck Semu, a Master of Education student at University of South Africa (UNISA). As a requirement for the award of a Master of Education degree in Natural Sciences in the Department of Science and Technology Education, I am currently undertaking a research under the supervision of Professor H.O Mokiwa, an Associate Professor in the College of Education. We are inviting novice science teachers across South Africa to participate in research entitled: “Using blended mentoring approach to support novice science teachers in under-resourced schools in Ekurhuleni South District".

I humbly request for your permission to conduct research on the above topic with novice science teachers from any schools in Ekurhuleni South district who have less than 5 years of teaching experience. Your schools have been selected because there are novice science teachers and they are convenient to the researcher who has worked for years in some of the schools around Ekurhuleni South District.

The aim of my study is to explore the mentoring experiences (induction and support) of novice science teachers in their first years of teaching as qualified teachers in South African schools using mixed methods research approach. My study is going to be in two phases. The first phase is an online survey (questionnaire) that will be done at a national scale to gain knowledge of novice science teachers' mentoring experiences on a wider scale and obtain quantitative data. In the second phase of my study, I will collect qualitative data through focus group interviews in Ekurhuleni district situated in Gauteng province, hence this request. Permission to conduct an online survey has been requested from the RCME Directorate.

Your province and district stand to benefit from this study since it will contribute to the professional development of novice science teachers through considering blended mentoring as an alternative support strategy for novice teachers in South Africa. Novice science teachers who are going to participate in the focus group and survey stand to benefit from this research through sharing information about blended mentoring which is a relatively new concept in teacher professional development in the country. Participation in this study can help to improve confidence levels of participants to serve as future mentors in their schools. Quality induction experiences of future graduate teachers can help to reduce attrition rate of science teachers and increase the subject pass rate in their schools.

Kindly note that there will be no interruptions to normal school programmes since the researcher will arrange with interested participants to conduct focus group discussions during weekends. In this research project, interested novice science teachers will also respond to survey questionnaire during their own time on their mentoring experiences (induction and professional support) during their first years of teaching. All data collected in this research will be treated with confidentiality, kept safe and only used for the purposes of this study. Names of your schools and participating educators will be kept anonymous and never used in the analysis of the data. Research participation is voluntary and the researcher will seek all participants to give consent before collecting any data from them. More so, participants can withdraw from this research at any time if they want to. However, no incentives or financial benefits will be paid for participation in this study. Only equal reimbursements for travelling and meal expenses will be made for novice science teachers who are going to participate in face-to-face focus group interviews with the view to re-compensate them.

The nature of my study is rated low risk potential. This means no reasonable harm is expected on the part of all participants and all efforts will be made to avoid any harm in accordance to Unisa's Code of Research Ethics. However, in the event that any harm is caused, reasonable steps will be made to enable the participant to receive the necessary help.

Take notice that all participants in this research including your Provincial Office are entitled to receive feedback of my research findings. Your Provincial Office will receive a written report informing you of my findings and recommendations. A face-to-face feedback session will be arranged for my focus group participants and those who participate in the online survey shall be informed individually and privately through internet or social media channels.

For any further queries and clarifications on this study you can contact me on my details provided above or my supervisor Professor H.O Mokiwa on 066 082 1524 (email: mokiwho@unisa.ac.za).

Looking forward to your positive response.

Yours faithfully,

Misheck Semu
(Masters candidate and Researcher)

APPENDIX G

FOCUS GROUP CONSENT AND CONFIDENTIALITY AGREEMENT

FOCUS GROUP CONSENT AND CONFIDENTIALITY AGREEMENT

I____ grant consent that the information I share during the focus group may be used by Misheck Semu for research purposes. I am aware that the group discussions will be digitally recorded and grant consent for these recordings, provided that my privacy will be protected. I undertake not to divulge any information that is shared in the group discussions to any person outside the group in order to maintain confidentiality.

Participant's Name (Please print): __________________________________

Participant Signature:__________________________ Date: _____________

Email address/Contact Number: ____________________________________

Researcher's Name: (Please print): _________________________________

Researcher's Signature: ____

Date: ____

APPENDIX H

LETTER TO INFORM SCHOOL PRINCIPALS, SGBs, DISTRICT OFFICIALS ON PERMISSION GRANTED TO CONDUCT ONLINE RESEARCH (SURVEY) WITH NOVICE SCIENCE TEACHERS IN SCHOOLS

Faculty of Education
Department of Science and Technology Education
University of South Africa (UNISA)
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa

Mr Misheck Semu
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Contacts: +27 63 226 4213
Email: 45032106@mylife.unisa.ac.za

10 August 2023

RE: LETTER TO INFORM SCHOOL PRINCIPALS, SGBs, DISTRICT OFFICIALS ON PERMISSION GRANTED TO CONDUCT ONLINE RESEARCH (SURVEY) WITH NOVICE SCIENCE TEACHERS IN SCHOOLS IN YOUR DISTRICT

Dear Principals/SGBs, District/Head Office Directors/ Senior Managers,

My name is Misheck Semu, I am conducting research under the supervision of Prof Mokiwa, an Associate Professor in the Department of Science and Technology Education towards a Master of Science degree at the University of South Africa.

I write to inform you that I have been granted permission by ECDoE to conduct research with novice science teachers who are based in your district/schools. My study is entitled: “Using blended mentoring approach to support novice science teachers in under-resourced schools in Ekurhuleni South District”. The aim of my study is to explore the mentoring experiences (induction and support) of novice science teachers in their first years of teaching as qualified teachers in South African schools, with the view to contribute towards reducing novice teacher attrition through improving the quality of mentoring that they receive.

Your district has been selected because you have novice science teachers who have less than five years of teaching experience who may voluntarily take part in this study. Your teachers are therefore qualified to give us the much-needed reliable data of their lived mentoring experiences (induction and support) since their deployment. Such quality data will help me as a researcher to make valid conclusions and recommendations at the end of this study. Your school/district is also situated in Eastern Cape Province which is convenient for the researcher to access virtually and conduct this research.

The study entails a mixed methods approach where novice teachers from the Eastern Cape will respond to online survey questions, hence the collection of quantitative data in the first phase of the study. An anonymous web-based survey will be posted on internet and/or social media platforms for responses by participants from other provinces. In the second phase, qualitative data will be collected through the participation of novice science teachers selected randomly from Ekurhuleni South district schools where a focus group discussion consisting of between 5-12 novice science teachers will be conducted at an agreed venue during a weekend. The focus group will discuss in detail mentoring experiences of participants and how blended mentoring can enhance mentoring practices in South Africa. The focus group discussion may take between 45-90 minutes to give all participants the opportunity to contribute.

This study will contribute to the professional development of novice science teachers through considering blended mentoring as an alternative support strategy for novice teachers in South Africa. Participants in this study stand to benefit through sharing information about blended mentoring which is a relatively new concept in teacher professional development in the country. Consequently, one can improve their confidence levels to serve as future mentors in your schools/district and contribute towards quality induction experiences of future graduate teachers thereby contributing to improving the quality of science teaching/learning in your schools/districts. The wider scientific community and society stands to benefit from learners with excellent science pass rates who can serve as responsible citizens who can bring solutions to scientific problems that bedevil society. Hybrid mentoring experience to be dealt with in this research will ultimately help to reduce attrition rate of science teachers from South Africa and increase professional performance levels.

The nature of my study is rated low-risk potential, hence there are very little to no risks associated with this study. Only adult novice teachers will be used and the focus group interview shall be conducted during a weekend to avoid disturbing school/district programmes. Every effort will be made to ensure avoidance of any form of physical or psychological harm through adherence with Unisa's Code of Research Ethics and ECDoE research approval conditions. Participants may be inconvenienced in terms of their time but consent shall be sought from individual focus group participants before commencement of this study.

Please be informed that no incentives or financial benefits will be paid for participation by your teachers in this study. In view of travelling expenses that will be incurred by participants from Ekurhuleni South district who are required to attend face-to-face focus group discussions at a predetermined venue, only equal reimbursements for travelling and light meal expenses will be made with the view to re-compensate them. This will help to alleviate any participation barriers for those willing to volunteer to take part but may not afford to incur expenses outside their budgets.

Lastly, all participants in this research including your schools/district are entitled to receive feedback of my research findings. Your schools/district will receive a written report informing you of my findings and recommendations. A face-to-face feedback session will be arranged with all focus group participants from your schools/district for them to receive feedback at the conclusion of this study.

Looking forward to your school's participation in this study

Yours faithfully,

Misheck Semu (Masters candidate and Researcher)

APPENDIX I

UNISA ETHICS CLEARANCE LETTER

UNISA | university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE
REVIEW FEEDBACK

Date: 2023/06/07

Dear Mr M SEMU

Thank you for the application for research ethics clearance submitted to the UNISA College of Education (CEDU) Ethics Review Committee (ERC).

The **medium** application was reviewed in compliance with the UNISA Policy on Research Ethics and the UNISA Standard Operating Procedure on Research Ethics Risk Assessment on 7th June 2023. **The application is referred back for revisions and clarifications.** The following comments, emanating from the reviews, are tabled for your attention, clarification and/or amendment:

3.6 The applicant should explain the concept of "blended mentoring" in the context of his study. This is crucial as "blended mentoring" is central to his study.
3.7.1 The research design has not been indicated.
3.7.2 Tick "18 years and older".
3.7.4 The video taped data can not be "destroyed immediately after data analysis" as it should also be stored securely for a period of five years.
All participants in the focus group interviews should also sign the confidentiality agreement, not only the person doing the video recording.
3.8 Why will the following be included? "A completed questionnaire will be given to respondents via the internet and social media platforms". How will this influence the participants' responses?
3.9 Which programmes will be used for data analysis? E.g., SPSS for quantitative data and Atlas ti for qualitative data. It is insufficient to state that, "If the data allows, computer software will be used to conduct thematic analysis."
The applicant should include aspects such as member checking.

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The revised application and the supporting documents must be submitted to the College of Education chair Prof AT Motlhabane motlhat@unisa.ac.za for full review by the committee on or before 15 June 2023.

Please provide the committee with a ***cover letter*** *explaining how you have addressed the above mentioned aspects. Additionally, the application should be amended to indicate the recommended changes.* ***Highlight all changes*** *made on the application document to streamline the review process.*

Failure to submit the clarifications and/or revised document/s by the expiry 15 June 2023 will mean that all subsequent submissions related to the project will be regarded as a new application for ethics review.

Data collection activities, as indicated in the application documents, may not commence until final approval has been granted by the CEDU ERC.

It is your responsibility to ensure that the proposed research adheres to the values and principles expressed in the UNISA Research Ethics Policy.

Please note:
If your re-submission does not adhere to the procedure set out above it will not be tabled for ethics review and will be returned to you within 48 hours.

Yours sincerely,

Prof AT Motlhabane
CHAIRPERSON: CEDU RERC
E-mail: motlhat@unisa.ac.za
Tel: (012) 429-2840

APPENDIX J

EASTERN CAPE PED PERMISSION TO CONDUCT RESEARCH

Province of the
EASTERN CAPE
EDUCATION

CORPORATE PLANNING, MONITORING, POLICY AND RESEARCH COORDINATION

Steve Vukile Tshwete Complex, Zone 6 Zwelitsha, 5608, Private Bag X0032, Bhisho, 5605 REPUBLIC OF SOUTH AFRICA:
Enquiries: **Ms. F. Pakade Tel: 040 608 7170/4001 . Fax :040 608 4372. Email:** fundiswa.pakade@ecdoe.gov.za
Website: www.ecdoe.gov.za

Date: 31July 2023

Mr. Misheck Semu

3 Trio Court

King Street

Germiston

1401

Dear Mr. M. Semu

PERMISSION TO UNDERTAKE A MASTERS RESEARCH: USING BLENDED MENTORING APPROACH TO SUPPORT NOVICE SCIENCE TEACHERS IN UNDER-RESOURCED SCHOOLS IN EASTERN CAPE AND EKURHULENI SOUTH DISTRICT

---

1. Your application to conduct the above-mentioned research involving Novice or beginner science teachers with less than 5 years teaching experience mainly from under-resourced schools under the jurisdiction of the Eastern Cape Department of Education (ECDoE) is hereby approved based on the following conditions:

   a. there will be no financial implications for the Department;

   b. institutions and respondents must not be identifiable in any way from the results of the investigation;

   c. you seek parent's consent for minors;

   d. it is not going to interrupt educators' time and task;

   e. the research may not be conducted during official contact time;

   f. the research may not be conducted during official contact time, provided that an arrangement to do research at the school including getting inside a classroom has been arranged and agreed upon in writing with the Principal and the affected teacher/s;

   g. you present a copy of the written approval letter of the Eastern Cape Department of Education (ECDoE) to the Cluster and District Directors before any research is undertaken at any institutions within that particular district;

[Type here]
growth education

Customer care line: 086 063 8636
Website: www.ecdoe.gov.za

Province of the
EASTERN CAPE
EDUCATION

h. you will make all the arrangements concerning your research;

i. should you wish to extend the period of research after approval has been granted, an application to do this must be directed to Chief Director: Corporate Strategy Management;

j. you present the Department with a copy of your final paper/report/dissertation/thesis free of charge in hard copy and electronic format. This must be accompanied by a separate synopsis (maximum 2 – 3 typed pages) of the most important findings and recommendations if it does not already contain a synopsis;

k. you present the findings to the Research Committee and/or Senior Management of the Department when and/or where necessary;

l. you are requested to provide the above to the Chief Director: Corporate Strategy Management upon completion of your research;

m. you comply with all the requirements as completed in the Terms and Conditions to conduct Research in the ECDoE document duly completed by you;

n. you comply with your ethical undertaking (commitment form);

o. You submit on a six-monthly basis, from the date of permission of the research, concise reports to the Chief Director: Corporate Strategy Management.

2. The Department reserves a right to withdraw the permission should there be non-compliance to the approval letter and contract signed in the Terms and Conditions to conduct Research in the ECDoE and/or legal requirements to do so.

3. The Department will publish the completed Research on its website.

4. The Department wishes you well in your undertaking. You can contact the Mrs. Fundiswa Pakade on the numbers indicated in the letterhead or email fundiswa.pakade@ecdoe.gov.za should you need any assistance.

T. MASOEU
CHIEF DIRECTOR: CORPORATE STRATEGY MANAGEMENT

FOR ACTING HEAD OF DEPARTMENT: EDUCATION

[Type here]
growth
education

Customer care line: 086 063 8636
Website: www.ecdoe.gov.za

APPENDIX K

GAUTENG PED PERMISSION TO CONDUCT RESEARCH

GAUTENG PROVINCE
Department: Education
REPUBLIC OF SOUTH AFRICA

8/4/4/1/2

GDE RESEARCH APPROVAL LETTER

Date:	**31 July 2023**
Validity of Research Approval:	**08 February 2023– 30 September 2023** **2023/286**
Name of Researcher:	**Semu M**
Address of Researcher:	**3 Trio Court**
	King Street / Germiston
Telephone Number:	**063 226 4213**
Email address:	**45032106@mylife.unisa.ac.za**
Research Topic:	**Using blended mentoring approach to support novice science teachers in under-resourced schools in Ekurhuleni South District**
Name of University:	**UNISA**
Type of qualification	**Masters**
Number and type of schools:	**Primary Schools, Secondary Schools and LSEN Schools**
District/s/HO	**15 Districts**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

23/07/2023

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1

Making education a societal priority

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

1. *Letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*
3. ***Because of the relaxation of COVID 19 regulations researchers can collect data online, telephonically, physically access schools or may make arrangements for Zoom with the school Principal. Requests for such arrangements should be submitted to the GDE Education Research and Knowledge Management directorate.***
4. ***The Researchers are advised to wear a mask at all times, Social distance at all times, Provide a vaccination certificate or negative COVID-19 test, not older than 72 hours, and Sanitise frequently.***
5. *A copy of this letter must be forwarded to the school principal and the chairperson of the School Governing Body (SGB) that would indicate that the researcher/s have been granted permission from the Gauteng Department of Education to conduct the research study.*
6. *A letter / document that outline the purpose of the research and the anticipated outcomes of such research must be made available to the principals, SGBs and District/Head Office Senior Managers of the schools and districts/offices concerned, respectively.*
7. *The Researcher will make every effort obtain the goodwill and co-operation of all the GDE officials, principals, and chairpersons of the SGBs, teachers and learners involved. Persons who offer their co-operation will not receive additional remuneration from the Department while those that opt not to participate will not be penalised in any way.*
8. *Research may only be conducted after school hours so that the normal school programme is not interrupted. The Principal (if at a school) and/or Director (if at a district/head office) must be consulted about an appropriate time when the researcher/s may carry out their research at the sites that they manage.*
9. *Research may only commence from the second week of February and must be concluded before the beginning of the last quarter of the academic year. If incomplete, an amended Research Approval letter may be requested to conduct research in the following year.*
10. *Items 6 and 7 will not apply to any research effort being undertaken on behalf of the GDE. Such research will have been commissioned and be paid for by the Gauteng Department of Education.*
11. *It is the researcher's responsibility to obtain written parental consent of all learners that are expected to participate in the study.*
12. *The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.*
13. *The names of the GDE officials, schools, principals, parents, teachers and learners that participate in the study may not appear in the research report without the written consent of each of these individuals and/or organisations.*
14. *On completion of the study the researcher/s must supply the Director: Knowledge Management & Research with one Hard Cover bound and an electronic copy of the research.*
15. *The researcher may be expected to provide short presentations on the purpose, findings and recommendations of his/her research to both GDE officials and the schools concerned.*
16. *Should the researcher have been involved with research at a school and/or a district/head office level, the Director concerned must also be supplied with a brief summary of the purpose, findings and recommendations of the research study.*

The Gauteng Department of Education wishes you well in this important undertaking and looks forward to examining the findings of your research study.

Kind regards

....
Dr. Gumani Mukatuni
Acting CES: Education Research and Knowledge Management

DATE: 31/07/2003 ....

Office of the Director: Education Research and Knowledge Management
7th Floor, 17 Simmonds Street, Johannesburg, 2001
Tel: (011) 355 0488
Email: Faith.Tshabalala@gauteng.gov.za
Website: www.education.gpg.gov.za

APPENDIX L

LIMPOPO PED PERMISSION TO CONDUCT RESEARCH

LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

CONFIDENTIAL

Ref: 2/2/2 Enq: Makola MC Tel No: 015 290 9448 E-mail:MakolaMC@edu.limpopo.gov.za

Semu M
3 Trio Court, King Street
Germiston
1401

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH

1. The above bears reference.

2. The Department wishes to inform you that your request to conduct research has been approved. Topic of the research proposal; **"Using Blended Mentoring approach to support novice science teachers under-resourced schools in Ekurhuleni South District."**

3. The following conditions should be considered:

3.1 The research should not have any financial implications for Limpopo Department of Education.

3.2 Arrangements should be made with the Circuit Office and the School concerned.

3.3 The conduct of research should not in anyhow disrupt the academic programs at the schools.

3.4 The research should not be conducted during the time of Examinations especially the fourth term.

3.5 During the study, applicable research ethics should be adhered to; in particular the principle of voluntary participation (the people involved should be respected).

3.6 Upon completion of research study, the researcher shall share the final product of the research with the Department.

REQUEST FOR PERMISSION TO CONDUCT RESEARCH : SEMU M Page 1

Cnr 113 Biccard & 24 Excelsior Street, POLOKWANE, 0700, Private Bag X 9489, Polokwane, 0700
Tel:015 290 7600/ 7702 Fax 086 218 0560

The heartland of Southern Africa-development is about people

4 Furthermore, you are expected to produce this letter at Schools/ Offices where you intend conducting your research as an evidence that you are permitted to conduct the research.

5 The department appreciates the contribution that you wish to make and wishes you success in your investigation.

Best wishes

16/08/2023

Mashaba KM
DDG: CORPORATE SERVICES

Date

Cnr 113 Biccard & 24 Excelsior Street, POLOKWANE, 0700, Private Bag X 9489, Polokwane, 0700
Tel:015 290 7600/ 7702 Fax 086 218 0560

The heartland of Southern Africa-development is about people

APPENDIX M

MPUMALANGA PED PERMISSION TO CONDUCT RESEARCH

education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

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

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

Mr. Misheck Semu
UNISA
Tel: 0632264213
E-mail: 45032106@mylife.unisa.ac.za

RE: "REQUEST FOR PERMOSSION TO CONDUCT AN ONLINE SURVEY (RESEARCH) WITH NOVICE SCIENCE TEACHERS IN MPUMALANGA PROVINCE."

Your application to conduct research study was received and is therefore acknowledged. The title of your research project reads: **"Request for Permission to Conduct an Online Survey (Research) with Novice Science Teachers in Mpumalanga Province."**
I trust that the aims and the objectives of the study will benefit the whole department especially the beneficiaries. Your request is approved subject to you observing the provisions of the departmental research policy which is available in the department website. You are requested to adhere to your university's research ethics as spelt out in your research ethics.

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

For more information kindly liaise with the department's research unit @ 013 766 5015/5124 0r c.maphanga@mpuedu.gov.za
The department wishes you well in this important project and pledges to give you the necessary support you may need.

MRS LH MOYANE
HEAD: EDUCATION

18 / 08 / 2023
DATE

MPUMALANGA

APPENDIX N

LANGUAGE EDITING AND PROOF-READING CERTIFICATE

<u>DISCLAIMER:</u> IT IS THE STUDENT'S RESPONSIBILITY TO ENSURE THAT ALL IN-TEXT CITATIONS AND LIST OF REFERENCES ARE COMPLETE, ACCURATE, CONSISTENT AND ADHERE TO THE INSTITUTIONAL REFERENCING STYLE GUIDELINES.

Editing Certificate

This hereby serves to confirm that I, Dr Pamela Makati, edited the Masters dissertation titled "Using blended mentoring approach to support novice science teachers in under-resourced schools in Ekurhuleni South District" by Mr Misheck Semu (45032106). I declare that I have ensured clarity, coherence and cohesion in the presentation of ideas, corrected grammar, spellings and language use, and ensured consistency in spellings, language use and formatting.

Dr Pamela Makati (D Litt. in English, MA in English, BA Hons in English)
Academic Editor (member of PEG, SATI & EASA)
Date: 07 January 2024

pmmakati@gmail.com | +27632739957

APPENDIX O

TURNITIN SUMMARY REPORT

45032106_MEd Dissertation

ORIGINALITY REPORT

24%	22%	6%	11%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS