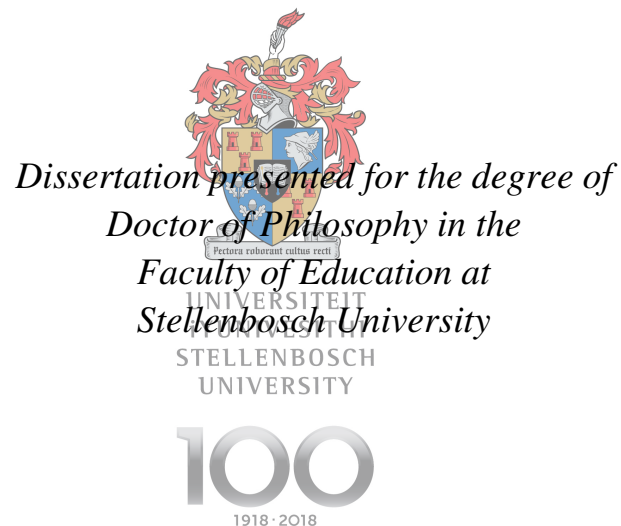


THE PROFESSIONAL DEVELOPMENT OF NATURAL SCIENCES TEACHERS: POSSIBILITIES OF A COMMUNITY OF PRACTICE

by

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December 2018

Declaration

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“Knowledge is a treasure, but practice is the key to it.”

Thomas Fuller (English churchman and historian, 1608-1661)

ABSTRACT

Continuing professional teacher development (CPTD) that is effectively undertaken presents a significant opportunity to reform education in South Africa. However, CPTD is currently trapped in traditional transmissionist approaches that are misaligned to teachers' needs and their shortcomings. As a result, education practitioners and researchers are increasingly calling to abandon these low-impact initiatives in favour of CPTD models that improve teachers' subject content knowledge and pedagogy by affording teachers opportunities to collaborate.

A community of practice (CoP) for teachers, which is known to foster teacher collaboration has design characteristics appealing to the effective facilitation of CPTD. Taking a dissident position, this study intended setting up a teacher CoP with the researcher as the initiator and facilitator, to determine its potential contributions to the professional development of ten participating Senior Phase Natural Sciences teachers from the rural school district of Vredendal, Western Cape Province. This study also aimed to establish the principles and aspects influencing the effective operation of such a teacher CoP.

In South Africa, CPTD is regulated by guidelines contained in the National Policy Framework for Teacher Education and Development (NPFTED), hence the theoretical framework considered for this study needed alignment to it. A descripto-exploratory research design, underpinned by a social constructivist ontology, interpretivist epistemology and a multi-method qualitative case study methodology was found appropriate for observing the experiences of the participating teachers in a naturalistic setting.

This study embraces Wenger's (1998) CoP construct as a theoretical framework. A CoP, by original definition, features the following three foundational elements, namely the domain, the community and the practice. In this study, the domain encapsulates the CPTD, the participating teachers and the researcher as an observer-participant represent the community, and the practice includes different strategies used during the CoP sessions that were used to explain and demonstrate specific contexts as well as the corresponding concepts.

Primary data were collected via different techniques including questionnaires, semi-structured interviews and CoP observations. Secondary data encompassed participant diaries, field notes, the researcher's reflective journal and an extensive document review. The construct of rigour was applied to ensure that the experiences of the teacher participants reflected the study accurately and demonstrated the credibility of the research. Transcribed and re-organised data were subsequently categorised, coded and subjected to thematic analysis to answer the research questions.

The results highlight two critical problems. Firstly, teacher participants admitted that they are not adequately equipped to teach the subject content effectively and expressed a need to understand the theory better, and to teach the subject relevant to everyday life. Secondly, teacher isolation hampers CPTD efforts in the Vredendal school district extensively as teachers have difficulties to collaborate due to the vast distances between schools, a poor telecommunications network, lack of finances and inadequate facilities and equipment.

The CoP intervention augmented the professional identity of the teacher participants meaningfully by helping to build specific competences required by the authoritative norms set out in the NPFTED. Participants improved their subject content knowledge, notably. They developed the ability to teach Natural Sciences theory relevant to real-life situations and raised their skill level to conduct demonstrations and practical work more confidently. Opportunities for self-reflection appeared instrumental in entrenching the newly acquired teaching practices. These positive changes are considered to have benefitted from including the participants in key aspects of the design and operation of the CoP.

Teacher participants explicitly appreciated the constructive interaction and collaboration in the CoP sessions and approved of its enabling influences on their professional development. An inclusive CoP structure, established professional relationships among CoP members and a motivated CoP membership proved to be the critical aspects essential to the effective operation of a teacher CoP. This study found that professional relationships built on mutual respect and trust are the most significant enabler for accomplishing successful teacher collaboration.

The findings of this study support global research, indicating that teacher collaboration is the common foundation of effective CPTD strategies. Accordingly, a CoP presents an enticing opportunity to facilitate CPD effectively as it is purposely designed to foster teacher collaboration, and it is recognised to break down teacher isolation, which is especially prevalent in rural school environments.

Potentially operationalising teacher CoPs in the South African education system, both as a standalone initiative or integrated with endorsed professional learning communities (PLCs) requires modification of the original construct. In this context, a teacher CoP needs a formal, but an inclusive structure preferably with an education specialist as a facilitator in the leading role. A blended CoP approach, with its characteristic focus on deriving value from employing information and communications technologies and smart electronic teaching aids, could improve the operation of a teacher CoP.

OPSOMMING

Effektiewe voortgesette professionele onderwysersontwikkeling (VPOO) bied 'n gulde geleentheid om onderwys in Suid-Afrika te hervorm. VPOO is egter vasgevang in tradisionele benaderings wat onderwysers se behoeftes en hul tekortkominge misken. As gevolg hiervan eis opvoeders en navorsers toenemend om hierdie oneffektiewe inisiatiewe te laat vaar en VPOO-modelle te aanvaar wat onderwysers se vakinhoudskennis en pedagogiek sal verbeter deur samewerkingsgeleenthede vir hulle aan te bied. 'n Gemeenskap van Praktijk (GvP) vir onderwysers, wat bekend daarvoor is om onderwysersamewerking te bevorder, toon eienskappe wat bevorderlik is vir die effektiewe fasilitering van VPOO. Hierdie studie beoog om 'n GvP met die navorser as fasiliteerder tot stand te bring, om sodoende die potensiële bydraes daarvan tot die professionele ontwikkeling van tien deelnemende Senior Fase Natuurwetenskappe-onderwysers binne die landelike skooldistrik van Vredendal, Wes-Kaapprovinsie, vas te stel. Hierdie studie is ook daarop gemik om die beginsels en aspekte wat die effektiewe werking van so 'n onderwyser-GvP beïnvloed, te bepaal.

In Suid-Afrika word VPOO gereguleer deur riglyne soos vervat in die Nasionale Beleidsraamwerk vir Onderwysersopvoeding en -ontwikkeling (NBROO) en daarom moes die teoretiese raamwerk van hierdie studie dus daarmee in lyn gebring word. 'n Beskrywende navorsingsontwerp, ondersteun deur 'n sosiaal konstruktivistiese ontologie, 'n interpretivistiese epistemologie en 'n multi-metode kwalitatiewe gevallestudie-metodologie, is geskik gevind om die ervarings van die deelnemende onderwysers in 'n naturalistiese omgewing waar te neem.

Hierdie studie maak gebruik van Wenger (1998) se oorspronklike GvP-konsep as 'n teoretiese raamwerk wat uit drie fundamentele elemente bestaan naamlik die domein, die gemeenskap en die praktyk. In hierdie studie omsluit die domein die VPOO, die deelnemende onderwysers en navorser verteenwoordig die gemeenskap, en die praktyk sluit verskillende strategieë in wat tydens die GvP-sessies gebruik is om spesifieke kontekste te verduidelik en te demonstreer.

Primêre data is deur verskillende tegnieke ingesamel, insluitend vraelyste, semi-gestruktureerde onderhoude en GvP-waarnemings. Sekondêre data is verkry uit dagboeke, veldnotas, die navorser se reflektiewe joernaal en 'n uitgebreide dokumentoorsig. Geloofwaardigheidstoetse is toegepas om te verseker dat die ervarings van die deelnemende onderwysers die studie akkuraat weerspieël. Transkribeerde- en herorganiseerde data is vervolgens gekategoriseer, gekodeer en onderwerp aan tematiese analise om die navorsingsvrae te beantwoord.

Die resultate beklemtoon twee kritiese probleme. Eerstens het deelnemende onderwysers erken dat hulle nie voldoende toegerus is om die vakinhoud effektief te onderrig nie en dat hulle die teorie beter moet verstaan om die vak meer relevant aan te kan bied. Tweedens belemmer onderwyser-isolasie VPOO-pogings in die Vredendal-skooldistrik aansienlik aangesien onderwysers dit moeilik vind om saam te werk weens die groot afstande tussen skole, swak telekommunikasienetwerk, gebrek aan finansies en onvoldoende fasiliteite, asook toerusting.

Die GvP-ingryping het die professionele identiteit van deelnemende onderwysers betekenisvol uitgebou deur te help om spesifieke vaardighede te verbeter wat vereis word deur die norme wat in die NBROO uiteengesit word. Deelnemers het veral hul vakinhoudskennis verbeter. Hulle het die vermoë ontwikkel om die Natuurwetenskappe-teorie meer relevant te maak, asook hul vaardigheidsvlakke te verhoog deur praktiese aktiwiteite met meer selfvertroue te verrig. Geleenthede vir selfrefleksie was instrumenteel in die vestiging van die nuutverworwe onderwyspraktyke. Hierdie positiewe aanpassings word as voordelig beskou deurdat die deelnemers ingesluit was by sleutelaspekte van die ontwerp en werking van die GvP.

Onderwysers het die konstruktiewe interaksie en samewerking in die GvP-sessies waardeur en die positiewe invloed daarvan op hul professionele ontwikkeling bevestig. 'n Inklusiewe GvP-struktuur, gevestigde professionele verhoudings tussen die GvP-lidmaatskap en 'n gemotiveerde GvP-lidmaatskap is die sleutelaspekte wat noodsaaklik is vir die effektiewe werking van 'n onderwyser-GvP. Daar is bevind dat professionele verhoudings wat op wedersydse respek en vertroue gebou is, egter die belangrikste blyk te wees.

Hierdie studie ondersteun die groeiende oproep om transmissiere VPOO-benaderings te laat vaar ten gunste van meer effektiewe onderwyserontwikkelingsmodelle. Die ontwerpselemente van 'n GvP maak dit uiters geskik om onderwysersamewerking te bevorder en dienooreenkomstig onderwysersisolasie te verbreek, veral in landelike skoolomgewings.

Die moontlike operasionalisering van onderwyser-GvPs in die Suid-Afrikaanse onderwysstelsel, beide as 'n selfstandige of geïntegreerde inisiatief met professionele leergemeenskappe, vereis wysiging van die oorspronklike konsep. In hierdie konteks het 'n onderwyser-GvP 'n formele, maar 'n inklusiewe struktuur nodig, verkieslik met 'n onderwysespecialis in die fasiliteerdersrol. 'n Gemengde GvP-benadering, met 'n kenmerkende fokus op waardetoevoeging deur die gebruik van inligting- en kommunikasietegnologieë asook slim-elektroniese onderwys hulpmiddels, kan die effektiewe werking van so 'n onderwyser-GvP verder bevorder.

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LIST OF ACRONYMS AND ABBREVIATIONS

CAPS	Curriculum Assessment Policy Statement
CoP	Community of Practice
CoPs	Communities of Practice
CPD	Continuing Professional Development
CPTD	Continuing Professional Teacher Development
DBE	Department of Basic Education
DESC	Department of Ethics and Screening
DoE	Department of Education
FET	Further Education and Training
ICT	Information and Communications Technologies
INSET	In-Service Education and Training
IP	Intermediate Phase
IPET	Initial Professional Education Training
ISPFTEd	The Integrated Strategic Planning Framework for Teacher Education and Development in South Africa
NPFTED	National Policy Framework for Teacher Education and Development
PLC	Professional Learning Community
SACE	South African Council for Educators
SP	Senior Phase
STEM	Science, Technology, Engineering and Mathematics
SUNCEP	Stellenbosch University Centre for Pedagogy
TIMMS	Trends in International Mathematics and Science Study
WCED	Western Cape Education Department

CHAPTER 1

INTRODUCTION

In the following sections the background of the study, the problem statement, the researcher's personal motivation to conduct the study, the research questions and the appropriate research design, which included the theoretical framework and research methodology to investigate the research questions are discussed. This chapter concludes with an overview of the thesis layout.

1.1 Background

South Africa, like many of the BRICS countries (Brazil, Russia, India, China and South Africa) and other global emerging economies, critically needs to address the shortage of professionals in the Science, Technology, Engineering and Mathematics (STEM) fields to raise their global competitiveness, but also to sustain their internal economic growth strategies (Onwu & Sehoole, 2008:121; Pillay, 2011:2; WEF, 2017:19). The shortage of professionals in the STEM fields in South Africa is a direct result of a school education system failing foremost to produce enough school leavers passing mathematics and science, which are critical gateway subjects required for admission to study further in the STEM fields (Grayson, 2010:96; Wolhuter, 2014:2). Several global studies indicate that South Africa lags other developing countries regarding learner performance in mathematics and science (Bansilal et al., 2010:153; Ndlovu, 2011a:1402; Mullis et al., 2016). Mathematics and science learners from rural schools compared to their counterparts from urban schools underperform notably for a variety of reasons, including the political legacy, diverse cultures, general poverty, remoteness and teacher deficiencies (Gardiner, 2008:13; Pandey, 2010:55).

Several factors contribute to this poor state of mathematics and science education in South Africa, but teachers assume the most influential role that affects learner performance (Randall, 2008:37; Steyn, 2008:15, 2010a:212, 2011:43; Kriek & Grayson, 2009:185). The South African Department of Basic Education (DBE) and its provincial subsidiaries have understood quality education, which requires qualified and competent teachers to deliver well-prepared school skilled learners, is critical for skills development in a globally competitive economic environment (WCED, 2002:3). South Africa continues to suffer a shortage of qualified and trained mathematics and science teachers and in addition, many of them do not have appropriate qualifications (Kahn, 1995; Taylor & Vinjevold, 1999 in Jita & Ndlalane, 2009:58; Steyn & Mentz, 2008:679; Singh, 2011:1627; Pournara et al., 2015:2).

The recruitment and retention of competent, qualified, and experienced teachers in rural contexts are a global problem, but are particularly severe in developing countries like South Africa (Modisaotsile, 2012:4; Mukeredzi, 2013:4; Hlalele, 2014:463). Alarming, there are strong indications that the subject content knowledge of many mathematics and science teachers do not meet curriculum standards (Taylor, 2008:24; Spaull, 2013:5). Shortcomings in critical teacher dynamics such as their competence, attitude and performance present significant barriers to overcome this situation effectively (Laksov et al., 2008; Simon et al., 2011).

South Africa like many other countries has prioritised continuing professional teacher development (CPTD) to deal with this shortage of qualified and trained mathematics and science teachers (Kriek & Grayson, 2009:186; DBE, 2011:2; De Clercq & Phiri, 2013:77; Jita & Mokhele, 2014:2; Geldenhuys & Oosthuizen, 2015:204). Ensuring that CPTD is effective and sustainable, impact factors such as teachers' subject content knowledge and pedagogical content knowledge and skills, their competence, attitude towards teaching, work environment, and support systems, which includes mentoring, need to be recognised and gaps therein determined and resolved (Thomen, 2005:813; Desimone, 2009:182; Moodley, 2014:129).

The DBE has duly acknowledged the relationship between teacher competence and learner performance (Koekemoer & Olivier, 2002:43; Randall, 2008:37; Kriek & Grayson, 2009:185; Steyn, 2010a:212; Trygstad et al., 2014:2), and in response has been pursuing global educational reform strategies that concentrate on CPTD. During the past decade, the DBE launched numerous initiatives in support of its CPTD objectives, such as a renewed focus on teacher professionalism and teacher competence under the umbrella of the National Policy Framework for Teacher Education and Development (DoE, 2007), the introduction of the Curriculum Assessment Policy Statement (DBE, 2010), and most recently the rollout of the concept of Professional Learning Communities (DBE, 2015). Other outreach programs such as the Dinaledi Project, Maths, Science and Technology Schools, Khanya Technology in Education, Maths Leadership Program and Teacher Mentorship aimed to increase teachers' subject content knowledge and pedagogical skills (DoE, 2005; DBE, 2009).

However, despite these interventions learner participation and success rates in science and mathematics increased only marginally (DBE, 2017c; Robberts, 2017:12). In perspective, the figures remain dismal and inadequate as less than 1.5% of South African school leavers qualified for admission to STEM-related studies in 2010 (DBE, 2011).

Making matters worse, a recent study performed by the authoritative World Economic Forum ranks South Africa last out of 139 countries based on the quality of mathematics and science education (Baller et al., 2016:172).

Yet, the professional development of teachers is still a prime focus area to improve mathematics and science education in South Africa and elsewhere (Botha, 2012:2; Tsotetsi & Mahlomaholo, 2013:90; Nel, 2015:3; Chauraya & Brodie, 2017:224), creating opportunities for alternative, non-traditional educational approaches to identify and overcome teacher related challenges. As a result, investigations into the continuing professional development of mathematics and science teachers are pertinently imperative to understand and address their specific needs concerning the roles and competences they are expected to fulfil in the interest of effective teaching.

1.2 Problem statement

In South Africa, Continuing Professional Teacher Development (CPTD) refers to the in-service training and education (INSET) of teachers “whereby teachers continually improve their skills, knowledge and attitudes while continuing their employment” (Mestry et al., 2009:477). CPTD in South Africa is governed by the statutory South African Council of Educators (SACE), which is mandated by legislation and endorsed by national policies (SACE, 2008). The most important of these, the National Policy Framework for Teacher Education and Development (NPFTED) aims to deal with the lack of suitably qualified teachers (DoE, 2007:5), and its underpinned principles as expressed in the Norms and Standards for Educators (DoE, 2000) describe the roles, their associated set of applied competences (norms) and qualifications (standards) for the development of teachers.

The Norms and Standards for Educators (DoE, 2000) also draw attention to the professional identity of teachers, which is formed by their attitudes, beliefs, competences and values (Hong, 2010:1532; Dharsey, 2015:114; Körkkö et al., 2016:199). Existing research considers the professional identity of teachers as a critical factor in their confidence, motivation, effectiveness and retention and therefore it assumes a crucial role in their professional development (Sachs, 2001:154; Samuel, 2009:138; Izadina, 2012:709; Williams et al., 2012:248; Mukeredzi, 2013:8; Mushayikwa, 2013:283; Samson, 2013:154; Nel, 2015:46; Robberts, 2017:117).

The SACE carries ultimate responsibility for managing and implementing the CPTD system, with the support of the national and its nine provincial education departments. Regionally, there is no shortage of CPTD activities, which come in a variety of format and content, including workshops, conferences, consultation, coaching, mentoring, short, long and remedial courses, demonstrations and peer observation, induction for in-service teachers, job rotation, collaborative work, clustering of schools and school visits, school improvement projects, communities of practice, lesson studies, reflective supervision and technical assistance (Geldenhuys & Oosthuizen, 2015:204-205). However, only the SACE has the authority to approve CPTD service providers and endorse CPTD activities and programmes, i.e. the SACE must approve a service provider to offer SACE-endorsed CPTD activities and programs to the South African teaching community. These service providers must be credible, offering a quality service, and comprise private providers, higher education institutes, teacher unions, independent schools, provincial education departments and non-governmental organisations (SACE, 2008).

The Western Cape Education Department (WCED) has established a dedicated directorate, the Cape Teaching and Leadership Institute (CTLI) aiming to improve the quality of education in the Western Cape schools (Figure 1.1) through formal teacher training and development programmes (WCED, 2014, 2015). The WCED also utilises various higher educational institutions to re-train or upgrade the existing mathematics and science teachers as part of accredited training programs (Bansilal & Rosenberg, 2011:108). Non-profit governmental organisations (NGOs), which often partner with higher education institutions, provide a variety of accredited short courses. One such a noteworthy NGO, called the Stellenbosch University Centre for Pedagogy (SUNCEP), which has an expanded footprint in the Western Cape, Eastern Cape and Northern Cape offers under their Teacher Professional Learning (TPL) programme, both full qualification courses and accredited short courses to currently serving mathematics and science teachers (SUNCEP, 2017). As the researcher, I am currently employed by SUNCEP as a TPL project coordinator in the Vredendal area to provide in-classroom support and mentorship to mathematics and science teachers.

The study area, Vredendal (Dutch for “valley of peace”), is a town in the northwest corner of the Western Cape Province, South Africa, and it is situated on the banks of the Olifants River about 300 kilometres north of the city of Cape Town (Figure 1.1). It is the most northern rural school district governed by the WCED and comprises 31 public schools (5 high schools and 26 primary schools), with approximately 70 science and mathematics teachers (WCED, 2013).

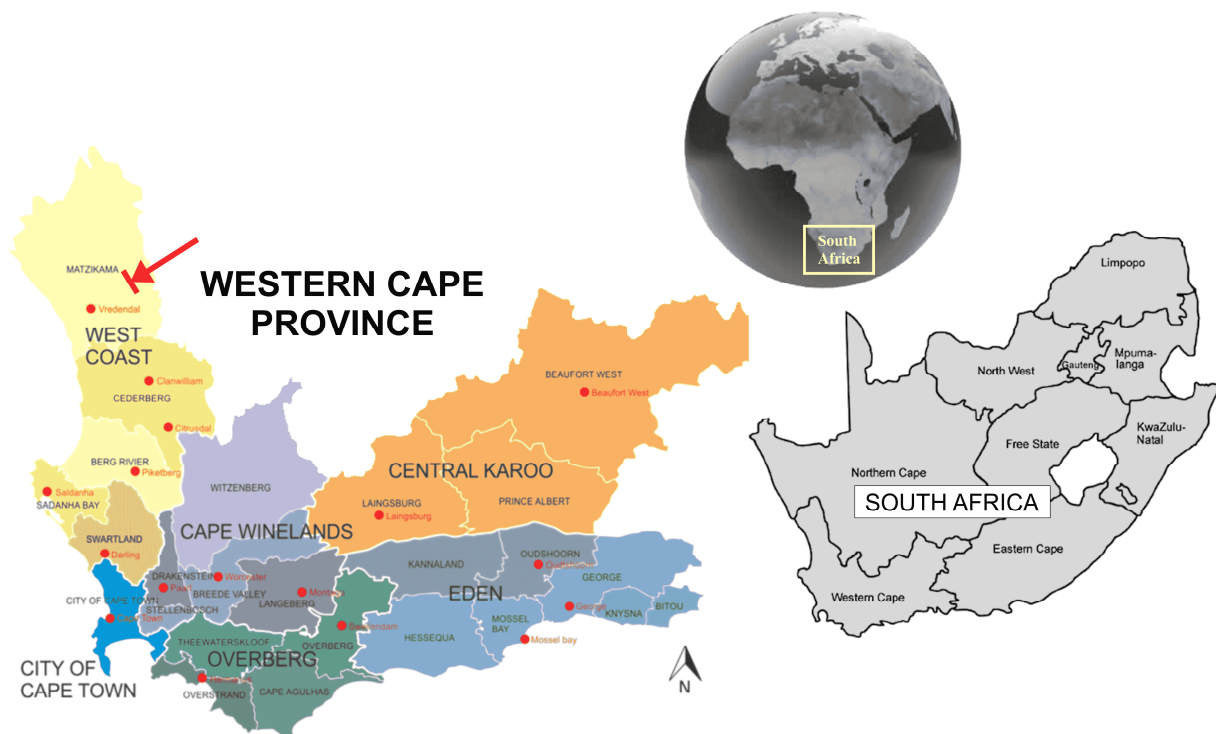


Figure 1.1 The WCED governs four rural school districts in the Western Cape Province, South Africa: West Coast, Cape Winelands, Eden and Karoo, and Overberg (WCED, 2013). The study area of Vredendal is situated in the most northern part of the West Coast school district as indicated by the arrow.

Compared to urban school districts that are centred around cities and large towns, rural school districts, such as Vredendal are dealing with particular obstacles that hamper effective CPTD, such as poor quality infrastructure, inadequate teaching resources, overcrowded classrooms, unqualified and underqualified teachers, shortage of basic necessities, lack of financial support, remoteness from main training centres, poor teacher motivation and multigrade teaching (Iwu et al., 2013:840; du Plessis & Subramanien, 2014:21; Heeralal, 2014:1795; Masinire et al., 2014:151). Also, teacher isolation is still arguably one of the most critical barriers to effective CPTD in rural school environments (Ndlalane, 2006:100; Steyn, 2008:18; Smith, 2014:233). The fact that four of the eight school districts governed by the WCED are classified as rural (WCED, 2013), underlines the relevance and the gravity of this predicament.

The WCED has been aware of these challenges in their rural school districts (WCED, 2017:61), and as early as 2012, in response deployed a multi-faceted strategy inclusive of a refocused CPTD program with the expectation to raise the level of mathematics and science education (WCED, 2011:10).

Most recently, the WCED has started to introduce “professional learning communities” as provisioned under the Integrated Strategic Planning Framework for Teacher Education and Development (DBE, 2015) to bolster its CPTD focus.

However, there is no conclusive evidence to suggest that after five years running with these interventions, learner performance in mathematics and science improved in the Vredendal school district. The fact is that learner participation rates and performance in these two gateway subjects remain disconcerting, for instance, in 2017 only 53 (15%) out of 349 Grade 12 learners enrolled in a mathematics-physical science subject combination (WCED, 2017). As a result, since 2015 the Vredendal school district stayed unresponsive at the lowest rank, classified as “Category 4: Low Mathematics / Physical Science participation rates” (WCED, 2011:9; DBE, 2017c). This paints a stark picture as the comparative participation figures are 36% for both the Western Cape and South Africa as a whole. Corresponding pass rates for mathematics and science plot commendably in the top percentile (DBE, 2017c), but the data suggest that only a fraction of Vredendal Grade 12 learners has passed well enough to meet the entry requirements for tertiary STEM studies.

This poor state of learner performance in the Vredendal school district is most likely rooted in the unfavourable reality that the area continues to be critically short of proficient mathematics and science teachers, as is the typical case in South Africa. Making matters worse, it is estimated that one out of five serving mathematics and science teachers are underqualified, or unqualified (Hofmeyr & Draper, 2015:10).

The popular intervention to send teachers from all over the Western Cape on accredited training and development programs to CTLI, or short courses by using specialist facilitators at centres of excellence such as SUNCEP is far from ideal for a couple of reasons. The logistics, including the vast distances within the Vredendal area to the training venues in and around Cape Town, as well as social and family responsibilities serve as barriers for local teachers to participate in these training programs. Most of these traditional “one-size-fits-all” (Lieberman & Wood, 2002), “one-shot” (Kriek & Grayson, 2009:186), “top-down” (Snyders, 2017:1) interventions employ transmissionist approaches (Ferguson, 2011:3) to accomplish teacher development, failing to accommodate individual teacher needs, and also often providing limited or no opportunity for group work or collaboration, during training and afterwards back in practice. These types of “attendance is mandatory, but learning is not” interventions (Kennedy, 2016:29) usually do not discriminate different teaching styles, schools- or classroom contexts, or between the needs of beginner and experienced teachers (Leenheer et al., 2003).

Many researchers have been supporting the move away from transmissionist approaches in favour of more collaborative CPTD models (Hofman & Dijkstra, 2010:1031; Kuijpers et al., 2010:1693; Hudson et al., 2013:1293; Geldenhuys & Oosthuizen, 2015:209; Kintz et al., 2015:121; Ngcoza & Southwood, 2015:9), as traditional CPTD approaches neglect to bring about real change (Lieberman, 2000; Hattie, 2009). In the case of the vast contextual differences between urban and rural school environments, Lyons (2008:30-31) suggest that CPTD offerings be customised according to the specific needs of the teachers, considering the support contribution or involvement of schools.

1.3 The value proposition of teacher CoPs

Effective CPTD remains the principal challenge to liberate the South African education system from its detrimental legacy of inequality, but it also continues to present, the most significant opportunity to improve school and learner performance (De Clercq & Phiri, 2013:77; Jita & Mokhele, 2014:2). Achieving real success with CPTD programs is situated in three core elements namely activities that are required to be intense and sustained, embedded in teaching practice, and provide teachers with opportunities to actively interact and engage with each other around curriculum and instruction (Opfer & Pedder, 2011; Tournaki et al., 2011:300; Admiraal et al., 2016:283). Accordingly, there is a dire need for collaborative approaches to facilitate CPTD effectively by harnessing the best practices mentioned above, importantly, within the legislative requirements of the SACE, but in ways that account for the challenging conditions teachers are facing in rural school districts such as Vredendal.

The populist term “community of practice” (CoP) is well-known and found purpose in diverse subject areas and disciplines (Wenger, 1998; Wenger, 2011:1), including educational research (Maynard, 2001; Mays, 2002; Printy, 2008; Wubbels, 2007). A teacher CoP, which represents “groups of people who share a concern or passion for something they do, and learn how to improve as they interact regularly” (Wenger, 2011:1), offers a conducive platform to effectively facilitate CPTD by allowing a fair degree of teacher autonomy, foster teacher collaboration, overcome teacher isolation, endorse certain styles of teacher practices, prompt self-reflection and contribute to their professional identity by encouraging positive changes in teachers’ beliefs, knowledge and practices as required by the National Policy Framework for Teacher Education and Development (Butler et al., 2004; Servage, 2009; Hofman & Dijkstra, 2010; Singh, 2011; Brody & Hadar, 2015; Sobkin & Adamchuk, 2015). Furthermore, a teacher CoP has the potential to reduce the urban-rural school gap, realising sustainable improvements in rural education (Islam, 2012:27).

The term “Professional Learning Community” (PLCs; Blankenship & Rouna, 2007; Brodie, 2013:6; Hargreaves et al., 2013; Vangrieken et al., 2017:48) is often used interchangeably with nomenclature such as “teacher clusters” (Mokhele, 2011; Jita & Mokhele, 2012, 2014; Mphahlele, 2014; Dharsey, 2015), “teacher networks” (Ndlalane, 2006; Dresner & Worley, 2006; Ngcoza & Southwood, 2015), “teacher communities of learning” (Tomlinson et al., 1997), and “teacher communities of practice” (Little, 2002; McKay, 2007; Lotz-Sisitka et al., 2010; Hoadley, 2012; Mak & Pun, 2015). All these structures promote teacher collaboration and are categorised as transitional CPTD models (Kennedy & Odell, 2014:345), and although they share some common elements, a real teacher CoP differs fundamentally otherwise (Wenger, 1998:2; Blankenship & Rouna, 2007:7; Hoadley, 2012:288). A crucial distinction is that the needs and interests of teacher participants take centre stage with a CoP, without the imposed structures and directives from governing bodies (Johnson et al., 2017:4).

The integrated approach of a CoP to support the professional development of teachers is well researched in many developed countries (Pugach, 1999a, 1999b; Evans & Powell, 2007; McArdle & Ackland, 2007; Akerson et al., 2009; Parker et al., 2012; Daniel et al., 2013; Nixon & Brown, 2013; Houghton et al., 2015), but in South Africa, this type of approach remains at the experimental level, matched with limited research output (Jita & Mokhele, 2014:1).

This study, therefore, also provides a valuable opportunity to contribute to the current discourse of utilising CoPs or similar collaborative models to facilitate the professional development of teachers, a contemporary focus area that has been poorly researched in the South African and a rural school context. It is envisaged that the research findings of this study would help expand this developing knowledge base.

1.4 The rationale for the study

In the African context, Bless et al. (2006:55) distinguish two types of social research, namely basic and applied research based on a researcher’s primary motivation. Accordingly, the primary motivation for basic research is to expand the current knowledge base of a phenomenon by collecting more information that could question existing theories, allowing new theories to be developed, but without the application of this newly acquired knowledge. By difference, the primary motivation for applied research is to help a specific community to address a particular problem or challenge. In the context of being a South African residing in a community faced with specific educational challenges, my primary motivation to perform this study is situated in applied research, with a secondary notion in basic research.

In South Africa, teachers are expected to take responsibility for their professional development (SACE, 2008), yet very few potential enablers, meaning those that could be supportive in this matter are prepared to engage by genuinely listening, and responding to the challenges and needs of teachers (De Clercq, 2013:77). The researcher brings personal context to the above by portraying the following three key perspectives of motivation for this study.

Teacher – I have more than eight years' experience as a competent and qualified Grade 8-12 Natural Sciences and Physical Science teacher serving in the today's urban school districts of Metro South and Metro North, the city of Cape Town. Thinking back, more than 25 years ago when I started my career in education, the administered approach with CPTD changed little since then. Operating in a metropole environment, we as teachers had a myriad of easily accessible CPTD opportunities at hand, which were further supported by the collaborative nature of the neighbouring schools and teachers.

Being a novice teacher, I soon slipped into a state of self-isolation, because despite my sound qualifications, I developed feelings of inferiority, which affected my motivation and ability to teach with confidence. Fortunately, two influential colleagues, at the time my department head and the curriculum advisor guided and mentored me to become a confident, competent professional teacher to the effect that it left an impression upon me, sparking the passion I continue to have for teacher development today.

Facilitator – With this sound footing, subsequently I joined an NGO for five years as an education facilitator and mentor, supporting Grade 8-12 Natural Sciences and Physical Science teachers serving in various urban and rural school districts, the city of Cape Town. Very quickly, I realised the value of supporting teachers in their natural context of teaching, i.e. the classroom, which contrasts with the one-directional, one-shot training efforts of the WCED that featured virtually no buy-in from the teachers, and offered little or no opportunities for teacher collaboration. Building on this teacher support-based career, I have since gained more than 15 years' experience as a SUNCEP facilitator and mentor in mathematics and science from the rural school district of Vredendal. My observation is that the WCED has been encountering challenges with its efforts to implement its CPTD strategies in the Vredendal district, for two reasons.

Firstly, the practice to send local teachers on accredited training and development programs continues undesirably without the follow-up teacher support back at school, or even more importantly in the classroom.

Secondly, it seems quite evident that the Vredendal district faces specific challenges where the relative remoteness of schools from main centres of training and support, far distances between schools, inadequate and costly ICT infrastructure, lack of financial sustenance, high teacher turnover and associated movements, the common practice of teachers teaching multigrade format and different subjects, aggravate the degree of teacher isolation, and conversely impede teacher collaboration. Therefore, the current situation locally merely is not conducive to constructive teacher collaboration, which is generally regarded as an essential cornerstone of effective CPTD (Steyn & Van Niekerk, 2005:131-132; Levine & Marcus, 2010:389; Kennedy, 2011:27; Forte & Flores, 2014:93-94; Geldenhuys & Oosthuizen, 2015:209; Ngcoza & Southwood, 2015:9).

Researcher – There is no doubt in my mind that the worryingly low learner participation and performance in local secondary school mathematics and science remain stationary because of a minimal impact from CPTD efforts. Taking a dissident stance, I, therefore, understand that a more formal, sustainable intervention is needed to overcome the barriers mentioned above and cultivate teacher collaboration in order to improve CPTD locally.

This problem stimulated my curiosity to a point where I started with some cursory research, and as a result, discovered the populist “communities of practice” (CoP) concept which was coined by Lave and Wenger (1991). My attention was at once drawn to the promise that a CoP offers a favourable platform to facilitate CPTD effectively. As I delved deeper into the literature, I found that research related to CPTD both in context of the Natural Sciences in South Africa, as well as rural school settings, are either poorly researched, or not well documented.

This study allows overdue action to address individual teacher needs in a challenging teaching environment, as well as creating the opportunity to contribute to a sparsely researched knowledge base. From my personal experience and interactions with education legislation, it was important that the research I considered would have to be structured within the guidelines of the policies mandating the South African education system. An added incentive is that in recent years the SACE highlighted research related to CPTD as a key priority. The call by my alma mater, Stellenbosch University for its alumni to uplift the communities where they reside added some extra weight in my decision to perform this study.

1.5 Purpose of the study and research questions

In South Africa compulsory primary education starts at the age of seven, covering seven years, from Grade R to Grade 6. Secondary education consists of the Senior Phase (Grades 7-9), and the Further Education and Training Phase (Grades 10-12).

This study intends to set up a teacher CoP with the researcher as the initiator and facilitator, and subsequently document the experiences of participating Senior Phase Natural Sciences teachers from the Vredendal area about CPTD. The study focuses on the Natural Sciences discipline for two reasons, firstly it is the researcher's field of interest and proficiency, and secondly, the Grade 12 learner participation and pass rates for WCED schools on aggregate continues to be lower for Physical Sciences than Mathematics (DBE, 2017a:5).

The main research question the study has the purpose of answering is:

What are the possibilities of a community of practice approach to support the professional development of Natural Sciences teachers from the rural school district of Vredendal?

Three sub-questions were unpacked in support of the main research question:

1. In what ways can a community of practice contribute to the professional development of Natural Sciences teachers within the National Policy Framework for Teacher Education and Development in South Africa?
2. How can a community of practice assist in facilitating the professional development of Natural Sciences teachers?
3. What principles and aspects can influence the effective operation of a community of practice?

1.6 The significance of the study

The researcher presumes that a diverse stakeholder and role-player group involved with CPTD, as well as the world of knowledge (Babbie & Mouton, 2011) are to benefit from the outcomes of this study.

CPTD in South Africa is captured by traditional transmissionist (administered) approaches that are misaligned to teachers' needs and their shortcomings (Lieberman & Wood, 2002; Kriek & Grayson, 2009:186; Snyders, 2017:1). Globally, there has been a collective call to abandon transmissionist CPTD initiatives, and embrace CPTD models that improve teachers' subject content knowledge and pedagogy by affording teachers opportunities to collaborate, and share knowledge and classroom teaching practices (Admiraal et al., 2016:283).

This study aims to understand how a teacher CoP as a collaborative type CPTD model is experienced by a select group of Natural Sciences teachers from a specific rural school district. It is envisaged that this study would, therefore, highlight their needs, identify competence issues, evaluate the effectiveness of a CoP intervention to facilitate their CPTD, and have them name the barriers and enablers that could influence the effective operation of a CoP. Thus, most importantly is the likelihood that the research might be of great benefit to the group of participating teachers that at the end of this study would have been empowered to help themselves with their continuing professional development. Also, this study could add to the current understanding of sustaining CPTD and CoPs contextually.

The findings of this study could assist curriculum developers and policymakers to consider reviewing existing policies for the potential inclusion of other best practices such as teacher collaboration and teaching practices, in addition to the current focus on teacher professionalism. Higher education institutions and training service providers could find the outcomes of this study valuable by becoming aware that collaborative CPTD interventions aligned to teacher needs would yield better successes than transmissionist approaches. The results should encourage the education departments to investigate their CPTD programs, and redesign and restructure their efforts to accommodate teachers as centre-stage to the CPTD process, and focus on teacher collaboration.

The construct of a teacher CoP is relatively new to the South African education community, thus apart from contributing to a sparse knowledge base, this study could serve as a node for further research, especially in the local context, but also in the interest of rural school districts.

Teacher isolation is believed to be more common in rural schools and plays a significant role in obstructing CPTD in those teaching environments. This case study focuses on the concept of a CoP, which is recognised to break down teacher isolation, offering the ability to congregate other neighbouring schools' teachers, which could be of great benefit for the WCED that is currently looking into working solutions to address CPTD effectively in its rural school districts.

Lastly, there is a significant opportunity to adapt Wenger's (1998) CoP model in the context of CPTD, with specialisation in rural school districts.

1.7 Research design

This study adopts the six-step process cycle of educational research as proposed by Creswell (2014:7-8): identify a research problem, review the literature, specify a purpose for research, collect data, analyse and interpret the data, and report and evaluate research.

In this study, the researcher chose a descripto-exploratory research design (Hussey & Hussey, 1997:10). In summary, underpinned by a social constructivist ontology and interpretivist epistemology, a multi-method qualitative case study design was employed to explore the experiences of a group of Natural Sciences teachers situated a bounded system, i.e. the rural school district of Vredendal, illuminating their beliefs, views and experiences of a CoP approach to support their professional development.

1.7.1 Research philosophy, strategy and methods

A constructivist ontology is appropriate for this study because the reality cannot be separated from human practices and with the approach rich knowledge emerge from the contexts investigated (Mertens, 1998). Furthermore, teacher development, especially in a structured collaborative setting of teacher CoPs is a standard social practice, fitting “within the constructivist paradigm, the social surroundings are seen as decisive for how the individual learns and develops” (Postholm, 2012:406). Teacher development studies lean towards a socially constructivist ontology (Butler et al., 2004; Hung et al., 2005; Mckay, 2007; Gunawardena et al., 2009; Houghton et al., 2015; Patton & Parker, 2017).

The researcher prefers the lens of an interpretivist epistemology to address the research questions of this study, as the related richness and depth of data are generated from people making sense of their world and their social interactions. This characteristic of the interpretivist approach is one of its most recognised strengths to identify critical issues and to gain a greater understanding of a social phenomenon (Maree, 2016:55).

a) Theoretical framework

In South Africa, CPTD is regulated by strict guidelines contained in the National Policy Framework for Teacher Education and Development (NPFTED), which places an absolute premium on teacher professionalism, encompassing teacher competence, teacher autonomy and professional identity. For this reason, the theoretical framework and the associated CPTD model considered appropriate for this study needed to be aligned to the NPFTED guidelines.

A theoretical framework is a “device that enables a researcher to make sense of the data that has been collected” (Cohen et al., 2011:482). This research study, which explores how a CoP can contribute to the professional development of Senior Phase Natural Sciences teachers in a rural school district is based on existing theory in the world of knowledge which had been academically investigated and documented (Lave & Wenger, 1991; Little, 1993; Wenger, 1998, 2000, 2011; Guskey, 2002b; Kennedy, 2005; Desimone, 2009; Kuipers et al., 2010; Richter et al., 2011; Hadar & Brody, 2012; Mitchell, 2013; Macheng, 2014; Dharsey, 2015; Smith, 2015).

The authoritative Norms and Standards for Educators (DoE, 2000), an underpinning of the NPFTED requires teachers to be more than transmitters of textbook content, but for them to collaborate with colleagues, and assume extended roles and competences in their teaching duties. A teacher CoP, which is underpinned by a social constructivist paradigm (Lave & Wenger, 1991) is a collaborative type CPTD model that aims to foster teacher autonomy and teacher collaboration (Kennedy, 2005:243). A CoP offers a useful alternative mechanism to traditional approaches for engaging CPTD effectively, because the concept is seated in “situated learning” (Vygotsky, 1978; Lave & Wenger, 1991), a construct that is being endorsed by the Minimum Requirements for Teacher Education Qualifications, an update on the NPFTED (Reeves & Robinson, 2014:247).

Wenger’s (1998) model for CoPs is embraced as a theoretical framework for this study, serving the purpose to determine if a CoP could benefit the professional development of a specific group of Natural Sciences teacher participants. CoPs are essential “groups of people who share a concern or a passion for something they do, have a clear sense of purpose, work towards the shared facilitation of purpose through productive social contact and learn, through sustained endeavour over time, how to improve their practice” (Johnston, 2016:536).

A CoP, by Wenger’s (1998) original definition features the following three foundational elements, namely the domain, the community and the practice. The Domain, which constitutes “the area of knowledge that brings the community together, gives it its identity, and defines the key issues that members need to address” (Wenger, 1998:1), defines the identity of a CoP as the common area of shared inquiry and interest, which is not necessarily deemed expertise outside of the CoP. In this study, the domain encapsulates the continuing professional development of Natural Sciences teachers from the rural school district of Vredendal.

The Community, “the group of people for whom the domain is relevant, the quality of the relationships among members, and the definition of the boundary between the inside and the outside” (Wenger, 1998:2), refers to the membership of a CoP, which with shared competence collaborate with each other to accomplish collective learning. In this study, the Natural Sciences teachers and the researcher represent the community. The involvement of the researcher is explained at a later stage.

The Practice refers to a shared collection of resources that the community actively utilises to address their problems and issues, or Wenger (1998:12) states “the body of knowledge, methods, tools, stories, cases, documents, which members share and develop together”. In this study, the practice includes different strategies used in the CoP sessions that were used to explain and demonstrate specific contexts as well as the corresponding concepts. It also includes in-classroom and out-of-classroom support, the interviews and the reflections of the teacher community.

b) Case study research

The interrogative pro-adverbs such as “what,” “why,” or “how” used in research questions inform the types of study about research purpose, i.e., either exploratory, descriptive or explanatory studies. This study leans towards being “descripto-exploratory” (Saunders et al., 2009:140) as it explores the usefulness of teacher CoPs in a specific setting, but it also aims to add to the existing, relevant knowledge base of educational CoPs in general.

This study has utilised the case study as a research strategy to address the research questions (Creswell, 2014:1). A case study is defined as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident” (Yin, 2009:2). Essential to case study research is the contextual term “naturalistic”, which refers to studying the real-world situations as they unfold naturally, non-manipulative and controlling, where the researcher is open to whatever emerges (Babbie & Mouton, 2011:270; Yilmaz, 2013:312).

My intent as a researcher is to gain such a comprehensive understanding of a specific group of teachers participating in a CoP; hence, the researcher needed to furnish thick descriptions about them (Babbie & Mouton, 2011:281). Considering that case study research is confined to a specific phenomenon, equivalent to a community (Wenger, 1998), within in a specific context, analogous to a domain (Wenger, 1998), case study design seems most appropriate for this study (Merriam, 2002; Creswell, 2014), as for this particular study the phenomenon (case) and its context are difficult to separate (Yin, 2009:13).

c) Multi-method qualitative inquiry

Responding to the descripto-exploratory nature of this case study that contains “how” and “what” in the research questions, a qualitative research lens captures the essence of this study the best because it is appropriately aligned with the case study research strategy, which captures the naturalistic character of this study, the insider perspective as the researcher is embedded in data collection, the rich information expected from this study, and lastly the flexibility operating within the research design. Consequently, various kinds of qualitative data collection techniques were used, classifying this study as a multi-method qualitative study (Saunders et al., 2009:151).

Some information produced from this study was illustrated as a classical quantitative genre, but this does not qualify it as a mixed-methods choice as it does not endeavour to integrate qualitative and quantitative methods (Creswell et al., 2003:7; Creswell & Plano Clark, 2007:2; Creamer, 2017:6).

1.7.2 Data collection and analysis

A vital strength of the case study method is the flexibility of using of multiple sources and techniques in the data-collection process, allowing for ‘thick descriptions’ of the phenomena under study (Yin, 2009). In this multi-method qualitative case study, questionnaires, semi-structured interviews, observations, participants’ diaries, a reflective journal of the researcher, and an extensive document review were used to investigate the research questions served as data sources.

a) Sampling

This study used a purposive selection of teacher participants related to school locality (McMillan & Schumacher, 1997:434; Maree & Pietersen, 2007:177; Tongco, 2007:1; Rule et al., 2011:64). A purposive sampling method had been used to select the “case”, or “unit of analysis” or “community” who is represented by a specific group of Senior Phase Natural Sciences teachers from the rural school district of Vredendal, Western Cape Province, South Africa.

b) Questionnaires

According to Rogers et al. (2010:238), questionnaires are a well-established technique for gathering demographic data and respondents’ views. Pilot questionnaires (Addenda D and E) were used to test for ambiguity and clarity. A specific group of Natural Sciences teachers was used for the pilot to assess the effectiveness of the questionnaires as a data collection instrument.

The information about the proposed research study (Addendum J) including the pre-intervention questionnaire (Addendum F) was sent in advance via e-mail to the principals of all public and private schools, primary as well as high schools in the Vredendal, West Coast schools district. Only 23 candidates responded by returning completed pre-intervention questionnaires (Addendum F). These 23 candidates were contacted telephonically and invited to participate in the study, but only ten volunteered to be participants in this study. Subsequently, these ten participants, who represent ten different schools formed the core study group, they made up the CoP membership, were interviewed, and completed the post-intervention questionnaires (Addendum G).

c) Interviews

For this study, the semi-structured interview was chosen as the most appropriate interview research instrument to collect data (Thomas, 2010:291). Individual interviews afforded the opportunity to explore the meaning participants attach to their world (Suchman & Jordan, 1990; Lee, 2003; Ponterotto, 2005:131).

The researcher developed an interview schedule (Addendum H) of questions aligned with selected elements of the theoretical framework and research questions (Creswell, 2014:247). The semi-structured interviews conducted for this study were within the framework of selected elements and these questions included topics that emerged during the review of the literature on CPTD and CoPs (Eberlein, 2015:157-159). The interviews were transcribed, and the Afrikaans transcriptions are documented (Addendum L).

d) CoP observations

The researcher started with observations at the CoP sessions as soon as the interviews with the respective teachers were concluded. These observations not only afforded the researcher an opportunity for a more profound understanding of the interviews (particularly to observe issues that participants are not willing to discuss or participants themselves are not aware of), but also provided knowledge of the context observation as a data collection technique provides a lens to view the 'experiences' of teacher interaction in a CoP (Angrosino, 2005:733).

e) Field notes

Field notes were used based on Taylor et al. (2015) view that field notes are a primary source of recording conversations and observations. By using their suggestions for recording the field notes, two significant issues that had implications for the credibility of the study were addressed.

The researcher relied on the use of mental notes while interacting with participants and when the situation did not allow for full note-taking (Glesne, 2006), the researcher transformed these mental notes into short notes at a later stage as a reminder to write complete field notes (Berg, 2012).

f) Participant diaries

Participant diaries give the researcher an opportunity to capture the events and experiences of the participant, which in essence “captures life as it is lived” (Bolger et al., 2003:579). The researcher opted to use a “paper and pencil” participant diary format (Addendum M), because it is simple and effective, but also because the researcher did not want to burden the teachers with more tasks.

The researcher asked that teachers note their reflective experiences during the CoP sessions (Addenda N & O). Participants had to record the date, curriculum learning area, topic, activities done and the co-operation among them in their diaries (Charmaz, 2005).

g) Reflective journal

Reflexivity is a familiar feature in most qualitative studies that could be introduced from the beginning of the study to increase a researcher’s understanding of the studied area (Edwards, 2001:122). Merriam (2009:149) explains that researcher-generated documents, like a reflective journal assists the researcher to understand the investigated, people or experience better.

At the beginning of the study, the researcher kept written notes in an A4 notepad and then documented the information on a computer. These notes were the descriptions of the researcher’s observations and comments on the observations, as shown in the reflective notes (Addendum P), which played an essential part in the analytical process.

h) Document review

The final phase of data collections was to use document review, which is a systematic procedure for reviewing or evaluating printed and electronic documents (Bowen, 2009) that is worthwhile to “uncover meaning, develop understanding, and discover insights relevant to the research problem” (Merriam, 1998). As one of the sub-questions of this study deals with the legislation of CPTD, relevant documents from the Department of Education were comprehensively studied.

i) Data preparation

Producing meaningful interpretations and findings from interview transcripts and observations needs qualitative data analysis to discover patterns, concepts, themes and meanings from the data (Miles & Huberman, 1994; Seidel, 1998; Marshall & Rossman, 1999; Ely et al., 2003; Merriam, 2009; Krippendorff, 2013; Wellington, 2015).

Corresponding activities completed include data preparation and organisation, re-organising or re-structuring the data, data coding, establishing categories and themes and, analysing and interpreting the data before finally presenting the data and findings (Nieuwenhuis, 2010a:103; Creswell, 2014:261). The researcher followed the guidelines of McLellan et al. (2003) to prepare transcripts as well as to track and store the digital audio recordings. The researcher transcribed all the digitally recorded semi-structured interviews herself following good practices (Nieuwenhuis, 2010a:104; Cohen et al., 2011:536) and chose to do it in the language in which it was conducted originally, namely Afrikaans and not to translate it to English in order to remain authentic.

The next step in the data development process was to edit the recorded data into a simplified format to make data handling easier (McMillan & Schumacher, 2014:398). Subsequently, the researcher utilised Miles and Huberman's (1994:23) data reduction methodology to condense the mass of raw data into a manageable form. The researcher went ahead to re-organise the data into pre-determined categories (Cohen et al., 2011:551; McMillan & Schumacher, 2014:397) pertinent to the theoretical framework of this study.

j) Data coding

Once the data were transcribed and re-organised into pre-determined categories, the data were coded to create gathering points for further data analysis (Patton, 2005:463; Nieuwenhuis, 2010a:105). This process entailed the careful, line-by-line reading and re-reading of the data to "get a sense of the whole" (Creswell, 2014:268), followed by the assigning of unique codes (Cohen et al., 2011:559) to meaningful parts of the data (McMillan & Schumacher, 2014:398). Content analysis was used where categories and patterns started to appear from the data, rather than being decided on before the data collection process (McMillan & Schumacher, 2014:374). A process of open coding (Nieuwenhuis, 2010a:105; Cohen et al., 2011:561) enabled the researcher to create both subcategories within the pre-determined categories and to create new categories. A list of factors contributing to effective CPTD was compiled from the emerging data, grouping concepts into categories and subcategories.

k) Thematic analysis

The researcher's choice of hand-over-computer analysis resides in the essence of staying authentic to the wording of the original interviews, preserving the richness of each (Eberlein, 2015:164). The researcher employed thematic analysis, which is defined as a method for identifying themes and patterns of meaning across a dataset to answer the research questions (Patton, 2005:453; Thomas, 2010:291; Braun & Clarke, 2013).

In this study, the researcher searched the texts in the interview transcripts, reflective journals, and questionnaires for recurring words or themes that could inform valuable interpretations and key findings (Teddle & Tashakkori, 2009:343). The content of the purposively selected participants' diaries and reflective journal were analysed to find significant themes as explained (Henning et al., 2004:6; Patton, 2005:463; McMillan & Schumacher, 2014:374). Clustering concepts together into a smaller number of groups allowed the researcher to visualise the major themes emerging from the data, which were grouped under broad categories based on the theoretical framework, specific teacher needs, possibilities of CoPs to address CPTD, aspects of an effective CoP and the contributions of a CoP.

1.7.3 Rigour of the study

Rigour, defined as “the quality or state of being very exact, careful, or with strict precision or the quality of being thorough and accurate” is intrinsically part of research design and represents the appropriateness of the methods used to answer the research questions (Cypress, 2017:254). The rigour of qualitative research is typically established by using the four strategies of credibility, transferability, dependability and conformability, which correspond to the quantitative criteria of internal and external validity, reliability and neutrality (Guba & Lincoln, 1981; Krefting, 1991; Talbot, 1995; Daymon & Holloway, 2002; Creswell, 2007).

Credibility is described in qualitative research as the degree to which the data and data analysis are reliable and trustworthy (Daymon & Holloway, 2002:93; Golafshani, 2003:601; Babbie & Mouton, 2011:277). This study uses prolonged engagement, member checking, peer examination, reflexivity and triangulation to demonstrate the credibility of the research. The credibility of this study leans firmly on triangulation, which refers to the use of multiple data sources such as the questionnaires, interviews and observations.

Transferability refers to the extent that research findings could apply to other contexts or populations (Golafshani, 2003:601; Babbie & Mouton, 2011:277), but qualitative research is not readily generalised to larger populations.

“Thick description”, which is described as an “extensive and careful description of the time, place, context, and culture of the interactions in a social setting” (Mertens, 2005:256) is a common feature of case study research that enhances the transferability of the findings to other similar settings (Creswell & Miller, 2000:129). Transferability of the results of this study was enhanced by supplying thick descriptions of the research setting, the participants, research design, data analysis, particularly the themes formulated and by providing examples of raw data where the actual words of the participants have been continuously used.

Dependability is the consistency of observing the same finding under similar circumstances (Merriam, 1998; Daymon & Holloway, 2002:94; Saunders et al., 2009:319). Since it is impossible to repeat a qualitative research project with the same respondents in the same context and achieve the same results, this means opening both the research findings and the research process by which they were obtained to public scrutiny. In pursuing an audit trail, the researcher aimed through the systematic, detailed clarification and presentation of the research process and research design to enhance the dependability of the study (Creswell & Miller, 2000:128; Akkerman et al., 2008:265; Anney, 2014:278). The researcher provides comprehensive access to all processes of documenting this study.

Confirmability refers to the degree that the research conclusions are related to the focus of the study and not to the biases of the researcher; the degree to which the research findings could be confirmed or corroborated by others (Daymon & Holloway, 2002:94; Ferreira, 2006:159). Reflexivity in a research context refers to the process of critically reflecting the knowledge that unfolds and the role of the researcher in constructing that knowledge (Braun & Clarke, 2013:36). The observations of the research process were documented in participant diaries, and the researcher kept a reflective journal to ensure the objectivity of this study.

1.8 Research ethics

Research ethics refers to the “appropriateness of your behaviour concerning the rights of those who become the subject of your work or who are affected by it” (Oates, 2006:54; Saunders et al., 2009:183; Rule et al., 2011:106; Mouton, 2013:276).

Access and acceptance, and informed consent are the two critical issues relating to the ethics of social research studies (Cohen et al., 2011:81; Creswell, 2014:166; Gay et al., 2014:16; McMillan & Schumacher, 2014:130).

The DESC (Department of Ethics and Screening), Stellenbosch University granted ethical clearance to perform this study (Addenda B and C). Subsequently, the researcher also applied for and was permitted by the Director of Research Services, Western Cape Education Department to conduct the study in the Vredendal school district (Addendum A). Copies of the approval letter were included in an information circular (Addendum J) that were sent to all principals in the Vredendal school district.

Copies of a typed letter of consent (Addendum K) were sent to all Natural Sciences teachers in the Vredendal school district, and this was followed up with a telephonic clarification to ensure that there were no misunderstandings. Signed consent forms were received from those teachers that agreed to participate in this study confirming them to “acknowledge the protection of their rights” (Creswell, 2014:167).

The participants’ biographical information, as well as all the documentation, audio and video recordings, photos, and data related to the study, were kept confidential (Kvale & Brinkmann, 2009:147), stored in digital password-protected format on a private computer that only the researcher can access.

1.9 Thesis outline

The thesis is structured as follows:

Chapter 1 (Introduction) relates one of the most significant and contemporary teacher problems in South Africa to ineffective, outdated CPTD practices, a situation that could be addressed by adopting a CoP approach. Discussions pay attention to the rationale, purpose and significance of the study that centrally aims to explore the potential a CoP offers to support the professional development of a selected teacher group. A cursory account of the research design is provided.

Chapter 2 (Literature Review) contextualises CPTD and CoPs concerning the current South African state of education. CPTD is dissected with a focus on definitions, theory, models, practice, current developments, barriers and success factors, elaborating and clarifying what effective CPTD constitutes. Attention is drawn to the legislative aspects relating to CPTD in South Africa, and the challenges that impair rural schools to progress with their CPTD efforts. The construct of teacher CoPs is discussed based on Wenger’s (1998) foundational theory, and its potential to facilitate CPTD effectively as an alternative collaborative approach is highlighted.

Chapter 3 (Research Process and Design) details the research design, inclusive of the philosophical framework, the accompanying research approaches, strategies and methods that were followed and the corresponding data collection and analysis techniques and procedures used. Considerations relating to rigour and ethics are also addressed.

Chapter 4 (Results) presents the assimilation, illustration, analysis and interpretation of data that were collected using questionnaires, interviews and observations, and other secondary means. Major themes emerging from content analysis converge instrumentally into the key findings of this study.

Chapter 5 (Discussion and Conclusions) draws the study to a close by summarising the key findings in the context of answering the research questions. A critique of the study is undertaken, and the researcher touches on self-reflection. This chapter also shares key learnings that could be of value to practitioners and provides some guidance for future research in the conclusion.

1.10 Conclusion

This chapter highlighted the research problem of the study, both in the local and general South African context, and presented the motivation for selecting a CoP approach to support CPTD. Underpinned by a social constructivist ontology and interpretivist epistemology, a multi-method qualitative case study design was deemed appropriate for this study to explore the experiences of a group of Natural Sciences teachers situated in a bounded system, i.e. the rural school district of Vredendal, illuminating their beliefs, views and experiences of a CoP approach to support their continuing professional development.

Primary data were collected via different techniques including questionnaires, semi-structured interviews and CoP observations. Secondary data encompassed participant diaries, field notes, the researcher's reflective journal and document review. Several aspects of data preparation, organisation, reduction, presentation, and interpretation were discussed. Appropriate measures were taken to ensure rigour during the entire research process, and consideration was given for relevant ethical considerations. The significance of this study could potentially help multiple stakeholders and role-players in education.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In the previous chapter, the problem statement related to this study was highlighted as that CPTD interventions are not delivering on their expected outcomes in science and mathematics education, in South Africa, regionally in the Western Cape Province, and locally in the rural school district of Vredendal. Following a global trend, South African researchers are increasingly demanding that collaborative CPTD models replace the current low-impact transmissionist approaches to CPTD. A CoP, a collaborative CPTD model by classification, has design characteristics appealing to the effective facilitation of CPTD, but it needs to conform to legislation because CPTD is governed in South Africa.

After the research problem was named, an initial literature study helped to formulate the main research question, which was refined by the departmental post-graduate committee as part of the research proposal process. Subsequently, a comprehensive literature review aimed to direct and detail the sub-questions, illustrating the potential contribution of this study's findings to the existing knowledge by using subtopic analysis (Figure 2.1).

Using Creswell's (2014:8) approach to a literature review of locating, selecting and summarising resources, this chapter provides an expansive, but compacted literature review of teacher development and CoPs, the two terms featuring in the main research question.



Figure 2.1 Illustration showing the importance of the literature review in the formulation of the main research question and sub-questions.

2.2 Literature searches

Different databases such as EBSCO-Host, which included Academic Research, Eric, Sabinet, Scopus, Web of Science and Google Scholar were used to conduct the literature study. The phrases “Professional Teacher Development”, “Professional Teacher Development” and “Communities of Practice,” as well as “Teacher and Training” and “Professional Learning Communities” were researched.

The electronic literature investigation yielded more than 1196 hits, but the search was narrowed down to result in 665 references. After reading through these, further refinement brought about 250 references into focus. Cross-referencing within these references, pushed the final set to 276 different references, which were selected to pursue the main research question.

Through this process, leading authors such as Avalos (2011), Berliner (2001), Borko (2004), Botha (2012), Desimone (2009), Guskey (2002a, 2002b, 2003), Hord (1997), Jita and Mokhele (2012, 2014), Kennedy (2005, 2011), Little (1993, 2002), Ndlovu (2011a, 2011b), Opfer & Pedder (2011), Postholm (2012), Servage (2009), Smith (2014, 2015), Steyn (2008, 2009, 2010a, 2010b, 2011) and Wenger (1998, 1999, 2000, 2002, 2010, 2011, 2015), were identified that helped with the expansion of the literature study and this method also yielded several more articles of relevance. A breakdown by reference type and publication year are given in Figure 2.2. The Mendeley program was used to store the references in electronic format, which made citations and creating the reference list easier.

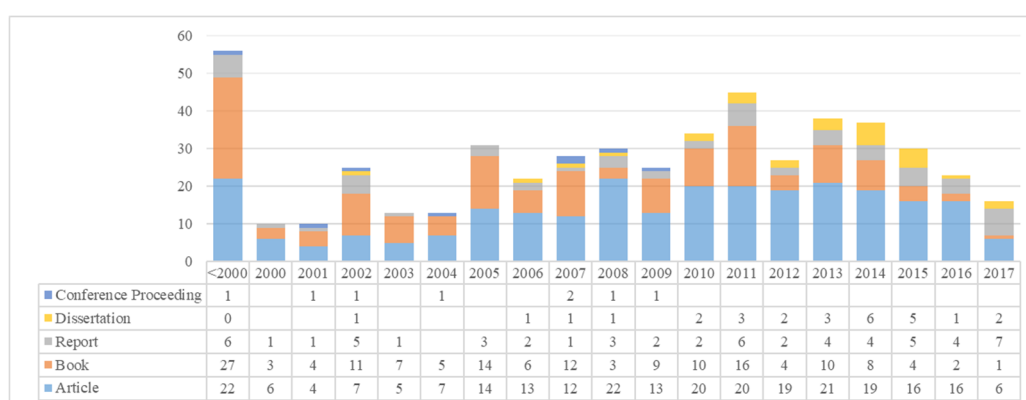


Figure 2.2 References used in this study segmented by reference type and publication year.

2.3 Formulation of argument

Rapid globalisation driven by digital transformation from the onset of the 21st century has created an increasing need for a workforce qualified in the science, technology, engineering and mathematics (STEM) fields to sustain economic growth rates and meet development aspirations, in both developed and emerging economies (Hackling, 2015:1; National Science Board, 2015:3).

The economic justification for STEM education is profound as it provides the pipeline of future scientists and engineers needed to grow advancing economies (Donovan et al., 2014:1). As a result, improving STEM education at secondary school and tertiary higher education levels in this context stays paramount in developing countries, emerging economies, and long-established economies such as Europe and the United States (Kennedy & Odell, 2014:248).

South Africa as the second-largest economy in Africa, critically needs to grow its STEM-capable workforce in order to improve its global economic competitiveness (Onwu & Schoole, 2008:121; WEF, 2017:19), but there is a prevailing sentiment that South Africa has a failing education system as clearly stated by Wolhuter (2014:2):

In academic circles (among scholars of Education, social science scholars and researchers from other fields, as well as the managers of education, such as university rectors), and among business leaders, public opinion-makers (such as newspaper editors), teachers, learners, parents, students and the broader public, there is a widespread feeling that the South African education system is bad, or the weakest link in the chain tasked with uplifting society to its appropriate place in the world of the twenty-first century.

A core obstacle to advancing STEM education in South Africa is the inadequately low learner participation at secondary school level, and student enrolment at tertiary education level (Mji & Makgato, 2006:254; Council on Higher Education, 2009:4; Case et al., 2013:1; Marginson et al., 2013:57; DBE, 2014:35; Dharsey, 2015:62; OECD, 2016:32).

Learner performance in science and mathematics, the gateway subjects required for STEM education at secondary level, continues to be consistently dismal throughout the past decade (Maree et al., 2006:229; Reddy et al., 2012:2; Dhurumraj, 2013:1; Bertram, 2014:91; Letseka, 2014:4865; Semeon, 2014:1; Robberts, 2017:12), despite the claimed improvement in general National Senior Certificate pass rates (DBE, 2017a). This crisis is affecting learners from rural schools far worse compared to those attending urban schools for a variety of reasons, including the apartheid legacy, diverse cultures, general poverty, remoteness and teacher isolation (Gardiner, 2008:13; Pandey, 2010:55).

In support of these statements, a disconcerting picture appears when the National Senior Certificate 2016 (DBE, 2017b) results are properly interrogated:

- nationally, the drop-out rate was an alarming 6.8% (19 596 of 285 406 learners) for mathematics, whereas 5.9% (12 077 of 204 695) learners initially enrolled in physical science did not write the final exams
- nationally, only 13% of mathematics learners and 15% of physical science learners that wrote the final exams passed with grades $\geq 60\%$, a cut-off usually considered for successful tertiary STEM education entry
- locally in the Vredendal area, where this study is undertaken, only 15% (51 of 333) of Grade 12 learners enrolled in a mathematics-physical science subject combination.

Five years (1995, 1999, 2003, 2011, 2015) of participating in the Trends in International Mathematics and Science Study (TIMSS) confirm that South African mathematics and science learners lag their international counterparts significantly, with a persistent failure to lift learner performance the past decade (Bansilal et al., 2010:153; Ndlovu, 2011a:1402; Mullis et al., 2016). Another leading study performed globally by the World Economic Forum ranks South Africa bottom of the log out of 139 countries on the quality of mathematics and science education (Baller et al., 2016:172).

Several factors contribute to this unsatisfactory state of education in South Africa, but teachers assume the most influential role that affects learner performance (Steyn, 2008:15, 2010:212, 2011:43; Randall, 2008:37; Kriek & Grayson, 2009:185). Malm (2009:78) simplifies this by stating “the quality of an educational system cannot exceed the quality of its teachers”. Furthermore, Dharsey (2015:77) is of the view that “there is general accord among education policymakers, researchers and practitioners that knowledgeable and competent science teachers play a critical role in any program for boosting interest in, and aptitude for, science”.

Shortcomings in the quantity and quality of South African science teachers continue to be concerning as the “issue of teacher availability, and teacher quality is viewed as very important in the teaching of Science in South African schools” (Mtsi et al., 2016:110). The current situation is worsened by a significant percentage of science teachers that are underqualified, or unqualified (Mji & Makgato, 2006:254; Onwu & Schoole, 2008:123; Steyn & Mentz, 2008:679; Nel, 2015:45; Pournara et al., 2015:2).

In the South African context, the relationship between teacher quality and learner performance is well understood. According to Pandey (2010:17), the “fundamental assumption is that by improving the quality of teaching the quality of the education that pupils and students receive is improved”.

The South African government has placed significant emphasis on teacher development since the 1980s, but there is insufficient evidence to suggest that it affected learner performance positively as learners performed poorly in national and international assessments the past two decades (Bertram, 2014:9).

A proliferation of studies, however, concluded that teacher development remains the best approach to transform education effectively and sustainably (Little, 1993; Berliner, 2001; Guskey, 2002a; Borko, 2004; Kennedy, 2005; Desimone, 2009; Doppelt et al., 2009; Klieger & Bar-Yossef, 2010; Avalos, 2011; Opfer et al., 2011; Simon et al., 2011; Lumpe et al., 2012; Mitchell, 2013; Trygstad et al., 2014; Geldenhuys & Oosthuizen, 2015; Admiraal et al., 2016).

Thus, an investigation into the continuing professional development of Natural Sciences teachers becomes imperative to understand and address their needs concerning the roles and competences they are expected to fulfil in the interest of effective teaching.

2.4 Continuing Professional Teacher Development (CPTD)

The value proposition for teacher development rests on two fundamental premises. Firstly, it speaks to personal career management, as all careers need a continuous update of knowledge and skills to keep pace with a fast-evolving world, and the teaching profession is no exception (Steyn & Van Niekerk, 2005:129). Secondly, most of the global educational reforms are focused on teacher development, as teachers are perceived as key to improving learner performance (King & Newman, 2001:86):

...teachers have the most direct, sustained contact with students, as well as considerable control over what is taught and the climate of learning. It is reasonably assumed that improving teachers' knowledge, skills and dispositions are one of the most critical steps to improving student achievement.

Admiraal et al. (2016:281) agree that teachers should be actively developing themselves throughout their careers to remain relevant in the learning processes of their learners. Hewson (2007:2) touches on a very important aspect, answering the question why teacher professional development should not be applied selectively, but should cover all practising teachers, because "in the current climate of reform, teachers' practices, even when they were highly effective at an earlier stage, may be in need of reconsideration and updating".

Teacher development is an expansive research topic, of which selected elements depicted in Figure 2.3 are discussed in the following sections.

2.4.1 Definitions

References to teacher development in literature are vast, and related terminology is sometimes ambiguous, and is often interchangeably used. Some analogous terminology met in relation to teacher "development" include "education", "learning", "teaching" and "training", in many cases coupled with "professional" as prefix, and words like "cluster/s", "community", "communities", or "network/s" are frequently used in a collective context.

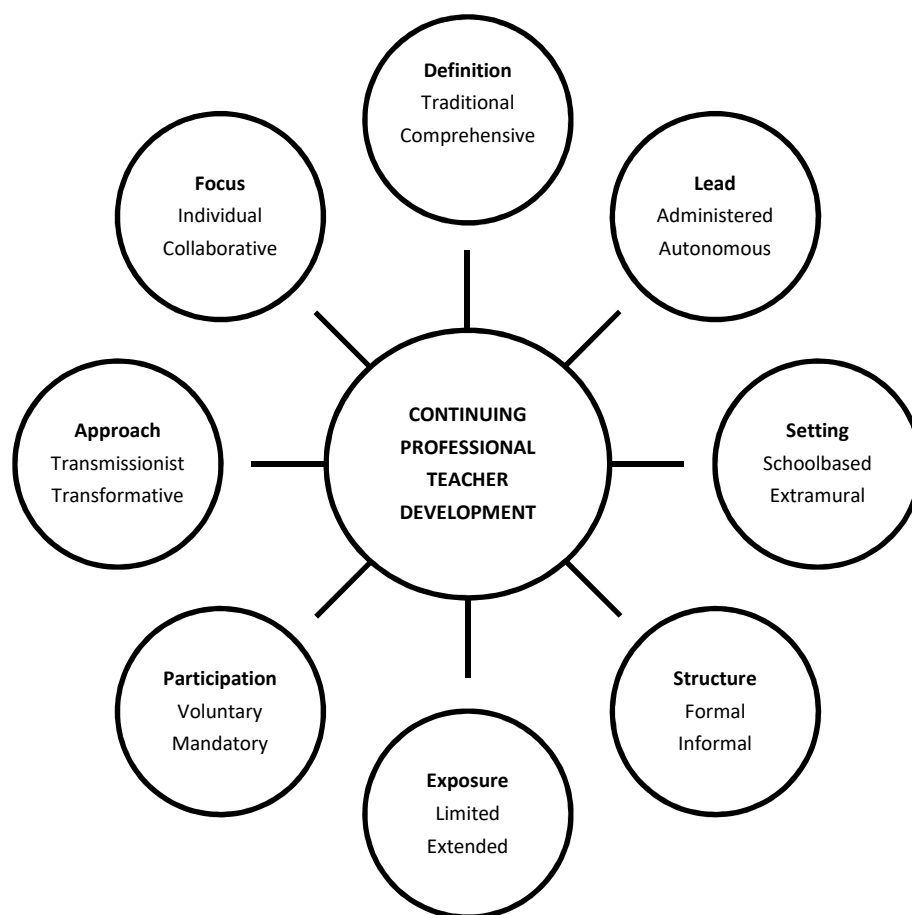


Figure 2.3 Some essential aspects of Continuing Professional Teacher Development (CPTD).

Some researchers (McMillan et al., 2016:152) regard teacher learning and teacher development as the same construct, but this study maintains the view of Mitchell (2013:389) that teacher learning refers to processes, resulting in changes in the professional knowledge, skills, attitudes, beliefs or actions of teachers, whereas professional development refers to more comprehensive changes that may occur over an extended period.

Correspondingly, Simon et al. (2011:7) highlight that teacher development and teacher learning are different concepts:

Teachers' professional learning can be taken to represent the processes that, whether intuitive or deliberate, individual or social, result in specific changes in professional knowledge, skills, attitudes, beliefs or actions of teachers. Teachers' professional development, on the other hand, is taken to refer to the broader changes that may take place over a longer period of time resulting in qualitative shifts in aspects of teachers' professionalism.

In this study, the researcher favours the acronym CPTD (Continuing Professional Teacher Development) because it touches on two especially important aspects of teacher development. Firstly, “Continuing” declares that teacher development is not a once-off event but occurs throughout a teacher’s career (Forte & Flores, 2014:93), one of lifelong learning (Rogers, 2006:510; Steyn, 2011:46; Smith, 2015:54; McMillan et al., 2016:151). The extensive research concluded that CPTD activities need to be focused and prolonged, instead of short and infrequent so that teachers are afforded the time to understand, develop, discuss and practice newly gained knowledge (Admiraal et al., 2016:283).

Gathered, teacher development includes all in-service activities “that go beyond initial teacher preparation to include a number of planned and non-planned activities in which teachers engage throughout their careers and a variety of activities and learning experiences” (Forte & Flores, 2014:92), of which the “opportunities may be voluntary or mandatory, individual or collaborative, and formal or informal” (Patton et al., 2015:28), with the intention “to update, develop and broaden the knowledge teachers acquired during initial education and/or provide them with new skills and professional understanding” (Lipowski et al., 2011:687).

Richter et al. (2011:117) clarify the difference between formal and informal teacher development by defining formal learning opportunities as tied to structured learning environments with a specified curriculum, whereas informal learning opportunities, by difference, is not guided by a specified curriculum and are not limited to specific environments.

The second qualifier in the acronym CPTD, namely “Professional” acknowledges teachers as professionals (Feldman & Fataar, 2014:1529; Feldman, 2016:87), referring in some cases to the term “professional identity” (Hong, 2010:1532). Dharsey (2015:114) predicates that the professional identity of a teacher, which is forged by their attitudes, beliefs and values, forms a crucial aspect in their ability to teach with confidence. Körkkö et al. (2016:199) provide linkage between professional identity and development by declaring that “teachers’ personalities and experiences are seen as essential sources of their work, and it has been argued that identity strongly affects a teacher’s satisfaction, commitment, motivation, and self-efficacy”.

Avalos (2011:10) emphasises that the ability and willingness to examine each teacher’s conviction and beliefs are key factors in their development. Existing global research considers the professional identity of teachers as a critical factor in their motivation, effectiveness and retention (Sachs, 2001:154; Samuel, 2009:138; Izadinia, 2012:709; Williams et al., 2012:248; Mushayikwa, 2013:283; Samson, 2013:154; Nel, 2015:46; Mukeredzi, 2013:8; Robberts, 2017:117).

2.4.2 Structure, effective enablers and influencing factors

Borko (2004:4) illustrates that any professional development system includes four elements, namely the professional development program with its activities, teachers, the facilitator and the context in which professional development occurs.

De Vries et al. (2013:85) divide CPTD activities, which may include varied lesson-related content, including subject matter, didactics, pedagogics, and pedagogical content knowledge into three groups:

- **Instructive.** After primary training, the practical knowledge of teachers may increase through experience and teaching practice, but their theoretical knowledge needs continuous renovation to stay aligned with educational developments and innovations.
- **Reflexive.** These vital activities, often subconscious, require a particular form of thinking to question existing knowledge, beliefs, possibilities, ideas, and actions, allowing teachers to take better control of classroom situations.
- **Collaborative.** Subdivided into exchange activities (e.g. discussing teaching problems, exchanging instructional materials) and professional collaboration (e.g. developing educational materials, co-teaching), their aim is to help shape the learning environment and impact student learning.

Recent research yielded common enablers for effective CPTD to increase teacher knowledge and skills and to improve their practice with the aim to improve student achievement (Lipowski et al., 2011:689). Smith (2014:217) broadens this statement by adding that the “teaching of primary science focuses in particular on support in the form of professional development, improving teacher confidence, science content knowledge, pedagogical content knowledge and instructional practice”.

Guskey (2003:749-750) identifies 21 attributes of effective CPTD, of which he focused much of his discussion on the five most frequently mentioned that includes enhancing teachers’ content and pedagogical knowledge, providing enough time and other resources, promoting collegial and collaborative exchange, establishing procedures for evaluating the professional development experience, and conducting school or site-based professional development.

Desimone (2009:183) summarises five effective elements in CPTD namely content focus, active learning, coherence, duration and collective participation.

Loucks-Horsley & Matsumoto (1999) list seven principles of effective CPTD for science and mathematics teachers, adding to Guskey's list of five. Three more ideas that include establishing a clear image of classroom learning and teaching, creating a design that is based on research and engages teachers as adult learners, and developing a support system for teachers so they may learn to serve in leadership roles in their schools and districts.

Locally, Steyn (2009:117-119) highlights four aspects that could play a crucial role in the effective implementation of CPTD namely a focus on learning, effective leadership, feedback on teachers' development, and the provision of CPTD programs, detailing content focus, duration, time, evaluation and presentation. Kriek and Grayson (2009:199) supported by Ndlovu (2011b:526) proposes that teachers need simultaneous development along three dimensions, which refer to content knowledge, teaching approaches and professional attitudes.

More recent studies continue with the same theme, providing empirical evidence that the most effective CPTD programs, whose goal is to increase teachers' knowledge and skills and improve their teaching practice, include the following three characteristics, namely activities that are ongoing and sustained over time, focus on subject content and how students learn that content, and provide teachers with opportunities to interact actively and engage with each other around curriculum and instruction (Tournaki et al., 2011:300). Admiraal et al. (2016:283) concur with the work of Opfer and Pedder (2011), resonating that CPTD activities must be intense and sustained, embedded in teaching practice, and collaborative and collective.

Patton et al. (2015:29-36) hold an alternative belief, stating that effective CPTD should be linked to teacher engagement, teacher practice, and student learning, with core features highlighted in Figure 2.4. All these embrace CPTD at various levels.



Figure 2.4 Patton's et al. (2015) representation of core features for effective CPTD.

Labone and Long (2016:57-58) suggest that effective CPTD is determined by features summarised as follow, it highlights participation, practices, reflections, professional learning, collaborative practices, coherence in teacher's knowledge and beliefs in the following diagram, (Figure 2.5).

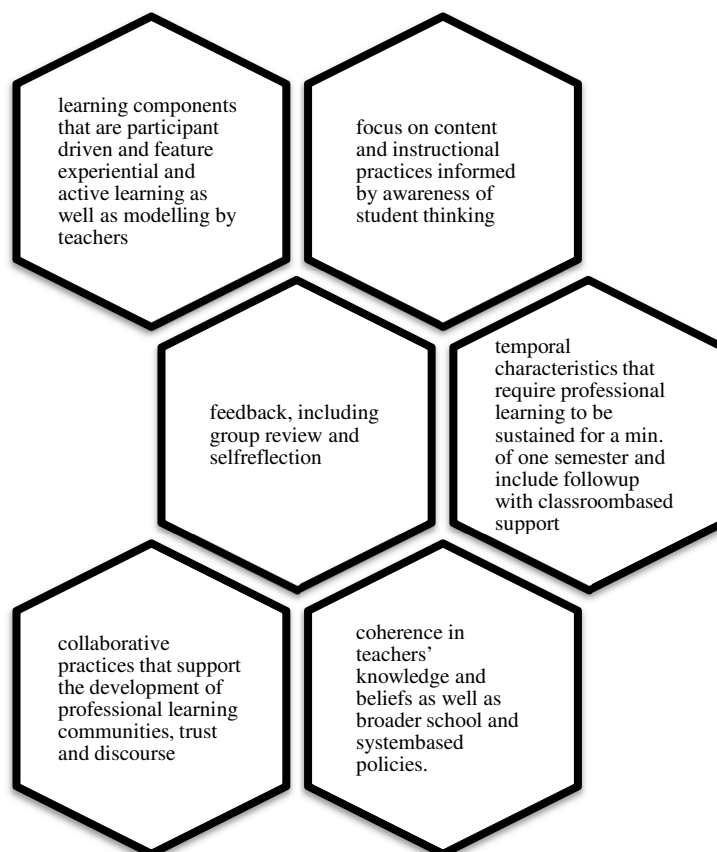


Figure 2.5 Labone and Long's (2016) six features for effective CPTD.

Guskey (2002a:45) emphasises the importance of measuring the impact of CPTD on learner performance, stating that it requires the collection and analysis of five critical levels of information where level 1 reflects participants' reactions, level 2 participants' learning, level 3 organisation support and change, level 4 participants' use of new knowledge and skills, and level 5 student learning outcomes. However, he cautions that direct relationships between CPTD and learner performance in real-world settings are complex, and instead of looking for evidence that CPTD is working, prove that its measures are meaningful to stakeholders in the assessment process (Guskey, 2002a:48).

Literature is packed with references related to factors that influence the success of CPTD, as well as barriers to effective CPTD. There are some common themes from different studies, but many of the studies report specific issues and problems.

Opfer and Pedder (2011:21) list teachers, schools and the features of CPTD activities as key barriers. Lipowski et al. (2011:696) highlight some necessary conditions for CPTD, which include time, financing, suitable CPTD, employer support, incentives and social status of the teaching profession. As teachers are principally responsible for their professional development and personal growth, most of the challenges for effective CPTD relate to teachers; teacher beliefs and attitudes are central to the success of CPTD (Opfer & Pedder, 2011:5).

Teachers' reluctance to take part in CPTD programs, in some cases connected to their career development and stage, unwillingness to collaborate with other teachers and failure to self-reflect were observed (Geldenhuys & Oosthuizen, 2015:209). Many of these traits refer to the concept of "teacher individualism" (Wong, 2010:131; Snyders, 2017:38), or "teacher isolation" (Hadar & Brody, 2010:1643; Daniel et al., 2013:162; Smith, 2014:228; Admiraal et al., 2016:282).

Macheng (2014:62-71) names teacher commitment, school leadership, collaboration, school culture, time and financial resources as significant success factors. According to Tsotetsi and Mahlomaholo (2013:91-92) some of the challenges with CPTD include "a lack of creating space for sharing information and good practices; beginner teachers not receiving mentoring; lack of a strategic plan; the fault-finding attitude of seniors; less focus on pedagogical content knowledge or pedagogical practices; and teachers programmes developed without taking into consideration the understanding of professional development from the teachers' perspectives".

McMillan et al. (2016:163) draw attention to personal, intrinsic motivators such as growth, advancement or achievement, probably supported by relevant contingent factors such as interpersonal relations (friendships within the association) and policy (school expectation and ethos) as barriers to effective CPTD.

The literature shows that there are gaps regarding the professional development of teachers in rural areas that are situated far from the teacher training institutions. Usually, professional development programs are presented in bigger towns and surroundings, mostly for extended periods. The logistics, inclusive of extreme travelling distances, as well as social and family responsibilities could serve as barriers to teacher participation.

The literature shows that the schools are the first point for effective CPTD, and school support is vital, but some schools are not providing conducive environments for teacher collaboration to take place (Kuijpers et al., 2010:1693; Geldenhuys & Oosthuizen, 2015:209). Some of the critical contributions of schools in CPTD are to allow access, provide support and encourage teachers to participate in professional learning activities (Admiraal et al., 2016:284).

In the case of the vast contextual differences between urban, rural and remote schools, Lyons (2008:30-31) advises against a one-size-fits-all CPTD approach, but suggest that CPTD offerings be customised according to the needs of the teachers in these different environments, considering the support contribution or involvement of the school.

2.4.3 Models

In the literature CPTD is embedded within various models (Little, 1993; Guskey, 2002b:383; Desimone, 2009:184; Kuijpers et al., 2010:1691; Richter et al., 2011:117; Hadar & Brody, 2012:147; Mitchell, 2013:392; Macheng, 2014:50; Dharsey, 2015:48; Smith, 2015:37).

In a seminal piece of research, Kennedy (2005) distinguishes nine CPTD model types, organised into three categories, namely transmissionist, transitional and transformative, suggesting that the capacity for teacher autonomy increases in that order (Figure 2.6). Transmissionist relates to the initiation of teachers by more experienced colleagues, transformative refers to a teacher relationship that provides a “supportive, but challenging forum for both intellectual and effective interrogation of practice” (Kennedy, 2005:243), whereas transitional is a compatible means of supporting both these purposes of CPTD.

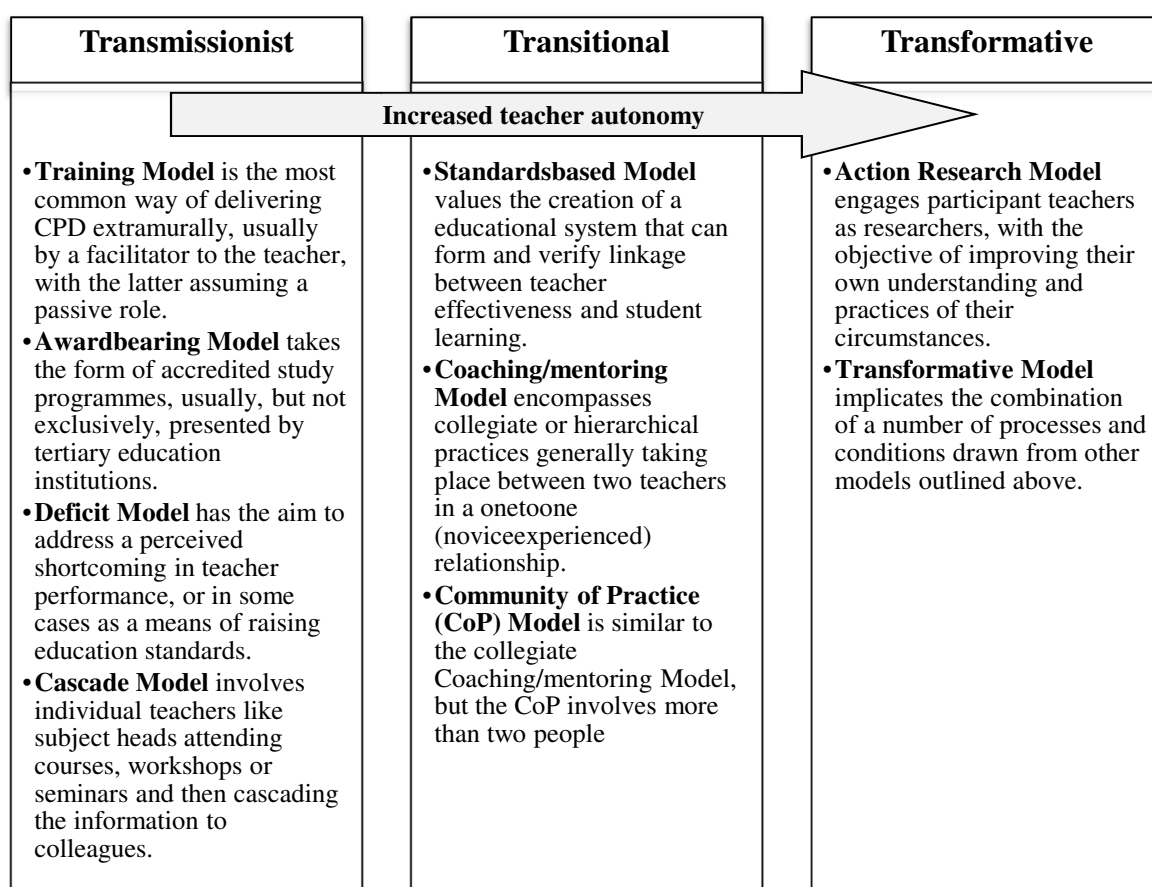


Figure 2.6 Different teacher development models (after Kennedy, 2005).

Some of these models have distinct applications, posing specific benefits, but are also marked by certain disadvantages. In recent years, there has been a move away from traditional CPTD models that are transmissionist, in favour of employing models that foster teacher collaboration (Lessing & De Witt, 2007:56; Kriek & Grayson, 2009:186; Steyn, 2009:116-117; Klieger & Bar-Yossef, 2010:771; Opfer & Pedder, 2011:4; Simon et al., 2011:7; Roblin & Margalef, 2013:18; Labone & Long, 2016:56). This shift is motivated by several studies that highlight the benefits of teacher collaboration in relation to CPTD (Steyn & Van Niekerk, 2005:131-132; Levine & Marcus, 2010:389; Kennedy, 2011:27; Forte & Flores, 2014:93-94; Geldenhuys & Oosthuizen, 2015:209; Ngcoza & Southwood, 2015:9).

2.4.4 The South African narrative

In South Africa, CPTD refers to the in-service training and education (INSET) of teachers “whereby teachers continually improve their skills, knowledge and attitudes while continuing their employment” (Mestry et al., 2009:477). The South African Council of Educators (SACE), the statutory body for professional teachers (Geldenhuys & Oosthuizen, 2015:205) was appointed in 2008 to govern CPTD in South Africa (SACE, 2008):

Teaching is at the heart of the schooling system. The quality of teachers’ professional practices is at the root of the quality of schooling, and the development of these practices is a continuing process that lasts for the duration of the career of a committed professional teacher. Continuing professional teacher development is, therefore, an essential component of a comprehensive teacher education system of high quality.

The following six resolutions were outlined for CPTD in South Africa (SACE, 2013):

- Improve schooling and quality of learner achievements.
- Coordinate CPTD activities to achieve sharper focus and effectiveness.
- Revitalise the teaching profession & foster renewed commitment to the development of South Africa.
- Contribute to responsible autonomy and confidence in the teaching profession.
- Enable the profession to re-establish its standing and role in advancing social justice.
- Acknowledge effective teacher participation in CPTD.

The CPTD system, managed by the SACE works on a point-based system, allowing affiliated teachers to earn points based on approved professional development activities that meet their personal needs. In South Africa there is no shortage of CPTD activities, which comes in a variety of format and content, including workshops, conferences, consultation, coaching, mentoring, short, long and remedial courses, demonstrations and peer observation, induction for in-service teachers, job rotation, collaborative work, clustering of schools and school visits, school improvement projects, CoPs, lesson studies, reflective supervision and technical assistance (Geldenhuys & Oosthuizen, 2015:204-205).

However, the SACE is prescriptive concerning the choice of CPTD activities, which were initially categorised into school-driven activities, employer-driven activities, qualification-driven activities, and activities offered by approved organisations (Steyn, 2009:115). Subsequently, the SACE (2013:9) reduced these four categories to three. School priority activities are directed by school management and staff, targeting whole school development, institutional circumstances of learning and improved teaching. Profession priority activities entail enhancing the professional status, practices and commitments of teachers in challenging areas as determined by the Department of Education, professional bodies and organised teacher labour.

For example, the Department of Education engaged tertiary institutions of higher education to present formal teacher development initiatives such as the Advanced Certificate (ACE) programs to re-train or upgrade the qualifications and competency of existing teachers (Bansilal & Rosenberg, 2011:108).

The WCED has recognised the importance of continuing teacher development and as a result, engages their science teachers in accredited training programs for in-service teacher training. Some of these programs are presented at the Cape Teaching Institute. The Advanced Certificate in Education (ACE) courses are presented by various higher educational institutions.

Following global trends, the Department of Basic Education implemented various policies during the last decade to bring about educational reform. Policy statements such as the Curriculum 2005 (DoE, 1997), Revised National Curriculum Statement (DoE, 2002) and the current Curriculum Assessment Policy Statement (DBE, 2010), were all designed to address the shortcomings identified in previous curriculums and to address the changing needs within the education system.

The National Policy Framework for Teacher Education and Development (NPFTED), which is supported by two complementary subsystems known as Initial Professional Education Training (IPET) and Continuing Professional Teacher Development (CPTD) aims to deal with the lack of suitably qualified teachers (DoE, 2007:5). The Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED) in South Africa 2011-2025 expects teachers to take responsibility for their professional development (DBE, 2011). However, the NPFTED is also expecting that the national and provincial education departments should provide the necessary environments to enable CPTD.

The NPFTED recognises that “both conceptual and content knowledge and pedagogical knowledge are necessary for effective teaching”, placing a focus on skills development and not necessarily qualifications. However, the Department of Basic Education soon realised the value of qualifications and introduced a new set of policy guidelines called the Minimum Requirements for Teacher Education Qualifications (Reeves & Robinson, 2014:237).

The principles underpinned by the NPFTED as expressed in the Norms and Standards for Educators (DoE, 2000) highlight the topic of teacher professionalism. The policy describes the roles, their associated set of applied competences (norms) and qualifications (standards) for the development of teachers. According to this policy, in order to be recognised as a competent professional teacher in South Africa (Botha & Reddy, 2011:260), teachers are required to assume seven roles that are further divided into three competences (Figure 2.7).

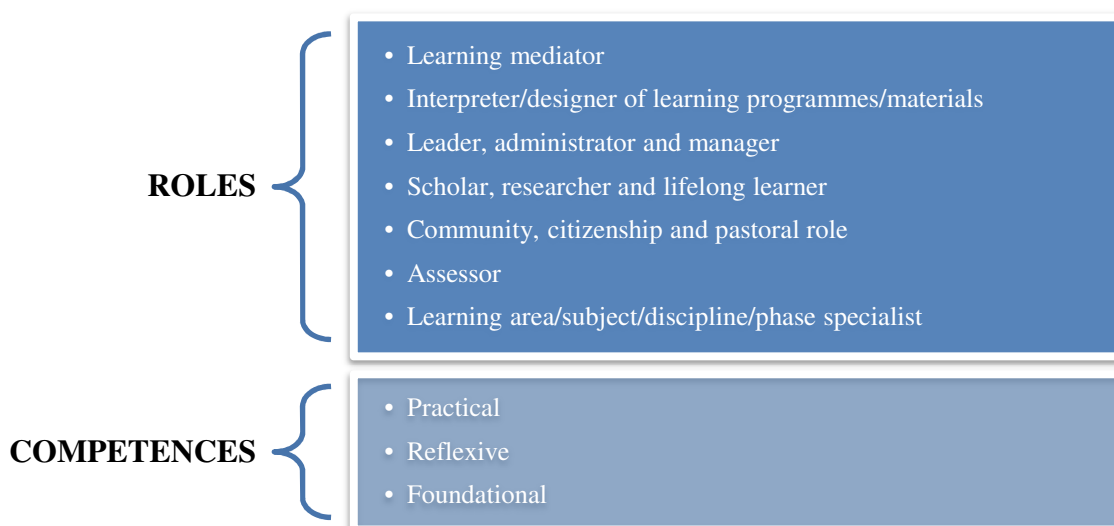


Figure 2.7 Roles and associated competences - Norms and Standards for Educators (DoE, 2000).

2.5 Communities of Practice (CoPs)

In the following sections, the concept of a CoP is discussed concerning the theory, its possibilities to transform the CPTD and the potential value it presents to the South African education system.

2.5.1 Theory and construct

The populist term “community of practice” (CoP), originally coined by Lave and Wenger (1991) is well-known and found purpose in diverse subject areas and disciplines, including educational research (Palincsar, 1999; Maynard, 2001; Mays, 2002; Printy, 2008; Wubbels, 2007). The concept of a CoP since then evolved and broadened from being a descriptive term (Hoadley, 2012:287) to being more prescriptive (Wenger, 1998, 2000, 2011), and most recently it has been described as a social construct “formed by people who engage in a process of collective learning in a shared domain of human endeavour” (Wenger-Trayner, 2013:107; Wenger-Trayner & Wenger-Trayner, 2014:15; Wenger, 2015:1).

Initially, the proposition read that “a community of practice is a set of among persons, activity, and world, over time and about other overlapping CoPs” (Lave & Wenger, 1991:98). According to Wenger (1998:51), a CoP is a social practice where the concept of practice is a process by which people can experience the world and their meaningful engagement with it. A CoP represents “groups of people who share a common concern or a passion for something they want to learn or improve as they interact regularly” (Wenger, 2000:1). Wenger et al. (2002:4) define CoPs as “groups of people who share a concern, a set of problems, a passion about a topic and who deepen their knowledge and expertise in that area by interacting on an ongoing basis”.

Brouwer et al. (2012:348) view CoPs as “groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly”. Pyrko et al. (2016:3) provide a similar interpretation of CoPs, by declaring that “Put simply, CoPs refer to groups of people who genuinely care about the same real-life problems or hot topics, and who on that basis regularly interact to learn together and from each other”.

Researchers such as McKay (2007:3) and Levine and Marcus (2010:389-398) are of the opinion that a CoP is not just a website, a database, or a collection of best practices, but is a group of people who interact, learn together, build relationships and in the process develop a sense of belonging and mutual commitment.

Over the years, CoPs changed form from one-directed communication that included everyday learning interactions to more engaged mutual forms of knowing interactions, under non-routine circumstances (Pyrko et al., 2016:7).

In the context of education, Hoadley (2012:288) defined the first, feature-based definition, of a CoP, which was constructed from the words of teachers themselves. He defined a CoP as a platform where the sharing of practices among teachers could occur, which could ensure learning in a more relational context interaction. At the core of most CoP approaches are the teachers' collaborative problem-solving efforts in pursuit of common goals, where groups of teachers and researchers work together locally, within schools, or peripherally (Ball & Cohen, 1999).

Gabriel (2011) views CoPs as separating teachers from their immediate practice to develop new ways of teaching. Secondly, these latest ideas are individually or collectively evaluated by teachers in their classrooms, and they monitor the success of their efforts, and thirdly they converge to review their instruction, discuss outcomes and critically reflect on their teaching (Englert & Tarrant, 1995; Ball & Cohen, 1999).

CoPs are often considered the precursors to “Professional Learning Communities” (Hord, 1997; Stoll et al., 2006; Street, 2008; Vescio et al., 2008; Botha, 2012; Brodie, 2013; Watson, 2014; Feldman, 2016; Snyders, 2017), and other interchangeably used concepts, such as “teacher clusters” (Mokhele, 2011; Jita & Mokhele, 2012, 2014; Mitchell & Jonker, 2013; Mphahlele, 2014; Dharsey, 2015), “teacher networks” (Ndlalane, 2006; Dresner & Worley, 2006; Farley-Ripple & Buttram, 2013; Ngcoza & Southwood, 2015), “teacher communities of learning” (Tomlinson et al., 1997; McLaughlin & Talbert, 2006), and “teacher communities of practice” (Graven, 2002; Little, 2002; McKay, 2007; Luluvein, 2010; Lotz-Sisitka et al., 2010; Brandon & Charlton, 2011; Hoadley, 2012; Mak & Pun, 2015).

All these nomenclatures involve collaborative forms of teacher development with the aim of sharing good or best practices (Wenger, 1998:2; Hoadley, 2012:288), but “not everything called a community is a community of practice” (Wenger, 2015:1), and in order to constitute a CoP by original definition, the combination of three crucial elements must be present, namely the Domain, the Community and the Practice (Wenger, 2015:2-3).

These three elements provide the formation, cohesion, and the goal of a CoP (Seaman, 2008:271). Parker et al. (2012:313) translate this as:

Communities of practice are meaningful, purposeful, and revolve around authentic tasks. They share a domain of interest; community members collectively pursue that interest. Shared practice evolves over time through sustained interaction as CoPs develop a unique and personal set of resources, experiences, and ways of addressing issues.

The Domain strengthens the idea that a CoP is not a network of connections, or a club of people, but is defined as the area of shared inquiry and interest, where “membership implies a commitment to the domain of interest, and as a result, a shared competence that distinguishes members from other people” (Wenger, 2015:1).

The Community describes the relationships among members and the sense of belonging, where “members engage in joint activities and discussions, help each other, and share information”, allowing them to “build relationships that enable them to learn from each other” (Wenger, 2015:2). Membership in a CoP is flexible and fluctuating, allowing members to leave, while new ones may join, but the work of the community continues (Anfara & Angelle, 2008:54).

The Practice portrays the shared practices, considering the members as practitioners that “develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems” (Wenger, 2015:2).

Parker et al. (2012:313) propose another essential element, which sets a CoP apart from other member groups, and that is the trust and respect that exists among CoP members. Pursuing the same line of thought, the study of Buysse et al. (2003) confirmed that members of the CoP should commit to a long-term professional relationship with the community since trust building within the group is necessary for success. Eraut (2002) mentioned that the commitment of community members is a high priority. As new members are socialised into the community, they adjust to the values and beliefs of the group, but they also bring with them prior learning and knowledge, which is then absorbed into the community.

The theoretical foundation of a CoP is primarily seated in the notion of situated learning (Lave, 1991:7; Borko, 2004:3; Hung et al., 2004:196; Fuller et al., 2005:50-53; Hung et al., 2005:161; Printy, 2008:190; Jimenez-Silva & Olson, 2012:336; Williams et al., 2012:246), which conceptualises learning to occur socially through critical reflection with others who share the same experience, instead of the traditional theory of the “learner being the receptacle of knowledge” (Anfara & Angelle, 2008:53).

Hoadley (2012:299) agrees that CoPs are grounded in situated theories of knowledge, “where people, through a process of legitimate peripheral participation, take up membership in and identify with a community which serves as the home of these shared practices”.

Butler et al. (2004:437) state that “learning is inextricably linked with the process of developing an identity”, and in this context, Wenger (2010:4) distinguishes three modes of identification or belonging (Jimenez-Silva & Olson, 2012:336) namely engagement, imagination, and alignment.

Howlett et al. (2016:743) touch on a different aspect of identity within a CoP, stating that “while CoPs do not have defined hierarchy or leadership roles, the implementation of the process does require a champion to promote the CoP and engage participants (Wenger, 1998; Wenger, 2002).

Mitchell and Jonker (2013:103) are of the opinion that while knowledge communities can take many forms, communities of interest and knowledge-building communities, have a degree of informality that is low to moderate institutionalisation, which makes it a community and not an organisation. However, high connectivity and tight social relationships exist between members of the community and a high degree of identification with the group.

Participants in such communities learn, or jointly construct practices, which can be understood as ways of achieving their desired or mutual goals. Levine and Marcus (2010:390) maintain that practices should be understood as theoretical entities that focus on specific purposes and social-cultural traditions that influence the socially-constructed practice. In a CoP, beginners and experienced practitioners can learn from observing, asking questions, and participating alongside others who have either more experience or different experiences. Learning is facilitated when beginners and experienced practitioners organise their work in ways that allow all participants the opportunity to observe, discuss, and engage in shared practices (Wenger, 1998). Daniel et al. (2013:161) refer to the term “critical transformative dialogue”, where within a CoP “feedback forms the basis of regular critical reflection and allows for ongoing examination of current understandings in the domain, expanding the knowledge of the community and contributing to its future development”.

For effective implementation of CoPs, Wenger et al. (2002) accentuate that learning should be placed in the context of people’s experience of participation in the world instead of the learning organisation and knowledge management. In order to implement a CoP successfully it needs to follow its basic definition, referring to the CoP as a social structure that focuses on knowledge and explicitly enabling the management of knowledge to be placed in the hands of the practitioners (Mckay, 2007:14).

Goodnough (2008:19) lists six design principles for cultivating a CoP: open a dialogue between inside and outside perspectives, invite various levels of participation, develop both public and private spaces, focus on value, combine familiarity and excitement, and create a rhythm for the community.

Wenger (1998:2) states that the implementation process of a CoP needs to be dynamic where collaboration must be motivated by a common goal with the aim of sharing practices. Accordingly, a CoP does not keep to stationary processes, but typically follows specific stages of development, namely potential, coalescing, active, dispersed, and memorable, from inception to culmination (Figure 2.8; Wenger, 1998:3). Most, but not all CoPs, follow these stages of development (Seaman, 2008:275).

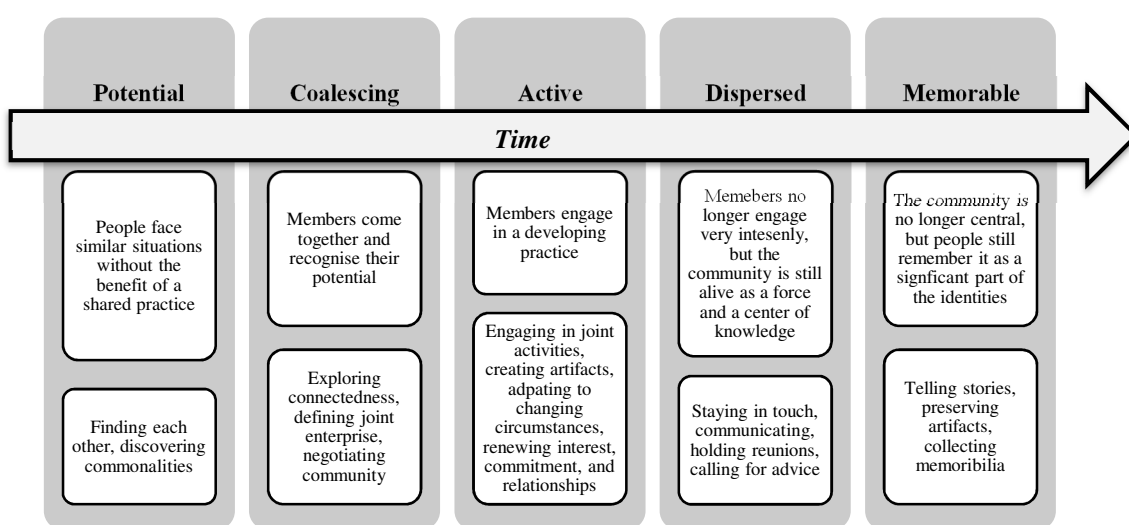


Figure 2.8 The development stages of a community of practice (Wenger, 1998).

It is worth mentioning that CoPs are not without critique (Butler et al., 2004:438; Akerson et al., 2009:1100; Brandon & Charlton, 2011:171; Daniel et al., 2013:169; Howlett et al., 2016:742), as CoPs could be “diverse, subtle and complex” (Wenger, 2015:7). Lack of power is often an issue (Daniel et al., 2013:161) as CoPs are viewed as anachronistic by some, and the shift away from the original analytical concept to an instrumental one.

The effective operation of a CoP in organisational settings faces challenges (Addicott et al., 2006; Waring & Currie, 2009; Pyrko et al., 2016:2). Conversely, in this CoP context, knowledge could be shared which could help to change teachers’ mindsets about teaching practices or concepts.

It is not always possible for teachers to meet on a regular basis as needed from CoPs. Another problem, especially in the rural areas, is the vast distances the schools are located from each other. As the concept of CoPs encourages participants to meet frequently face to face, other ways of effectively operating CoPs must be considered.

Current literature shows that the use of electronic media can be an alternative way of conducting CoPs (Hartnell-Young, 2006; Evans & Powell, 2007; Annetta & Shymansky, 2008; Jang, 2008; Owston et al., 2008; Berger et al., 2008; Cleaves & Toplis, 2008; Hauge & Norenes, 2009; Kopcha, 2010; Marsh et al., 2010; Gallagher et al., 2011; Zhang et al., 2011; Fowler et al., 2013; Ndlovu et al., 2013; Al-Balushi & Al-Abdali, 2015; Franklin, 2015; Bakir, 2016; Zhang & Sun-Keung, 2016).

2.5.2 Possibilities of facilitating CPTD in South Africa

Effective continuing professional teacher development (CPTD) holds the promise to liberate the South African education system from its detrimental legacy of inequality, but it also continues to present, possibly the most significant opportunity to improve school and learner performance (De Clercq & Phiri, 2013:77). However, a key challenge for South Africa is to find effective CPTD approaches, or programs that have the potential to improve teachers' knowledge, beliefs and practices (Jita & Mokhele, 2014:2).

After initial formal professional qualifications, CPTD occurs primarily through a variety of structured and unstructured activities within the teaching environment, instead of formal courses (Boyle et al., 2005). While there is considerable understanding about how formal CPTD development can be effectively structured and facilitated, little is understood about how less organised teacher development occurs (Boud & Rooney, 2011; Richter et al., 2011:117).

The traditional tendency is to bring experts from outside into the school to improve the instructional qualities of teachers through a one-size-fits-all set of solutions (Lieberman & Wood, 2002), which usually does not discriminate different teaching styles, schools or classroom contexts, or between the needs of beginner and experienced teachers (Leenheer et al., 2003).

Regarding teachers own classroom context, traditional CPTD approaches neglect to bring about real change (Lieberman, 2000; Hattie, 2009). Hence, there has been an increasing call to move away from traditional approaches to more collaborative models in addressing the challenges related to CPTD (Hofman & Dijkstra, 2010:1031; Hudson et al., 2013:1293; Ngcoza & Southwood, 2015:9; Kintz et al., 2015:121).

The South African Department of Education took many CPTD principles, policies and content from other countries to align itself to global trends in educational reform, but it seems that teachers are not benefitting from it as intended.

In its latest attempt to accelerate CPTD (DBE, 2015), the Department of Basic Education is rolling out the concept of Professional Learning Communities (PLCs). The claim for PLCs to support learner achievement is enticing as it is suggesting that teachers who have entered PLCs tend to act more autonomously, develop greater confidence, experience a higher level of self-efficacy, grow enthusiasm for collaboration and express greater commitment to different practices (Hargreaves et al., 2013:19).

PLCs are derivatives of CoPs, and both are classified as the transitional type of CPTD models (Kennedy & Odell, 2014:345) that share quite a few other similarities, but they differ fundamentally, as Blankenship and Rouna (2007:7) argue:

Not only are the two concepts distinctly different, but also the models within each concept vary in terms of membership, leadership, and knowledge sharing. Although the PLC models address team or group learning that is focused on student needs and increasing student achievement, the models seem to place greater emphasis on the organisational level in terms of building a culture of collaboration that would lead to school improvement. While the CoP models address the need for alignment of the CoPs to the organisational strategy, they are more focused on improvement of practice. Finally, PLC's, in general, seem to emphasise the role of the leader external of the community while the CoP literature seems to downplay that role in favour of a more "grassroots" leadership from within the community.

Similarly, CoPs are far removed from the concept of "teacher clusters", which by definition are "groups of schools that are brought together for what is mostly administrative or organisational capacity purposes" (Jita & Mokhele, 2014:3). In critique, "teacher clusters" try to address structural shortcomings in education collectively (De Clercq & Phiri, 2013:81), but in doing so does not focus on the personal aspects of CPTD.

The potential of CoPs to facilitate CPTD in South Africa was evaluated within the guidelines of the National Policy Framework for Teacher Education and Development (NPFTED), by comparing CoPs to traditional CPTD models in the context of the enablers and barriers identified from the literature, which were highlighted in section 2.4.2. In generalising the literature research findings, and interpreting the relevant South African education policies, effective CPTD interventions should allow a fair degree of teacher autonomy, foster teacher collaboration, overcome teacher isolation, endorse certain styles of teacher learning, prompt reflection and encourage positive changes in teachers' attitudes, beliefs, knowledge and practices.

The approach of employing CoPs to support CPTD is well researched in many developed countries such as the USA, England, Germany, Singapore and China (Pugach, 1999a, 1999b; Evans & Powell, 2007; Akerson et al., 2009; McArdle & Coutts, 2010; Gallagher et al., 2011; Parker et al., 2012; Patton & Parker, 2012; Daniel et al., 2013; Nixon & Brown, 2013; Hou, 2015; Patton & Parker, 2017).

However, in South Africa, this integrated type of approach is still at the experimental level. Therefore, limited research is currently available on CoPs in a South African context (Jita & Mokhele, 2014:1).

Maistry (2008:364) is mindful that teacher development through engagement in teacher CoPs is a new phenomenon that has significant potential for advancing CPTD in South Africa. Jita and Mokhele (2014:1) agree that in the South African context, teacher CoPs are a new and accessible approach to support CPTD.

The same two value propositions that CoPs present to the field of education in general, apply to South Africa in even greater measures as Butler et al. (2004:436) recommends:

On a practical level, collaborative inquiry in a CoP may also be beneficial for teachers by structuring opportunities for reflection not typically available to practising teachers. Thus, at a theoretical level, the concept of CoP has been profitably employed to understand teacher learning better.

Daniel et al. (2013:170) agree with this by affirming that teacher CoPs offer two major opportunities to promote rejuvenation in the profession of education, it allows response to individual teacher needs and circumstances of the classroom, as well as contributing to existing knowledge in a sparsely researched educational field.

Singh (2011:1629) considers teachers as ideal participants in CoPs:

Teachers, in essence, can be viewed as practitioners who belong to a community of practice because they share a joint enterprise, function as a community, and develop a common repertoire. Furthermore, resources are found within teachers, their teaching contexts or the programs in which they teach.

CoPs have specific elements that present a strategic platform to launch and support CPTD within a more conducive setting than teacher learning environments that are either traditionally prescriptive, or otherwise collaborative, but directionally rigid (Jita & Ndjalane, 2009; Pop et al., 2010:142; Essien, 2013).

CoPs create a useful platform to enhance CPTD, based on the following core beliefs, in that CPTD is crucial to improve student learning, professional development is most effective when it is collaborative, and work should involve inquiry and problem-solving in realistic contexts of daily teaching practices (Servage, 2009).

CoPs are formed from evolving goals, values, and theoretical frameworks that drive the nature of schooling, curricula, and teachers' decision-making in classrooms (Butler et al., 2004:445).

These researchers continue to accentuate the idea that CoPs are shaping teachers' learning in a group as individuals which implicates that the construction of their knowledge does not happen independently. By implication, this construction of their knowledge, beliefs, attitudes and skills is socially and culturally situated in the engagement of activities that promote continued reflection on practice and underlying assumptions (Borko et al., 1997:3).

Hofman and Dijkstra (2010:1032) conclude that CoPs have a significant role to play in positively changing teachers' characteristics, such as shared vision and values, professional reflection, collective responsibility, collaboration and group learning. A significant motivation for teachers to participate in CoPs centres around the possibility of improving subject content knowledge, which in turn could influence their job efficacy, job motivation, quality of classroom instruction and student performance (Hofman & Dijkstra, 2010:1032).

Sobkin and Adamchuk (2015) verbalise that CoPs could help teachers to improve their quality of teaching and recent research indicates that a common theoretical framework, which includes the essential features of effective CPTD could be used as a foundation to enable formal or informal learning communities, which in turn could act as powerful mechanisms for teacher growth and development (Desimone, 2009:181-182). Teachers need to become conscious of participating more often in CoPs as they become aware of the benefits it offers to advance their professional development (Brody & Hadar, 2015:248).

Reflexive competence defined as the "ability to integrate or connect performances and decision-making with understanding and with an ability to adapt to change and unforeseen circumstances and to explain the reasons behind these adaptations" in the Norms and Standards for Educators is a requirement to achieve professional teacher status in South Africa (DoE, 2000:4).

Studies in this decade focused primarily on teacher reflection as a change agent and how self-reflection could serve to advance CPTD in several ways (Avalos, 2011:2). Teacher reflection directly affects teacher beliefs, experiences and practices, suggesting that teacher reflection assumes an active role in CPTD (Harrison et al., 2008:581; Antoniou et al., 2011:15; Postholm, 2012:407; Roblin & Margalef, 2013:29; Geldenhuys & Oosthuizen, 2015:209).

CoPs are particularly beneficial in structuring opportunities for teacher reflection (Butler et al., 2004:438; Wubbels, 2007:231; Levine & Marcus, 2010:389-398; Jimenez-Silva & Olson, 2012:342; Salleh, 2016:298).

CoPs, due to their specific construct present an ideal means to improve teachers' practices, which is shaped by the social, cultural, and historical contexts within which teacher development occurs (Cox, 2005:536).

CoPs promote CPTD, which occurs when people are engaged in the process of collective learning in a shared domain of human endeavour where teachers can share experiences, skills and problems (Wenger, 2011). This approach is receptive to teachers' needs and goals and how they learn, as it has a greater impact on changing teachers' practices (Lee, 2005:46; Simon et al., 2011:7-8). Wenger (1999:30) further emphasises the importance of the social context, i.e. the notion of situated learning and stresses that teachers need a structure wherein they can continuously acquire a body of knowledge and skills to guarantee their successful professional development.

The social context allows the individual to benefit from opportunities to share expertise while engaging in a shared activity, while the cultural context of the CoPs determines the way the knowledge and experience of the teachers are constructed, and it influences the dialogue that is formed in the community. Little (1993:129) argues that all three elements, namely the domain, community, and practice play a significant role in the interaction in the CoPs and that these contexts of teaching and schooling are embedded in the transformation initiatives that teachers can construct on their own.

The failure of most CPTD efforts has resulted in a number of researchers emphasising the importance of teacher collaboration to address the issue of teacher isolation (Ndlalane, 2006:100; Hadar & Brody, 2010:1642; Musanti & Pence, 2010:79; Mukeredzi, 2013:12; McLelland-Crawley, 2014:22; Smith, 2014:218; Admiraal et al., 2016:284; Owen, 2016:406). It is precisely the rural schools in South Africa that suffer the most from teacher isolation, and (Smith, 2014:232-233) recommends that "teachers in small rural schools specifically need collaborative professional development programs to break down the common prevalence of teacher isolation in this specific environment".

Collaborative approaches to CPTD, such as CoPs are purposely designed to break down teacher isolation by providing opportunities for teachers to work together, exchange ideas, share resources and reflect on their classroom practices (Kgabo, 2011:59; Abdella, 2015:43).

Teacher collaboration is desirable for teachers in sharing their classroom practices (Levine & Marcus, 2010:396; Jita & Mokhele, 2012; Mphahlele, 2014:218). The case to embrace collaborative CPTD models, such as CoPs was widely augmented in section 2.4.2. Avalos (2011:4) concurs that teachers themselves also think that teacher collaboration would be more successful compared to the more traditional forms of teacher professionalisation.

Notions of CPTD are also continually changing, and it is common for teachers in search of innovative ideas or willing to try new methodologies to look for collaborative opportunities and support outside the school (Macia & Garcia, 2016). Teachers reflecting, interacting and practising collectively could be helpful to the effective operation of CoPs. Lee (2008) and Puchner & Taylor (2006) suggest that teacher collaboration and co-learning through feedback are key components for improving the effective operation of CoPs.

Kennedy (2005:244) classifies CoPs as a transformative type CPTD model that enables a high degree of teacher autonomy, a critical endorsement contained in the National Policy Framework for Teacher Education and Development (NPFTED), which empowers teachers to take ownership of their professional development (DoE, 2007:5). The concept of teacher autonomy has a dual meaning, referring to “teachers developing the competence to take charge of their own growth and resolve their own problems”, but also otherwise “the professional independence of teachers in schools, especially the degree to which they can make autonomous decisions about what they teach to students and how they teach it” (Short, 1994:488).

The concept of teacher autonomy according to Mahlaela (2012:35) refers to the “understanding, skills and disposition that are necessary to become critically reflective of one’s own assumptions and to engage effectively in discourse to validate one’s beliefs through the experiences of others who share universal values”. De Clercq (2013:35) views teacher autonomy as integrally a part of teacher professionalism, observing that “as teachers gained more autonomy over their work, they were expected to improve their work practices by sharing their experience and by acting as reflective practitioners”. This implies that teachers should be allowed to have constructive input into their professional development, and they should be actively involved with it as well (Steyn, 2008:23; Steyn, 2009:117; Geldenhuys & Oosthuizen, 2015:209), because they know their individual development needs the best (Singh, 2011:1365).

Increased autonomy usually leads to positive changes in teaching practice, creating a more significant change in CPTD programs to be effective (Little & Veugelers, 2005:285; McCarthy & Youens, 2005:152; Stoll et al., 2006:226; Watson & Manning, 2008:707; Steyn, 2009:117; Steyn, 2011:50; Stolk et al., 2012:1504; Dharsey, 2015:117; Hargreaves, 2015:23).

However, balance should be maintained between principal control and autonomy (Ferguson, 2006:48), and Snyders (2017:133) provides guidance in this regard by mentioning the term “collective autonomy” in relation to CoPs, expressing that “professionalism demands autonomy, but individual autonomy can lead to individualism, while collective autonomy means that teachers have to cede some decision-making to the group”.

One of the other strengths of CoPs is the trust that exists among the community members, and as the trust increases in these collegial relationships, it makes members more forthcoming to want to turn to one another for help, reducing the risks associated with change. The trust can also reduce the effects of potential conflicts and differences in views of teaching, help in building a shared commitment to reform objectives, and contribute to positive school norms (Penuel & Riel, 2007:615). Change in practice requires opportunities to communicate and have a dialogue about one’s own and others’ practices. Established trust opens the communication channels, and vulnerable, honest communication tends to produce opportunities for learning and enhance professional teacher development (Penuel et al., 2012:107).

In summary, although more research is needed, specifically in the South African context, the existing research shows that teacher CoPs could be a useful practice to sustain CPTD (Hofman & Dijkstra, 2010:1038).

2.6 Critical overview

In this section, the literature reviewed in this study is critically assessed, with a twofold aim, one to motivate why a CoP model was found appropriate for addressing the problem statement, and secondly to highlight subtopics derived from the literature review, which are used to help define the sub-questions of this study.

2.6.1 Current developments in CPTD

Firstly, the researcher agrees with many other researchers that CPTD plays a critical role in the performance of learners, and that the current underperformance in science and mathematics in South Africa is deeply seated in unsuccessful CPTD strategies marred by legacy issues. However, the researcher also acknowledges the South African government’s continued efforts to focus on CPTD with the aim of transforming education effectively and sustainably.

In previous sections, a descriptive account of several CPTD aspects was given. Different researchers maintain diverse understandings of what CPTD represents and how to deliver on it effectively (Loucks-Horsley & Matsumoto, 1999; Guskey, 2003; Desimone, 2009; Kriek & Grayson, 2009; Steyn, 2009; Avalos, 2011; Ndlovu, 2011b; Opfer & Pedder, 2011; Tournaki et al., 2011; Postholm, 2012; Roblin & Margalef, 2013; Patton et al., 2015; Admiraal et al., 2016; Labone & Long, 2016). There is, however, a general accord that CPTD should be directed at enhancing teachers' subject content knowledge and pedagogical content knowledge (Shulman, 1986).

Interpretations of what effective CPTD constitutes are vast otherwise, but some of the empirical evidence presented in the literature suggests that the most effective CPTD approaches have some common characteristics, of which teacher collaboration takes centre stage.

Globally, over the past two decades, traditional approaches have been ineffective and failed to address the current challenges or needs of CPTD successfully. There is an increasing trend to discard traditional CPTD practices, in favour of collaborative models (Lessing & De Witt, 2007:56; Kriek & Grayson, 2009:186; Steyn, 2009:116-117; Klieger & Bar-Yossef, 2010:771; Opfer & Pedder, 2011:4; Simon et al., 2011:7; Roblin & Margalef, 2013:18; Labone & Long, 2016:56).

The researcher is supporting the recommendations for a collaborative approach to enhance the co-operation of teachers. Following global trends, the DBE has been rolling out the concept of Professional Learning Communities (PLCs), which intend to build a culture of teachers collaborating that would lead to school improvement. Admittedly, it might be premature to evaluate the impact of PLCs in South Africa at this stage, but since its rollout in 2015, learner performance in science and mathematics remain unchanged. It is also important to understand that a PLC by design targets the organisational level and does not support specific teacher needs about CPTD. Similarly, "teacher clusters" (Jita & Mokhele, 2014:3) aim to address organisational shortcomings in education by promoting collaboration, but neglects the personal aspects of CPTD (De Clercq & Phiri, 2013:81).

In South Africa, the failure of most CPTD efforts has resulted in many researchers emphasising the importance of teacher collaboration to address the issue of teacher isolation, especially prevalent in rural schools (Ndlalane, 2006:100; Musanti & Pence, 2010:79; Mukeredzi, 2013:12; Owen, 2016:406). Teacher isolation is one of the major challenges that impede CPTD in rural schools. Therefore an approach that could mitigate teacher isolation is considered important (Smith, 2014:232).

2.6.2 Regulatory influences on CPTD

In South Africa, CPTD is governed and profoundly wrapped in legislation with many policies, of which the National Policy Framework for Teacher Education and Development (NPFTED) is the most important (DoE, 2007:5). Its underpinned principles as expressed in the Norms and Standards for Educators (DoE, 2000) describes the roles, their associated set of applied competences (norms) and qualifications (standards) required for the development of teachers.

According to this policy, in order to be recognised as a competent professional teacher in South Africa (Botha & Reddy, 2011:260), teachers are required to assume seven roles that are further divided into three competences (Figure 2.7). The three competences are practical, reflexive and foundational, and the seven roles teachers are required to fulfil include learning mediator; interpreter/designer of learning programmes/materials; leader; administrator and manager; scholar, researcher and lifelong learner; community, citizenship and pastoral role; assessor, and learning area/subject/discipline/phase specialist.

Fundamentally, teacher competences (norms) encapsulate teacher autonomy and professional identity (Jansen, 2004). The Norms and Standards for Educators (DoE, 2000) draw attention to the professional identity of teachers, which is formed by their attitudes, beliefs, competences and values (Hong, 2010:1532; Dharsey, 2015:114; K rkk  et al., 2016:199). Existing research considers the professional identity of teachers as a critical factor in their confidence, motivation, effectiveness and retention and therefore it assumes a crucial role in their professional development (Sachs, 2001:154; Samuel, 2009:138; Izadinia, 2012:709; Williams et al., 2012:248; Mushayikwa, 2013:283; Samson, 2013:154; Nel, 2015:46; Mukeredzi, 2013:8; Robberts, 2017:117).

Policy statements such as the outcomes-based Curriculum 2005 (DoE, 1997), Revised National Curriculum Statement (DoE, 2002) and the current Curriculum Assessment Policy Statement (CAPS; DBE, 2010) were implemented to address the shortcomings found in previous curriculums and to focus on the changing needs within the education system. However, some South African researchers believe the CAPS is obstructing CPTD, by restricting teacher autonomy and teacher professionalism (Ndlovu, 2011a:1406; Fataar, 2012:57; De Clercq, 2013:47; Feldman, 2016:15; Phasha et al., 2016:69; Snyders, 2017:79).

2.6.3 The motivation for teacher CoPs

There are a couple of different CPTD models (Little, 1993; Guskey, 2002b; Desimone, 2009; Kuijpers et al., 2010; Richter et al., 2011), but the researcher favours the seminal work of Kennedy (2005), who distinguished nine teacher development models, organised into three categories, namely transmissionist, transitional and transformative, allowing progressively more teacher autonomy in that order. Transmissionist relates to the initiation of teachers by more experienced colleagues, transformative refers to a teacher relationship that provides a “supportive, but challenging forum for both intellectual and effective interrogation of practice” whereas transitional is the midway by providing a compatible means of supporting both these purposes of CPTD. Many researchers from developing countries advocate abandoning traditional CPTD approaches and embracing transformative models.

However, the current reality in South Africa is that CPTD is trapped in transmissionist approaches and the call to implement transformative CPTD models in the researcher’s opinion is unfeasible at this stage. Hence, the researcher proposes a modest move to a transitional model first, specifically a teacher CoP to address the shortcomings in the South African context, particularly for rural school districts.

In generalising the literature research findings, and interpreting the relevant South African education policies, together with the appreciation of the challenges that local rural school districts face, an effective CPTD approach should be teacher-focused, and ideally utilise a research-based design, embed conducive teaching practices, embrace leadership, foster teacher collaboration, provide feedback mechanisms for teachers, prompt teacher self-reflection, promote teacher competence, allow a fair degree of teacher autonomy, nurture teacher professional identity and overcome teacher isolation (Figure 2.9), which in the end could encourage positive changes in teachers’ attitudes, beliefs, knowledge, and practices. A teacher CoP demonstrates many of these essential characteristics, which serve as the motivation to employ a CoP approach in this study.

Firstly, a teacher CoP allows scope for individual teacher needs, and teachers are considered ideal participants to share their classroom practices (Levine & Marcus, 2010:396; Singh, 2011:1629). It was already said that CoPs differ fundamentally from PLCs and teacher clusters, in that for a CoP the needs and interests of teacher participants take centre stage, without the imposed structures and directives from governing bodies (Johnson et al., 2017:4).



Figure 2.9 Essential characteristics of effective CPTD approaches, sourced from various empirical studies, South African legislation and the challenges of rural school districts.

Teacher CoPs are well researched and understood in developed economies, and all these studies draw upon the established theoretical framework of Wenger's (1998) CoP model, with specific reference to its three foundational elements, namely community, domain and practice, which provide the formation, cohesion, and the goal of a CoP (Seaman, 2008:271). Employing a CPTD design or model that is based on research is crucial (Loucks-Horsley & Matsumoto, 1999; Desimone, 2009:181).

A significant motivation for teachers to participate in CoPs centres around the possibility of improving both their subject content knowledge and pedagogical content knowledge, which in turn could influence their job efficacy, job motivation, quality of classroom instruction and student performance (Hofman & Dijkstra, 2010:1032; Brody & Hadar, 2015:248; Sobkin & Adamchuk, 2015).

There is a debate on the topic if a CoP should be without a leader as originally intended (Anfara & Angelle, 2008:54). However, De Clercq and Phiri (2013:79) are adamant that self-determined teacher communities have their limitations, and a leader is needed. Other researchers suggest that a CoP should include different leadership roles, which the membership could assume in a rotating manner (Avalos, 2011:17; Stanley, 2011:75; Lewis et al., 2012:373; Mak & Pun, 2015:8; Trust & Horrocks, 2017:652), but the leader (facilitator) needs to balance power and sustainability (Elliott, 2012; Tan, 2014:51).

At the core of most CoP approaches are the teachers' collaborative problem-solving efforts in pursuit of common goals, where groups of teachers and researchers work together locally, within schools, or peripherally (Butler et al., 2004:445; Hofman & Dijkstra, 2010:1032).

A teacher CoP, which by design fosters teacher collaboration, occurs when people are engaged in collective learning in a shared domain of human endeavour where teachers can share experiences, skills, and problems (Wenger, 2011). This collaborative approach is receptive to teachers' needs and goals and how they learn, as it has a greater impact on changing teachers' practices (Lee, 2005:46; Simon et al., 2011:7-8).

Feedback from teachers through teacher collaboration and co-learning could be crucial components for improving the effective operation of CoPs (Puchner & Taylor, 2006; Lee, 2008). CoPs are beneficial in structuring opportunities for teacher reflection (Butler et al., 2004:438; Wubbels, 2007:231; Levine & Marcus, 2010:389-398; Jimenez-Silva & Olson, 2012:342; Daniel et al., 2013:161; Salleh, 2016:298).

A CoP enables a high degree of teacher autonomy, a critical endorsement contained in the National Policy Framework for Teacher Education and Development (NPFTEd), which empowers teachers to take ownership of their professional development (DoE, 2007:5). This implies that teachers should be allowed to have constructive input into the CoP, which has been neglected with current CPTD approaches (Steyn, 2009:117; Singh, 2011:1365; De Clercq, 2013:35; Geldenhuys & Oosthuizen, 2015:209). Increased autonomy usually leads to positive changes in teaching practice, and creates a more significant change in CPTD programs to be useful (McCarthy & Youens, 2005:152; Stoll et al., 2006:226; Watson & Manning, 2008:707; Steyn, 2011:50; Stolk et al., 2012:1504; Dharsey, 2015:117; Hargreaves, 2015:23).

The professional identity of teachers, an underlying construct of teacher professionalism is formed by their attitudes, beliefs, competences and values, and plays an essential part in a teacher's ability to teach with confidence and it plays a significant role in their professional development (Mukeredzi, 2013:8; Mushayikwa, 2013:283; Nel, 2015:46; Dharsey, 2015:114; Körkkö et al., 2016:199; Robberts, 2017:117). Teachers must acquire instructive, reflexive and collaborative competences in order to develop their professional identity as set out in the authoritative Norms and Standards for Educators (DoE, 2000). A CoP presents a conducive platform to help build these required competences, and by doing so, contribute to developing a teacher's professional identity.

Collaborative approaches to CPTD, such as CoPs are purposely designed to break down teacher isolation by providing opportunities for teachers to work together, exchange ideas, share resources and reflect on their classroom practices (Kgabo, 2011:59; Abdella, 2015:43). The "move from isolation to collaboration" (Patton & Parker, 2017:358) leads to increased confidence and improved teaching.

2.6.4 Factors influencing the effective operation of CoPs

Literature is packed with references related to aspects that influence the success of CPTD in general, and some of these have a bearing on teacher CoPs, but very few studies have considered the impact of the so-called enablers or barriers that could affect the effective operation of teacher CoPs specifically. The motivation for highlighting this under-researched area is the association it has with sustainability as truly little is known about the possibilities of establishing functional teacher CoPs sustainably (Richmond & Manokore, 2010:565).

Only a couple of CoP studies could be found that list these “help or hinder factors” (Stoll et al., 2006:243) and the most common theme implicates the teacher participant, either as an individual or within group dynamics (McAlister, 2016:131).

Opfer and Pedder (2011:5) consent on the teacher aspect, saying that teacher beliefs and attitudes are central to the success of CoPs because teachers are principally responsible for their professional development. Many of these traits refer to the concept of “teacher individualism” (Wong, 2010:131; Snyders, 2017:38), including teachers’ reluctance to participate, unwillingness to collaborate with other teachers, and failure to self-reflect (Macheng, 2014:62; Geldenhuys & Oosthuizen, 2015:209; Trust & Horrocks, 2017:653), probably relating to teachers that assert specific preferences or predispositions (Roberts, 2006:629). As mitigation Patton and Parker (2017:357) highlight the importance of establishing professional relationships in teacher CoPs, where members mutually respect and trust each other, and maintain an elevated level of commitment towards each other.

2.6.5 Linkage with the research questions

The previous sections illustrated the merits of a teacher CoP to effectively address CPTD under South Africa legislation, with specific reference to rural school districts. As a result, adequate evidence was presented to motivate the main research question:

What are the possibilities of a community of practice approach to support the professional development of Natural Sciences teachers from the rural school district of Vredendal?

Broadly, research related to CPTD and CoPs specific to Natural Sciences, or Sciences is sparse in the literature reviewed, less so from a South African perspective. However, in this study, it is assumed that the research about teacher CoPs, in general, is appropriately applicable and transferable to various communities, domains and practices.

The main research question was unpacked into issue-based sub-questions (Creswell, 2014:134) by looking at trends and gaps relevant to the study and target environment, as well as how it fitted into the formal education system. For instance, an important observation from the literature review is the distinct lack of research related to CPTD and CoPs specifically in the context of rural school districts in South Africa and particularly CPTD approaches that consider current legislation. Similarly, little is known about the practical aspects that affect the sustainability of teacher CoPs.

From the literature review, specific topics of interest raised the following sub-questions:

1. In what ways can a community of practice contribute to the professional development of Natural Sciences teachers within the National Policy Framework for Teacher Education and Development in South Africa?
2. How can a community of practice assist in facilitating the professional development of Natural Sciences teachers?
3. What principles and aspects can influence the effective operation of a community of practice?

Teacher CoPs are well researched in many developed countries, but in South Africa, this collaborative CPTD approach is a new phenomenon that has significant potential for advancing CPTD regionally (Maistry, 2008:364; Jita & Mokhele, 2014:1). However, critically viewed in the South African context, teacher CoPs are still at the trial stage, with little research output. As a result, this study presents a valuable opportunity to contribute to the current discourse of utilising teacher CoPs or collaborative analogies to facilitate CPTD in general, a contemporary focus area that has been poorly researched in the South African, and a rural school district context. Research findings of this study could contribute to this developing knowledge base. Teachers, the education authority, inclusive of policymakers and other role-players involved with CPTD could potentially derive value from this study.

2.7 Conclusion

At the start of this chapter, a brief background to literature searches and citations was given. Firstly, the problem statement was contextualised regarding the role of science and mathematics education plays in global and local economies. Next, CPTD was dissected with a focus on definitions, theory, models, practice, current developments, barriers and success factors, elaborating what professional development of teachers entails, why it is essential and the influence it has on the current state of the South African education system.

The focus was also to look at what other researchers have already investigated about practical solutions to advance CPTD and different collaborative approaches that could enhance teacher development. Specific reference was made to the legislative aspects relating to CPTD in South Africa, and the challenges that rural school environments pose to CPTD. Subsequently, the theory and construct of CoPs were discussed according to its foundational elements, followed by the possibilities of a CoP to facilitate CPTD as an alternative approach.

In a critical analysis of the literature reviewed it emerged that globally, and in South Africa, there is an accumulating call to replace transmissionist CPTD practices with collaborative teacher development models. Simplifying the literature research findings, and interpreting the relevant South African education policies, coupled with the challenges of local rural school districts, it was established that a teacher CoP has significant merits to address the main research question effectively, i.e. exploring the possibilities of a CoP approach to support CPTD of Natural Sciences teachers from the rural school district of Vredendal.

Teacher CoPs are poorly researched in South Africa, which opens the prospect for this study to contribute to an underdeveloped local knowledge base, with specific reference to rural school districts.

In the next chapter, the research process and the research design of this study are detailed, explaining the nexus with the main research question and three sub-questions.

CHAPTER 3

RESEARCH PROCESS AND DESIGN

3.1 Introduction

This chapter briefly engages with the research process, and subsequently, the research design in detail, inclusive of how the study is framed within a philosophical premise. The research approaches, strategies and methods to conduct the study are introduced, and the corresponding data collection techniques and procedures employed are discussed. Considerations relating to rigour and ethics are also discussed extensively. The justification for the choice of each of the data collection methods used in the study is discussed. The chapter concludes with the reasoning for thematic data-analysis as the method of choice of analysing the data in an attempt to answer the research questions effectively.

3.2 Research process

This study adopts the process of educational research as proposed by Creswell (2014:7-8): identify a research problem, review the literature, specify a purpose for research, collect data, analyse and interpret the data, and report and evaluate research. The flow of the general research process is illustrated in Figure 3.1 modified from (Creswell, 2014:12).



Figure 3.1 The general flow of the research process (modified from Creswell, 2014).

The main research question the study has the purpose of answering is:

What are the possibilities of a community of practice approach to support the professional development of Natural Sciences teachers from the rural school district of Vredendal?

The previous chapter reviewed the literature relating to continuing professional teacher development (CPTD) in South Africa as well as the applied concept of CoPs, from which critical themes emerged that were used to unpack the main research question into sub-questions.

A principal theme from the literature review is that CPTD in South Africa is profoundly legislated and governed by a mandating body; a second theme is that teacher CoPs in general offer significant potential to address current teacher development issues, and the final theme highlights the impact factors related to teacher CoPs. As a result, three sub-questions were unpacked in support of the main research question, aligned with its local setting:

1. In what ways can a community of practice contribute to the professional development of Natural Sciences teachers within the National Policy Framework for Teacher Education and Development in South Africa?
2. How can a community of practice assist in facilitating the professional development of Natural Sciences teachers?
3. What principles and aspects can influence the effective operation of a community of practice?

3.3 Research design

A research design, which can be summarised as a justification for the preference of how a study is to be conducted, is fundamentally guided by the nature of its research questions (Salkind, 2003:15; Creswell, 2014:5). In this study, the researcher chose a descriptive research design (Hussey & Hussey, 1997:10), with the broad purpose of contributing to the existing knowledge base, understanding perceptions and the general discourse of teachers' experiences within a CoP to facilitate their professional development potentially within the legislative context of the South African education system.

Definitions and descriptions for the term "research design" appear rife in the literature, but the researcher has no purpose to engage in the so-called "paradigm wars" (Poni, 2014:411), but to demonstrate the researcher's competence in the research design process. In support of the researcher's knowledge gained with research design, the researcher includes confirmation of her attendance of the 5th Annual Summer School in Research Methods 2014 hosted by the African Doctoral Academy of Stellenbosch University (Addendum T).

Babbie and Mouton (2011:74) define research design as a "blueprint of how the researcher intends to conduct his/her research". Kothari (2004:31) agrees, stating "the research design is the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement, and analysis of data". Bless et al. (2006:71) views a research design as "operations to be performed, to test a specific hypothesis under a given condition".

Another viewpoint of describing research design is the study of methods by which knowledge is gained, in other words, a work plan of the research (Rosaline, 2008:8). Research design refers to “the plan or proposal to conduct research, involves the intersection of philosophy, strategies of inquiry, and specific methods” (Creswell, 2014:5).

The research design is a systematic way to solve a problem, portraying the science of how the research is to be carried out, defining the procedures how the researchers go about to portray their research, explaining and predicting phenomena (Ryan & Branscombe, 2013:8). Creswell (2007:15) indicates that the research design provides the researcher with a clear research framework, directing the investigation of the research questions (Walliman, 2010:13). The research design represents a “mixed-bag approach of different alternatives and options” to ensure that the research questions, which determine the methods and procedures to be employed for the proposed research are answered (Zikmund et al., 2010:66).

In social research studies, inclusive of educational research the researcher found that research design terminology is grammatically “loose,” often interchangeably used and the different classifications and definitions are ambiguous. As a result, the researcher prefers to describe this study’s research design concerning the well-known “Research Onion” construct (Saunders et al., 2009) as it provides a useful framework to explain the design elements in a clear and structured manner. These authors identify six elements, called layers as core to almost any type of research design, and illustrate the intra-relationships between these elements using an onion as a metaphor (Figure 3.2). Moving in from the outside, each layer of the onion describes a more detailed element of the research design process, progressing through the order of research philosophy, approach, choice, strategy, time horizon and finally techniques and procedures.

Underpinned by a social constructivist ontology and interpretivist epistemology, a multi-method qualitative case study design was employed in this study to explore the experiences of a group of Natural Sciences teachers situated in a bounded system, i.e. the rural school district of Vredendal, illuminating their beliefs, views and experiences of a CoP approach to support their continuing professional development. For this study, several practical references (Braun & Clarke, 2013; Creswell, 2014; Maree, 2016) were used to wire the different research design elements (layers of the onion), and the following sections motivate specific preferences (Figure 3.3).

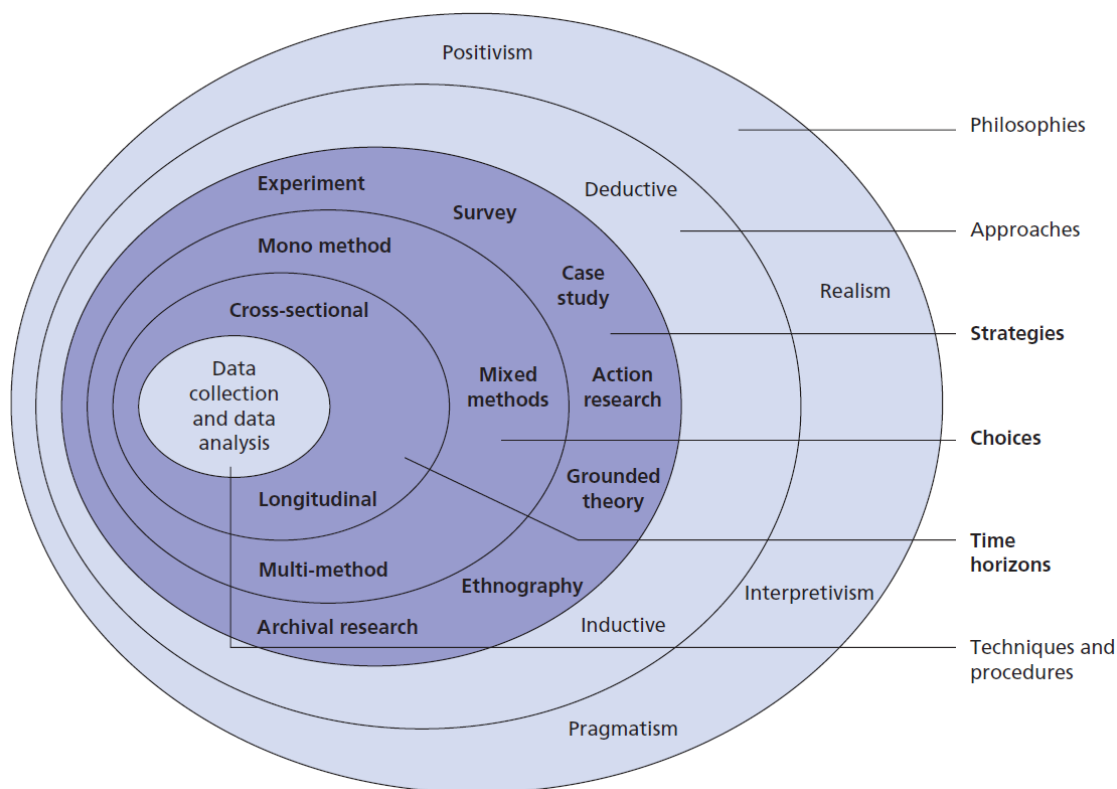


Figure 3.2 The Research Onion of research design (after Saunders et al., 2009).

3.3.1 Research philosophy

Fundamental to research design is the choice of an appropriate research philosophy, which is defined as an “all-included system of interrelated practice and thinking, defining the nature of the research process” (Terre Blanche & Durrheim, 1999:6). The types of beliefs held by researchers often lead to embracing a particular paradigm.

All research is based on some underlying philosophical assumptions (Creswell, 2007:15). Therefore, to conduct and evaluate any research, it is essential to know what these assumptions are as it plays a crucial role in helping to conceptualise and understand the research questions (Willis, 2007:25).

Understanding the research questions within the contexts of the research philosophy assists the choice of appropriate data analysis methods in order to explain the findings, to build on and develop ideas of others and to generate ideas from the data (Gay et al., 2010:466).

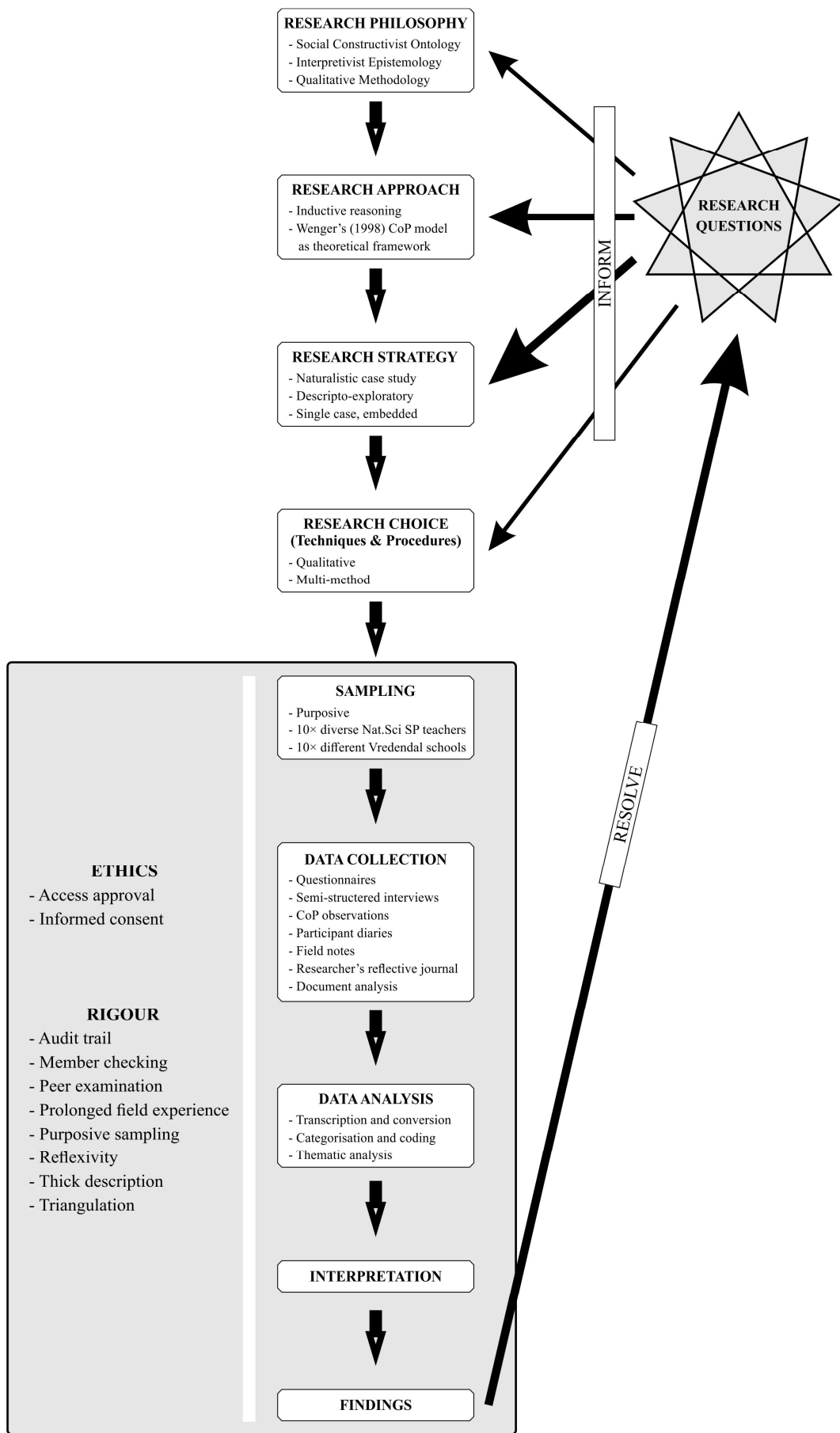


Figure 3.3 An illustration of the detailed research design of this study.

Layer 1 of the Research Onion (Figure 3.3) deals with research philosophy relating to “the development of knowledge and the nature of that knowledge” (Saunders et al., 2009:107). Alternative terms for philosophy includes “worldview” (Guba, 1990:17; Nieuwenhuis, 2010b:9; Creswell, 2014:6), or “paradigms” (Mouton & Marais, 1990:150; Mouton, 1996:203; Lincoln & Guba, 2005b:207; Creswell, 2007:19; De Vos et al., 2011:40; Neuman, 2011:94; Collis & Hussey, 2013:55; Babbie, 2014:33; Le Grange, 2014:2).

Kuhn (1962) who coined the term paradigm defines it as “an integrated cluster of substantive concepts, variables, and problems attached with corresponding methodological approaches and tools”. Paradigms are “basic belief systems based on ontological, epistemological and methodological assumptions” (Lincoln & Guba, 2005a:107), whereas axiology, the branch of philosophy dealing with values is considered equally important (Creswell et al., 2007:238).

Ontological and epistemological assumptions fundamentally guide a researcher’s methodology, and axiology, hence the importance to situate research within clearly explained research philosophies (Figure 3.3; Mertens, 2005:15-17).

a) Ontology

Ontology is defined as “the study of being” (Crotty, 2003:10), specifying the relationship between the world and human interpretations and practices, that refers to the nature and form of reality of research (Braun & Clarke, 2013:109). This implies that knowledge obtained through the data is always going to reflect the human perspective (Braun & Clarke, 2013:27). Social realities exist due to varying human and perspectives, including people’s knowledge, opinions, interpretations, and lived-experiences. Hence, ontology plays a substantial part in the social research process as it is concerned with how people make sense of their social worlds in natural settings employing everyday numbers, conversations, and writings while interacting with others around them (Cohen et al., 2011:157).

Two opposing positions (stands) of ontology are widely recognised, namely objectivism and subjectivism, the latter which is more commonly known as constructivism in social science research (Saunders et al., 2009:110). Objectivism is an ontological position asserting that social phenomena and its meaning exist independent of social actors, i.e., beyond their influence, whereas constructivism maintains that social phenomena are continually constructed by the perceptions and following actions of social actors (Goldenberg & Goldenberg, 2008:342; Bryman, 2012:18).

Knowledge is always deemed a human construction, and categories of knowledge and reality are actively created by social relationships and interactions, in so that social constructivists typically seek understanding of the world in which they live and work (Lincoln & Guba, 2005b:170; Crotty, 2003:58; Schwandt, 2007:102; Neuman, 2011:75).

b) Epistemology

Epistemology is defined as “how we know what we know” (Crotty, 2003:8), and focuses on the relationship between the knower and the known, i.e., defining the relationship of the researcher with the research, explaining how the researcher knows what he/she knows. Epistemology is concerned with the “study of knowledge and what we accept as being valid knowledge” (Collis & Hussey, 2013:48), or “the question of what is (or should be) regarded as acceptable knowledge in a discipline” (Bryman, 2012:13).

Epistemology finds common application in scientific research as it searches for proven facts and information supported by rigorous testing, rather than unpredictable situations and opinions (Kuhn, 2012:96). The results are explained through the reasoning processes of interpretation that is determined by interaction with social contexts, and those participating in the research process socially construct knowledge by seeing the real world in its natural settings (Gilliland, 2014:84). Hence, the researcher maintains either an insider or an outsider view of the research (Brown et al., 2004:471).

There are three key positions tied to epistemology namely positivism, realism and interpretivism. Positivism seeks facts or causes of social phenomena, with little regard to the subjective state of the individual as it assumes that reality is independent of the researcher and exists regardless of whether we are aware of it (Babbie & Mouton, 2011:23; Neuman, 2011:82). Positivism entails a scientific approach to social research using quantitative data to ensure objectivity and reliability and requires developed hypotheses to be tested against the existing theory, which creates a body of knowledge that could be replicated by other researchers (Mulkay, 2015:9). Realism is like positivism, also believing that social reality and the researcher exist independently, and although a scientific approach to the development of knowledge is followed, realism by contrast views theories as changeable, and could use multiple methods to perform research (Saunders et al., 2009:114).

Interpretivism is an approach that aims to understand people foremost (Babbie & Mouton, 2011:28), arguing that the interrelationship of the researcher and the object or reality is inseparable, and that it is crucially “necessary for the researcher to understand differences between humans in our role as social actors” (Saunders et al., 2009:116).

Interpretivism has roots in phenomenology, which refers to the way in which we as humans make sense of the world around us, and symbolic interactionism where “we are in a continual process of interpreting the social world around us in that we interpret the actions of others with whom we interact and this interpretation leads to adjustment of our meanings and actions” (Saunders et al., 2009:116).

An interpretivist epistemology is concerned with understanding the world of subjective experiences of individuals, including meaning-oriented research methods (Kaplan & Maxwell, 1994:67). Interpreting and appreciating everyday experiences, occasions, and social structures in the context of people attaching value to these phenomena denote the purpose of interpretivist research (Rubin & Babbie, 2011:37).

In the context of constructivism and interpretivism, a purely scientific inquiry is not suitable for the study of the social world and its phenomena, because there are different perceptions and understandings of reality (Ormston et al., 2014:4). Interpretivism becomes the preferred choice of philosophy when “conducting research among people rather than upon objects, adopting an empathetic stance as to understand their social world and the meaning they give to it from their point of view” (Saunders & Tosey, 2013:58).

The basic generation of meaning that develops from the interaction of the human community has always been the fundamental emphasis of social studies (Longino, 2016:1). People engaged with their world and make sense of it based on their past and social perceptions. In this social context, individuals developed subjective meanings of their experiences, meanings which are focussed toward specific objects or matters, and these meanings can be numerous and diverse, leading the researcher to investigate the complexity of perspectives rather than limiting meanings (Byrne, 2001:7). As a result, social science researchers seek to interpret the context or setting of the participants through visiting this context and gathering information personally (Dammak, 2015:2).

Cohen et al. (2011:19) agree, saying that the role of the interpretivist researcher is to “understand, explain, and demystify social reality through the eyes of different participants”.

Pragmatism is not committed to one philosophy and reality and arises out of actions, situations, and consequences rather than classical considerations (Creswell, 2014:10). It focusses on the research problem and finds it appropriate to work with variations in epistemology, ontology, methodology and axiology (Saunders et al., 2009:109).

c) Axiology

Axiology is a branch of philosophy that is engaged with the evaluation of the researcher's values and opinions in all the stages of the research process. This is important because it influences both the research design and research findings (Creswell, 2007:18). However, social research cannot be entirely value-free, because "social science is part of the social world, and social phenomena occur in the real world, where moral, political, and cultural values are an integral, but often unseen part of the social landscape" (Walters, 2014:13).

Qualitative researchers need to clarify and converse their values as they are subjectively immersed in their research (Gilliland, 2014:86). In qualitative studies, researchers must acknowledge the value-laden character of the study and actively state their preferences and aversions as well as the value-laden nature of information gathered from the field. Contextual understanding is developed as researchers' position themselves in a study (Wahyuni, 2012:72).

d) The philosophical stand of this study

Researchers select a research philosophy that is appropriate for answering the research questions, which is formulated and shaped by the researcher's own experiences and background (Kothari, 2004:19).

The choice of a research philosophy is usually seated in the researcher's personal orientation about the world, which underpins the research strategy and related methods of choice (Saunders et al., 2009:59). Ontological and epistemological choices determine the methodology of a research study (Maree, 2016:124).

For this study, a constructivist ontology is appropriate because the reality cannot be separated from human practices and with this approach rich knowledge could emerge from the contexts investigated (Mertens, 1998:160). The goal of constructivist research is to rely as much as possible on the participants' views of the situation being studied, which in this study is CPTD within the context of a CoP. Furthermore, teacher development, especially in a structured collaborative setting of PLCs and CoPs is a standard social practice, fitting within the "constructivist paradigm, the social surroundings are seen as decisive for how the individual learns and develops" (Postholm, 2012:406). Teacher development studies lean towards a socially constructivist ontology (Butler et al., 2004; Hung et al., 2005; Mckay, 2007; Gunawardena et al., 2009; Houghton et al., 2015; Patton & Parker, 2017).

In socially orientated studies, an interpretivist approach gives the researcher the opportunity to explore research questions within the context of a natural worldview, analysing the situation under study and provide insight into the way in which a particular group of people makes sense of their situation or the phenomena (Cohen et al., 2011:40). The researcher prefers the lens of an interpretivist epistemology to address the research questions of this study, as the related richness and depth of data are generated from people making sense of their world and their social interactions. This characteristic of the interpretivist approach is one of its most recognised strengths to identify critical issues and to gain a greater understanding of a social phenomenon (Maree, 2016:55).

Braun and Clarke (2013:24) are in accordance that the interpretivist approach allows a rich, full context and more profound understanding of a phenomenon investigated in a real-world situation, focussing to comprehend the human understandings and constructions about it, “where the situational context is crucial in understanding behaviour” (McMillan & Schumacher, 2014:322).

The interpretivist approach is appropriate for this study as the in-depth descriptions of behaviours, group dynamics, interactions and events are ideal to understand the CoP best, as it helps to understand the social interaction in the CoP concerning its specific context (Mouton, 2013:149).

From the start, it remains clear that my role as a researcher is to appreciate teachers’ reflections from their position, and not from my perspectives, because interpretivism endeavours to comprehend the subjective world of human experience, with a genuine concern for the person, attempting to understand from “inside” (Cohen et al., 2011:20).

From an axiology stance, the researcher understands she is subjectively positioned within the research, making the research value-bound.

3.3.2 Research approach

Layer 2 of the Research Onion deals with the research approach, with two choices, that of deduction (testing theory), or induction (building theory). The deductive research approach, akin to scientific inquiry needs the development of both theory and hypothesis together with a research strategy to test the hypothesis, whereas a theory is developed from synthesising collected data with an inductive approach (Fellows & Liu, 2015:276).

Usually, but not exclusively, deduction is associated more with positivism and conversely induction with interpretivism (Henning et al., 2004:20), but it is common to combine deduction and induction within the same piece of research, which Saunders et al. (2009:127) refers to as a multi-method research approach.

It naturally follows that this study, which maintains an interpretivist epistemology, would be inclined towards an inductive research approach, with the subjectively immersed researcher generating meaning from the data collected in the field (Mack, 2010:4). All the characteristics related to induction are well aligned with this research. However, there is one specific feature of deduction, i.e., “moving from theory to data” about a theoretical framework that this study employs to interpret the research findings and shape the conclusions. Saunders et al. (2009:159) refer to this as a “hybrid approach” when an inductive research approach is using existing theory to help explain collected data. Other researchers also advocate the joint use of both inductive and deductive approaches (Cavaye, 1996:236).

Theoretical framework

A theoretical framework is a “device that enables a researcher to make sense of the data that has been collected” (Cohen et al., 2011:482), a “blueprint for examining and interpreting the findings of the research” (Yin, 2009:46), a “set of interrelated concepts, definitions, and propositions that present a systematic view of a phenomenon by specifying relationships between variables with the aim of explaining and predicting a phenomenon” (De Vos et al., 2005:442), or “an attempt to develop a general explanation for some phenomenon” (Best & Kahn, 2006:10).

The primary role of a theoretical framework is to assist the researcher in framing the research study (Mallick & Verma, 2005:6; Blumberg et al., 2011:36; Reeves & Robinson, 2014:245). It could also indicate “missing ideas or links” and provide additional data required to understand how things are fully connected, and to establish sets of propositions or generalisations” (Henning et al., 2004:14), as well as promoting knowledge development (Inglis & Maclean, 2005:17; Kawulich, 2009:37). Merriam and Tisdell (2016:85) state that “a theoretical framework is an underlying structure, the scaffolding or frame” of a study, consisting of concepts or theories that inform and direct the study.

This research study, which explores how a CoP can contribute to the professional development of Senior Phase Natural Sciences teachers in a rural school district is based on existing theory in the world of knowledge that had been academically investigated and documented.

These include recognised teacher development models (Little, 1993; Guskey, 2002b; Kennedy, 2005; Desimone, 2009; Kuijpers et al., 2010; Richter et al., 2011; Hadar & Brody, 2012; Mitchell, 2013; Macheng, 2014; Dharsey, 2015; Smith, 2015), and the theory of CoPs (Lave & Wenger, 1991; Wenger, 1998, 2000, 2011).

In South Africa, continuing professional teacher development (CPTD) is regulated by strict guidelines contained in the National Policy Framework for Teacher Education and Development (NPFTED). For this reason, the theoretical framework and the associated CPTD model considered appropriate for this study needed to be aligned to the NPFTED guidelines. In the literature review discussed in Chapter 2, compelling evidence emerged that collaborative CPTD models, which accommodate a high degree of teacher autonomy, such as “teacher clusters,” “professional learning communities” and “communities of practice” match the NPFTED guidelines the best.

The next sections briefly recap the value proposition of selecting Wenger’s (1998) community of practice (CoP) model as the theoretical framework of this study.

The NPFTED states that “teachers are the essential drivers of a good quality education system” and expects teachers to “take charge of their self-development by identifying the areas in which they wish to grow professionally, and to use all opportunities made available to them for this purpose” (DoE, 2007:5). The policy furthermore recommends that the “professional education and development of teachers work best when teachers themselves are integrally involved in it, reflecting on their practice; when there is a strong school-based component; and when activities are well organised” (DoE, 2007:5). In summary, the NPFTED places an absolute premium on teacher autonomy and teacher collaboration concerning CPTD.

The authoritative Norms and Standards for Educators (DoE, 2000), an underpinning of the NPFTED, requires teachers to be more than transmitters of textbook content, but for them to collaborate with colleagues, and assume extended roles and competences in their teaching duties. Hence, the traditional framework of teacher autonomy is inadequate to accomplish the objectives of the NPFTED. It is primarily the novice (Berliner, 2001:477), beginner (Geldenhuis & Oosthuizen, 2015:201) and less-experienced (Fick & Kapp, 2007:444) teachers that suffer most from teacher isolation. While the traditional view of teacher development is believed to take place in isolation, modern theories indicate that it is carried out collaboratively (Anfara & Angelle, 2008:52).

“Teacher clusters”, professional learning communities” (PLCs), and “communities of practice” (CoPs) are compatible CPTD models that aim to foster teacher autonomy and teacher collaboration (Kennedy, 2005:243). Teacher clusters focus on school organisation (Jita & Mokhele, 2014:3), PLCs target learner performance (Blankenship & Rouna, 2007:7), whereas CoPs aims to concentrate on teachers (Akerson et al., 2009:1092).

Teacher cluster and PLC practices are structured, formal, administered and mandatory, in contrast to CoPs that offer a higher degree of flexibility, attending to the diversified needs of individual teacher members.

A CoP offers a useful alternative mechanism to traditional approaches for engaging CPTD effectively, because the concept is seated in “situated learning” (Lave & Wenger, 1991:66), a construct that is being endorsed by the Minimum Requirements for Teacher Education Qualifications, an update on the NPFTED (Reeves & Robinson, 2014:247).

The concept of CoPs in the context of CPTD originated in response to several barriers, such as the isolated nature of teaching (Maistry, 2008:365). CoP members share concerns and problems and by convergence, increase their knowledge through their interaction (Johnson & Bremer, 2005:1). This collaborative learning creates meaningful interactions with peers, enhanced by an environment for interdependent relations, where teachers could grow as autonomous individuals within a CoP (Wenger, 1998:2).

This study recognises that a CoP in principle is underpinned by a social constructivist paradigm (Lave & Wenger, 1991:64) that is fundamentally rooted in situated learning (Vygotsky, 1978:88). Wenger’s (1998) model for a CoP is embraced as a theoretical framework for this study, serving the purpose to determine if a CoP could benefit the professional development of Senior Phase Natural Sciences teacher participants. The literature review shows a research gap in understanding the intricacies of pedagogical interest, full functioning or construction of knowledge related to teachers CoPs (Patton & Parker, 2017:352). However, this study has no intention to pursue these issues from a design perspective. Thus, only the CoP principles believed relevant to this study are discussed below.

CoPs are essential “groups of people who share a concern or a passion for something they do, have a clear sense of purpose, work towards the shared facilitation of purpose through productive social contact and learn, through sustained endeavour over time, how to improve their practice” (Johnston, 2016:536).

A CoP, by Wenger's (1998) original definition features the following three foundational elements, namely the domain, the community and the practice (Figure 3.4). The Domain, which constitutes "the area of knowledge that brings the community together, gives it its identity, and defines the key issues that members need to address" (Wenger, 1998:1), outlines the identity of a CoP as the common area of shared inquiry and interest, which is not necessarily deemed expertise outside of the CoP. In this study, the domain encapsulates the continuing professional development of Natural Sciences teachers from the rural school district of Vredendal.

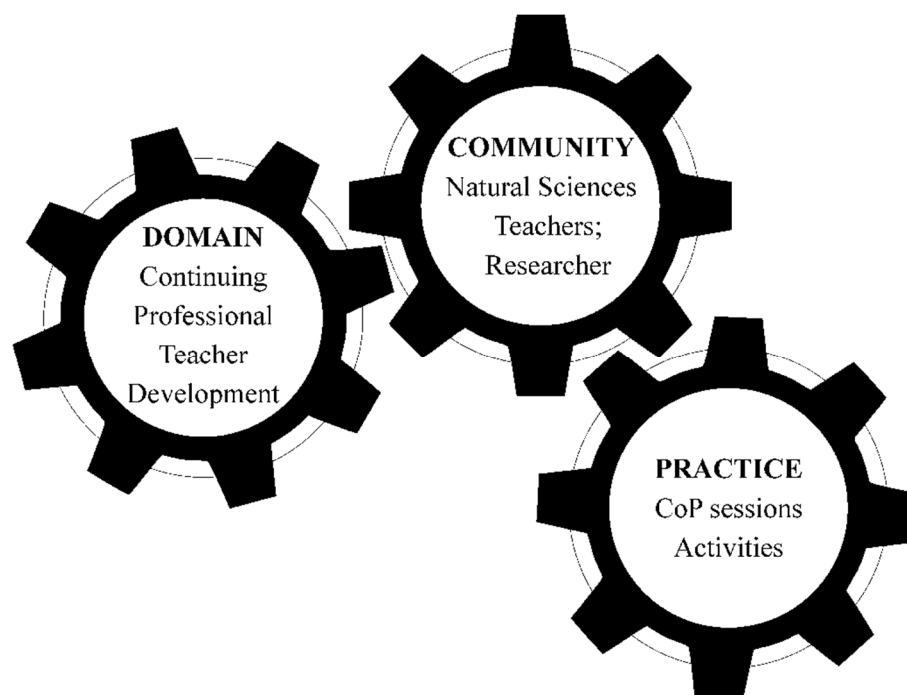


Figure 3.4 A simplified illustration of the theoretical framework of this study, based on Wenger's (1998) model of a community of practice.

The Community, "the group of people for whom the domain is relevant, the quality of the relationships among members, and the definition of the boundary between the inside and the outside" (Wenger, 1998:2), refers to the membership of a CoP, which with shared competence collaborate with each other to accomplish collective learning. In this study, the Natural Sciences teachers and the researcher, who assumed multiple roles stand for the community. The involvement of the researcher is explained at a later stage.

The Practice refers to a shared collection of resources that the community actively utilises to address their problems and issues, as Wenger (1998:12) states "the body of knowledge, methods, tools, stories, cases, documents, which members share and develop together". In this study, the practice includes different strategies used in the CoP sessions meant to explain and demonstrate specific contexts as well as the corresponding concepts.

It also includes in-classroom and out-of-classroom support, the interviews and the reflections of the teacher community. These activities are meant to improve the teaching and learning practice of the teachers in their school context. Furthermore, the practice is also directed at helping the Natural Sciences teachers render the theoretical knowledge into a more understandable manner to their learners.

An individual's engagement in a CoP necessitates a "process of negotiation of meaning", which happens in the presence of two complementary processes, namely participation, phrased as individuals' "acting and interacting", and reification that gives bearing to "artefacts such as tools, words, symbols, rules, documents, concepts, theories, and so on around which the negotiation of meaning is organised" (Wenger, 2009:57). Over time, participants of a CoP use these two processes to "develop and negotiate a set of criteria and expectations by which they recognise membership" (Wenger, 2010:180).

These criteria include: a joint enterprise ("a collective understanding of what the community is about, its purpose"), mutual engagement ("interacting and establishing norms, expectations, and relationships), and a shared repertoire ("using the communal resources, such as language, artefacts, tools, concepts, methods, standards"), which a CoP uses to set guidelines as to "what it is to be a competent participant, an outsider, or somewhere in between" (Wenger, 1998:137), ensuring success (Howlett et al., 2016:743).

Wenger (1998:228) acknowledges the significance of member identification, which stems from an individual's sense of belonging as crucial to the effectiveness of a CoP, and distinguishes three behaviours of identification, namely engagement ("doing things together, talking, producing artefacts"), imagination ("reflecting, constructing an image of the practice and its members and seeing self as one of them"), and alignment ("following directions, aligning self with expectations/standards, coordinating actions towards a common goal").

Another topic of importance is that of member identity (Wenger, 2010:181), which is forged from CoP participation, and the learnings from the practices: "Because learning transforms who we are and what we can do, it is an experience of identity" (Wenger, 1998:125).

One of the most powerful attributes of a CoP is its ability to develop knowledge as interaction from participants continues, and reification converts the shared knowledge to understand and solve problems into the "tools and artefacts that embody a CoP's regime of competence" (Smith et al., 2017:213). The socially, individually generated knowledge is unambiguous, dynamic and implicit (Wenger et al., 2002:1).

Responding to critique that questions the significance of CoPs, Wenger et al. (2011) presents the concept of “value creation,” defining five cycles within a CoP: immediate value, potential value, applied value, realised value, and reframed value. Immediate value materialises from solving a problem straight away, potential value includes benefits to a future reference, and applied value refers to new contexts. Realised value denotes the contributions to achieving important goals, whereas reframed value entails the identification and definition of new criteria for success.

3.3.3 Research strategy

The research questions mainly drive the research strategy that is represented Layer 3 of the Research Onion (Figure 3.2), the philosophical underpinnings (Layer 1), as well as the extent of existing knowledge (Saunders et al., 2009:141). The interrogative pro-adverbs such as “what,” “why,” or “how” used in research questions inform the types of study about research purpose, i.e., either exploratory, descriptive or explanatory studies.

An exploratory study is a relevant means of determining “what is happening; to seek new insights; to ask questions and to assess phenomena in a new light”, descriptive research “portray an accurate profile of persons, events or situations”, whereas explanatory studies aim to establish causal relationships between variables (Robson, 2002:59). This study leans towards being “descripto-exploratory” (Saunders et al., 2009:140) as it explores the usefulness of teacher CoPs in a specific setting, but it also aims to add to the existing, relevant knowledge base of educational CoPs in general.

Saunders et al. (2009:141) distinguish seven different research strategies, namely experiment, survey, case study, action research, grounded theory, ethnography and archival research. Some of these resort under the deductive approach, whereas others belong to the inductive approach, but this is the norm, not the exclusion.

This study has utilised the case study as a research strategy to address the research questions.

a) Definition of case study

Yin (2009:2) defines a case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not evident”. Creswell (2014:1) offers a similar definition: “A case study is also described as an investigation of a bounded system or case over time through detailed, in-depth data collection involving multiple sources of information-rich in context”.

Gay et al. (2010:445) have a similar view: “a case study is an in-depth description and analysis of a bounded system”. Robson (2002:178) views a case study as “a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real-life context using multiple sources of evidence”. The case study method involves systematically gathering information about a group, social setting, or phenomenon, to understand how the subject operates or functions (Berg, 2012:251).

Essential to case study research is the contextual term “naturalistic”, which refers to studying the real-world situations as they unfold naturally, non-manipulative and controlling, where the researcher is open to whatever emerges (Babbie & Mouton, 2011:270; Yilmaz, 2013:312). Rule and John (2011:15) consider a case study as a systematic, in-depth inquiry of a particular case in a real-life situation with the purpose of generating knowledge.

Cohen et al. (2011:289) define a case study as “a specific instance that is frequently designed to illustrate a more general principle” and as “the study of an instance in action”. Case studies present the researcher the opportunity to apply various analysis techniques in considering all the views of the participants in the observed situation, and the interaction between them (Nieuwenhuis, 2010b:99). A case study allows for the detailed examination of a “bounded system,” using sources of data situated within the case or situation (Bryman; 2012:66; McMillan & Schumacher, 2014:32).

Creswell (2014) reiterates that a case study is an in-depth exploration of a bounded system, whilst Merriam (2009) highlights that the single most defining characteristic of case study research is situated in delineating the object of the study, the case, or “unit of analysis” (Babbie & Mouton, 2011:281). Merriam (1998:27) refers to a case as the object of a research study: “a thing, a single entity, and a unit around which there are boundaries”, which in the context of education could be learners, teachers, schools, or communities, or a case could refer to a single individual, several individuals separately or in a group, a programme, events or activities (Creswell, 2014:439). A case, therefore, describes a single entity, a unit delineated by boundaries that is unique, according to place and time and participant characteristics (McMillan & Schumacher, 2014).

b) Classification of case studies

Case studies are classified according to the nature of the case (Stake, 1995), or general aims (Yin, 1993). Stake (1995) distinguishes three types of case studies: intrinsic, instrumental and collective. An intrinsic case study refers to a unique case, where the particular case itself is of interest. In an instrumental case study, the case is of secondary interest, but it plays a supportive role to provide insights into a problem, or to develop an existing theory (Stake, 2000, 2005). Finally, the collective case study extends to several cases (Gay et al., 2010:434).

Yin (1993:22) also sets apart three kinds of case studies: exploratory, causal and descriptive case studies. In an exploratory case study, the collection of data precedes the formulation of research questions, compared to a causal case study that aims to establish cause-and-effect relationships, pursuing critical theories of the phenomena, whereas the descriptive case study needs a theoretical framework to guide the collection of data. Yin (2009:46) distinguishes single and multiple case study designs, according to numbers. Case studies can be embedded, where the case allows more than one subunit, or holistic, where a global programme of the organisation is typically contemplated.

The type of detailed case study deemed most appropriate for this study is an instrumental (Stake, 1995), and descriptive (Yin, 1993:22) case study, which is used primarily to research a phenomenon within its natural context by studying it comprehensively against a firmly grounded theoretical framework (McMillan & Schumacher, 2014:371). Explicit to this study is that a specific group of Natural Sciences teachers from the rural school district of Vredendal represent the case, or the equivalent term community as per Wenger's (1998) theoretical framework, and by the same reasoning, CPTD stands for the context or domain.

This study is described as a single, embedded case study. The single case refers to the main unit of analysis, which is the group of teachers studied, whereas embedded case reference allows the differentiation of subunits, for instance like the teachers' level of specialisation, teaching experience, professional status. Subunits "can often add significant opportunities for extensive analysis, enhancing the insights into the single case" (Yin, 2009:44).

c) The motivation for case study research

The descripto-exploratory nature of this study requires a detailed understanding of the research phenomenon, which is a specific group of teachers participating in a CoP (Yin, 2009:13). Case study research is a suitable choice to answer explanatory questions, e.g., "how or why did it happen?" or descriptive research questions, e.g. "what happened?" (Gay et al., 2010:434), offering more insights into an issue or improving current theory (Opie, 2004:74).

A case study is the preferred research strategy of performing social inquiry when dealing with ‘how’ or ‘why’ research questions, a definitive feature of this study (Schwandt, 1997:13; Yin, 2009:9). In this case, a researcher’s interest is drawn to the “process rather than the outcome, context rather than a specific variable, discovery rather than confirmation” (Merriam, 1998:18; Henning, 2004:41). Typically, the case study strategy opportunely utilises multiple methods of data collection, such as interviews, document reviews, archival records, and direct and participant observations, producing “thick descriptions” of the phenomena studied (Yin, 2009).

A case study has much to offer to educational researchers because of its appealing research strengths (Merriam, 1998:41; Mertens, 1998:145), which allows a detailed, in-depth understanding of the intricacies of a phenomenon in context (Merriam, 1998:226; McMillan & Schumacher, 1997), within a real-life context (Yin, 2009:8). Merriam (1998:33) highlights two more advantages, saying it may be selected “for its very uniqueness, for what it can reveal about a phenomenon and the knowledge acquisition we would not otherwise have access to”.

My intent as a researcher is to gain such a comprehensive understanding of a specific group of teachers participating in a CoP, hence, the researcher needed to furnish thick descriptions about the teacher participants (Babbie & Mouton, 2011:281).

As a result, considering the joint constructivist-interpretivist position adopted in this study and the nature of the research questions, the researcher believes that the case study approach is the most appropriate research strategy for this study because of its advantages in illuminating detailed, exclusive perceptions and concerns of individual participants in a real-world situation that otherwise would have been overlooked in quantitative strategies (Nieuwenhuis, 2010a:75; Cohen et al., 2011:183; Maree, 2011:715; Gay et al., 2014:13). Both Stake (1995) and Yin (2009) motivate their approach to a case study on a constructivist stand.

Considering that case study research is confined to a specific phenomenon, equivalent to a community (Wenger, 1998:2), within in a specific context, analogous to a domain (Wenger, 1998:1), a case study design seems most appropriate for this study as for this particular study.

As for this study, the phenomenon (case) and its context are difficult to separate (Yin, 2009:13). Unlike many other research strategies, a case study does not utilise any particular method of data collection or data analysis (Merriam, 1998:28), but a combination of data collection methods, the so-called “multi-method choice” (Saunders et al., 2009:152). This becomes an appealing choice, leading to a more coherent picture of a unique situation, presenting an opportunity to understand a specific problem or situation in greater depth (Du Plooy, 2002:162; Yin, 2009:1; Babbie & Mouton, 2011:280).

Lastly, a case study is accommodating, and responsive to changes in focus and unforeseen concerns (Simons, 2009:4).

d) Limitations of case study design

A strong motivation was given in the afore discussion on the strengths of a case study research and its appropriateness for this particular study. However, case study research is not without limitations. Case study research has three main drawbacks. Firstly, since the data collected are commonly rich and complex, and often open to different interpretations, there are claims that case studies are limited by the researcher's sensibility, sensitivity, and integrity, and the related bias is a constant risk to objective data gathering and analysis (Merriam, 1998:42; Anderson, 2002:37; Best & Kahn, 2006).

Secondly, generalisation from single-case research study to other cases is unfeasible (Cohen et al., 2011; Edwards, 2001:127; Rule & John, 2011:21 Fraenkel et al., 2012; Wellington, 2015). Lastly, case studies are perceived as lacking in rigour (Denscombe, 2007), as described by de Vaus, (2001:237): "while case studies may achieve excellent internal validity by providing a profound understanding of a case, they have been widely criticised as lacking in external validity".

However, several authors provide counter-arguments against these contentions. Some researchers have highlighted that case studies do not claim to be representative (Marshall & Rossman, 1999; McMillan & Schumacher, 2014; Wellington, 2015), but its focus is on what can be learned from a single case (Tellis, 1997), as the basis of a single case study is "not to prove, but to improve" (Stufflebeam et al., 2000:283). Some authors argue that case studies could generalise a particular set of results to some broader theoretical propositions (Denzin & Lincoln, 2005:193).

3.3.4 Research choices

Saunders et al. (2009) disregard the reference to "quantitative" and "qualitative" in the context of "methodology" as described in the traditional ontology-epistemology-methodology model (Lincoln & Guba, 2005a:107). Instead, Saunders et al. (2009:151) describe the way in which a researcher selects to combine quantitative and qualitative research methods, concerning techniques and procedures as research choice, which represents Layer 4 of the Research Onion (Figure 3.2).

The method of data collection, data analysis and presentation differ fundamentally between qualitative and quantitative methods. Quantitative methods include data collection techniques or data analysis procedures that produce, or use numerical data, whereas qualitative methods generate or employ non-numerical data, or research with narrative descriptions instead of numbers (Willis, 2007:40; Corbin & Strauss, 2008:25).

Both quantitative and qualitative methods apply to educational research, but neither method is intrinsically superior to the other. The suitability of which methods to apply is determined by the context, purpose, and nature of the research study in question (Thomas, 2010:302).

It is important to note that research choice and the underlying philosophical position adopted are independent, although they could be used in complementary fashion as both quantitative and qualitative methods apply to descriptive, explanatory and exploratory research (Yin, 2009), for instance, an interpretivist approach does not necessarily lead to a qualitative methodology.

As individual quantitative and qualitative techniques and procedures are often braided in research, Saunders et al. (2009:152) propose a useful classification scheme to illustrate the different possible research choices (Figure 3.5). The primary choice to answer the research questions is to either use a “mono method”, which employs a single data collection technique and corresponding analysis procedures, or the use of “multiple methods,” which is characterised by more than one data collection technique and analysis procedures.

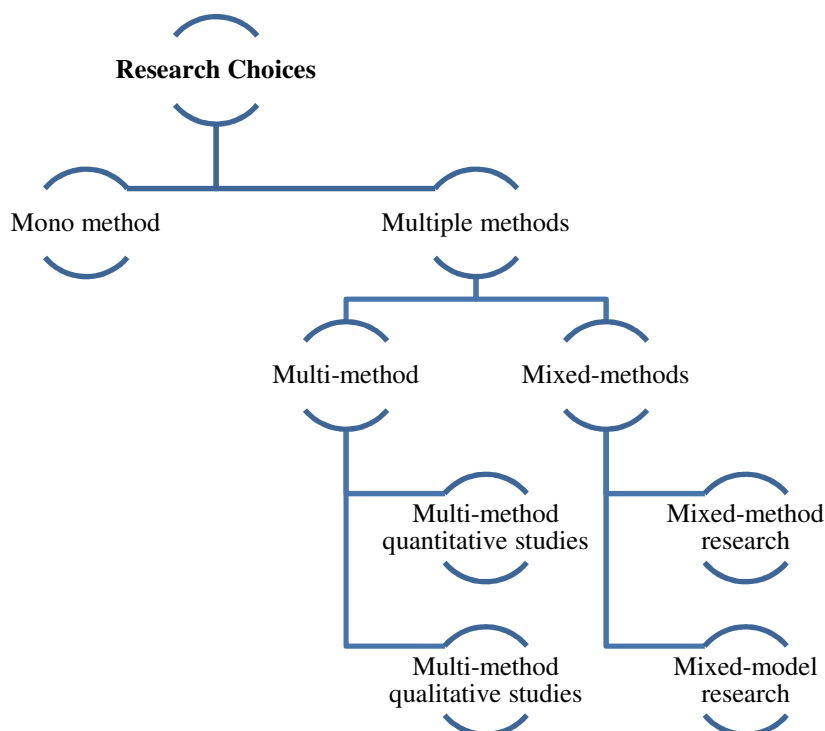


Figure 3.5 Classification for different research choices (after Saunders et al., 2009:152).

The term “multi-method” refers to those combinations where more than one data collection technique is used with associated analysis techniques, but this is restricted within either a quantitative or qualitative context, but not a combination thereof. “Mixed methods” is the general term for when both quantitative and qualitative data collection techniques and analysis procedures are used in research design (Creswell, 2014:535).

Responding to the descripto-exploratory nature of this case study that contains “how” and “what” in the research questions, qualitative research methods are considered appropriate. Consequently, various kinds of qualitative data collection techniques were used, classifying this study as a multi-method qualitative study (Saunders et al., 2009:151; Gay et al., 2010:307; Cohen et al., 2011:272; Harwell, 2011:154). Some biographical information gathered during this study resembles a classical quantitative genre, but this does not qualify it as a mixed-methods choice as it does not endeavour to integrate qualitative and quantitative methods (Creswell et al., 2003:7; Creswell & Plano Clark, 2007:2; Creamer, 2017:6).

The motivation for a qualitative study

A qualitative research lens captures the essence of this study the best because it is appropriately aligned with the case study research strategy (section 3.3.3). It captures the naturalistic character of this study, the insider perspective as the researcher is embedded in data collection, the rich information expected from the study, and the flexibility operating within the research design.

Unlike quantitative methods, the qualitative research seeks to understand events and phenomenon as they naturally occur, referring to the naturalistic character of this case study (Daymon & Holloway, 2002:6; Babbie & Mouton, 2011:270). Two significant characteristics mark qualitative research; namely it focusses on understanding the phenomena happening in natural settings, and secondly, it entails studying those phenomena in all their complexity, aiming to understand the situation from the participants’ perspective (Du Plooy, 2002:29; Henning, 2004:3; Jones & Kottler, 2006:83; Leedy & Ormrod, 2010:94; Kumar, 2011:13; Creswell, 2014:175; McMillan & Schumacher, 2014).

Patton (2002:39) defines qualitative research as “an approach that uses a naturalistic approach” that seeks to understand phenomena in context-specific settings, such as real-world settings. It is all research that produces findings not arrived at using mathematical methods or other means of quantification, but alternatively the sort of research that provides findings derived at from real-world settings where the phenomena of interest unfold naturally.

The unfolding of the phenomena confirms that qualitative researchers “study things in their natural settings, attempting to make sense of or to interpret, phenomena regarding the meanings people bring to them” (Denzin & Lincoln, 2005:3). Creswell (2007:15) views qualitative research as a systematic inquiry based on definite methodological conventions of research that investigate a social or human problem in a natural setting, allowing the researcher to get an “insider perspective on social action” (Denzin & Lincoln, 2005:2; Babbie & Mouton, 2011:270). The insider perspective, therefore, refers to the researcher’s aspiration to see and understand the world through the eyes of the participants (Daymon & Holloway, 2002:6; Babbie & Mouton, 2011:271).

Furthermore, qualitative research tends to be more flexible than quantitative research, allowing the researcher to be flexible in the inquiry (Trochim, 2006). Unlike quantitative research, qualitative research does not necessarily require a hypothesis as the starting point, however qualitative case studies in education are frequently supported by concepts, models, theories and frameworks, either theoretical or conceptual (Merriam, 1998:11), with the researcher becoming an instrument of data collection (Daymon & Holloway, 2002:5).

Qualitative research “implies an emphasis on the qualities of entities and on processes and meanings that are not experimentally examined or measured” (Denzin & Lincoln, 2005:10). Using words, images or other non-numerical data sources (Saunders et al., 2009:470), qualitative research, usually excludes using formal, structured instruments (Holloway, 2005:4). It draws on systematic, organised, intuitive data collection of subjective narrative data through participants’ and researcher observations, in-depth interviews with individuals or focus groups, questionnaires, and related documents and texts, lending itself to the thick narrative description of the participants’ behaviours in their natural environment (Babbie & Mouton, 2011; Myers, 2013). The result of in-depth, detailed collection of information required for qualitative research, usually involves a small number of participants (Hofstee, 2006), as is the case for this study.

3.4 Data collection

This study employs case study research to answer the research questions. A vital strength of the case study method is the flexibility of using multiple sources and techniques in the data-collection process, allowing for ‘thick descriptions’ of the phenomena under study (Yin, 2009). In this multi-method qualitative case study, questionnaires, semi-structured interviews, observations, participants’ diaries, a reflective journal of the researcher, and document analysis were used to investigate the research questions served as data sources (Figure 3.6).

Although questionnaires are usually used as a collection method for quantitative methodology, it has been used in this study to obtain information regarding participants' qualifications, their continuing professional development and their experience and ideas regarding their opinions before the start of the intervention, and to determine their levels of satisfaction with the intervention (Saunders et al., 2009:151). This information helped to better plan the structure and purpose of the intended intervention, which is the CoP in this study. All these techniques share a single aspect, i.e. the researcher is the primary data collection instrument.

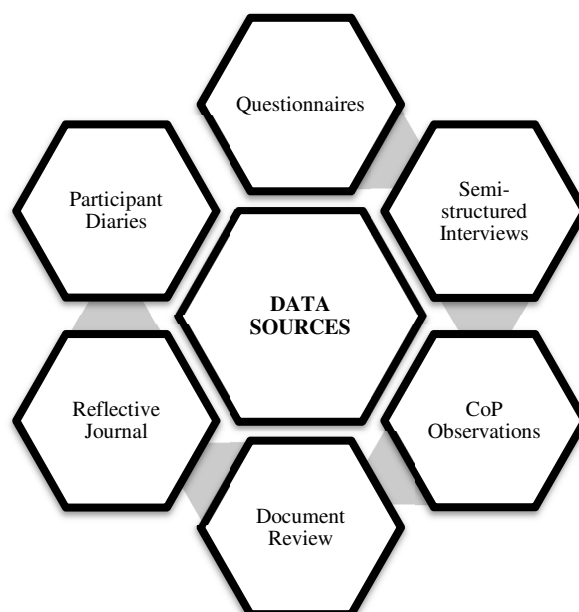


Figure 3.6 Illustration of the various data sources employed in this study.

3.4.1 Sampling

The term “participant” is used to portray the individuals (teachers) that are taking part in the study (Merriam, 2009:162). Sampling implies that a choice had been made of people within a larger group for a particular study with the intention of representing a particular community (Gall et al., 2007:166; Scott & Morrison, 2007:219; Neuman, 2011:246). Purposive sampling is a technique used by researchers where participants are deliberately chosen because of their suitability in advancing the purpose of the research (Rule et al., 2011:64).

Maxwell (2013:88) defines the purposeful selection of cases as “a strategy in which particular settings, persons, or activities are selected deliberately in order to provide information that cannot be forgotten from the choices made”. McMillan and Schumacher (1997:434) offer a similar definition: “a strategy to choose individuals likely to be knowledgeable and informative about the phenomenon of interest”.

Furthermore, purposive sampling allows the collection of detailed information for a specific group of people, used for both qualitative and quantitative research techniques (Tongco, 2007:1; Maree & Pietersen, 2007:177). Purposive sampling takes place when the researcher selects a sample from which the most could be learned (Merriam, 1998). It is the most common sampling strategy in qualitative research and seeks rich information for the cases, studied in a great deal about issues of crucial importance for the purpose of the research (Van Heerden, 2012:88).

The benefit of purposive sampling is “some common patterns that emerge from great variation are of particular interest and value in capturing the core experience and central, shared dimensions of a setting or phenomenon” (Thomas, 2010:291).

This study employs a purposeful selection of schools and subsequently purposive sampling of teacher participants. A purposive sampling method had been used to select the “case”, or “unit of analysis” or “community” who is represented by a specific group of Senior Phase Natural Sciences teachers from the rural school district of Vredendal (West Coast schools district), Western Cape Province, South Africa.

The information about the proposed research study (Addendum J) including the pre-intervention questionnaire (Addendum F) was sent in advance via e-mail to the principals of all public and private schools in the Vredendal district, primary as well as high schools offering Natural Sciences. Only 23 candidates responded by returning completed pre-intervention questionnaires. These 23 candidates were contacted telephonically and invited to participate in the study, but only ten volunteered to participate further in this study. Subsequently, these ten participants formed the core study group, they constituted the CoP membership, were interviewed, and completed the post-intervention questionnaires (Figure 3.7). All ten teacher participants represent public, rural district schools.

Table 3-1 illustrates the composition of the teacher participants, which are differentiated on levels of specialisation (qualified, underqualified), and teaching experience (beginner, senior, veteran).

The number of participants is considered sufficient, based on the aspect of data saturation that implies that if no new or further information can be added, rich data have been gathered and data saturation has been reached (Thiétart, 2007:166). In this study, the saturation principle is trustworthy (Guest et al., 2006), as it confirms that the number of participants was enough, and enough information was provided to enable the researcher to acquire rich data with the questionnaires, semi-structured interviews, the observations and reflective diaries.

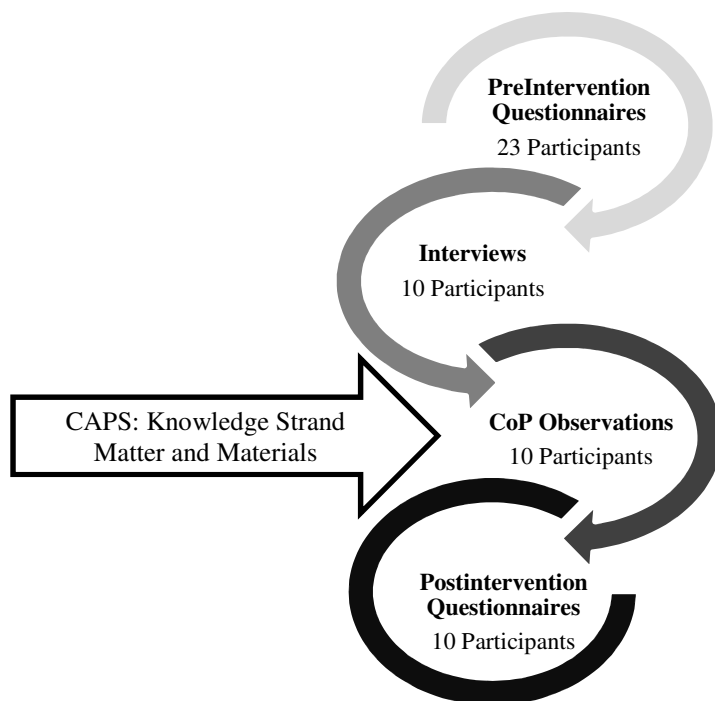


Figure 3.7 Flow-chart illustrating the different methods used to gather data.

Table 3-1. Summarised teacher profiling, according to teaching experience and qualification.

	Qualified	Underqualified	Total
Pre-Intervention Questionnaire	18	5	23
Beginner	7	3	10
Senior	4	1	5
Veteran	7	1	89
Post-Intervention Questionnaire and CoP participation	7	3	10
Beginner	3	3	6
Senior	2		2
Veteran	2		2

3.4.2 Questionnaires

a) Overview

According to Rogers et al. (2010:238), questionnaires are a well-established technique for gathering demographic data and respondents' views. Myers (2013:156) states that questionnaires may be applied to extract information and thoughts. The motivation for using questionnaires in this study is that it provides confidentiality to respondents as they could complete it in their comfort. The flexibility of questionnaires is ideal to address multifaceted situations when questions have to be adapted to suit several types of people; exploring feelings, beliefs, emotions, and experiences of people; and investigating sensitive social issues (Oates, 2006). Although questionnaires are generally used as a quantitative research method, relevant literature showed that it could also be used for qualitative case studies (Chasteauneuf, 2010:669; Seale, 2012:183).

Broadly, two types of questions are discriminated. Open-ended questions allow respondents to state their thoughts using their sentences and descriptions (Gilliland, 2014:101), whereas closed questions can be posed in many different formats to measure human characteristics.

Questions in questionnaires should be unambiguous and set ways to obtain facts or information from human respondents as honestly as possible. Questions should be relevant, brief, specific and objective (Oates, 2006:222). In the development of the questionnaires, the researcher drew from Creswell's (2014:401) guidelines on how to compose questions for a useful questionnaire. He mentioned that the questions must not be unclear, not too tedious; it must not include inappropriate words and jargon. Furthermore, he suggests making sure that there is no overlapping of responses that could lead to confusion and that the questions should not include exceedingly technical language, but should be straightforward to ensure that all participants could easily understand the questions (Van Heerden, 2012:97).

A key limitation of the questionnaires is that the researcher was not present during the completion of the questionnaires. Therefore, the respondents' answers cannot be directly followed up to clarify issues the respondents could have had. The researcher's absence makes it challenging to establish an understanding of the respondents' responses, making it difficult to watch the non-verbal behaviour of respondents, restricting the depth to which the researcher could examine any particular matter. With a questionnaire, the interpersonal experience of face-to-face interaction and collection of data relating to feelings and emotions are not easily captured as with interviews (Hofstee, 2006:133; Van Heerden, 2012:95-97).

b) Questionnaire procedure

The questionnaires used in this study contain both open and closed-ended questions. Closed-ended questions include simple rating scales of choice, such as “yes/no” or “agree/disagree”. The category range provided five options, which led to more information collected from respondents (Gilliland, 2014:101).

The Likert scale is a well-known measure of attitudes where respondents indicate how strongly they agree or disagree with carefully constructed statements (Oates, 2006:223; Zikmund et al., 2013:316). A Likert scale, which is an attitude-measurement technique, was used for most of the questions in both the pre- and post-intervention questionnaires (Gilliland, 2014:101). In this study, the scale 1 to 5 descriptions was for one no role, three for fairly and five for very good.

In this study, pilot questionnaires (Addenda D and E) were used to test for ambiguity and clarity. A specific group of Natural Sciences teachers were involved in the pilot to assess the efficacy of the questionnaires as a data collection instrument. The information obtained through the pilot pre- and post-intervention questionnaires were used to produce the finalise two questionnaires for the actual study. The pilot questionnaires were sent to a couple of Natural Sciences teachers in the Vredendal area. After feedback was received, changes were made by omitting or changing some of the questions, making it more suitable for the actual study to take place. Most of the changes involved the logical grouping of questions or changing terminology into a more familiar and uniform language in order to drop any uncertainties raised by the respondents (Gilliland, 2014:103).

However, the data obtained from the returned pilot questionnaires were not employed as part of the data analysis of the study. After the researcher discussed the changes with her study leader, the updated questionnaires were finalised and submitted for approval to the DESC (Department of Ethics and Screening), Stellenbosch University.

The information obtained from the pre-intervention questionnaire (Addendum F) assisted the researcher in aligning the functionality of the planned CoP intervention with the needs of the participants. The purpose of the post-intervention questionnaire (Addendum G) was therefore to determine changes in the opinions of teachers about professional development as well as the role that the CoPs play in adding value to their professional development.

The questions contained in the pre- and post-intervention questionnaires were structured specifically to help answer the main research questions and the sub-questions.

Section A: Purpose of the questionnaire as well as the instructions on how to complete it.

Section B: General information about the participant. Questions in this section aimed to obtain some biographical information of the respondents as well as information about their resident schools.

Section C: Questions one to three with the subdivisions of the three questions include question one focusing on the teaching of Natural Sciences, in other words, the pedagogy and the understanding of the subject content knowledge to teach it effectively. Question two focuses on matters about the teachers' professional development and the role role-players such as tertiary institutions, and non-government organisations could play while question three concentrates on CPTD and CoPs in relation.

The pre-intervention questionnaire (Addendum F), with precise and pre-coded questions, was used to determine teachers' biographical information. Furthermore, their experience as Natural Sciences teachers as well as the involvement of other institutions with the improvement of professional development were dealt with. Likewise, questions about their opinions and needs about their level of professional development, their previous experience of CoPs, and their opinions about favourable circumstances as well as the primary obstacles to launch and effectively operate CoPs were included. The pre-intervention questionnaire aimed to determine the teachers' ideas and experiences regarding CPTD and their previous involvement in CoPs.

The biographical information obtained through the pre-intervention questionnaire assisted with teacher profiling, such as teachers' names, their age, gender, qualifications, experience and further professional development needs. The biographical profile of the ten participants who participated in the full aspect of the study included six beginner, two senior and two veteran teachers.

Geldenhuys and Oosthuizen (2015:210) discuss the relationship between teachers' career stage (experience) and their needs to be involved in CPTD. They explain that a teacher's career cycle typically consists of five phases, but due to the size limitations of this study, their classification was simplified to three phases according to the number of years of teaching experience: beginner (1-6 years), senior (7-19 years) and veteran (20 years and more).

In reference to the NPFTED (DBE, 2014), a qualified Natural Sciences teacher in South Africa refers to a teacher that has the necessary qualifications to teach Natural Sciences, whereas underqualified means that the teacher has some form of formal teaching qualification, but not to teach Natural Sciences. Three of the beginner teachers that participated in the full aspect of the study were underqualified at that stage. The biographical information about the teacher participant group is summarised in Table 3-2.

Table 3-2. Teacher profiling, according to various biographical characteristics.

Code	Post Level	Experience	Teaching Areas	Status	Pre-questionnaire	Post-questionnaire	CoP participation
T01	Principal	Senior	NS Gr7-9	Qualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T02	HOD	Veteran	NS Gr7	Qualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T03	HOD	Veteran	NS Gr7-9	Qualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T04	Teacher	Beginner	NS Gr7-9	Underqualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T05	Teacher	Beginner	NS Gr8-9, PS	Qualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T06	Teacher	Beginner	NS Gr7	Qualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T07	Teacher	Beginner	NS Gr7-9	Qualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T08	Teacher	Beginner	NS Gr7	Underqualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T09	Teacher	Beginner	NS Gr7	Underqualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T10	Teacher	Senior	NS, PS	Qualified	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
T11	Teacher	Veteran	NS Gr7	Underqualified	<input checked="" type="checkbox"/>		
T12	Teacher	Senior	NS Gr7-9	Qualified	<input checked="" type="checkbox"/>		
T13	Teacher	Beginner	NS Gr9, LS	Qualified	<input checked="" type="checkbox"/>		
T14	Teacher	Beginner	NS Gr9, PS	Qualified	<input checked="" type="checkbox"/>		
T15	Teacher	Senior	NS Gr7	Underqualified	<input checked="" type="checkbox"/>		
T16	Teacher	Senior	NS Gr9	Qualified	<input checked="" type="checkbox"/>		
T17	Teacher	Beginner	NS Gr7-9	Qualified	<input checked="" type="checkbox"/>		
T18	Teacher	Veteran	NS, PS	Qualified	<input checked="" type="checkbox"/>		
T19	Teacher	Veteran	NS Gr9, LS	Qualified	<input checked="" type="checkbox"/>		
T20	Principal	Veteran	NS Gr7	Qualified	<input checked="" type="checkbox"/>		
T21	HOD	Veteran	NS Gr9, PS	Qualified	<input checked="" type="checkbox"/>		
T22	HOD	Veteran	NS Gr9, LS	Qualified	<input checked="" type="checkbox"/>		
T23	Teacher	Beginner	NS	Qualified	<input checked="" type="checkbox"/>		

3.4.3 Interviews

a) Overview

Interviews are techniques for gathering information through verbal questioning using a collection of pre-planned focus questions (Kvale, 2011:5). Interviews usually yield rich information since the interviewer pursues specific matters of concern that may lead to focused and valuable suggestions. In qualitative research, only a few participants are needed to gather rich and detailed data, and therefore interviews are suitable data-collection methods for gathering detailed information (Shneiderman & Plaisant, 2005).

Edwards (2001:131) is of the opinion that when case study researchers investigate phenomena, they often use interviews to explore their interpretations of the data. Interviews differ from questionnaires in the sense that the researcher could change the data collection situation to fit the respondent's replies (Van Heerden, 2012:103).

Interviews can be unstructured, structured, and semi-structured with individuals, or a focus group (Thomas, 2010:291). Unstructured interviews tend to generate rich exploratory data when participants can talk without much interference of the researcher (Rogers et al., 2010:585). In unstructured interviews, the researcher does not use an interview schedule. Instead, the researcher decides on the sequence and wording of the questions during the interview led by conversation at the time (Gall et al., 1996; McMillan & Schumacher, 2014; Eberlein, 2015:157; Wellington, 2015). Structured interviews consist of the same pre-determined, fixed questions for every participant, usually with pre-coded answers. Researchers often use an interview guide to supply the required structure to guarantee that conversational interviews are to the point and useful (Cannold, 2001:179).

Semi-structured interviews allow the flexibility to probe participants' answers to the questions while still working within the framework of an interview schedule as a guide (Oates, 2006; Rogers et al., 2010:585). In semi-structured interviews the interviewer uses a schedule of structured questions, but has the flexibility to probe more deeply and deviate from the interview schedule where needed, which in turn makes for greater detail in participants' responses and consequently for greater depth and richness of data (Gall et al., 1996; Thomas, 2010:291; Nieuwenhuis, 2010a:87; Bryman, 2012:470; McMillan & Schumacher, 2014; Wellington, 2015). The semi-structured interview is one of the principal data collection instruments that could be used with questionnaires, observations, journal reflections and field-notes.

b) Interview procedure

For this study, the semi-structured interview approach was chosen as the most proper interview research instrument to collect data. Individual, face-to-face, semi-structured interviews afford the opportunity to explore the meaning participants attach to their world (Ponterotto, 2005:131), allowing the opportunity to observe non-verbal cues and appropriately react or modify the inquiry in response to non-verbal signals of participants (Holbrook et al., 2003; Lee, 2003). In this regard, the researcher was able to constructively respond to these signs by reducing task difficulty and strengthen interest by omitting selected questions which the researcher felt was answered adequately.

The process of personally conducting the face-to-face interviews was crucial as the researcher could modify the line of inquiry by probing into unanticipated, compelling or unique participant responses (Suchman & Jordan, 1990; Lee, 2003). Although the interview schedule was pre-designed, the researcher was at liberty to modify and change the sequence of the questions according to the manner, appropriateness, and context in which the conversation flowed (Fontana & Frey, 2005).

Fraenkel et al. (2012) mentioned that interviews are employed to examine what people think or how they feel about a situation. Therefore, a limitation of this method of data collection is that participants may tend to provide responses that they think or feel the researcher wants to hear or wants to know (Glesne, 2006). In an attempt to reduce these responses, the researcher regularly visited the participating teachers at their resident schools to improve trust relationships with the participants before starting with the interviews. Various communication channels such as e-mails, short message (SMS), WhatsApp messages and telephone calls helped to develop this relationship of trust with the participants, before scheduling the interview meeting.

For this study, the researcher developed an interview schedule (Addendum H) of questions that align with selected elements of the theoretical framework and research questions (Creswell, 2014:247). The individual, semi-structured interviews conducted for this study were within the framework of selected elements, and these questions included topics that emerged during the review of the literature on CPTD and CoPs (Eberlein, 2015:157-159).

The researcher designed six questions to guide the interview process. The interviews aimed to obtain specific data from the participants (interviewees) and also to follow up on the responses given in the pre-intervention questionnaire. Ten of the 23 participants who completed the pre-intervention questionnaire agreed to further participate in the study and were interviewed as a follow-up to their specific responses to the questions on the pre-intervention questionnaire.

The interview schedule (Addendum H) steered the format of the interviews and individual discussions. All the participants received the interview schedule with the interview questions beforehand, for perusal (Patton, 2002:343). The interview schedule was prepared to ensure that the same required principles of inquiry were pursued with each person interviewed and provided topics or subject areas within which the interviewer was free to explore, probe, and ask questions which would elucidate and illuminate that particular subject (Patton, 2002:343). All interviews were recorded, and field notes were made.

The researcher ensured that participants signed the consent form before participating in the study, which declared their permission for the recording of the interview discussions (Scribner et al., 2007:16; Gilliland, 2014:99). Before continuing with the interview, permission was obtained to record the interview electronically with a cell phone which is pin-protected. Making use of recordings reduced the risk of making the respondent uneasy and less forthcoming (Patton, 1990:348; Gall et al., 1996; Fraenkel et al., 2012:457; McMillan & Schumacher, 2014).

Immediately after the interviews took place, the voice recordings were downloaded and converted to a particular file format for smooth playback during transcription. These interviews were transcribed, and the transcriptions became the data source for analysis. Audio recording the interviews was helpful during the categorising and data analysis, and to cut the problems associated with note-taking that interfere with the continuity of interviews. It allows for the speedy composition of complete, accurate and objective records of interviews, providing recordings is clear and accurately transcribed (Cohen et al., 2011). The benefit of this is that transcribed data from clear recordings could be analysed more thoroughly than scribbled interviewers' notes (Gall et al., 1996).

The questions in the interview schedule focused on the experiences of the participants about their participation in a CoP, as well as suggestions from the participants about how a CoP could function effectively. Furthermore, questions were included in determining participants' ideas of how to address the challenges that influence their participation in face-to-face contact sessions.

Following the literature guidelines (Gubrium & Holstein, 2002:87; Kvale & Brinkmann, 2009:31), the duration of an interview was 45-60 minutes, depending on the interviewees' participation. Discussions and interviews were pre-arranged and occurred during and after regular school hours. Almost all the interviews were conducted at the school. However, a few of the participants preferred a place away from their resident school. Audio clips of the interviews were transferred to a computer and labelled with the date of the interview.

The interviews were transcribed, and relevant quotes were translated into English for referencing purposes. Afrikaans transcriptions were saved and documented (Addendum L). Categorising of the data obtained via the interviews was done according to specific emerging themes identified. The primary purpose of transcriptions was to record the wording used in the interview, but it also allowed the recording of other features of the interview that could also be transcribed (Sim & Wright, 2000:148).

3.4.4 CoP observations

Case study designs often have the specific aim to analyse data from one source that can inform the way data from other, or various sources could be gathered (Edwards, 2001:123). In this study, this particular data were collected with observations recorded by the participants in diaries (Addendum O), and by the researcher in a reflective journal (Addendum P).

Compensating for the richness of the data reached from direct observation offers meaningful insights. Spending prolonged periods and paying continuous attention to the significant behaviour or interactions taking place in the ongoing interactive process is both informative and beneficial for the data collection process (Rolfe et al., 2001:230; Van Heerden, 2012:100).

Observation as one of the primary data gathering techniques used in this study posed some challenges as it is time-consuming and subject to interpretation by the researcher (Musante & De Walt, 2010). Minimising researcher bias and maximising observational efficacy, a standardised observational method was used (Angrosino, 2005:732).

a) Establishment of the Community of Practice

Usually, in a more traditional context, teacher CoPs engage teachers collectively in collaborative planning, curriculum work and learning assessment (Servage, 2009). It is crucial to construct a positive and supporting, collaborative environment wherein the dedication of the teachers could be nurtured, moving towards reaching the goals of the CoP. Furthermore, embracing open communication between all participants, striving to understand different perspectives, and fostering motivation and ownership toward a shared vision could aid establishing an active CoP (Akerson et al., 2009:1093).

Hofman and Dijkstra (2010) highlight the value of understanding how teachers collaborate and share their practices as this could play a vital role in the successful operation of a CoP. Several related research studies illustrate the use of different research techniques used in qualitative studies to determine the requirements for the successful functioning of groups, as well as the impact on teachers' understanding, identity and activity in groups (Niesz, 2007).

In this study, the CoP was set up as a platform from where teacher support could be facilitated, accommodating the teachers' specific needs, and supporting teachers continually in improving their skills, knowledge, and attitudes while continuing their employment. The primary focus of the CoP sessions is to support teachers in improving their confidence in teaching the subject, understanding the content knowledge better, to engage with pedagogical content knowledge and instructional practice, and to broaden their professional development opportunities.

Ten teachers voluntarily agreed to participate in the CoP. All the participants were Senior Phase (Grade 7-9) Natural Sciences teachers representing ten different schools located in the Vredendal area. Participants included beginner, experienced, qualified and under-qualified teachers (Table 3-2).

The CoP community engaged in ten interactive “face to face contact sessions” presented during the first and second term of 2016. During the first CoP contact session, detailed information about the study was shared. Eight of the CoP sessions occurred during the second term when the CAPS related knowledge strand Matter and Materials, in the Natural Sciences curriculum for the Senior Phase were dealt with. Communication usually happened via the face-to-face sessions, but electronic platforms such as e-mail and WhatsApp were also used to accommodate teachers that were located remotely.

The focus of this study is Senior Phase Natural Sciences teachers, and according to the Norms and Standards, they are required to be subject specialists, meaning that they need to understand the four knowledge strands Matter and Materials, Earth and Beyond, Energy and Change and Life and Living as stipulated by the CAPS. The following viewpoints serve as motivation for focussing on the knowledge strands as part of the study. Teachers who have a better understanding of the subject content knowledge and the pedagogical content knowledge are more effective teachers as their knowledge, skills and practice improved (Lipowski et al., 2011:689).

Although all four knowledge strands are crucial for the understanding of the Natural Sciences subject content, Matter and Materials was presented during this study according to the scheduled CAPS curriculum. The plan is to present the other knowledge strands in future CoP sessions. Therefore, Matter and Materials was used as knowledge strand to address the concerns raised concerning teaching practices and teachers’ understanding of the content knowledge.

These include different topics, such as properties of materials, different separating mixtures, the periodic table, chemical substances, the particle model of matter, the reaction of metals and non-metals with oxygen, acids, bases and neutrals, the reactions of acids with bases and the theory and practicals about reactions of acids with metals, metal oxides and metal carbonates.

The researcher started with observations during the CoP sessions as soon as the interviews with the respective teacher participants were concluded. These observations not only afforded the researcher an opportunity for more profound understanding of the interviews, mainly to observe issues that participants are not willing to discuss or participants themselves are not aware of, but also provide knowledge of the context observation as a data collection technique provides a lens to view the ‘experiences’ of teacher interaction in a CoP.

The researcher structured the observations by using three procedures as delineated by Angrosino (2005:733) inherent in observational research. Regarding anecdotal observations, the researcher tried to avoid preconceptions by using field notes and detailed descriptions of everything that took place. Focused observation was employed in which the researcher chronologically documented field notes on the observations and materials that were significant to the study, concentrating on distinct categories of pedagogy and teacher co-operation within the CoP. The researcher also made careful observations in general on how the teacher participants plan and perform practical work and how they address problem-solving activities. All these observations could play a significant role in improving the establishment, operation, and sustainability of future CoPs. The findings of the observations are discussed further in Chapter 4.

b) The researcher as an observer-participant

It is not uncommon in social research, particularly in case studies for the researcher to be part of the study, as an observer and/or participant where “the researcher attempts to participate fully in the lives and activities of subjects and thus becomes a member of their group, organisation or community” to collect important data (Fraenkel et al., 2012:446). Maistry (2008:363) emphasises that “as socially orientated researchers, we need to recognise that we are invariably a part of the process in which we seek to understand and expand teachers’ knowledge and learning”. Gill and Johnson (2002:144) in Saunders et al. (2009) developed a fourfold categorisation of the role the participant observer could adopt: complete participant, complete observer, observer as participant, or participant as an observer (Figure 3.8).

The researcher’s identity is concealed for the roles of complete participant and the complete observer, whereas the roles of the observer as participant and participant as observer entail revealing the researcher’s identity (Henning et al., 2004:42). For this study, the researcher should be mindful not to adopt a participant role, as this would cloud the objectivity of the study to a great extent. Therefore, the researcher assumed multiple roles as an observer-participant in the context of the CoP, though not necessarily at the same time.

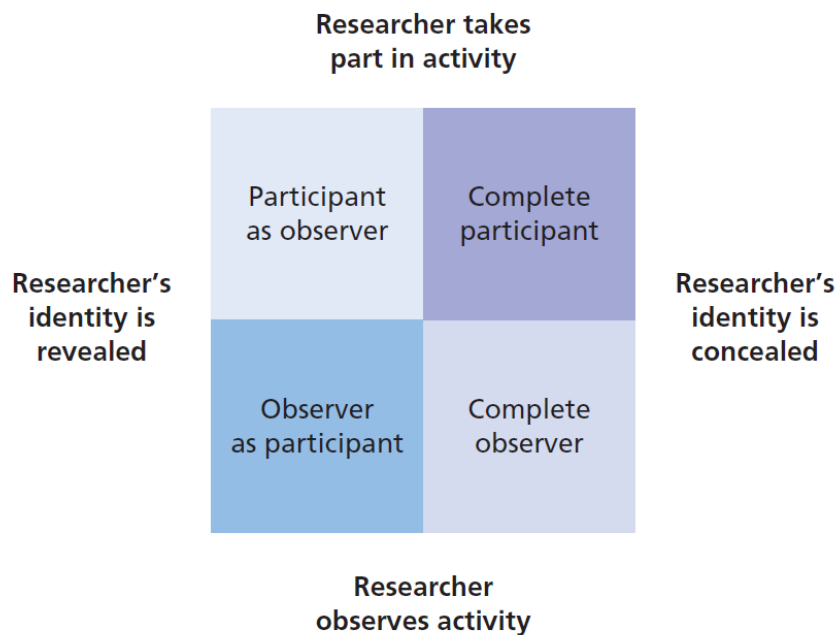


Figure 3.8 Different researcher roles (Gill and Johnson, 2002 in Saunders et al., 2009:293).

The following roles of initiator, coordinator, facilitator, observer and mentor that the researcher fulfilled during this study are discussed below.

The role of the initiator is controversial because by original intent a CoP is initiated by the members rather than by an external party (Anfara & Angelle, 2008:54). However, within the context of this study setting, it is doubtful if the CoP membership would have been able to instigate such a complicated construct as a CoP unaided. De Clercq and Phiri (2013:79) are adamant that self-determined teacher communities have their limitations, but need non-school educationists or experts to generate new conceptual knowledge. In this study, the researcher took on the role of initiator based on personal motivation, and interest to address teacher needs as found with a questionnaire.

The coordinator helps the community (CoP) to stay focused on its activities and to maintain healthy relationships between the members (Wenger, 2002). Mak and Pun (2015:8) stated that the coordinator is also responsible for the communications and logistics related to the CoP. In this study, the researcher handled all the base communications and as well as the communications with the CoP participants and their reporting structures.

The facilitator is responsible for creating the conditions that promote teacher development (Avalos, 2011:17; Lewis et al., 2012:373), and yet not to overstep boundaries that could create problems for the implementation, scaling, and sustainability of future learning communities (Tan, 2014:51).

Importantly, the facilitator needs to impose a structure, preventing the teachers from becoming too reliant on the facilitator, because this in itself may threaten the sustainability of the professional development efforts (Elliott, 2012). In this study, the researcher facilitated all the CoP activities, guiding the participants in their learning process, without being commanding.

The observer role sets the risk of being biased but could gain deep insights into the activity of the community (Mckay, 2007:9). Therefore, the observer has to avoid any selective or biased observation by minimising any interference in the activities of the community, and it needs focusing on translating what was discovered and documented only (Mak & Pun, 2015:9). The most accurate information typically comes from direct observations, either with trained observers in real time or by reviewing video- or audiotapes. These observations, however, should be kept as modest as possible (Guskey, 2002a:51). During the CoP sessions, as well as school support sessions, the researcher fulfilled the role of the observer were vital dynamics of the CoP, as well as individual practitioners in their classrooms, were observed.

The mentor provides teachers with hands-on support while they apply their newly acquired experiences, knowledge, and skills, gained through the community interaction and in their practice (Kopcha, 2010:177). This role further entails that the mentor needs to help the teachers to manage their teaching experience gained through the newly acquired knowledge and pedagogy (Mak & Pun, 2015:8). In this study, the researcher mentored the participants in the CoP, helping them to apply their newly acquired skills, knowledge and pedagogy in their private school context.

In this study, the researcher fulfilled all five roles mentioned above in order to establish the success of the CoP and to ensure the effective operation thereof.

3.4.5 Field notes

Field notes were used based on Taylor et al.' (2015) view that field notes are a primary source of recording conversations and observations. By using their suggestions for the recording of the field notes, two significant issues that had implications for the credibility of the study were addressed. Firstly, the researcher had to ensure that the note-taking was thorough and detailed in describing the situated context and secondly, the researcher had to reflect and differentiate between what was said or observed as opposed to the interpretations of what was said or observed. Two basic approaches to field observation were used, namely direct and indirect observations. The researcher spent enough time in the context of the social study for direct observation by recording the observations in the form of detailed field notes or journal entries directly.

The researcher relied on the use of mental notes while interacting with participants and when the situation did not allow for full note-taking (Glesne, 2006), the researcher transformed these mental notes into short notes at a later stage as a reminder to write complete field notes (Berg, 2012). The rationale for these “cryptic notes” was to capture events as they unfolded during the CoP sessions, serving as a memory aid for constructing better field notes (Glesne, 2006).

3.4.6 Participant diaries

Bolger et al., (2003:579) put forward the view that participant diaries give the researcher an opportunity to capture the events and experiences of the participants, which in essence “captures life as it is lived”. The primary benefit derived from participant diaries is that they promote the review of documented situations and events as they occur in their real and natural context (Julien & Michels, 2004). The advantage of this method of data collection is less distortion that may occur when reflecting on past events or experiences (Clayton & Thorne, 2000). This method of data capturing also provides complementary information to the study.

In this study, the researcher followed Merriam’s (2009) advice to ask teacher participants explicitly to capture evidence about their observations of activities in a diary throughout the inquiry period (Machado & Meyer-Botnarescue, 2001:19). Bolger et al. (2003) propose various diary designs and many formats that may be used in research studies. The researcher opted to use a “paper and pencil” participant diary format (Addendum M), as it is simple and effective, but also because the researcher did not want to burden the teachers with additional tasks.

The researcher asked that teachers note their reflective experiences during the CoP sessions (Addenda N & O). Teacher participants had to record in their diaries the date, curriculum learning area, topic, activities done and the co-operation among them (Charmaz, 2005). However, in some cases, the researcher noted that the participants did not document this data, possibly because they were overburdened with paperwork.

3.4.7 Reflective journal

Reflexivity is a familiar feature in most qualitative studies that could be introduced from the beginning of the study to increase a researcher’s understanding of the studied area (Edwards, 2001:122). Case study designs often have the specific aim that the analysed data from one source can inform the way data from a different source is gathered. In Edwards’ (2001:123) opinion, “reflexivity is one of the significant advantages of qualitative designs”. Merriam (2009:149) explains that researcher-generated documents, like a reflective journal, help the researcher to better understand the investigated state of affairs, people or experience.

There are advantages and shortcomings when a researcher chooses to keep a reflective journal. A limitation that Merriam (2009:137) warns about is that regardless of the observer's position, they cannot prevent influencing, and also being influenced by the settings and, therefore, some distortion of the situation might occur. Finally, she alerts the observers to make detailed documentation of the observations as they form the database for analysis. It is clear that there is a variety of types for field notes, but that they must include descriptions, direct quotations and observer comments (Van Heerden, 2012:100). Furthermore, a reflective journal is quite extensive, necessitates careful management and needs to have detailed descriptions of the participant's experiences and not be mere diary inscriptions of events and activities (Van Heerden, 2012:98-100).

At the beginning of the study, the researcher kept written notes in an A4 notepad and then documented the information on a computer. These notes were the descriptions of the researcher's observations and comments on the observations, as shown in the reflective notes (Addendum P), which played an essential part in the analytical process. As Ely et al. (2003:80) explain, researchers' "spontaneous" comments on observations recorded in their logs could eventually "become part of the journal".

Ely et al. (2003) suggest that the reflective notes of researchers could be used in a couple of ways. Firstly, reflective notes could be expanded into "analytical memos", which Creswell (2014) describes as notes researchers write to themselves about the observation and research process. These analytical memos then become part of the reflective journal. Secondly, the researcher may use reflective notes to watch what is explored as well as a means of trying to control subjectivity. The reflective notes can be viewed as part of the researcher's ongoing evaluation of events seen as "what good research entails" (Fraenkel et al., 2012). Initially, the researcher found it challenging to describe observations, and hence limited the evaluations of situations to the reflective notes, but over time the researcher became more accomplished at doing so.

A reflective journal helps to deepen understanding of the research processes (Janesick, 1998). In this regard, the use of a reflective journal was twofold, firstly it helped the researcher as a writer, and secondly, it helped to make the researcher's work more accessible.

3.4.8 Document review

The final phase of data collection was to introduce a document review, which is a systematic procedure for reviewing or evaluating printed and electronic documents (Bowen, 2009) that is useful to “uncover meaning, develop understanding, and discover insights relevant to the research problem” (Merriam, 1998). As one of the sub-questions of this study deals with the legislation of teacher development, the researcher considers the following documents collected from the Department of Education, the Republic of South Africa as important:

- 2000: National Education Policy Act, 1996 Norms and Standards for Educators.
- 2002: National Curriculum Statement Grades R-9 (Schools): Overview.
- 2007: The National Policy Framework for Teacher Education and Development.
- 2010: Curriculum Assessment Policy Statement (CAPS).
- 2011: Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011-2025.
- 2014: The National Policy Framework for Teacher Education and Development in South Africa.
- 2015: Professional learning communities: A guideline for South African schools.

3.4.9 Time horizon

Layer 5 of the Research Onion (Figure 3.2) denotes the duration of a research study, providing two alternatives, i.e., cross-sectional, which is analogous to a so-called “snapshot” taken at a particular time, or longitudinal, which represents events or activities over a given period. Once again, the research question guides the choice for the time horizon, but the elective is independent of research strategy, or research choice (Saunders et al., 2009:155).

This study was conducted throughout three years, gathering data through observations, journal and diary entries, questionnaires and concluding interviews, so classifying it as a longitudinal study. This allowed the researcher to draw on the fundamental strengths of longitudinal research, with the affordance to study change and development of the teacher participants over time.

3.4.10 Techniques and procedures

Data collection is an integral part of any research undertaken. The Research Onion approach, Layer 6 (Figure 3.2) focusses on the collection and subsequent analysis of data using various techniques and procedures (Saunders et al., 2009:127). The research strategy usually informs the research methods of choice, which in turns moulds the format of the data-gathering process and how the data should be analysed (Cohen et al., 2011:8; Cooper & Schindler, 2011:183; Thomas et al., 2011:357; Maxwell, 2013:79; Gilliland, 2014:83).

In the following sections, aspects of data collection and analysis are discussed.

3.5 Data analysis

Case studies typically generate large volumes of interview transcripts and observational notes that need to be analysed to produce meaningful findings (Marshall & Rossman, 1999; Ely et al., 2003; Merriam, 2009; Wellington, 2015). Qualitative data analysis aims to discover patterns, concepts, themes and meanings from the data (Miles & Huberman, 1994; Seidel, 1998; Krippendorff, 2013). It implies taking apart words, sentences, and paragraphs through organising, reducing, describing and reviewing the data, with the purpose to make sense of, and interpret that data (Henning et al., 2004:6). Creswell (2014:230) states that for qualitative data to be analysed meaningfully, the researcher needs to understand how to make sense of text and images so that he or she could answer the research questions correctly.

Cohen et al. (2011:537) define data analysis as the process of “organising, accounting for and explaining the data”. McMillan and Schumacher (2014:395) state that this process “is primarily an inductive process” that involves sorting the data into categories so that patterns, trends and themes could emerge and the relationships between categories can be identified and studied. Notwithstanding that there is no single correct practice of analysing qualitative data (Cohen et al., 2011:537; McMillan & Schumacher, 2014:395), the integrity of the process of data analysis selected for a given study is vital in supporting the rigour of the study (Nieuwenhuis, 2010a:113; Creswell, 2014:221).

A sound framework is needed for a rigorous process of data analysis (Nieuwenhuis, 2010a:103; Creswell, 2014:261). This includes data preparation and organisation, re-organising or restructuring the data, data coding, establishing categories and themes and, analysing and interpreting the data before finally presenting the data and findings.

The words of Ary et al., (2002:425) describe what the researcher attempted to achieve in this study, specifically through data analysis: “The collected data are in the subjects’ experiences and perspectives; the qualitative researcher attempts to arrive at a rich description of the people, objects, events, places, conversations, and so on”.

Bos and Tarnai (1999:660) describe content analysis as “a means of analysing texts” suitable for analysing data from observations. Content analysis describes an inductive process of looking at qualitative data sources from different angles in order to understand and interpret the raw data (Nieuwenhuis, 2010a:101). The use of inductive reasoning allows for the study of a number of individuals or cases so that generalisations can emerge (Cohen et al., 2011:5), in other words, inductive reasoning allows the researcher “to be open to new ways of understanding” (McMillan & Schumacher, 2014:347). The inductive nature of content analysis allows findings to emerge from the data, making this data analysis strategy suitable for the qualitative study being reported on here (Eberlein, 2015:167).

3.5.1 Data preparation

The first step in the data analysis process is the data preparation (Creswell, 2014:195; McMillan & Schumacher, 2014:396), and the starting point of data preparation is to provide a detailed description of the sampling process and the actual participants (Nieuwenhuis, 2010a:104), which was detailed in section 3.4.1.

The researcher followed the guidelines of McLellan et al. (2003) to prepare transcripts as well as to track and store the digital audio recordings. Transcriptions could be time-consuming and, if not done by the interviewer him or herself, essential details such as the mood and context of the interviewee could be overlooked (Eberlein, 2015:164).

The researcher transcribed all the digitally recorded semi-structured interviews herself following good practices (Nieuwenhuis, 2010a:104; Cohen et al., 2011:536). By personally transcribing each interview the researcher could reflect on the experience of the interview as the researcher listened to the voice of the participant again, making contextual notes in the transcription, so the researcher could at once reflect on the conversation. Transcriptions should, if possible, remain authentic to the language of the original interview. Therefore, the researcher chose to transcribe and analyse all the interviews in the language in which it was conducted originally, namely Afrikaans and not to translate it to English. However, in instances where the researcher quotes directly from an Afrikaans interview, an English translation of that quote is provided.

The researcher prepared the transcripts of the interviews for the final analysis by adding line numbers to the text for easy reference as suggested by Gall et al. (1996), replacing the names of respondents and other role players with identifying pseudo names, e.g. T1 for the first teacher involved in the study (refer to section 3.4.1; Table 3-2). The next step in the data development process was to edit the recorded data into a simplified format to make data handling easier (McMillan & Schumacher, 2014:398).

The researcher utilised Miles and Huberman's (1994:23) data reduction methodology to condense the mass of raw data into a manageable form. Drawing on their "components of data analysis", the researcher subjected raw text data to refinement as a distinct process in the data analysis process. During the data reduction phase, the qualitative data were reduced by selection, summarising and paraphrasing of text. The primary purpose of data reduction was to reduce the data into a suitable form that could be examined for patterns and relationships.

Before isolating the data sections, the researcher read the transcripts a couple of times. Literature suggests that reading and re-reading the text helps with familiarisation and facilitates the identification of thoughts emerging from the data (Fraenkel et al., 2012; Wellington, 2015).

The researcher proceeded to re-organise the data into pre-determined categories (Cohen et al., 2011:551; McMillan & Schumacher, 2014:397), which mainly involved "cutting and sorting" (Nieuwenhuis, 2010a:104) the data from each interview into new documents under the headings of selected elements pertinent to the theoretical framework of this study. Although the data was re-organised into pre-determined categories at this point, final categorisation took place after data coding was completed (Eberlein, 2015:165).

3.5.2 Data coding

Concerning case study research, Yin (2009) discusses the need for searching the data for patterns that could explain or find causal links in the data. In the data analysis process, the researcher focused on all the data first, then tried to find distinct categories in order to understand and express it more meaningfully. Final categorisation helped the researcher in comparing the similarities as well as the contrasts between the patterns. Furthermore, the aim was to create detailed categories that would provide a preliminary framework for thematic analysis at a subsequent stage (Thomas, 2010:291).

Patton (2005:452) warns about the complexity of categorisation and argues that a researcher needs many underlying abilities to continue to thematic analysis. Developing some easy classification or coding scheme is the first step of the analysis with the goal to categorise for better interpretation (Patton, 2005:463).

Once the data were transcribed and re-organised into pre-determined categories, the data were coded to create gathering points for further data analysis (Nieuwenhuis, 2010a:105). This process entailed the careful, line-by-line reading and re-reading of the data to “get a sense of the whole” (Creswell, 2014:268), followed by the assigning of unique codes (Cohen et al., 2011:559) to meaningful parts of the data (McMillan & Schumacher, 2014:398). The first step in developing the coding system to analyse texts involved examining each transcript to find segments of data that had a single concept. Content analysis was used where categories and patterns started to appear from the data, rather than being decided on before the data collection process (McMillan & Schumacher, 2014:374). The dataset inclusive of field notes of interview schedules and reflective journal inscriptions and questionnaires were photocopied, each response coded to differentiate between the sources, and the responses were classified into types and sorted into categories.

This process of open coding (Nieuwenhuis, 2010a:105; Cohen et al., 2011:561) enabled the researcher to create both subcategories within the pre-determined categories and to create new categories. A master list of codes was established (Creswell, 2014:269) which was then, after the initial coding phase, re-applied to the data to discard repetitive codes and to link related codes into the proposed categories or alternately to inductively find new categories (Nieuwenhuis, 2010a:108).

A list of factors contributing to effective CPTD was compiled from the emerging data, grouping concepts into categories and subcategories. Bos and Tarnai (1999:666) emphasise the importance of developing “a reliable and valid category-system”. The system of categories and subcategories into which concepts are grouped to form the coding system is a crucial step in open coding because the categories and subcategories signify key notions are appearing from the data (McMillan & Schumacher, 2014:376). Data saturation was applied to the data. Data saturation is when more data are analysed, and no new items can be added to any category, and the relationships between the various categories appear to be well established (Miles & Huberman, 1994; Gall et al., 1996). Each category and sub-category were then named and defined according to the central idea it represented.

The disadvantage of this phase of qualitative analysis is that coding and entering data are labour intensive and tedious, with the possibility of mistakes (Patton, 2005), but this was addressed by repeating the process and comparing the responses in the coding system to the original data sources (McMillan & Schumacher, 2014:364).

Creswell (2014:263) observes that despite the popularity of various computer software programmes available for use in data analysis, researchers still “have a choice about whether to analyse data manually or to use a computer” to do so. According to Creswell (2014:265), hand analysis is suitable when the data set is small (fewer than 500 pages of transcribed data) as well as where the researcher has been personally involved in the data collection process and wants to remain close to the data and keep a hands-on feel for the study. An added factor that motivates the researcher’s choice of hand over computer analysis is the essence of staying authentic to the wording of the original interviews and preserving the richness of each (Eberlein, 2015:164). Although the data for this study was hand analysed, all the preparation and organisation of the data collected through semi-structured interviews (Addendum L) were coded and analysed with techniques adapted from methods supported by Charmaz (2005).

3.5.3 Thematic analysis

In this study, the researcher used thematic analysis, which is defined as a method for identifying themes and patterns of meaning across a dataset to answer the research questions (Braun & Clarke, 2013). Patton (2005:453) refers to thematic analysis as any qualitative data reduction and sense-making effort that tries to find core consistencies and meanings from large qualitative data. The aim is to identify trends in the coded data so that themes emerge from the rich data, which could inform valuable interpretations and key findings (Teddlie & Tashakkori, 2009:343).

In this study, the researcher searched the texts in the interview transcripts, reflective journals, and questionnaires for recurring words or themes. The content of the purposively selected participants’ diaries and reflective journal were analysed to identify significant themes as explained in section 3.5.1 (Henning et al., 2004:6; Patton, 2005:463; McMillan & Schumacher, 2014:374). Clustering concepts together into a smaller number of groups allowed the researcher to visualise the major themes emerging from the data, and to handle large numbers of concepts better.

Figure 3.9 illustrates the preliminary categorisation of themes before it was simplified into core themes that are depicted and discussed in Chapter 4. The themes emerging from the transcribed interviews were grouped under broad categories based on the theoretical framework, specific teacher needs, possibilities of CoPs to address CPTD, aspects of an effective CoP and the contributions of a CoP.

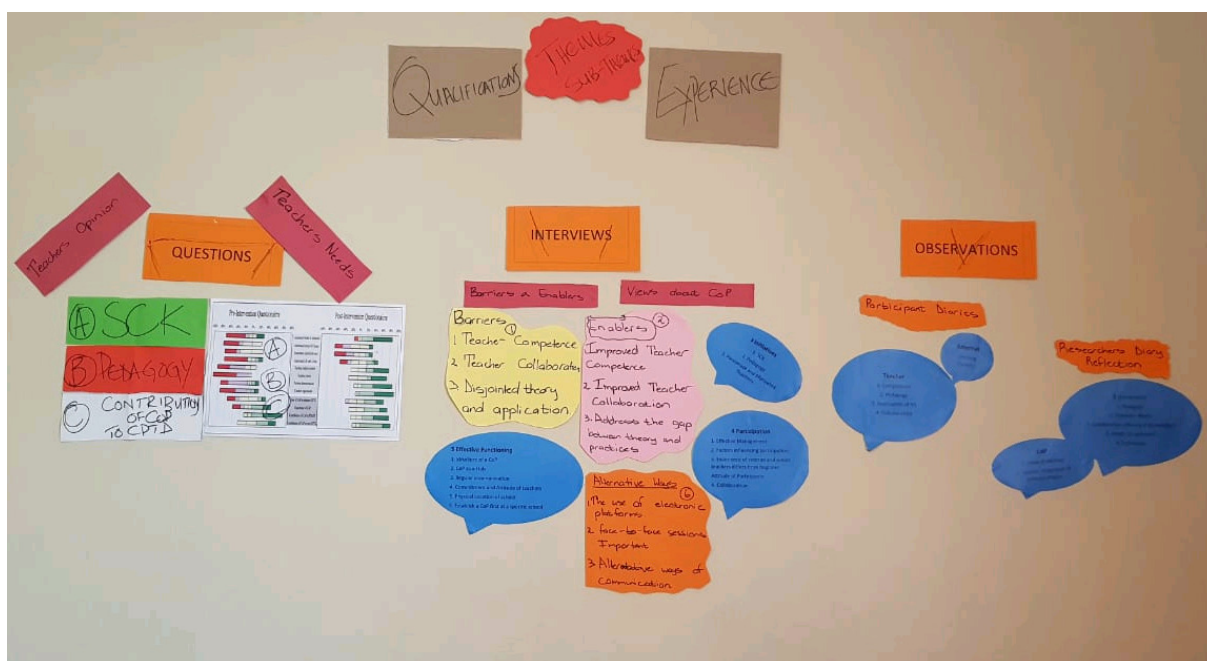


Figure 3.9 An example of a preliminary thematic map emerging from this study.

3.5.4 Data interpretation

Following the coding of separate data sources, the researcher compared all the responses from the different datasets about similar themes and investigated specific patterns and categories that emerged from the data. These patterns and categories are reflected in the interpretation of findings where the researcher concentrated on comparisons, causes, consequences and relationships to make sense of the data (McMillan & Schumacher, 2014:374). The results and findings are discussed in Chapters 4 and 5.

3.6 Rigour

Rigour, defined as “the quality or state of being very exact, careful, or with strict precision or the quality of being thorough and accurate” is intrinsically part of the research design and stands for the appropriateness of the methods used to answer the research questions (Cypress, 2017:254). It is considered the extent to which the data and data analysis are believable and trustworthy (Floden, 2007:505).

The purpose of rigour in qualitative research is to demonstrate sound practice, particularly reflecting the research participants' experiences accurately (Streubert & Carpenter, 2011:39).

However, the concept of rigour in qualitative research has been the subject of contention for many decades. Nomenclature for the same quality of research constructs appear ambiguous and confusing, and the argument whether qualitative and quantitative research should have different assessing frameworks continue to be debated (Pole & Lampard, 2002:207; Ely et al., 2003:94; Nieuwenhuis, 2010a:80; Cohen et al., 2011:181; Creswell, 2014:283). The call for employing unitary concepts of rigour, rather than using similar terminology in qualitative and quantitative research has found mixed appeal (Maxwell, 1992:284; Creswell, 2014:259; McMillan & Schumacher, 2014:157). The researcher has no interest in joining this argument, and the intention with this section is merely to furnish adequate evidence to give defensible credence to this study as one that followed sound rigour during the entire research design process.

As a result, acknowledging the qualitative (naturalistic) research design of this study, the researcher is in support of the notion of several authors (Tobin & Begley, 2004:389; Twycross & Shields, 2005:36; Onwuegbuzie & Leech, 2007:239; Morse, 2015:1212) that prefer the term "rigour" instead of the more common analogous term "trustworthiness". The latter, which is defined as the degree of trust or confidence that the researchers have in the results, or the measure to judge the quality of research design (Baxter & Jack, 2008:556).

Rigour needs to establish the merit of the research with the researcher's audience (readership), indicating that the quality of research is determined by the readership (other researchers) and the researcher's responsibility is to provide sufficient information so that readers can form their judgement (Babbie & Mouton, 2011:276), or as Lincoln and Guba (1985:29) state "how can the inquirer persuade his or her audience (including self) that the findings of an inquiry are worth paying attention to, worth taking account of?"

Several frameworks have been developed to evaluate the rigour of qualitative research, but the researcher favour the seminal work of Guba and Lincoln (1981), which was later expanded (Lincoln & Guba, 1985), and refined (Guba & Lincoln, 1989) (Table 3-3). The key aspects relating to rigour in research are truth-value, generalisability, consistency and neutrality (Ary et al., 2002:457).

However, the strategies of how qualitative and quantitative research respectively address these elements are profoundly different (Talbot, 1995:487; Pole & Lampard, 2002:207; Polit & Hungler, 2003:36; Streubert & Carpenter, 2011:38), although some scholars are of the opinion that it is incongruous to transfer terminology across philosophies (Huberman & Miles, 2002:38; Tobin & Begley, 2004:388).

The rigour of qualitative research is typically established for the following four criteria: credibility, transferability, dependability and conformability, which correspond to the quantitative criteria of internal validity, external validity, reliability and objectivity (Guba & Lincoln, 1981:881; Krefting, 1991:217; Talbot, 1995:428; Daymon & Holloway, 2002:93; Creswell, 2014:259).

Krefting (1991) systematically reviewed the work of Lincoln and Guba (1985), and her presentation of these qualitative criteria with their underpinned strategies is discussed below (Table 3-3), with the manner of how it was applied in this study to maintain the rigour of this multi-method qualitative case study. Notably, some strategies apply to more than one criterion. The qualitative strategies used to prove the rigour of this multi-method case study is depicted in (Table 3-4).

Table 3-3. The four qualitative criteria with their corresponding strategies to prove rigour in a study (modified after Krefting, 1991:217).

Credibility (Truth Value)	Dependability (Consistency)	Transferability (Generalisability)	Confirmability (Neutrality)
<ul style="list-style-type: none"> • Establishing authority of the researcher • Interview technique • Member checking • Peer examination • Prolonged and varied field experience • Referential adequacy • Reflexivity • Structural coherence • Time sampling • Triangulation 	<ul style="list-style-type: none"> • Coderecode procedure • Dense description of research methods • Dependability audit • Peer examination • Stepwise replication • Triangulation 	<ul style="list-style-type: none"> • Comparison of sample to demographic data • Dense description • Nominated sample • Time sample 	<ul style="list-style-type: none"> • Confirmability audit • Reflexivity (field journal) • Triangulation

Table 3-4. The strategies used to prove the rigour of this study, and the quality criteria they address.

Strategy	Credibility	Dependability	Confirmability	Transferability
Audit trail		☑	☑	
Member checking	☑			
Peer examination	☑	☑		
Prolonged field experience	☑			
Purposive sampling				☑
Reflexivity	☑		☑	
Thick description		☑		☑
Triangulation	☑	☑	☑	

3.6.1 Credibility

Credibility in qualitative research is described as the degree to which the data and data analysis are reliable and trustworthy, that is, how research findings agree with reality (Golafshani, 2003:601; Silverman, 2013:275; McMillan & Schumacher, 2014:471). Therefore, it is concerned with whether the constructed realities of the study are acknowledged as truth by the people in the study, or in other words, do the participants of the study agree that the findings of the study reflect their social reality (Daymon & Holloway, 2002:93; Teddlie & Tashakkori, 2009:296).

Krefting (1991:217) suggests several strategies to ensure the credibility of qualitative research (Table 3-3), of which prolonged engagement, member checking, peer examination and triangulation were used to demonstrate the credibility of the research.

a) Prolonged engagement

Krefting (1991:217) highlights the importance for researchers to “spend an extended time with informants” in the field during the study, referring to a term called “prolonged engagement”, which contributes to a greater “consistency over time with regard to what researchers are seeing or hearing (Fraenkel et al., 2012:459), allowing researchers to understand better what they intend out to study, and enabling the researcher to observe and learn about the culture of the participants and improving the credibility of the inferences made (Lincoln & Guba, 1985:301; Merriam, 1998:213).

A frequently used complementary term called “persistent observation” refers to ongoing and thorough observation, aiming to “establish the relevance of the characteristics for the focus” (Cohen et al., 2011:108); posing the question “as to whether the researcher or the research team has done an in-depth study to gain detail (Bitsch, 2005:83), enabling the researcher to verify “hard data” with observational data.

However, there is no reference made to the length of time needed to collect data, which depend on the design and of the study (Krefting, 1991:218). However, staying for prolonged periods in the field affords pluralistic perspectives from participants about the phenomenon being studied (Creswell & Miller, 2000:128).

The researcher spent roughly 18 months collecting data, starting in February 2016 (Addendum U), which allowed the researcher to gain sufficient insight to address the research questions confidently. I, as the researcher and an observer-participant were in contact with the teacher participants and CoP activities from June 2016, and as the researcher was immersed in the situation, and in doing so the researcher gained comprehensive understanding of the phenomena under investigation as the researcher was able to make continuous observations in the natural settings of the participants (Addendum U). This also contributed to building trust and rapport with the participants, unlocking valuable information. On the topic of persistent observation, the researcher had regular contact with teacher participants via electronic mail and the WhatsApp platform during the study period.

b) Triangulation

Cohen et al. (2011:112) define triangulation as an “attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint”; “comparing many sources of evidence in order to determine the accuracy of information or phenomena” (Briggs & Coleman, 2007:100). Triangulation is commonly cited as one of the key mechanisms of ensuring that data collected, as well as the findings are ‘valid’ (Patton, 1999:556; Daymon & Holloway, 2002:98).

The value of triangulation is situated in the premise that the weakness in a single method would be compensated for by the strength of the other, and therefore it typically may include multiple data sources, participants (informers), researchers, methods, and theoretical perspectives in order to gather multiple perspectives on the same issue so as to gain a more complete understanding of the phenomena studied (Schwandt, 2005:443; Saunders et al., 2009:139).

Usually triangulation is not used as a verification procedure in qualitative case study research as such (Cohen et al., 2011:143; McMillan & Schumacher, 2014:374), but is employed explicitly by researchers searching for convergence among multiple and different sources of information to find common themes or categories by eliminating overlapping areas (Leedy & Ormrod, 2010:99), facilitating “thick, rich description of the case and illuminating to its broader context” (Rule & John, 2011:7).

Four types of triangulation are identified by Denzin and Lincoln (2005), namely data triangulation where data are collected at different times and from different sources, investigator triangulation where different investigators independently collect data, methodological triangulation involves using more than one method to gather data and theory triangulation requires using more than one theoretical scheme in the interpretation of the phenomenon (Flick, 2011, 2014). Data and methodological triangulations were applied to prove the credibility of this multi-method qualitative case study, which covers multiple data sources and multiple methods to gain more understanding of the phenomenon investigated.

Firstly, this study embodies a single, embedded case study, meaning that there is differentiation of subunits, for instance, teacher participants’ level of specialisation, teaching experience, professional status (section 3.3.3; Table 3-2). In dissection, the 23 teacher participants that completed the pre-intervention questionnaires, and the ten teacher participants, which completed the post-intervention questionnaires, and formed the teacher CoP, were interviewed and carefully observed by the researcher, are diverse in terms of their gender, tertiary qualifications, service years, their organisational status in the WCED structures. The teachers that completed the pre-intervention questionnaires represent 19 different schools, those that participated in the post-intervention questionnaires, interviews and formed the teacher CoP stand for ten different schools, of varied sizes with different community backgrounds, thus providing multiple sources of information from which to form themes.

Secondly, the three primary sources of data collection originate from pre-, and post-intervention questionnaires, individual, face-to-face, semi-structured interviews and observations within an established teacher CoP (section 3.4; Figure 3.10). This minimised the shortcomings of single-source research, and it provided a thicker and richer description, sourced first-hand, from the lived experiences of the teacher participants, allowing the converging of themes. Secondary data were generated from a comprehensive literature review (CHAPTER 2; section 3.4.8), participant diaries (section 3.4.6), and the researcher’s field notes (section 3.4.5) and reflective journal (section 3.4.7).

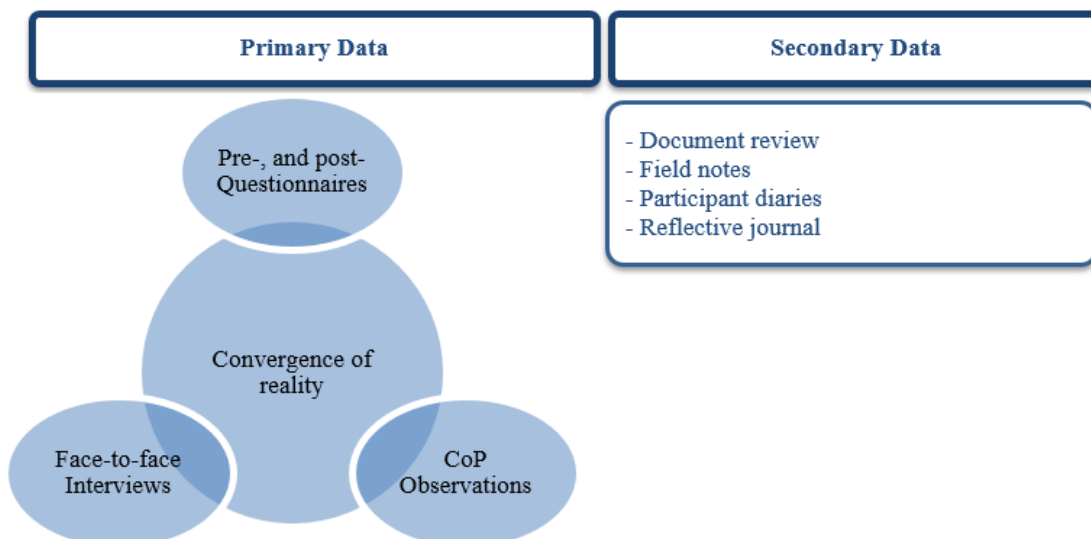


Figure 3.10 Triangulation of primary sourced data, about secondary sourced data.

c) Member checking

Member checking is a simple construct, but it symbolises the core of credibility (Lincoln & Guba, 1985:314) by pronouncing that “data and interpretations are continuously tested as they are derived from members of various audiences and groups from which data are solicited” (Guba, 1990:85). It aims to minimise researcher bias by allowing research participants to evaluate, and provide input into the researcher’s data, analysis, interpretations and conclusions (Creswell & Miller, 2000:127; Anney, 2014:277; McMillan & Schumacher, 2014:343).

This strategy of confirmability was achieved by employing a strategy in which the questionnaire results, interview transcripts, and CoP observations were fed back to the participants, allowing them the opportunity to view, comment on and verify the accuracy of data collected. Member checking with the teacher participants was mostly done in face-to-face sessions, but where more clarification was needed, the researcher resorted to e-mail, telephone or WhatsApp as a communication medium, specifically to accommodate those teachers that live remotely. The researcher also consulted their participant diaries to help answer remaining queries.

The researcher checked the pre-intervention questionnaire data with the teacher participants individually during the follow-up interviews in June 2016 (section 3.4.3), the results thereof the researcher fed back to the participants at the first few CoP sessions in July/August 2016. The post-intervention questionnaire and preliminary findings of the study, inclusive of the CoP observations were checked with the teacher participants at the closeout CoP sessions in September 2016. The researcher has accounted for the participants’ comments and input during these member-checking sessions in the results.

d) Peer examination

Peer examination, also known as peer debriefing is “exploring one’s analysis and conclusions to a colleague or other peer on a continuous basis” (Robson, 1993:404), or it “provide inquirers with the opportunity to test their growing insights and to expose themselves to searching questions” (Guba, 1990:85).

Peer examination can take three forms, such as the researcher discussing the research process and emerging findings with impartial, knowledgeable colleagues, or presenting the findings and implications to interested parties, or defending methods and findings at research conferences (Krefting, 1991:219; Long & Johnson, 2000:34; Shenton, 2004:67; Rolfe, 2006:305; McMillan & Schumacher, 2014:328). Holloway and Wheeler (1996:165) highlight the role of the supervisor (study leader) interacting with their students to guarantee rigour in their studies.

The researcher used peer examination to enhance the credibility of this study. The researcher consulted an ex-colleague, who is a lecturer at the Cape Peninsula University of Technology and a specialist in case study research to help with the research design. At the beginning of the study, the post-graduate research committee and the DESC helped to mould the study with regular engagement. The researcher sought help with data collection and analysis from an expert in qualitative educational studies, affiliated then with SUNCEP, Stellenbosch University.

Subject specialists in social research associated with the Centre for Child, Family and Youth, North West University reviewed and commented on the rigour and ethical aspects of this study. The researcher’s study leader was instrumental as a peer examiner, from the start of the study, the research design, data processing and interpretation to the final thesis submission, always being a soundboard to deepen the researcher’s understanding.

Regular departmental visits, PhD support sessions, collaborative research writing workshops at Stellenbosch University created many opportunities for others to critique this study. The researcher also had the chance to share and discuss the research with peers at the Scholarship of Teaching and Learning Conference (24-25 October 2017, Somerset West). Suggestions and recommendations from all these peer-checking sources were genuinely considered, and those applicable were incorporated in the final submission of this thesis.

3.6.2 Transferability

Transferability refers to the extent that the data and context of a research study, inclusive of research findings could be applied, or generalised to other similar settings or populations with the purpose of sharing knowledge (Golafshani, 2003:601; Teddlie & Tashakkori, 2009:287; Babbie & Mouton, 2011:277). However, transferability in qualitative research is considered a major challenge due to the subjectivity from the researcher as the key data collection instrument (de Vaus, 2001:237). On top of that, single case studies are commonly lacking in transferability, because it focuses on an isolated situation, often with a small number of participants, thus making it difficult to generalise or transfer the findings to other settings (Edwards, 2001:127; Rule & John, 2011:21).

There are a couple of means to deal with the challenges of limited transferability of single case studies. Yin (2009:10) provides a useful solution through “analytical generalisation”, for which research findings are used to support, disprove or amend an existing theory as opposed to the findings being relevant only to a specific population. The case study design acquired an elevated level of analytical generalisation when solid theoretical propositions before data collection were developed, and the data are analysed in the context of these propositions (Daymon & Holloway, 2002:93). By this means, a qualitative researcher can improve transferability by detailing the research methods, contexts, assumptions, and theoretical propositions underpinning the study (Shenton, 2004:70; Denzin & Lincoln, 2005:193).

Another way to improve transferability in case studies is to shift this liability to the reader (other researchers), in so that the reader “determines whether the researcher’s findings fit his or her situation” (Fraenkel et al., 2012:437). This requires the researcher to describe the setting and the interactions of the study comprehensively using “thick description” (Babbie & Mouton, 2011:277). In addition to the reference of thick description, Bitsch (2005:85) mentions the value of sampling in that the “researcher facilitates the transferability judgment by a potential user through ‘thick description’ and purposeful sampling”.

Krefting (1991:217) lists four strategies to address transferability, referring mainly to sampling and dense (thick) description. This study is a qualitative descriptive single case study, and as result transferability might not be applicable (Krefting, 1991:220; Shenton, 2004:69), but the fact that it has a strong underpinning in existing theory of CPTD and Wenger’s (1998) CoP model (1998) creates options for transferability. Also, this study by its naturalistic design further enhances the transferability of findings to other real-world settings. This study uses thick description and purposive sampling to demonstrate the transferability of the research.

a) Thick description

“Dense description”, or “rich description”, or “thick description”, which is described as an “extensive and careful description of the time, place, context, and culture of the interactions in a social setting” (Mertens, 2005:256) is a common feature of case study research that enhances the transferability of the findings to other similar settings (Creswell & Miller, 2000:129). Thick description intends to give readers sufficient detail of the case study setting to facilitate a comparison with other settings or contexts (Guba, 1990:86; Seale, 1999:45; Teddlie & Tashakkori, 2009:286; Cohen et al., 2011:109; Anney, 2014:278). It requires that the researcher explains the research design in detail, through the following processes to the findings of the study (Anney, 2014:278).

The researcher trusts the thick descriptions used in this study make the possibility of transferability possible. Transferability of the results of this study was enhanced by providing thick descriptions of the research setting (sections 1.1 & 1.2), the participants (section 3.4.1) research design (section 3.3), analysis, particularly the themes formulated (section 4.6), and by providing examples of raw data where the actual words of the participants have been continuously used. This allows readers the opportunity to appraise the applicability and relevance of the findings of this study, helping them to decide whether or not to generalise, and which aspects of the study they can do this for in similar settings.

b) Purposive sampling

Anney (2014:278) advocates in a cursory manner that purposive sampling poses specific benefits for transferability: “it provides greater in-depth findings than other probability samplings methods”. This study utilised purposive sampling (section 3.4.1), because of its strength to increase the variety of information that could be obtained within a specific context.

3.6.3 Dependability

Dependability refers to the extent to which research findings can be replicated with similar subjects in a similar context (Merriam, 1998:205), in other words the consistency of observing the same finding under similar circumstances (Daymon & Holloway, 2002:94; Bitsch, 2005:86; Babbie & Mouton, 2011:521). In qualitative case study research, this is virtually impossible, as the situated belief in multiple realities is in contrast with the replication requirement that presumes a single reality (Merriam, 1998:206; Golafshani, 2003:601).

Alternatively, dependability is viewed as the degree that the reader can be persuaded that the findings occurred as the researcher reported it (Terre Blanche & Durrheim, 1999:64; Cohen et al., 2011:199), or “whether the results are consistent with the data collected” (Merriam, 1998:206). Hence, achieving dependability requires the researcher to elucidate the research findings and the process by which they were obtained to the reader or other researchers so that they can establish the dependability for themselves (Seale, 1999:45; Pole & Lampard, 2002:207; Thomas, 2010:291).

Krefting (1991:217; Table 3-3) list six strategies to enhance dependability namely code-recode procedure, dense description, dependability audit, peer examination, stepwise replication and triangulation. The researcher previously discussed peer examination and triangulation under credibility and thick (dense) description under transferability and focuses on the aspect of a dependability audit next.

Audit trail

An audit trail “involves an examination of the inquiry process and product to validate the data, whereby a researcher accounts for all the research decisions and activities to show how the data were collected, recorded and analysed” (Anney, 2014:278), in order to establish the dependability of qualitative research (Creswell & Miller, 2000:128; Akkerman et al., 2008:265). The audit trail delivers rigour in qualitative study by providing a trajectory that connects the research findings to the focus of the study, allowing an auditor (another researcher) to establish if the research findings can be traced to their source and are supported by the evidence (Ary et al., 2002:456; Daymon & Holloway, 2002:94; Babbie & Mouton, 2011:278; McMillan & Schumacher, 2014:329).

Bowen (2009:307) posits that an “audit trail offers visible evidence from process and product that the researcher did not simply find what he or she set out to find”. Lincoln and Guba (1985:319) suggest the following documents should be kept for auditing purposes: raw data, data reduction and analysis products, data reconstruction and synthesis products, process notes, materials relating to intentions and dispositions, and instrument development information.

In pursuing an audit trail, the researcher aimed through the systematic, detailed clarification and presentation of the research process and research design (sections 3.2, 3.3, 3.4 and 3.5) to enhance the dependability of the study.

The researcher provides comprehensive access to all processes of documenting this study: research methods, data collection methods, limited raw data, analysed data, themes, timeline decisions and activities and reflexive accounts in the relevant appendices to strengthen the dependability of the study further. Other raw data, such as audio and video recordings and participant diaries are available upon request.

3.6.4 Confirmability

Confirmability refers to the degree that the research conclusions are related to the core of the study, minus the biases of the researcher in the procedures and the interpretations of results (Ary et al., 2002:456; Daymon & Holloway, 2002:94; Babbie & Mouton, 2011:278). Otherwise, confirmability is “concerned with establishing that data and interpretations of the findings are not figments of the inquirer’s imagination but are derived from the data” (Tobin & Begley, 2004:392). Confirmability, therefore, addresses whether the findings of a study could be confirmed by or corroborated by other researchers and whether researcher bias can be excluded in the context of the research findings (Ferreira, 2006:159).

However, all socially constructivist and qualitative studies face challenges with neutrality as the researcher stands central in the research process, causing subjectivity (Nieuwenhuis, 2010a:79; Kvale, 2011:86). As is the case for dependability, rather than refuting the human subjectivity present in qualitative research, the researcher should account for it using various strategies (McMillan & Schumacher, 2014:356).

Krefting (1991:217; Table 3-3) lists three strategies to enhance dependability namely a confirmability audit, triangulation and reflexivity. The researcher has previously discussed triangulation under credibility (section 3.6.1) and audit trail under dependability (section 3.6.3) and focuses on the aspect of reflexivity next.

Researcher reflexivity

The complex questions that qualitative researchers ask themselves suggest that they cannot be neutral, objective, or detached (McMillan & Schumacher, 2014:327), hence the need for reflexivity, which is “an assessment of the influence of the investigator’s own background, perceptions and interests on the qualitative research process” (Krefting, 1991:218), or the “rigorous self-scrutiny by the researcher throughout the entire process” (McMillan & Schumacher, 2014:356).

Reflexivity facilitates self-examination, enabling researchers to become critically aware of their positions and interests which affect all phases of the research process, which in turn leads to the researcher acknowledging values, assumptions and prejudice that could influence the research (Hammersley & Atkinson, 2007:15; Braun & Clarke, 2013:36; McMillan & Schumacher, 2014:328). However, reflexivity does not anticipate eliminating or minimising researcher bias, but instead it aims to compare the research findings with those of others in order to become aware of the impact of the researcher's subjectivity (Bleakley, 2002:10), with the notion to contribute to improved research practice (Thomson & Walker, 2010:144). Usually, a good practice is for a researcher to keep a reflective journal, which should include "all events that happened in the field, personal reflections about the study" (Anney, 2014:279).

Merriam (1998:42) suggests that it is a good measure for researchers to clarify their biases, assumptions, philosophical stands and theoretical orientation at the outset of the study. The researcher disclosed this in section 1.7, which was expanded in section 3.3. A deliberate effort was made to adopt a reasonable (not-knowing) position concerning both data collection and data analysis. Furthermore, by researching other studies and using them for reflexive considerations within this research, the researcher developed an awareness of potential shortcomings in this study's findings (Van Heerden, 2012:129). The researcher discusses self-reflexivity in the context of the study in section 5.5, whereas the reflective journal that the researcher kept is attached in Addendum P.

3.7 Ethical considerations

Research ethics according to Saunders et al. (2009:183) refers to the "appropriateness of your behaviour concerning the rights of those who become the subject of your work or who are affected by it". Researchers in all fields of research, but specifically in the social sciences, where the focus is on people, must always be aware of the moral issues implicit in their work, and about the possible and actual positive and negative effects their investigations have or could have on those who are involved (Cohen et al., 2011:75). Researchers should act responsibly and be accountable to society when conducting research, and always mindful of their role to protect and respect their research participants throughout the research study (Oates, 2006:54; Rule et al., 2011:106; Mouton, 2013:276).

Access and acceptance, and informed consent are the two critical issues relating to the ethics of social research studies (Cohen et al., 2011:81; Gay et al., 2014:16, Creswell, 2014:166, McMillan & Schumacher, 2014:130).

Access requires applying for and obtaining official permission to conduct the study in a specific location or engaging specific participants (Cohen et al., 2011:81, Gay et al., 2014:25). Before commencement of the research study, the DESC (Department of Ethics and Screening), Stellenbosch University was approached for a request to grant ethical clearance to perform this study, which by their criteria is classified as low-risk since it involves only adults. The ethical clearance certificate received from the DESC, allowed this study to be conducted (Addenda B and C). Subsequently, the researcher also applied for and was approved by the Director of Research Services, Western Cape Education Department to conduct the study in the Vredendal school district, West Coast school district (Addendum J), in order to engage with Senior Phase Natural Sciences teachers as potential participants. Copies of the approval letter were included in an information circular (Addendum J) that was sent to all principals in the Vredendal school district (Addendum I).

Informed consent is obtained when “individuals choose whether to participate in an investigation after being informed of the facts that would be likely to influence their decision” (Cohen et al., 2011:81). Every participant is required to receive all the information about the study to make an informed decision, and by implication, participation is voluntary (Gay et al., 2014:21). Typically, such information contains the purpose of the research, the role of the participants in the study if they agree to participate, potential advantages or consequences of their participation, their right to withdraw at any stage, the issue of privacy, confidentiality and anonymity and how the data are disseminated ultimately (Cohen et al., 2011:81; Creswell, 2014:167; Gay et al., 2014:22).

The researcher compiled a database containing the contact details of all the Natural Sciences teachers in the Vredendal school district with the help of local school administrators. Copies of a typed letter of consent (Addendum K) were sent to all these teachers, and this was followed up with a telephonic clarification to ensure that there were no misunderstandings. This letter of consent informed the potential participants that their involvement would be entirely voluntary (Cohen et al., 2011:80, Creswell, 2014:166), and that their choice to participate or not, would not affect their work relationships. The letter of consent also explained that they were at liberty to withdraw from the study at any time without any form of consequence (Creswell, 2014:167). Signed consent forms were received from those teachers that agreed to participate in this study confirming them to “acknowledge the protection of their rights” (Creswell, 2014:149).

The letter of consent also introduced the researcher of the formal study that aims to explore the possibilities of a community of practice approach to support the professional development of Natural Sciences teachers from the rural school district of Vredendal. From the start, the intent was to establish the integrity of the researcher with the notion of presenting honesty and accessibility.

Furthermore, the letter of consent detailed the required role the participants would be assuming in the study and explained the expectations of the researcher. The consent letter would ask for them to complete questionnaires, be interviewed and recorded (Gray, 2004:279), actively participate in, and be observed in CoP sessions, and keep diaries of their observations and experiences.

Other than contributing to the aims of the study, the letter of consent explained to participants that no other benefits would come from their participation in the study (Gay et al., 2014:131). It was also made clear that their participation in this study would not endanger or put them at undue harm or risk (Gay et al., 2014:132).

The letter of consent also assured the participants that their privacy would be protected through anonymity, and the confidentiality of the data they provide maintained (Cohen et al., 2011:82; Fraenkel et al., 2012:438, Gay et al., 2014:21; McMillan & Schumacher, 2014:133). A pseudo name methodology was used to ensure no personal characteristics or traceable details of the participants were possible, at all stages of data collection, reduction, analysis, and reporting. This coded table together with the participants' biographical information, as well as all the documentation, audio and video recordings, photos, and data related to the study, is kept confidential (Kvale & Brinkmann, 2009:147), stored in digital password-protected format on a private computer that only the researcher has access to. Hard copy files that hold confidential information such as signed consent forms completed questionnaires, participant diaries, the researcher's reflective journal are all stored in a safe to which only the researcher has access. All the information related to this study is stored safe and secure for at least two years after the study has been completed, after which it is to be destroyed.

In the letter of consent, participants are informed that the findings of this study would be published as a thesis that would be available in the public library domain. A copy of the completed thesis is to be sent to the Director of Research Services, Western Cape Education Department as asked.

3.8 Conclusion

This chapter presents intricacies of the research design, which is informed by the main research question that has the aim of exploring potential ways a CoP could contribute to the professional development of Senior Phase Natural Sciences teachers from the rural school district of Vredendal. In line with many other teacher development studies, a constructivist ontology is appropriate for this study, because a CoP is a standard social practice, and the researcher is dependent on the teacher participants' views of their professional development within a CoP context. Accordingly, the lens of an interpretivist epistemology was chosen to address the research questions of the study as the related richness and depth of behaviours, group dynamics, interactions and events are ideal to understand the CoP best as the teacher participants make sense of their world with their social interactions.

Underpinned by Wenger's (1998) CoP model as a theoretical framework, a qualitative case study was considered appropriate to answer the research questions based on its appealing research strengths. Supplementary terminology related to this case study includes "naturalistic", "descripto-exploratory", "instrumental", "single case" and "embedded". Application of Wenger's model reveals that the domain encapsulates the continuing professional development of Natural Sciences teachers from the rural school district of Vredendal, the Natural Sciences teachers with the researcher represent the community, and lastly the practice includes different strategies used in the CoP sessions that were used to explain and demonstrate specific contexts as well as the corresponding concepts.

Drawing on a significant advantage of case study research, data collection was done using a multi-method approach (not to be confused with mixed-methods), situated in a purposive sampling strategy. Detailed motivations are given for the choice of data collection methods. Primary data are collected via questionnaires, semi-structured interviews and observations, whereas secondary information is gained from participants' diaries, a reflective journal of the researcher, and document analysis. Matter and Materials, a knowledge strand from the CAPS curriculum is used as a means to address the concerns raised concerning teaching practices and teachers' understanding of the content knowledge during CoP sessions.

Subsequently, aspects relating to data such as preparation, conversion (transcription), organising, categorisation, classification (open coding), data reduction and finally, thematic analysis are highlighted.

Several strategies such as audit trail, member checking, peer examination, extended field experience, purposive sampling, reflexivity, thick description and triangulation are employed to prove the rigour of this study, addressing the quality criteria of credibility, transferability, dependability and confirmability. Ethical requirements related to this study are considered, and in the last part of this chapter, the evidence is provided showing that permission was granted to conduct this study, and consent was obtained from the teacher participants.

The next chapter discusses the analysis and results of the research study.

CHAPTER 4

RESULTS AND ANALYSIS

4.1 Introduction

This chapter focuses on the assimilation, illustration, analysis and interpretation of data that were collected using pre- and post-intervention questionnaires, interviews and observations (Figure 3.7; section 3.4). Data categorisation and thematic analysis were utilised to crystallise the results inductively into key themes.

4.2 Pre-intervention questionnaire

This section discusses the information obtained from the pre-intervention questionnaire with an overview at the end, in the context of teacher experience, which is categorised into beginner, senior and veteran teachers, as well as qualified and underqualified teachers (Table 3-2).

In the pre- and post-intervention questionnaires, the participants were asked to respond by using a five-point Likert scale (Likert, 1932), which presented respondents a choice to indicate their level of agreement or disagreement with a given statement or question based on pre-coded responses. The Likert scale is a method generally used in quantitative research, but the multi-method choice of this study allows its reasonable use in a qualitative approach of visually presenting the data to better understand it (Saunders et al., 2009). This is an addition to the detail-rich discussion of the data, which is key to a qualitative case study.

4.2.1 Understanding of knowledge strands

Question 1.1: A large percentage of Natural Sciences teachers do not feel equipped enough to teach Natural Sciences. Use a × to indicate from one to five to which extent you agree with the statement.

Response: One beginner participant agreed with the statement, while six veteran, four senior and four beginner participants agreed reasonable with the statement (Figure 4.1). One qualified participant agreed with the statement, four underqualified and ten qualified participants agreed reasonably, while three qualified participants agree strongly, and one underqualified and four qualified participants agree with the statement. In summary, most participants agreed reasonably with the statement.

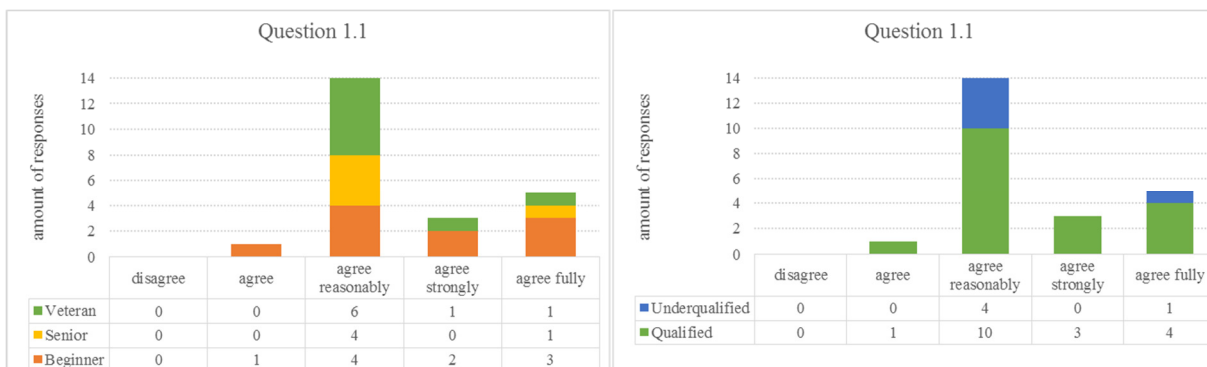


Figure 4.1 Graphic presentation of participants’ responses about their capability to teach Natural Sciences.

Question 1.2.1: To what extent do you experience problems with understanding the different Natural Sciences knowledge strands Matter and Materials, Energy and Change, Earth and Beyond, Life and Living?

Matter and Materials: Four beginners, one senior and four veteran participants indicated that they experience no problems with the understanding of the knowledge strand Matter and Materials, while two beginners and one senior indicated that they experience minor problems (Figure 4.2). Furthermore, two beginners, two seniors and three veterans indicated that they experience moderate problems while two beginners, one senior and one veteran indicated that they experienced serious problems with the understanding of this knowledge strand. Seven qualified and two underqualified participants indicated that they experience no problems; three qualified participants indicated that they experienced minor problems. Furthermore, six qualified and one underqualified participant indicated that they experience moderate problems and lastly, two qualified and two underqualified participants indicated that they experience serious problems. In summary, most participants said they experience none to moderate problems with the understanding of the knowledge strand Matter and Materials.

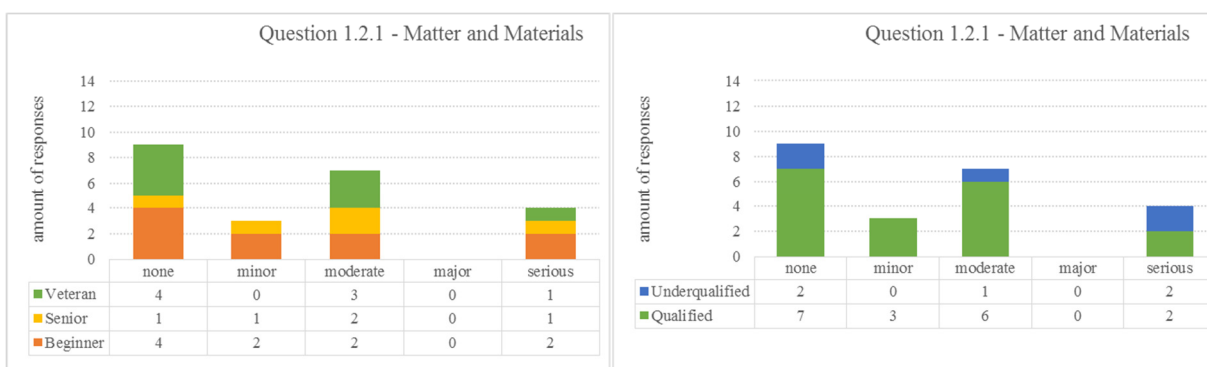


Figure 4.2 Graphic presentation of participants’ understanding of Matter and Materials.

Energy and Change: Five beginner and three veteran participants indicated that they experience no problems with the understanding of the knowledge strand Energy and Change (Figure 4.3). One beginner and two seniors indicated that they experience minor problems. Furthermore, four beginners, three seniors and four veterans indicated that they experience moderate problems and lastly, one veteran indicated to experience serious problems with the understanding of this knowledge strand. Seven qualified and one underqualified participants indicated that they experience no problems; three qualified participants indicated that they experienced minor problems. Furthermore, seven qualified and four underqualified participants indicated that they experience moderate problems and lastly, one qualified participant indicated that he/she experienced serious problems. In summary, most participants stated they experience none to moderate problems with the understanding of the knowledge strand Energy and Change.

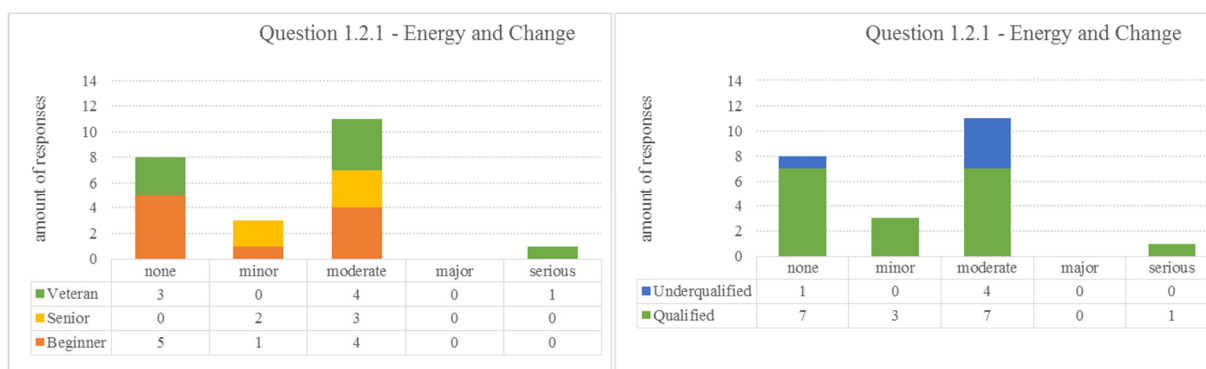


Figure 4.3 Graphic presentation of participants' understanding of Energy and Change.

Earth and Beyond: Four beginner, two senior and three veteran participants indicated that they experience no problems with the understanding of the knowledge strand Earth and Beyond, while one beginner and one senior indicated that they experience minor problems (Figure 4.4). Furthermore, five beginners, one senior and four veterans indicated that they experience moderate problems while one senior and one veteran indicated that they experienced serious problems with the understanding of this knowledge strand. Six qualified and three underqualified participants indicated that they experience no problems; two qualified participants indicated that they experienced minor problems. Furthermore, eight qualified and two underqualified participants indicated that they experience moderate problems and lastly, two qualified and two underqualified participants indicated that they experience serious problems. In summary, most participants declared they experience none to moderate problems with the understanding of the knowledge strand Earth and Beyond.

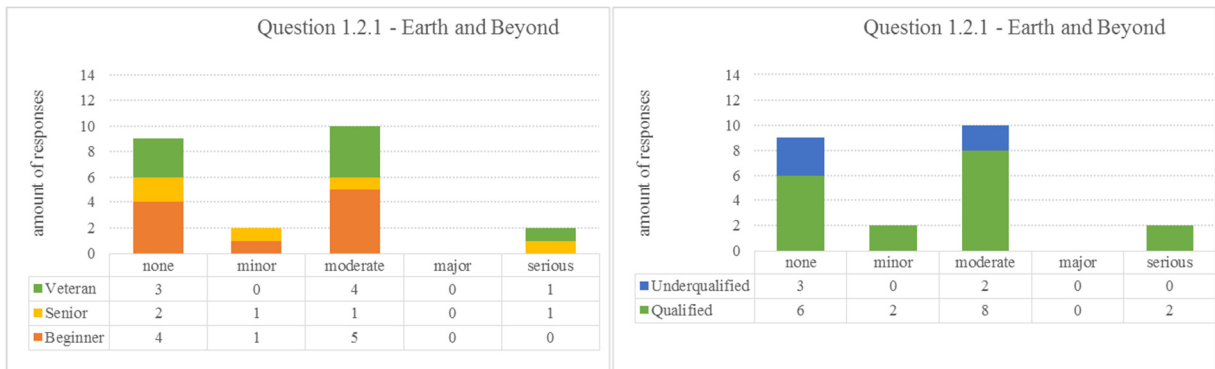


Figure 4.4 Graphic presentation of participants’ understanding of the Earth and Beyond.

Life and Living: Six beginner, four senior and five veteran participants indicated that they experienced no problems with the understanding of the knowledge strand Life and Living, while one veteran experienced minor problems (Figure 4.5). Furthermore, two beginners, one senior and two veterans indicated that they experienced moderate problems while one beginner experienced serious problems with the understanding of this knowledge strand. Eleven qualified and four underqualified participants indicated that they experience no problems; one qualified participant indicated that he/she experienced minor problems. Furthermore, four qualified and one underqualified participants indicated that they experience moderate problems, one qualified participant experienced major problems, and one qualified participant experienced serious problems. In summary, most participants said they experience none to moderate problems with the understanding of the knowledge strand Life and Living.

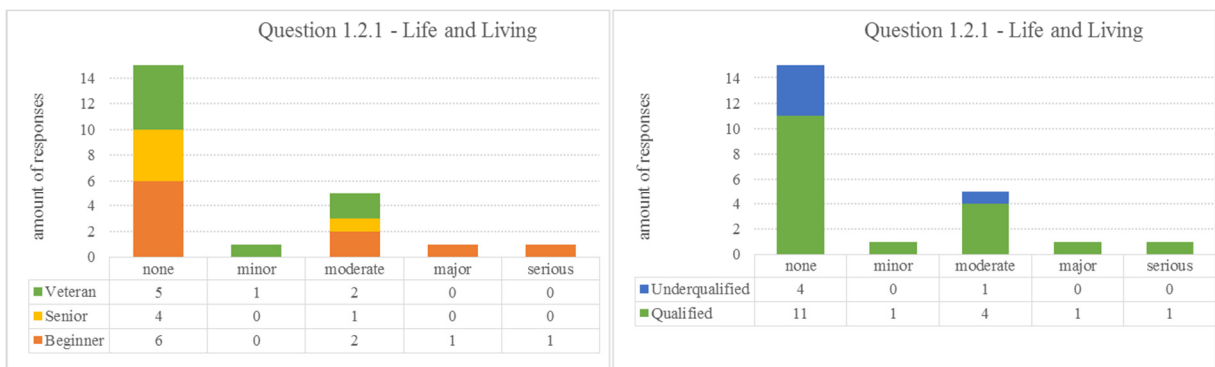


Figure 4.5 Graphic presentation of participants’ understanding of Life and Living.

4.2.2 Subject content knowledge

Question 1.2.2: To what extent do you experience problems with teaching the subject content relevantly to the learners?

Response: Three beginner and three veteran participants indicated that they experienced no problems with the teaching the subject content relevantly to the learners, while four beginners and four seniors and one veteran experienced minor problems (Figure 4.6). Furthermore, three beginners, one senior and three veterans indicated that they experienced moderate problems while one veteran experienced major problems with teaching the subject content relevantly to the learners. Four qualified and two underqualified participants indicated that they experience no problems; nine qualified participants indicated that they experienced minor problems. Furthermore, four qualified and three underqualified participants indicated that they experience moderate problems while one qualified participant, experienced major problems. In summary, most participants articulated that they experience none to moderate problems with teaching the subject content relevantly to the learners.

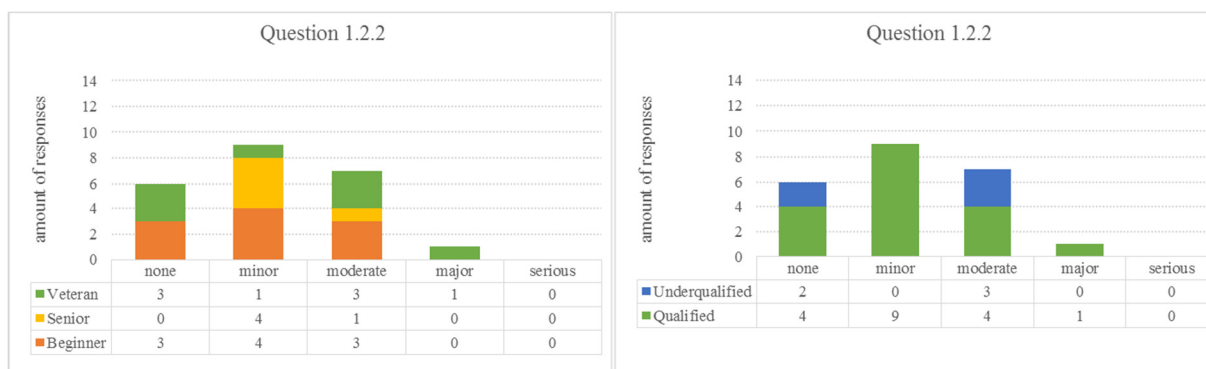


Figure 4.6 Graphic presentation of participants' responses to the problems they experienced with teaching the subject content relevantly to the learners.

Question 1.2.3: To what extent do you experience problems with conveying your knowledge of the theory in a clear manner?

Response: Six, beginner, two senior and five veteran participants indicated that they experienced no problems with conveying their knowledge of the theory in a clear manner, while two beginner, two senior and one veteran experienced minor problems (Figure 4.7). Furthermore, two beginner, one senior and one veteran indicated that they experienced moderate problems while one veteran experienced major problems with conveying knowledge of the theory in a clear manner.

Distinguishing between the responses of the qualified and underqualified participants, ten qualified and three underqualified indicated that they experience no problems. Furthermore, four qualified and one underqualified indicated that they experienced minor problems. Moreover, three qualified and one underqualified indicated that they experience moderate problems while one qualified participant, experienced major problems. In summary, whether you distinguish between years of experience, qualified or underqualified, most participants said they experience none to moderate problems with conveying their knowledge of the theory in a clear manner.

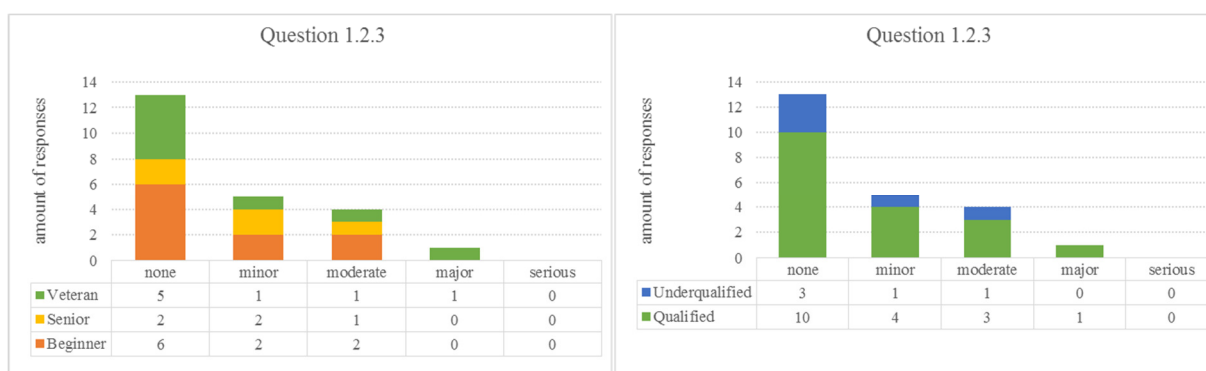


Figure 4.7 Graphic presentation of participants' responses to the problems they experienced with conveying their knowledge of the theory in a clear manner.

Question 1.2.4: To what extent do you experience problems with performing Natural Sciences demonstrations?

Response: Two beginner, two senior and three veteran participants indicated that they experienced no problems with performing Natural Sciences demonstrations, while four beginners, one senior and three veterans experienced minor problems (Figure 4.8). Two beginners, one senior and two veterans indicated that they experienced moderate problems while one beginner experienced major problems with performing Natural Sciences demonstrations. Moreover, one beginner and one senior participant experienced serious problems with performing Natural Sciences demonstrations. Five qualified and two underqualified participants indicated that they experience no problems, whereas eight qualified participants indicated that they experienced minor problems. Four qualified and one underqualified participants indicated that they experience moderate problems while one underqualified participant experienced major problems. Lastly, one qualified and one underqualified participant experienced serious problems. In summary, most participants said they experience none to moderate problems with performing Natural Sciences demonstrations.

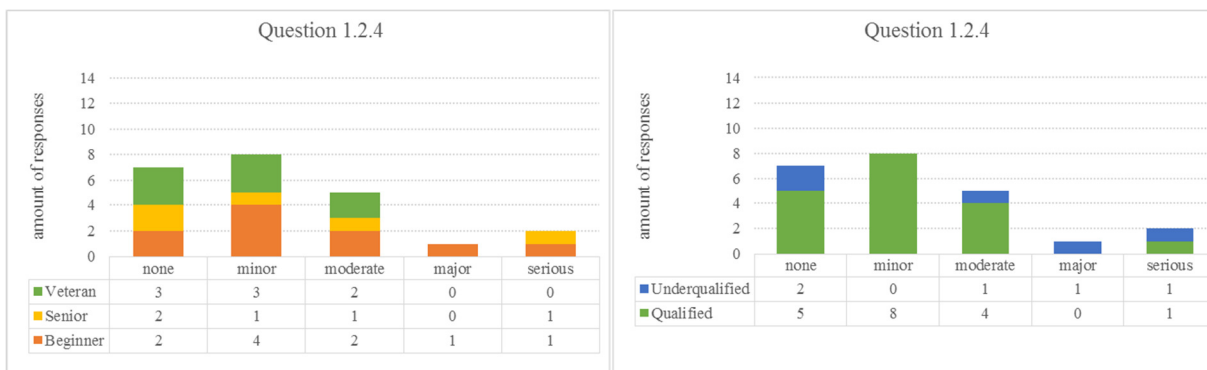


Figure 4.8 Graphic presentation of participants’ responses to the problems they experienced with performing Natural Sciences demonstrations.

Question 1.2.5: To what extent do you experience problems with the facilitation of practical work?

Response: Four beginner, one senior and two veteran participants indicated that they experienced no problems with the facilitation of practical work, while two beginners, one senior and two veterans experienced minor problems (Figure 4.9). Furthermore, two beginners, one senior and three veterans indicated that they experienced moderate problems while two senior experienced major problems with the facilitation of practical work. Two beginners and one veteran participant experienced serious problems with the facilitation of practical work. Five qualified and two underqualified participants indicated that they experience no problems, whereas five qualified participants indicated that they experienced minor problems. Six qualified participants indicated that they experience moderate problems while one qualified and one underqualified participant experienced major problems. Furthermore, one qualified and two underqualified participants experienced serious problems. In summary, most of the participants said they experience none to moderate problems with the facilitation of practical work.

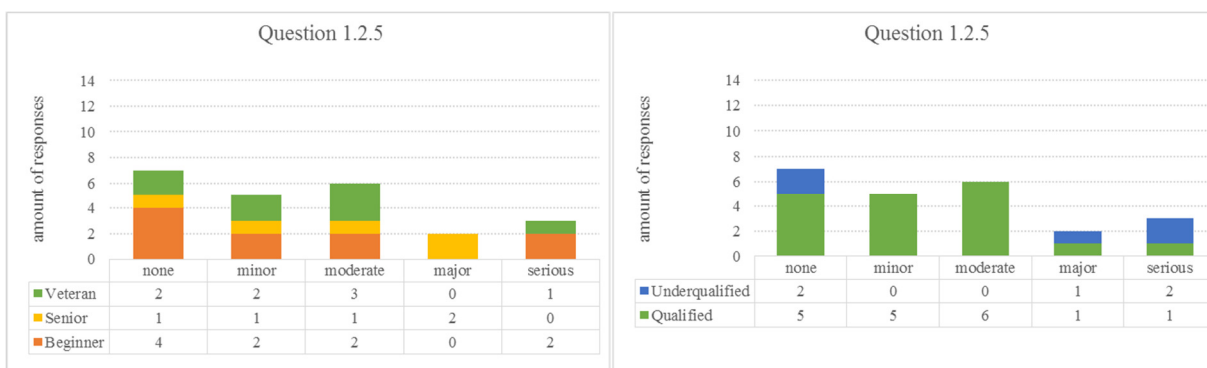


Figure 4.9 Graphic presentation of participants’ responses to the problems they experienced with the facilitation of practical work.

4.2.3 Use of computer-based technology

Question 1.2.6: To what extent do you experience problems in using computer-based technology in the teaching process?

Response: Five beginner, two senior and two veteran participants indicated that they experience no problems with the use of computer-based technology in the teaching process, while two seniors and one veteran experienced minor problems (Figure 4.10). Furthermore, four beginners and four veterans indicated that they experienced moderate problems while one beginner and one senior experienced major problems with the use of computer-based technology in the teaching process. One veteran participant experienced serious problems with the use of computer-based technology in the teaching process. Eight qualified and one underqualified participants indicated that they experience no problems, whereas two qualified and one underqualified participant indicated that they experienced minor problems. Seven qualified and one underqualified participants indicated that they experienced moderate problems while one qualified and one underqualified participant experienced major problems. Furthermore, one underqualified participant experienced serious problems. In summary, most participants said they experience none to moderate problems with the use of computer-based technology.

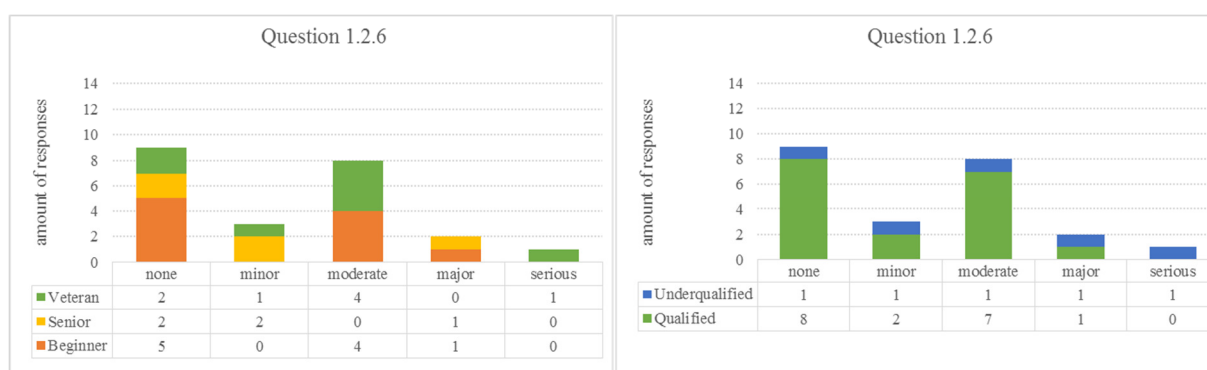


Figure 4.10 Graphic presentation of participants' responses about their familiarity with the use of computer-based technology in the teaching process.

4.2.4 External CPTD support

Question 2.1: Indicate to what extent tertiary institutions are involved in supporting in-service teachers with their professional development.

Response: One senior and two veteran participants indicated that tertiary institutions are not involved in supporting in-service teachers with their professional development (Figure 4.11). Moreover, two beginners and three seniors indicated that tertiary institutions are in a minor manner involved.

Four beginners and one senior indicated that tertiary institutions are moderately involved. Three beginners and three veterans indicated that tertiary institutions are majorly involved in supporting in-service teachers with their professional development and two veterans indicated that tertiary institutions are significantly involved with the support of in-service teachers with their professional development. Two qualified and one underqualified participants indicated that tertiary institutions are not involved with the support of in-service teachers, whereas four qualified and one underqualified participant indicated that tertiary institutions are in a minor manner involved. Furthermore, five qualified and one underqualified participants indicated that they are moderately involved. Likewise, six qualified participants indicated that they are in a major manner involved, while one qualified and two underqualified participants indicated that tertiary institutions are significantly involved in supporting in-service teachers with their professional development. In summary, most participants said they experience minor to a major involvement of tertiary institutions with their professional development.

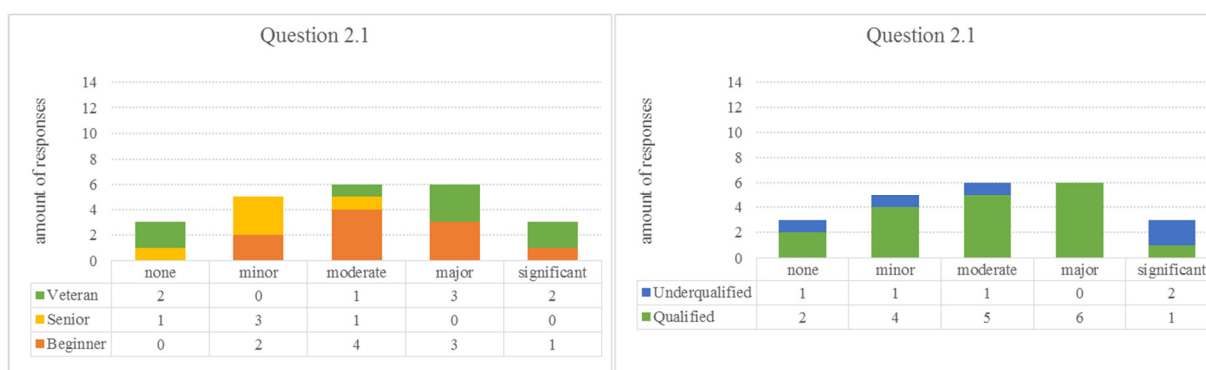


Figure 4.11 Graphic presentation of participants' responses indicating to what extent tertiary institutions are involved in supporting in-service teachers with their professional development.

Question 2.2: In your opinion, to what extent can non-governmental organisations (NGOs) support the professional development of in-service teachers?

Response: One beginner and one senior participant indicated that NGOs should be involved in a minor manner in supporting in-service teachers with their professional development, whereas two beginners indicated that NGOs should be involved in a moderate manner (Figure 4.12). Furthermore, four beginners, two seniors and two veterans indicated that NGOs should be majorly involved. Three beginners, two seniors and six veterans, indicated that NGOs should be significantly involved with their professional development. Two qualified participants indicated that NGOs should be involved at a minor level; one qualified and one underqualified participant indicated that NGOs should be involved moderately.

Furthermore, seven qualified and one underqualified participants required that NGOs should be majorly involved. Likewise, eight qualified and three underqualified participants indicated that NGOs are required to play a significant role in supporting in-service teachers with their professional development. In summary, most participants said they required minor to significant involvement of NGOs with their professional development.

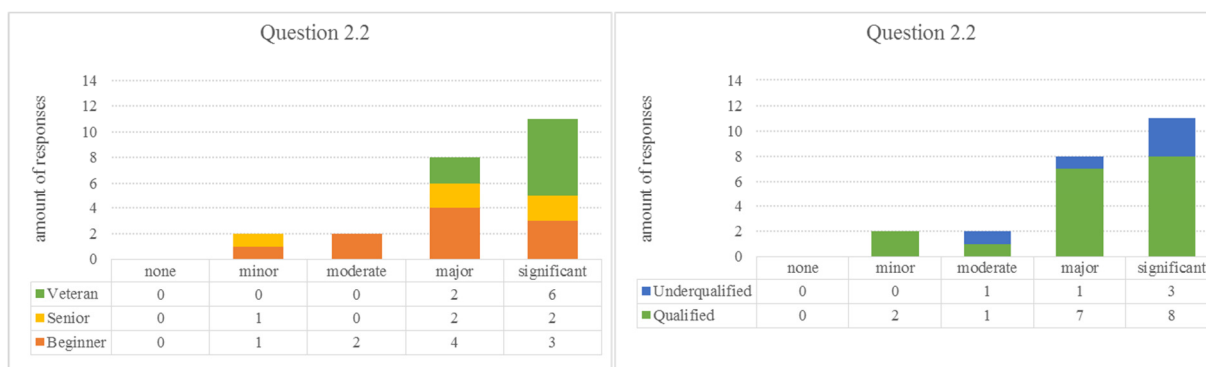


Figure 4.12 Graphic presentation of participants' responses indicating to what extent non-governmental organisations could support the professional development of in-service teachers.

4.2.5 Teacher collaboration

Question 2.3: Indicate the level of co-operation of teachers in the same subject department at your school.

Response: One beginner participant indicated that the level of co-operation of teachers in the same subject department at their school is non-existent (Figure 4.13). One beginner and one veteran indicated that the level of co-operation of teachers in the same subject department at their school is poor. Furthermore, four beginners, two seniors and three veterans indicated that the level of co-operation of teachers in the same subject department at their school is reasonable. One beginner, one senior and three veterans, indicated that the level of co-operation of teachers in the same subject department at their school is good. Likewise, three beginners, two seniors and one veteran indicated that the level of co-operation of teachers in the same subject department at their school is excellent.

One qualified participant indicated that the level of co-operation of teachers in the same subject department at their school is non-existent. Moreover, two qualified participants indicated that the level of co-operation of teachers in the same subject department at their school is poor. Seven qualified and two underqualified participants indicated that the level of co-operation of teachers in the same subject department at their school is reasonable.

Likewise, four qualified and one underqualified participants indicated that the level of co-operation of teachers in the same subject department at their school is good, while four qualified and two underqualified participants indicated that the level of co-operation of teachers in the same subject department at their school is excellent. In summary, most participants said they experience reasonable to excellent co-operation of teachers in the same subject department at their school.

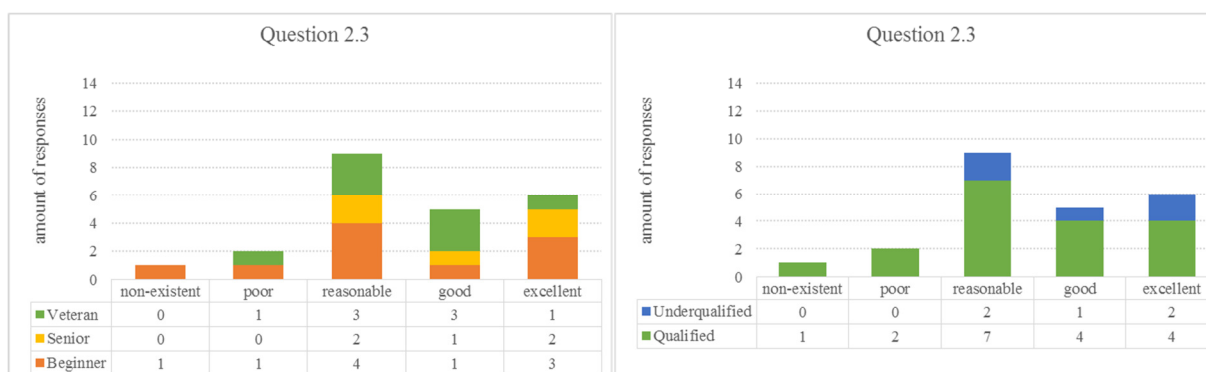


Figure 4.13 Graphic presentation of participants' responses on the level of co-operation of teachers in the same subject department at your school.

4.2.6 The contribution of CoPs to CPTD

Question 3.1: Indicate to what extent you had already participated in activities organised in CoPs, which had enhanced your professional development as a teacher.

Response: Two beginners, three seniors and one veteran indicated that they had never participated in activities organised in CoPs (Figure 4.14). One beginner indicated that he/she had minor participation in activities, while four beginners, two seniors and four veterans indicated that they had moderately participated in activities organised in CoPs that had enhanced their professional development. Two beginners and one veteran indicated that they had a major participation in activities organised in CoPs that had enhanced their professional development as a teacher.

Furthermore, one beginner and two veterans indicated that their participation in activities organised in CoPs had significantly contributed to the enhancement of their professional development as a teacher. Five qualified and one underqualified participants indicated that they had never participated in activities organised in CoPs. One qualified participant indicated minor involvement, while seven qualified and three underqualified participants indicated moderate involvement.

Furthermore, two qualified and one underqualified participant declared major involvement while three qualified participants had significant involvement in CoP activities that enhanced their professional development. In summary, most participants that participated in CoPs previously said they had moderate participation in CoPs that enhanced their professional development.

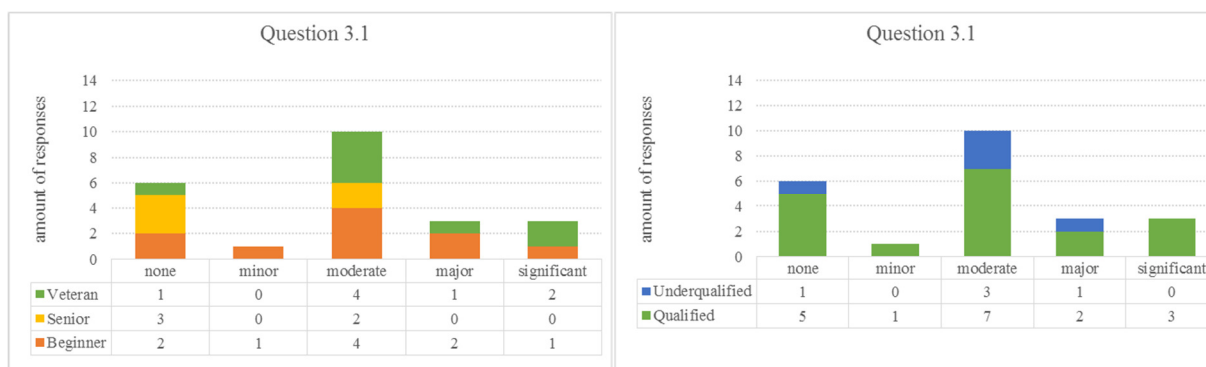


Figure 4.14 Graphic presentation of participants' responses to their level of participation in CoP activities, which had enhanced their professional development.

Question 3.2: If you have any previous experiences of participation in a community of practice, could you please indicate your experience regarding it?

Response: Two beginners, three seniors and one veteran indicated that they had not participated in activities organised in CoPs, whereas one beginner indicated that he/she had a poor experience of participation in activities organised in CoPs (Figure 4.15). Three beginners, two seniors and two veterans indicated that they had reasonable experience of participation in activities organised in CoPs. Two beginners and three veterans indicated that they had a good experience of previous participation in CoPs; two beginners and two veterans indicated that they had an excellent experience of participation in CoPs.

Five qualified and one underqualified participants indicated that they have no experience working in CoPs. One qualified participant that he/she had a poor experience of participating in CoPs. Six qualified and one underqualified participant had reasonable experience, while two qualified and three underqualified participants indicated that they had a good experience. Lastly, four qualified participants indicated that they had excellent experience with the previous engagement in CoPs. Most participants that participated previously in CoPs said they had a reasonable to excellent experience with CoPs.

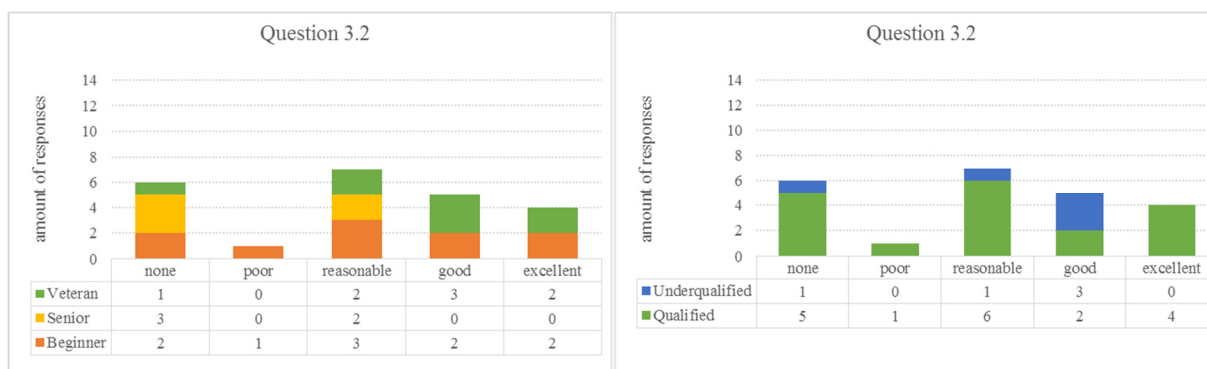


Figure 4.15 Graphic presentation of participants’ previous engagement with a CoP.

Question 3.3: Show to what extent a community of practice approach can contribute to the professional development of a Senior Phase Natural Sciences teacher.

Response: Two senior participants indicated that a CoP could contribute moderately to the professional development of a Senior Phase Natural Sciences teacher (Figure 4.16). Furthermore, four beginners, two seniors and two veterans indicated that a CoP could contribute majorly to the professional development of a Senior Phase Natural Sciences teacher. Moreover, six beginners, one senior and six veterans indicated that a CoP could contribute significantly to the professional development of a Senior Phase Natural Sciences teacher. One qualified and one underqualified participant indicated that a CoP could contribute moderately, while six qualified and two underqualified participants indicated that a CoP could contribute majorly to the professional development of a Senior Phase Natural Sciences teacher. Eleven qualified and two underqualified participants indicated that a CoP could contribute significantly to the professional development of a Senior Phase Natural Sciences teacher. In summary, most participants said a CoP could have contributed from a major to a significant influence on the professional development of a Natural Sciences teacher.

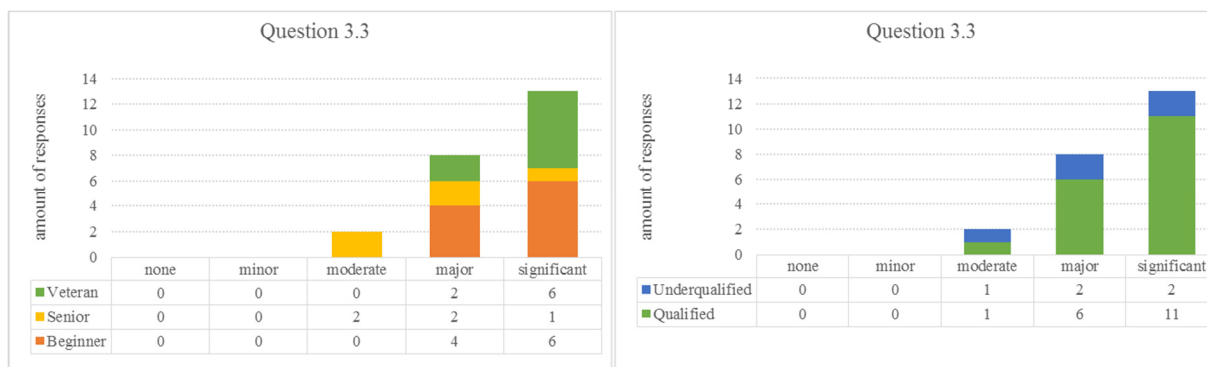


Figure 4.16 Graphic presentation of participants’ responses to what extent a CoP approach can contribute to the professional development of a Senior Phase Natural Sciences teacher.

Question 3.5: Indicate how your professional development can be improved by participation in a CoP.

Six beginner, two senior and one veteran participant indicated that their professional development could be moderately improved by participation in a CoP (Figure 4.17). One beginner, one senior and three veterans showed that the CoP could have a major influence on their professional development. Three beginners, two seniors and four veterans indicated that their professional development could be significantly improved by participation in a CoP. Six qualified and three underqualified participants showed that the CoP could have a moderate influence on their professional development, whereas four qualified and one underqualified participant showed that it could play a major role. Lastly, eight qualified and one underqualified participants showed that it would have a significant influence. In summary, most participants said that participation in a CoP could play a moderate to a significant role in improving their professional development.

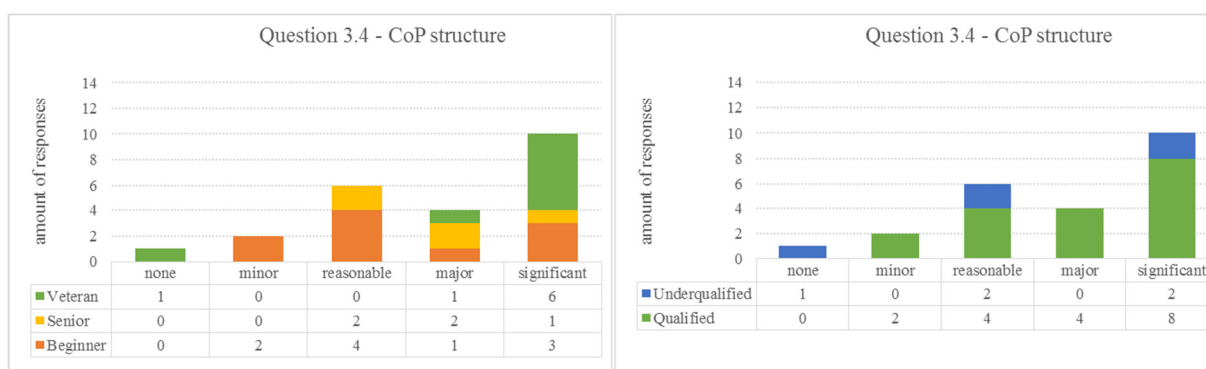


Figure 4.17 Graphic presentation of participants' responses on the role that a CoP can play in the improvement of professional development.

4.2.7 Principles and aspects of an effective CoP

Question 3.4: Indicate the important role the following factors, 1) the structure of CoP, 2) the competence level of the group, 3) the personal needs of the participating CoP members, 4) the content presented in the CoP, 5) the presenting strategies used in the CoP, 6) the frequency of the CoP sessions and 7) the feedback after each CoP session) can play in the successful operation of it.

The structure of a CoP: One veteran participant said that the structure of the CoP does not influence the successful operation of it (Figure 4.18). Two beginners demonstrated that the structure plays a minor role in the successful operation of a CoP. Furthermore, four beginners and two seniors indicated that the structure plays a reasonable role.

One beginner, two seniors and one veteran demonstrated that the structure of a CoP could play a major role. Moreover, three beginners, one senior and six veterans showed that the structure of a CoP could play a significant role. One underqualified participant showed that CoP structures play no role, while two qualified participants indicated that it plays a minor role in the successful operation of a CoP. Moreover, four qualified and two underqualified participants showed that a structure could play a reasonable role, while four qualified participants indicated that it could play a major role. Lastly, eight qualified and two underqualified participants demonstrated that it could play a significant role. In summary, most participants said that the structure of a CoP could play a reasonable to a significant role in the successful operation of it.

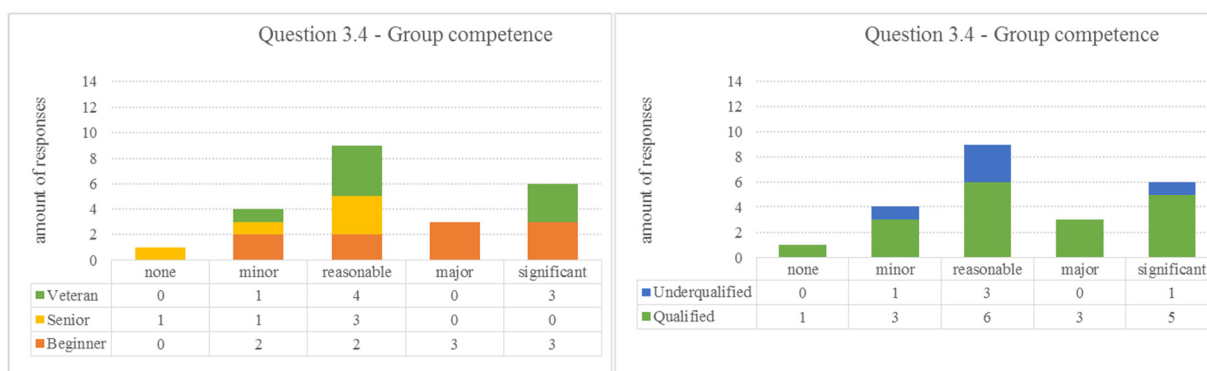


Figure 4.18 Graphic of participants' responses on the role the structure of the CoP plays in the successful operation it.

The competence level of the group: One veteran participant said that the competence level of the group does not influence the successful operation of the CoP (Figure 4.19). Two beginners, one senior and one veteran demonstrated that the competence level of the group plays a minor role in the successful operation of a CoP. Two beginners, three seniors and four veterans indicated that the competence level plays a reasonable role, while three beginners showed that it could play a major role, and three beginners and three veterans showed that the competence level of a CoP could play a significant role. One qualified participant showed that the competence level of a CoP plays no role, while three qualified and one underqualified participants indicated that it could play a minor role in the successful operation of a CoP. Moreover, six qualified and three underqualified participants showed that it could play a reasonable role, while three qualified participants indicated that it could play a major role.

Lastly, five qualified and one underqualified participants demonstrated that it could play a significant role. In summary, most participants said that the competence level of a CoP could play a minor to a significant role in the successful operation of it.

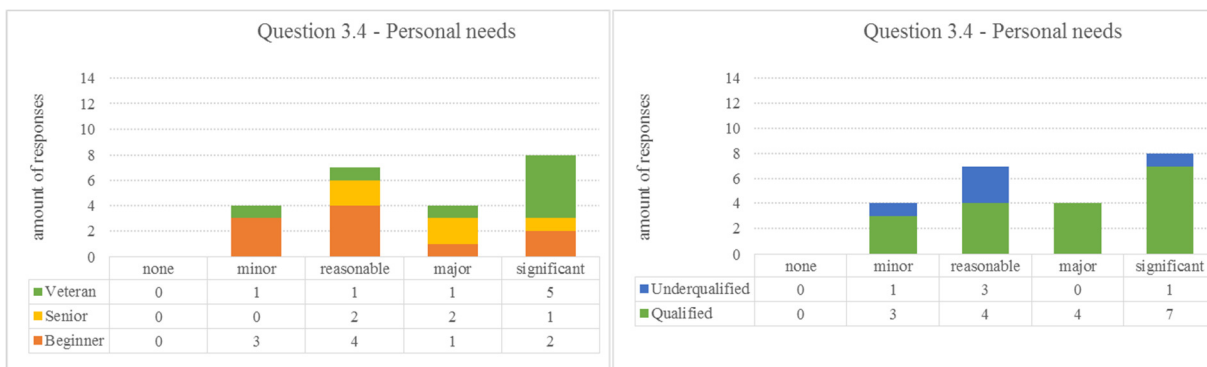


Figure 4.19 Graphic presentation of participants’ responses on the role the competence level of the CoP members plays in the successful operation it.

Personal needs of the participating CoPs members: Three beginners and one veteran demonstrated that the personal needs of the participating members play a minor role in the successful operation of a CoP (Figure 4.20). Furthermore, four beginners, two seniors and one veteran indicated that their personal needs play a reasonable role, while one beginner, two seniors and one veteran demonstrated that the personal needs of the participating members could play a major role. Moreover, two beginners, one senior and five veterans showed that it could play a significant role. Three qualified and one underqualified participants indicated that it could play a minor role in the successful operation of a CoP. Moreover, four qualified and three underqualified participants showed that it could play a reasonable role, while four qualified participants indicated that it could play a major role. Lastly, seven qualified and one underqualified participants demonstrated that it could play a significant role. In summary, most participants stated that the personal needs of the participating members of a CoP could play a reasonable to a significant role in the successful operation of it.

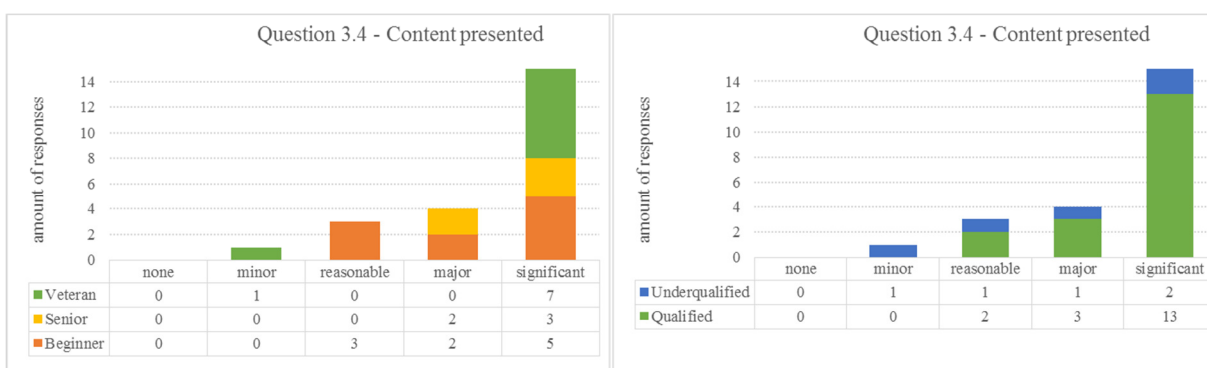


Figure 4.20 Graphic presentation of participants’ responses to the personal needs of the CoP members play in the successful operation it.

The content presented in the CoP: One veteran participant said that the content presented only has a minor influence while three beginners indicated it had a reasonable influence (Figure 4.21). Two beginners and two seniors demonstrated the content presented played a major role in the successful operation of a CoP. Furthermore, five beginners, three seniors and seven veterans indicated the content presented play a significant role. One underqualified participant showed the content presented could play a minor role in the successful operation of a CoP, while two qualified and one underqualified participant indicated it could play a reasonable role. Three qualified and one underqualified participants indicated the content could play a major role. Lastly, 13 qualified and two underqualified participants demonstrated it could play a significant role. In summary, most participants said that the content presented in a CoP could play a reasonable to a significant role in the successful operation of a CoP.

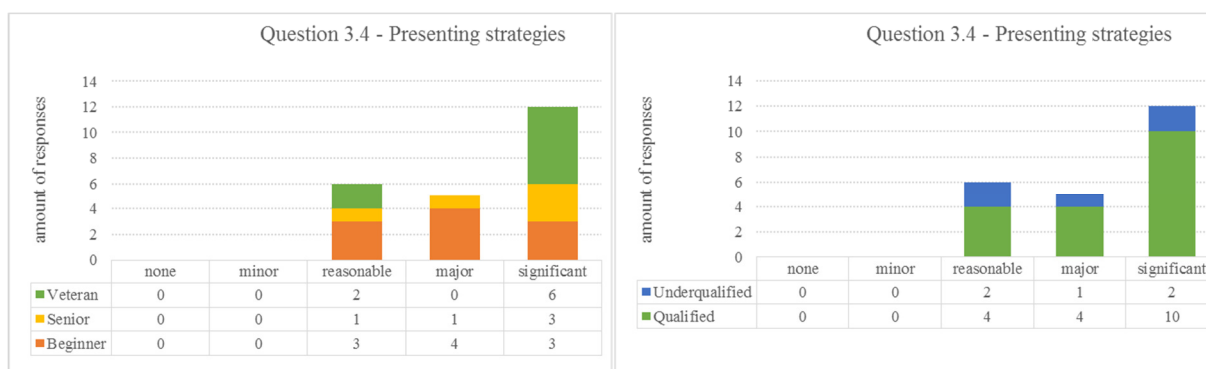


Figure 4.21 Graphic presentation of participants' responses to the content presented in the CoP.

The presenting strategies used in the CoP: Three beginner, one senior and two veteran participants indicated that it had a reasonable influence (Figure 4.22). Moreover, four beginners and one senior demonstrated that the presenting strategies play a major role in the successful operation of a CoP. Three beginners, three seniors and six veterans indicated that the presenting strategies play a significant role. Four qualified and two underqualified participants showed that the presenting strategies could play a reasonable role in the successful operation of a CoP. Likewise, four qualified and one underqualified participants mentioned that the presenting strategies play a major role. Lastly, ten qualified and two underqualified participants showed that the presenting strategies play a significant role in the successful operation of a CoP. In summary, most participants said that the presenting strategies used in a CoP could play a reasonable to a significant role in the successful operation of a CoP.

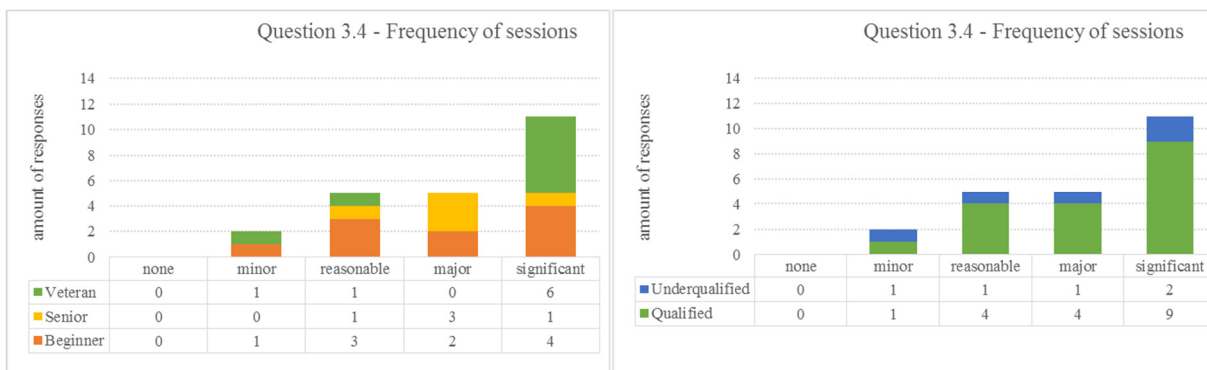


Figure 4.22 Graphic presentation of participants’ responses to the presenting strategies used in the CoP.

The frequency of the CoP sessions: One beginner and one veteran participant indicated that it had a minor influence, whereas three beginners, one senior and one veteran showed that the frequency of the CoP had a reasonable influence on the successful operation of a CoP (Figure 4.23). Moreover, two beginners and three seniors demonstrated that the frequency of the CoP sessions plays a major role in the successful operation of a CoP. Furthermore, four beginners, one senior and six veterans indicated that the frequency of the sessions plays a significant role. One qualified and one underqualified participant showed that the frequency of the sessions could play a reasonable role in the successful operation of a CoP. Likewise, four qualified and one underqualified participants mentioned that the frequency of the sessions plays a major role. Lastly, nine qualified and two underqualified participants showed that the frequency of the sessions plays a significant role in the successful operation of a CoP. In summary, most participants said that the frequency of the CoP sessions could play a reasonable to a significant role in the successful operation of a CoP.

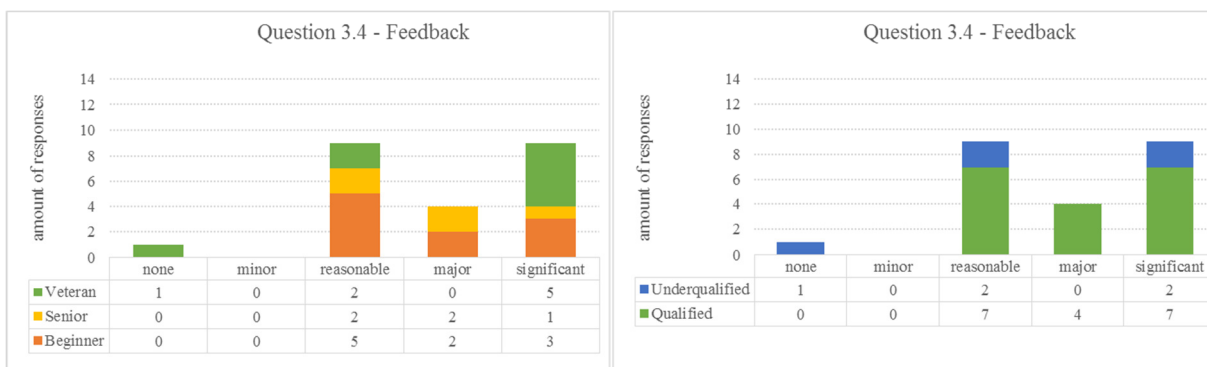


Figure 4.23 Graphic presentation of participants’ responses on how often the CoPs sessions happen.

Feedback after each CoP session: One veteran participant indicated that the feedback did not influence the successful operation of a CoP (Figure 4.24). Five beginners, two seniors and two veterans indicated that feedback plays a reasonable role, while two beginners and two seniors said that it could play a major role. Three beginners, one senior and five veterans showed that feedback after each session plays a significant role. One underqualified participant showed that the frequency of the sessions would play no role, seven qualified and two underqualified participants showed that it could play a reasonable role. Four qualified participants indicated that it could play a major role. Lastly, seven qualified and two underqualified participants showed that the feedback after each session could play a significant role in the successful operation of a CoP. In summary, most participants said that feedback after each CoP session could play a reasonable to a significant role in the successful operation of a CoP.

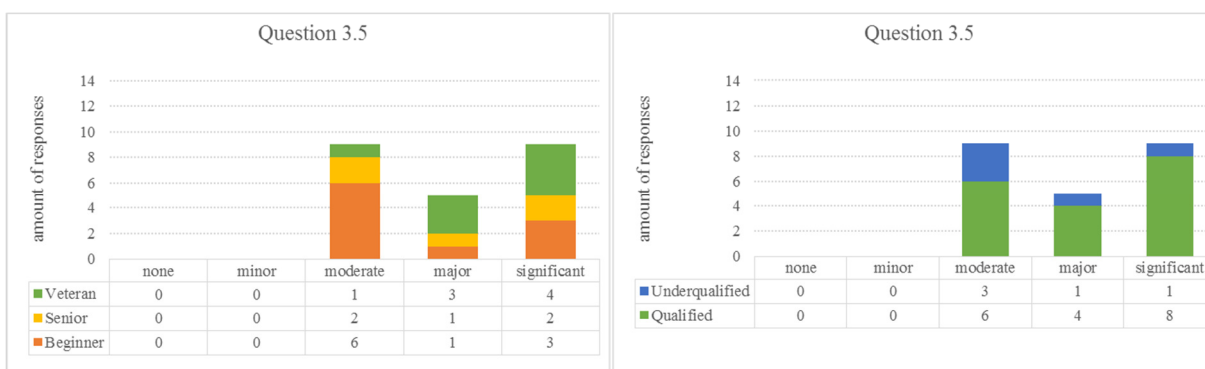


Figure 4.24 Graphic presentation of participants' responses on feedback after each CoP session.

4.2.8 Open-ended questions

Question 3.6: Is there anything else that you would like to discuss? If so, please elaborate.

Only three out of the ten participants answered this question. Their main concerns are as follows. The first concern was the time allocation for the knowledge strand Earth and Beyond presented in term four.

Training sessions would be more valuable if they can take place in the first and second term as the third and fourth term are usually too busy with school-related activities. The sessions will be more effective if the second term's work, of which the curriculum is sometimes more difficult; can be done earlier in the first term. [T06]

The second concern involved the lack of equipment needed to perform experiments and to do demonstrations in order to make Natural Sciences theory more understandable to the students. Added concerns relate to the involvement of the community to support the development of Natural Sciences in several ways.

For example, participants mentioned that the community could get involved as financial role-players or by providing qualified people to support the development of Natural Sciences.

The involvement of sponsors will be of great help in better supporting the schools. [T07]

4.2.9 Overview

There seems reasonable agreement among the participants that Natural Sciences teachers are not adequately equipped to teach the subject effectively. Beginner teacher participants expressed a greater level of agreement with this statement compared to the more experienced teacher participants (seniors and veterans). Surprisingly, in contrast to this response, in later questions, all the participants, regardless of teacher experience, or qualifications indicated that they have no, or moderate issues in understanding the four knowledge strands Matter and Materials, Energy and Change, Earth and Beyond, and Life and Living. This is probably because the workshops presented by the WCED and tertiary institutions mostly focussed on the knowledge strands Life and Living and Matter and Materials.

Similarly, participants indicated that they do not have major or serious issues to teach the subject content relevantly, convey the theory, perform demonstrations, or facilitate practicals. However, the underqualified teachers find the pedagogical aspects problematic. Most of the participants showed that they are familiar and confident with the use of computer-based technology in the teaching process.

Overall, participants' observations of the collaboration among teachers in the same subject department are encouraging but less so for beginners than the more experienced teacher participants. Mixed responses were received on the perceived involvement of tertiary institutions in supporting in-service teachers with their professional development. However, the participants expressed unanimously their need for non-governmental organisations to support the professional development of in-service teachers.

Seventeen of the 23 participants have previous experience of interacting with teacher groups, and from their involvement, they all indicated it had positive impacts on their professional development. All the participants responded positively in acknowledging the key role that a teacher CoP could play in their professional development, and consider a CoP to be an effective mechanism to enhance their professional development.

Likewise, helpful responses were received about factors that could influence the effective operation of a CoP. In this regard, the participants ranked content presented, presenting strategies and the frequency of CoP sessions higher in importance than individual teacher needs, competence level and composition of the CoP.

4.3 Interviews

Data collected from the pre-intervention questionnaires were used to formulate six questions for the subsequent interviews (Figure 3.7). Three of these questions dealt with the barriers and enablers to effective Natural Sciences teaching, and the other three questions probed the participants' views about teacher CoPs. Interviews were semi-structured, face-to-face with the approach to follow up, and elaborate on participants' responses to the pre-intervention questionnaire, allowing more in-depth discussions about their responses. Interviews were pre-arranged, non-compulsory and occurred after school. All interviews were recorded and transcribed. Field notes were made to document the behaviour of the participants during the interviews. Pseudonym codes (Table 3-2) were used for reference purposes when participants are quoted.

At the beginning of the interviews, participants were uncertain how to respond, probably being aware that their conversations were recorded and therefore they appeared uncomfortable. However, as the discussions progressed, the participants became relaxed, and the dialogue happened more spontaneously. An early and important observation from the interviews was that the responses of the more experienced teacher and the beginner teacher participants were markedly different. The responses of the ten participants (interviewees) based on the six questions asked are provided in the section that follows. Note that participants used the term "group" about a "community" during the interviews. Themes that appeared from the six interview questions are underlined and summarised at the end of this chapter.

4.3.1 Barriers and enablers to effective science teaching

In this specific section, the purpose was to determine the factors that influence effective Natural Sciences teaching.

Question 1: What factors are currently preventing the effective teaching of Natural Sciences at your school?

Participants mentioned that teachers need to be conscious of the factors that play a significant role in the effective teaching of Natural Sciences.

Furthermore, they said that in some situations, there are teachers who are not knowledgeable and are lacking Natural Sciences teaching experience and this could have a significant impact on the effective teaching of the subject. Moreover, participants mentioned that these problems of ineffective teaching do not occur in higher grades (Grade 10-12), but mostly in the lower grades (Grade 4-9) as many of these teachers do not have the experience to perform experiments or demonstrations.

Also, the lack of learners' experience to the everyday application of Natural Sciences theory influences their understanding of the subject. The inexperienced teachers cannot apply science in an everyday life context. Moreover, the lack of Natural Sciences laboratories and enough equipment has a significant effect on the effective teaching of the subject. Lastly, including technology in the teaching process is problematic as the physical location of the school determines the quality of the internet connection and thus whether the teacher can make use of internet and technology in the classroom.

Suggestions of the participants to remedy the situation sketched above are discussed in the section below.

a) Teacher competence

Some teachers are not qualified Natural Sciences teachers.

Especially in rural schools, where teachers need to teach multiple subjects, the situation sometimes occurs where teachers are generally qualified, but not formally trained to teach a specific subject such as Natural Sciences. Consequently, Natural Sciences are neglected, as it is not a priority of the teachers because they are not knowledgeable or lack the confidence to teach the subject in a more motivating manner.

In some circumstances the lower grade (Grade 4-9), teachers are qualified, but not necessarily qualified Natural Sciences teachers. Consequently, these teachers do not have the confidence to teach the subject and the senior teachers as the heads of the department, or the subject heads are not equipped to support these teachers.

At small rural schools, Natural Sciences are just one of the many subjects that the teachers are teaching that lead to that untrained Natural Sciences teachers teaching the subject. [T07]

Beginner teachers or teachers who are not trained to teach Natural Sciences teachers lack the confidence to perform experiments or demonstrations. They also lack the skill to manage their learners while doing experiments, which then result in chaos. [T08]

Teachers are not skilled, or do not have the confidence to perform experiments or demonstrations.

When teachers are using experiments or demonstrations to explain or demonstrate the theory to the learners, it helps them to understand the theoretical content better. Many of the schools do not have laboratories, and if they have, limited resources are available. In the small, rural schools, the lack of enough money prevents schools from buying the necessary equipment for Natural Sciences.

Limited resources also affect the effectiveness of teaching; for example, our school does not have a science laboratory, but this does not prevent me from doing experiments. I am still doing experiments that do not need a laboratory to be conducted. [T06]

In my specific case, I involved the grade six and seven learners by asking them to bring potatoes and bread from their homes to show the test of starch to them. The learners who could not bring the material I asked for, work together with those who that have the necessary material. [T07]

b) The gap between theory and practice

Teachers have difficulty in applying the Natural Sciences theory in the real life of learners.

Teachers need to be creative and consider their learners' social background to show the learners the everyday application of science more effectively.

Our schoolyard is big, and there are many trees, plants and big stones. Under my supervision, the learners got the opportunity to identify the different habitats of the animals and to identify how many insects were sharing the same habitat. [T10]

However, to do such out of the classroom excursions needs sound planning and knowledge of the subject.

c) External Factors

Some schools do not have reliable internet.

Unfortunately, the finances of small schools do not allow for the installation of a reliable Wi-Fi system that could make a connection to the internet possible. This internet connection could aid teachers in finding applicable videos to demonstrate experiments that could be dangerous to demonstrate in a class. Because Natural Sciences is a discipline that learners understand better through observations, a reliable internet connection could help in making these scientific experiments easier to understand.

In summary, participants mentioned several factors that negatively affect the effective teaching of Natural Sciences at their specific school. This feedback is condensed in a category called “barriers that influence effective teaching”, which include teachers who lack the skill or do not have the confidence to perform experiments or demonstrations, lack the skill of applying the Natural Sciences theory in the real life of learners and do are not creative when they have limited resources. Furthermore, lack of teacher collaboration and disjointed theory and application of theory are included in the identified barriers.

Question 2: Do you have any suggestions on how the concerns mentioned in the previous question can be addressed?

The participants mentioned that it is crucial for teachers to communicate with one another to share ideas or ask for help as they play a crucial role in the manner in which the learners experience the subject. Teachers need to be excited and passionate about the subject and must understand the importance of CPTD to prevent them from stagnation. To enhance regular communication between teachers, a CoP could play an influential role. The participants said that teachers attending short courses could address the concerns noted in the previous question, particularly concerning what new teachers could gain.

a) Improved teacher competence

As a beginner teacher, I still lack the skill of effective classroom management, and that has an influence on the learning process in my class. [T01]

If you get teachers on board in the CoP and they develop confidence with the Natural Sciences context, they will apply the information and methods obtained from the group discussions in their class context. [T04]

I would say that teachers need to be excited about the subject in order for them to transfer this excitement to their learners. [T07]

In some situations, the teacher does not have a choice to teach Natural Sciences; this is especially the case at smaller schools where teachers need to teach the subject regardless of whether they are trained Natural Sciences teachers or not. Accordingly, this bears a major influence along the path they teach the topic. [T10]

b) Improved teacher collaboration

As explained earlier in this chapter, a CoP could play a significant role in addressing some of the concerns mentioned in the previous question. This group platform could be used to support teachers who are qualified but not necessarily in the field of Natural Sciences.

In this environment, honest, trustworthy relationships could be developed among colleagues, and their insecurities about the subject content knowledge as well as their teaching practices could be addressed. Thus, useful practices, which the experienced teachers obtained throughout the years, could be shared with those who are still inexperienced.

I think we as teachers need to start with ourselves; are we willing to work together with other teachers in the CoP? If so, we first need to work together with our colleagues in the same department and school. If this co-operation is working, we can expand this concept with other colleagues from other schools who are teaching the same subject. [T03]

There may be many approaches that one can use to address the issues that influence the effective teaching of the subject at the school. My suggestion will simply be the incorporation of CoPs, as this platform creates an environment of sharing experiences and knowledge among teachers. In this context, interactive learning can be ensured. [T06]

Participants mentioned that the CoP sessions could occur once a month and need to focus on the practices that could improve teaching methods.

Those teachers who are not used to working in a 'group context' are not always keen to work with other colleagues, but as they got more exposure to working with colleagues, they will get used to the 'CoP context'. [T03]

For me, in these CoP sessions, one can learn from the more experienced teachers and the occurrence of these meetings will depend on the participating teachers' needs and availability. [T04]

In this context, teachers could be aware of the needs of the different phases, and therefore in this collaboration, a more sustainable method can be formulated. [T04]

If we can meet monthly, it will help build confidence between the participating teachers. [T05]

c) Address the gap between theory and practice

However, for the CoP to be implemented successfully, the participants mentioned that a more practice-based approach should be used to relate the theory better to the practice, thus helping to teach the subject more effectively.

Many of the learners learn more effectively when they are visually stimulated. [T03]

If we as the teachers are explaining habitats to the learners, you need to show them in their local environment what it is or where they can find it. This will make the learning process much more meaningful as it links these concepts to their world of understanding. [T07]

Depending on your circumstances at school, you can determine what methods to use to make the theory more understandable. [T07]

At the schools that are not equipped with modern technology or where there is a lack of adequate internet connection, teachers need to use other ways to support the learners.

Learners do not always have access to a library or the internet. We as teachers can establish a good resource bank at school; you can involve learners to bring magazines to school, such as the National Geographic, Popular Mechanics and many others, which they can use in class when they need to conduct research regarding a specific topic. [T08]

In conclusion, the participants mentioned that teachers could play a key role in addressing the concerns mentioned in the previous question, which focussed on factors influencing the effective teaching of Natural Sciences at their school. These responses are categorised under “enablers for effective teaching”, which include improvement of teacher competency, improvement of teacher collaboration and addressing the gap between theory and practice. If teachers are passionate about their profession and the subject they teach, they become motivated to get involved with activities that could enhance their professional development. CPTD could be addressed by accredited short courses, which could help them from stagnating in their careers. As discussed in the section above, many of the schools are in a situation where the senior teachers are not necessarily qualified Natural Sciences teachers, and therefore lack the knowledge to support the beginner teachers who need guidance to adjust efficiently to the school system.

Moreover, the importance of the establishment of CoPs is essential for the role it could play in supporting those teachers who still need guidance or help to adapt to the school system or the teaching of the subject. Furthermore, effective communication among colleagues of the same and neighbouring schools plays a significant role in the establishment of CoPs, which could play a substantial role in supporting beginner teachers as well as underqualified Natural Sciences teachers. Lastly, teachers need to be aware of the resources that their schools have access to, and they need to be creative to counteract related deficiencies in equipment.

Question 3: Considering your teaching experience in the past years, do you have any suggestions regarding more effective teaching methods for Natural Sciences?

To make use of more effective teaching methods teachers need to deepen their subject content knowledge by continuously reading and attending workshops, to teach the subject to learners as effective as possible. This could only happen if teachers are passionate about the subject and motivated to create the best learning opportunities for their learners. Furthermore, effective teaching methods could be improved in the CoP, and to make this approach even more useful teachers of the intermediate phase (Grade 4-6, Senior Phase Grade 7-9), as well as the Further Education and Training Phase (Grades 10-12), need to be included in the CoP sessions.

Teachers also must know the context of their learners in order to make use of proper strategies that could better develop learners' critical thinking skills. To enhance these skills, teachers need to make use of different strategies, which include practical demonstrations, using technology to demonstrate experiments that are difficult to conduct in class, learners doing the experiments themselves, and have enhanced discussions about different Natural Sciences concepts. The participants mentioned that the attitude of a teacher is especially important as this determines the successful teaching of the subject at a school.

If you as a teacher are not passionate about the subject, it influences the way you are teaching it. [T07]

a) Pedagogy

The possibilities of a CoP to enhance effective teaching methods for Natural Sciences.

Effective teaching methods could be shared among teachers in a CoP, as they share their knowledge, practices, experiences, and ideas about the use of different teaching strategies in their classroom. The participants also mentioned that this platform could be used to solve subject-related problems and to help teachers with the planning and composition of formal assessment tasks.

Teachers' teaching practices could be enhanced through the participation in the CoP as a platform where the exchanging of knowledge and practices can occur. This is especially the case for those teachers who are not confident in conducting experiments. [T08]

In some of the instances where there is a lack of equipped laboratories, the CoP platform could be used to demonstrate teachers' alternative approaches, such as the use of technology that could help to improve the efficiency of teaching science. This support via the CoP could be facilitated in different ways, such as teachers who share short video clips about how to conduct experiments or the use of alternative teaching practices that could help them improve their teaching skills. The success of the CoP to increase effective teaching is dependent on the attitude of teachers and their willingness to participate in a group, regardless of their teaching inabilities and their willingness to learn from to each other.

We as teachers need to realise that we cannot operate in isolation; we need to network with different role-players, which includes the curriculum advisors. [T08]

To make the CoP approach even more effective, teachers of the Intermediate Phase (Grades 4-6), Senior Phase (Grades 7-9) as well as Further Education and Training Phase (Grades 10-12) need to be included. This could help to make teachers aware of what aspects are addressed in different phases.

Such a group must not only focus on the Senior Phase but also needs to include teachers of the intermediate as well as the FET-phase. [T04]

A more practical approach could help to accomplish teaching that is more effective.

Participants said that considerably more practical learning could take place when learners have the opportunity to conduct experiments. Although such a scenario could create chaos in a class, especially in the case of beginner teachers, it could be of significant help to make the theory much more accessible. The advantages of experiencing science in action could help learners become more excited and curious about Natural Sciences. Participants also saw that, as Natural Sciences is a practical matter, the instructors need to introduce it as practically possible.

This is particularly relevant in the lower Grades (4-7) where the teachers focus more on the theoretical aspects of the experiments, whereas the younger learners are more fascinated by practical demonstrations. [T01]

To build a circuit yourself is very stimulating and will keep the learners creatively busy. They are stimulated to investigate different characteristics of conductors, semiconductors and non-conductors. [T06]

b) Collaboration

Participants suggested that a workable alternative for schools that are not equipped with well-resourced laboratories is to make use of a mobile laboratory, which could alternate between the schools. However, to manage such a mobile laboratory, a trained facilitator needs to be employed, which has financial implications for many schools in the Vredendal. To overcome the shortage of equipment or chemicals, teachers need to make use of alternative methods that could address the problem of expensive Natural Sciences equipment.

I think if there is a mobile laboratory, which can alternate between schools, it can address the problem of inadequately equipped school laboratories. With the mobile laboratory, a qualified person who is trained well can facilitate the experiments, which will assist teachers in this process, especially unqualified Natural Sciences teachers necessarily. [T05]

We need to take learners out of the classroom to explore the application of science in their local environment, especially learners in the lower grades who are stimulated more by the visual presentation of Natural Sciences. Teachers need to accommodate these learners by changing their teaching approach from a theoretical to a more practical one. [T07]

c) Passionate and motivated teachers

Technology should be used more to improve effective teaching.

If technology is used appropriately, a teacher could make a lesson so much more interesting, which could lead to teaching that is more effective. Teachers could help each other with the choice of electronic software that applies to the Natural Sciences disciplines.

With the Smartboard, you have so many ways to demonstrate the subject content visually to the learners; for instance, in life sciences and physical sciences, the use of the Smartboard to demonstrate the theory is limitless. [T02]

Children love visual presentations, and a teacher can use video clips to introduce new or difficult concepts or to explain something that is not always possible to demonstrate, like the functioning of a human heart. [T03]

Learners need to be engaged in the teaching process to ensure effective teaching.

One of the challenges that teachers face is to engage learners actively in the teaching process. To ensure effective teaching, teachers need to make use of appropriate teaching strategies to ensure the development of critical thinking (Lai, 2011:2).

Learners need to experience the everyday application of the subject content; they need to be able to follow instructions and conduct experiments without the support of a teacher. [T04]

Many of us as teachers make the mistake of doing demonstrations without actively engaging the learners in the learning process. [T09]

After learners have conducted the experiments, they watched videos that explain specific Natural Sciences concepts or observe practical demonstrations and partake in detailed discussions to share their observations and explanations of how they have drawn their conclusions.

Teachers need to know the social background of their learners.

Teachers need to be aware of the social background of the learners as it could play a vital role in the methods they use to ensure effective teaching.

In many instances, we as teachers just assume that learners have access to computers or the internet at home. In my case, I told my learners so many times to make use of the internet to research a specific topic, forgetting that many of them do not have computers and internet access at home. [T10]

In conclusion, teachers need to make use of more effective teaching methods to teach Natural Sciences more effectively. Furthermore, they need to be passionate about the subject and must consider the learners' background in order to use appropriate teaching strategies. Teachers need to make use of different teaching strategies, which include practical demonstrations to develop learners' critical thinking skills. Learners should also conduct the experiments themselves and teachers should use technology to demonstrate their work, which could not be done in class because of safety hazards. Lastly, teachers need to enhance discussions about the concepts that were displayed visually. These approaches, which the participants mentioned, could, therefore, play a significant role in the successful teaching of the subject at school.

4.3.2 Views about CoPs

Question 4: What is your experience regarding participation in a CoP?

A fundamental view obtained from the feedback of the participants in response to this question is that the beginner teacher participants acknowledged their lack of experience when working together in CoP. Also, the more experienced teacher participants agree that they do work well in a 'group' setting but do not refer to it as a 'CoP' *per se*. Regardless, both the beginner teachers, as well as the more experienced teacher participants, emphasised the need for teachers to work better in a group capacity in order to make this co-operation in CoP more sustainable. Lastly, they stress the key role that the effective management of CoP plays in its successful operation. These main thoughts are discussed individually in the section below.

a) Different opinions regarding participation in CoPs

Beginner teachers lack the experience of a CoP setting.

Six of the ten participants are beginner teachers (1-6 years' experience) in the Vredendal area, and their experience of working together in a group or participating in a CoP was limited to the sessions arranged by the curriculum advisor. These sessions, which were more formal and informative, focussed on one-way communication, which informed teachers about what was expected of them. Hardly any informal discussion occurred in which they could share their experiences or raise their concerns about teaching-related issues.

I have only worked for three years in the Vredendal area, of which I taught one year at a primary school and two years at a high school. The only time when I had contact with Natural Sciences teachers of other schools, was at the beginning of the year at the meeting, which the curriculum advisor had arranged. At this meeting, the planning of the year's work is reviewed, but our needs regarding subject-related challenges are not addressed. [T02]

I do not think there is enough co-operation among the teachers; once a term, meetings are organised by the subject advisors where all communication is focused on the formal curriculum work. Therefore, no time is available for informal communication about subject-related issues. [T08]

In my case, this informal discussion about the subject occurred twice last year. Moreover, there is currently no structured CoP where we as colleagues can tap from each other's knowledge and experiences. [T09]

Experienced teachers' opinions about CoPs.

Six of the ten participants had more experience in working together in a group, which in this study is described as a CoP. The responses of the more experienced teachers indicated that co-operation between teachers in Natural Sciences and Mathematics was more established, although not necessarily recognised by the participants as a CoP.

We had the opportunity to collaborate with different teachers at our school by making use of workshops. Working together with colleagues on our own and at other schools in the area is not so new to me. I can say that I do have quite a bit of experience with CoPs. [T03]

b) Collaboration

Suggestions to make co-operation in a CoP more sustainable.

Participants who had experience with CoPs mentioned that the co-operation between teachers is initially active. However, when teachers are back in their busy programs, the biggest challenge they face is to complete their tasks, which were assigned to them in the CoP. Consequently, this leaves the responsibility of these tasks to one or two teachers who are compelled to do all the work, and this could contribute to a negative experience of a CoP.

My experience is that co-operation is reasonably good when we engaged in CoP, but once you are back at school and occupied with your school-related responsibilities, the tasks that were assigned to you in the CoP is very difficult to accomplish. [T01]

Teachers do not always have the time to work together in a 'group', which this study defines as 'CoP'. Our preparation and extra-mural activities keep us very busy; I will suggest that once a term is attainable to meet as a group. [T05]

The effective management of a CoP to improve its successful operation.

If the co-operation between the teachers in a CoP is managed correctly, the CoP could be of major help. Therefore, the approaches intending to make collaboration sustainable need to be planned thoroughly.

Participants mentioned that those teachers who have the right attitude and who have the necessary resources available could better assist fellow members in the CoP. However, the primary task is to focus on simple, inexpensive ways to demonstrate practicals and facilitating assessment projects. If this collaboration with fellow teachers in CoPs could be established effectively, teachers could benefit as they share their knowledge, experience and practices with their fellow participants.

My experience from the past is that the co-operation between teachers in CoP is initially effective; however, the challenge is to keep it sustainable. [T07]

This process of working together is not a new thing, and if it is managed correctly, the teachers can learn from each other's experience. Furthermore, they could exchange useful practices, which could help their fellow participants with the teaching of difficult work. This is especially the case when you go back to your work situation as the support provided in CoP could help you teach more confidently and successfully. [T10]

With an increase in the understanding and operation of the CoP as well as its implementation, teachers have developed more confidence in their fellow members and communication occurred more spontaneously. This led to teachers feeling less incompetent and, later, motivated them to contact fellow members for support with specific work-related matters.

When you are comparing your work in such a 'group', it helps you to evaluate your level of the assessment tasks and gives you an indication whether you are on the right track. [T10]

Participants also noted that working together and sharing knowledge with fellow teachers from other schools helped to keep them on track.

My experience was very positive, and I have found that people are willing to help. [T09]

In conclusion, the feedback of participants shows that there is a need to establish a CoP. However, the collaboration between teachers needs to be managed prudently for a CoP to function successfully. Currently few of the participants have experience in taking part in a CoP, and the commitment of the teachers to participate plays a role in its successful operation. Participants said that the demanding workload of teachers plays a crucial role in their CoP participation. Although most of the participants were positive about co-operation within the community, their primary concern was to make the CoP more sustainable. Consequently, including more schools in CoP, they suggested well-planned strategies and active co-operation between the members of the CoP.

Question 5: Do you have any suggestions for how such a CoP can function effectively?

All the participants suggested that for a CoP to function effectively, regular communication between members as well as complete dedication is essential. They suggested enhancing regular communication between members by implementing different communication platforms, which could be used to ensure the effectiveness of a CoP.

Feedback obtained from the participants in response to this question is that the CoP first needs to be set up at a specific school before expanding to neighbouring schools. Furthermore, they said that regular communication between educators in the CoP would enhance its effectiveness. Likewise, they emphasised the importance of taking into consideration teachers' demanding school-related responsibilities when planning the occurrence of CoP meetings. Similarly, they stated that the effectiveness of a CoP could also be determined by the physical location of a school, which could play a key role in the attendance of group meetings. They emphasised the essential role that the structure of a CoP plays in its effective operation and how the CoP platform could help to improve teachers' interaction. Lastly, it was recommended that, by encouraging teachers' commitment and enthusiasm, an effective CoP could be achieved. The feedback mentioned above is discussed in the section below.

The CoP needs to be established at a specific school first.

To ensure effective practice, 80% of the participants suggested setting up a CoP among colleagues who are teaching the same subject at the same school first.

I am suggesting first establishing a CoP at a school between teachers at the same discipline; this could represent the first level of CoP. [T07]

The collaboration will differ from school to school, but I believe that, if you first establish a strong group at your school between the teachers of different disciplines, then you can start to include teachers from other schools. [T08]

If this interaction in the CoP works effectively, it could develop to the next phase, which entails the inclusion of colleagues from neighbouring schools. Participants mentioned that better collaboration at a specific school could influence the collaboration within a larger community. They are of the opinion that teachers in a CoP, confronted with the same subject-related teaching challenges, could help each other to address those challenges more effectively. Regular communication between members, as well as the attitude of teachers about the CoP, played a significant role in its practical operation.

Regular communication between educators in the CoP could enhance effectiveness.

Regular communication between teachers in CoP is particularly important to support those who need help. Therefore, everyone should be conscious of the plans, strategies and the different ways of communication to address his or her needs.

Regular communication between teachers in CoP will allow them the opportunity to ask for assistance about the enhancing of specific skills in theoretical and practical work. [T10]

Although each school situation could differ, the basic principle of the successful operation of a CoP stays the same.

Regular communication is one of how you can enhance better collaboration between teachers, ensuring a strong and established basis at school. From this platform of communication, CoP could develop to include more teachers from other schools. [T07]

Teacher's school-related responsibilities have to be considered.

Participants mentioned that teachers' work-related schedules need to be taken into consideration when planning CoP meetings; therefore, they suggested a once-a-term meeting as a workable approach for a more sustainable CoP.

I preferred these physical get-together sessions as it helped me to communicate better with my colleagues from other schools about subject-related issues. [T01]

I think it will be good if the CoP can happen once a month or it does not have to be once a month, maybe once a term, or maybe a day during a holiday. When and how often it happens, will depend on the teachers' work-related program. [T05]

The physical location of a school plays a role in attendance.

The participants indicated that one of the biggest challenges is to include those teachers who are teaching at schools situated in areas where they have to travel far distances on gravel roads. These gravel roads are often in deplorable conditions.

In our area, teachers sometimes need to travel far distances on gravel roads, which are appalling. This could be one of the factors that influence teachers' attendance of CoP meetings, which could play a key role in its effectiveness. [T10]

The structure has a vital role in a CoP's effective operation.

Participants stated that to increase the effectiveness of the CoP, it needs to include both beginner and experienced teachers, as this difference in the competence level of the participants could be a big advantage to the CoP.

I trust that working together in CoP could work considerably well if the teachers are not at the same knowledge and competence level as this could help with exchanging knowledge and experience in a CoP. [T04]

It must be a diverse group so that the beginner teachers and those teachers like me who have extensive teaching experience, but not necessarily in Natural Sciences could be supported. [T06]

I think that, if you are an experienced Natural Sciences teacher and am unsure about how to teach it effectively, you develop a negative mindset about the subject. This could influence the way you teach Natural Sciences, and it is necessary that we as teachers influence one other positively to maintain a positive mindset. [T09]

The CoP platform could help to improve teachers' interaction.

The CoP is the platform where teachers work together and exchange ideas on how to change existing assessment tasks to make it more proper for their specific learners. These CoP sessions could help those teachers who only have textbook knowledge with approaches to present this work to their learners. Participants mentioned that, if the CoP could include a group of teachers who have different ideas about teaching, it could operate as a hub where rich resources such as questionnaires, assessment tasks, question papers, teaching practices and experiences could be exchanged. As teachers share successful, work-related practices, the collaboration between them could improve, which could ensure everyone reaches and maintains the same level of teaching.

It will be so lovely if you have teachers with whom you can work together and ask for support without feeling insecure. New teachers could benefit a lot from such collaboration between teachers. [T02]

In the CoP, teachers can tap into the other teachers' pool of experience and knowledge. [T03]

By encouraging teachers' commitment and enthusiasm, one can ensure an effective CoP.

Participants said that it is particularly challenging to keep teachers committed to, and enthusiastic about a CoP.

If some teachers are not committed to completing the tasks allocated to them, there is no motivation for the rest to complete the tasks assigned to them in CoP meetings. [T07]

Furthermore, they agreed that supporting the theory, conducting experiments or any other work-related needs of the teachers could be addressed in the CoP.

In conclusion, the effective operation of the CoP is dependent mainly on the commitment of the teachers and the effective communication between them.

Question 6: Considering teachers' busy schedules as well as the far distances they need to travel in rural areas to attend meetings, it is sometimes difficult to arrange physical contact sessions successfully. Can you think of any alternative ways of how these sessions could function more successfully?

All the participants agreed that there is a need for teachers to engage on a regular basis. Although electronic platforms could be used as alternative methods of communication, participants suggested that physical contact sessions still need to take place, because it creates a trustworthy environment in which participants could overcome their emotional incompetence and the stigma of feeling incapable. These physical contact sessions could enhance teachers' understanding of each other's circumstances, which could affect successful co-operation in the group. Successful co-operation could lead to the sharing of good practices among teachers.

There is a need for such gatherings, but there must be specific guidelines to ensure that it does not only consist of informal meetings, but that specific focuses will be addressed at the CoP meetings. [T07]

The main view supported by the participants is that the start and lead-in to a CoP have to be done via physical contact sessions. However, they mentioned that physical contact sessions are not always possible due to justifiable reasons such as teachers' busy working schedules as well as the long distances they need to travel to attend CoP sessions. Therefore, alternative ways of communication in the CoP need to be explored, and once the physical contact sessions have been set up, electronic platforms could be used.

This allows the participating teachers an opportunity to get to know each other and establish those relationships of trust first.

My opinion is that such a face-to-face session once a term is important; from that session, alternative communication via electronic platforms can be arranged. [T05]

A get-together session at the beginning of the year is very important because it will give teachers a chance to meet each other and to exchange contact information. Further communication can then occur through electronic platforms such as WhatsApp groups, e-mail or websites. [T06]

These electronic platforms, which represent alternative ways of communication of the CoP, could occur via WhatsApp groups, e-mail, blogs, and e-portals. It could help in overcoming the problems discussed in the section above, such as teachers' busy working schedules as well as the long distances they need to travel to attend workshops. Another possibility is to progress the CoP to social media platforms in the form of a discussion group where effective practices could be shared among teachers.

You feel more secure because you can exchange information and learn from each other. [T01]

The beginner teachers, who represented 60% of the participants in the study, mentioned that electronic platforms could be an alternative for physical contact sessions. These platforms could be helpful as not all the teachers are experienced with teaching the subject and thus need more sustainable support. Moreover, as beginner teachers tend to be younger of age, they are more likely to use technology and, therefore, this form of communication could be more beneficial to them. The opinions of the 40% who had more teaching experience were divided; some suggested that they feel comfortable with electronic platforms while others indicated the opposite.

The current reality is that not all Natural Sciences teachers in the Vredendal schools area are experienced. Hence, active co-operation among these teachers is essential, so that they could understand the subject they are teaching better. This is important because a significant amount of learning could occur among teachers of different schools, which they then could apply in their specific teaching context.

To overcome the problem of meeting face to face, the use of technology, such as the WhatsApp groups, can be used and, out of my experience, it worked. As everyone in our group had internet access, it helped us to address the issue of travelling long distances to attend sessions. [T01]

For me, because my time is minimal, an informal discussion group via social media could work better. Therefore, social media is the most appropriate form of communication regarding discussing work that you are unsure of, as well as questions from learners of what you do not know the answer. [T05]

The electronic platforms particularly help me to ask for assistance regarding questions of which I do not know the answers, as well as other work-related concerns. Through using these electronic platforms, we as teachers could support each other better. [T10]

However, these electronic platforms could only be successfully implemented at all the rural schools if they all have a secure internet connection.

The problems, which we have in the rural areas, are that many of the schools do not have secure internet or reliable internet connection and this influences the successful communication via an electronic platform. [T10]

To summarise the responses to this question, the participants are notably positive about communication via electronic platforms as the means to accommodate their busy work-related programs. These platforms could address this concern as this form of communication lessens the need for physical contact sessions. However, to use this form of communication optimally, it needs to be managed efficiently. This is dependent on good internet connection and teachers' commitment to collaboration, which relies on the trust that develops between teachers when they engage and interact regularly.

4.4 CoP observations

The physical contact sessions, which represent the intervention in the study, were observed within the CoP context. A discussion of these observations that were captured during the interaction among the participants in the CoP and the feedback of these participants are provided.

4.4.1 Physical contact sessions

The physical contact sessions refer to meetings where the participants got together for specific purposes, which are determined beforehand. These CoP sessions aimed to address the concerns that the participants raised in their questionnaires and interviews. During six consecutive months, ten CoP sessions, including the physical contact sessions with the corresponding activities were conducted, and the information about these sessions are discussed in the section that follows.

The first and second contact sessions were done as a means to produce a better approach to implement the forthcoming CoP sessions successfully. The way the CoP would function was explained to the participants; the discussion in these sessions was interactive, and the participants' feedback was used to plan the program of the following eight sessions. The researcher observed that the participants were hesitant to communicate during the first session, as they were unacquainted with their fellow CoP members and therefore felt uncomfortable in their presence. However, this discomfort gradually disappeared, as they got more familiar with each other.

During the second session, the researcher observed that participants were more enthusiastically involved in the discussion that helped to improve the interaction among the group significantly. The session started with informal conversations where the participants had the opportunity to share their experiences; this was used as an icebreaker to put them at ease. Subsequently, their participation became more active during the group discussions, which were directed by suggestions they had to enhance participation and engagement among each other. These suggestions served as a valuable reference to evaluate the effective operations of the CoP.

In the second session, the participants expounded the possibilities of a CoP as a platform to address the concerns mentioned during the interviews, such as ensuring effective teaching. The participants suggested that to increase the effectiveness of the CoP sessions, teachers of the Further Education and Training Phase, the Senior Phase as well as the Intermediate Phase need to be included. According to these participants, the CoP platform could be used to help those teachers who are qualified, but not trained Natural Sciences teachers to understand the subject better. Therefore, the underqualified Natural Sciences teachers could be supported in the CoP sessions and, as a result, improve their understanding of the theory and the development of practical skills. This is considered vital for them to present experiments or demonstrations in a better manner.

Furthermore, the participants pointed out that a more practical approach to teaching could bring about more effective teaching methods. Underqualified Natural Sciences teachers as well as beginner teachers, both mentioned that they need guidance on how to facilitate practicals for bigger classes specifically. This is especially the case when arranging and managing workstations in the class in a manner that ensures effective teaching. Teachers, who are teaching at schools that have a limited budget, and therefore cannot afford expensive equipment and chemicals, need advice on alternative ways to conduct experiments that are cost-wise.

The participants are of the opinion that a CoP platform could be used to support teachers with teaching strategies that they could use to demonstrate the application of Natural Sciences in real life. Similarly, participants emphasised the role that technology could play to improve effective teaching and the importance a reliable internet connection plays in this regard.

The eight CoP sessions that followed took place during the second term of the school year when the knowledge strand Matter and Materials, as prescribed in the Natural Sciences Senior Phase CAPS curriculum was dealt with. Therefore, this knowledge strand was used as a means to address the concerns discussed in the above section. Different topics and concepts specific to this knowledge strand were used to demonstrate the required corresponding teaching practices.

The information obtained during the CoP sessions three to ten is discussed in the following manner. Firstly, a short background about the focus of the sessions is provided; secondly, the researcher's observations of participants' interaction in the CoP sessions are discussed; thirdly, the feedback from the teachers relating to their experiences of the sessions is provided (translated feedback from Afrikaans to English is included in Addendum L) and, lastly, the researcher's response to address the needs and shortcomings that were observed during the sessions is given.

4.4.2 The focus of CoP sessions

During the CoP sessions, specific topics of the knowledge strand Matter and Materials were discussed, such as properties of materials, various separating mixtures, the periodic table, chemical substances, the particle model of matter, the reaction of metals and non-metals with oxygen, acids, bases and neutrals, the reactions of acids with bases and the reactions of acids with metals, metal oxides and metal carbonates. These topics included the content and concepts as well as the suggested activities as specified by the CAPS document.

The agenda used in each of the CoP sessions was the same; it started with a brief introduction of the activities of the session, which the participants received before the session via e-mail. After that, a detailed discussion of the topic, followed by its related content and concepts as well as corresponding experiments that could improve learners' understanding of the theory. Subsequently, the participants were divided into small groups of three to four each. In these small groups, they planned the strategy for conducting experiments, after that, the execution of experiments followed, which was concluded with an in-depth discussion of the results. This specific approach, which was used for each session, helped to create structure and helped the collaboration among the participants in the CoP. The observations that the researcher as the observer made during the CoP sessions are discussed in the section that follows.

4.4.3 Researcher's observations

The researcher observed that not all the participants had a clear understanding of the content and concepts they needed to know in order to teach the knowledge strand Matter and Materials effectively. Although the underqualified teacher participants had problems specifically with understanding the subject content, the qualified teacher participants also experienced minor problems. The content included the topics density, pressure, chemical substances, chemical bonding, as well as the writing and the balancing of the corresponding chemical equations.

The researcher observed that the collaboration between the participants played a significant role in the successful operation of the CoP. In this specific case, the participants had to overcome their feelings of inadequacy firstly, which had a considerable influence on their participation and engagement in the sessions. As they became more at ease, however, their participation and engagement in the CoP sessions improved. This type of interaction is crucial for the development of practical investigative skills among the participants. These skills included the reading and following of instructions, selecting the most appropriate method for experiments, how to collect the data, how to note the observations of the experiments, the interpretation of these observations, the analysis of the data as well as corresponding interpretations.

The researcher observed that both the experienced (senior and veteran), as well as the beginner teacher participants, were not confident with using the scientific apparatus, which could be a sign that they were not used to conduct experiments alone or with peers in a group. In the group interaction, the participants exchanged ideas about improving their ability to conduct the experiments, and during the interaction, the sharing of knowledge among the experienced teachers as well as the beginner teacher participants occurred.

The beginner teachers participated more actively with the facilitation of the experiments, which suggest that they had more confidence to conduct experiments in a group; or that they are comfortable to conduct experiments in general. This could be a result of their newly acquired skills as they finished their tertiary studies recently. However, the teachers who had extensive teaching experience, apparently had the advantage of required skills to address issues such as class management, especially when conducting experiments or when doing demonstrations. This they shared with the rest of the group.

Lastly, it was clear that only a few of the teachers made use of technology as a teaching aid. During the CoP sessions, teachers needed help with how to integrate different forms of technology as alternative teaching methods, despite their earlier responses in the pre-intervention questionnaire that they are familiar with computer-based instruction technologies.

4.4.4 Participants' feedback

Participants' feedback on sessions three to ten was translated from Afrikaans to English (Addendum L), and a summary of the main ideas is given in the section below.

The participants found the CoP sessions valuable as it introduced various teaching strategies; it equipped them with workable ideas about how to teach the content knowledge more understandably with the use of the corresponding experiments.

The sessions were valuable as it helps me with practical ideas and knowledge about how to present the lessons to the learners in a more interesting and understandable manner. [T01]

Furthermore, the collaborative and interactive nature of the sessions contributed to their positive experience as it promoted the sharing of ideas, skills and knowledge among the participants, which could be useful in the better understanding of the content.

I have learned enormously through the CoP sessions, as it was very interactive and the best for me was the communication among the teachers. [T04]

Participants stated that collaboration, which focused on both passive and active collaboration, enhanced the sharing of knowledge, experiences, ideas, and problems from their teaching context, and helped them to generate viable solutions.

The presentation and content of the CoP sessions were well structured as it was aligned to the CAPS document and the Natural Sciences Senior Phase pacesetter that made it easier for participants to use the material in their class context. Furthermore, the group interactions helped the participants to think of alternative ways to teach the content in order to engage learners actively and to make the content more understandable for them.

I do understand the theory, but not necessarily know what teaching method to teach it in my learners' context. [T10]

Some participants highlighted the importance of proper lesson planning play with the integration of alternative teaching methods, such as technology that included applicable video clips and the interactive whiteboard.

With proper lesson planning, you could effectively integrate the use of technology when it is not possible to demonstrate dangerous experiments to the learners. [T03]

These alternative methods could be used to demonstrate the everyday application of Natural Sciences and specifically the presentation of dangerous experiments, which are not allowed to be conducted in a typical classroom set-up.

Participants acknowledged the fundamental role that practical demonstrations and experiments, play in learners' better understanding of the theory.

The demonstration of the experiments, as well as the showing of the video clips, help to explain this difficult chemistry concept in a much more understandable way to the learners. [T02]

Moreover, participants mentioned that the practical applications of the theory included in the material presented during the CoP sessions facilitated a better understanding of the theory. Therefore, they are better equipped to teach the content with more confidence in their class context.

The participants underlined the possible role that a CoP could play to help underqualified Natural Sciences teachers.

In connection with the CoP sessions, it was shocking to see how teachers are teaching the subjects outside their fields of training and how this lack of experienced, trained Natural Sciences teachers is specifically a problem in the lower grades. [T04]

They acknowledged their need for help to teach theory to their learners in a more understandable manner and confirmed the significant role a CoP could play to refresh and improve their subject content knowledge and pedagogy. Likewise, they stated that all the participants could benefit from the work that was presented in the CoP sessions. Although the CoP sessions were found useful participants still need help with the content and concepts of the knowledge strands Energy and Change, and Earth and Beyond.

I acquired useful ideas regarding how to teach the knowledge as well as to conduct the corresponding experiments more effectively. This helped me, in particular, to focus on more interesting ways to explain or introduce new content and concepts to the learners. [T09]

In conclusion, the participants said that with the beginning of the CoP sessions, it was difficult to work together in the group, since not everyone was on the same level of understanding of the subject content and at that stage, the trust had not been established between the participants. Consequently, their level of participation influenced the success of the group activities, but as the sessions progressed essential relationships between the participating teachers developed and this improved co-operation among each other.

4.4.5 Addressing emerging needs and shortcomings

The researcher focused on the theory and experiments on topics within the knowledge strand Matter and Materials, namely, density, pressure, chemical substances, and the particle model of matter, chemical bonding and the writing of the chemical equations, as the researcher observed that the teachers still struggle with the mentioned topics. In order to help teachers to understand the difficult or challenging topics, content as well as concepts better, more time was given in the CoPs sessions to address these topics.

As all the sessions happened after school, the teachers were tired after a day at school and to address that; the researcher used icebreakers at the beginning of each session. This informal way of starting the sessions had a significant positive influence on the co-operation of the teachers for the duration thereof. To ensure more effective, cooperative learning in the group, the bigger group was divided into smaller groups, which were structured in such a way that it consisted of a combination of experienced, beginner and underqualified Natural Sciences teacher participants. This helped to improve the sharing of knowledge, experience, and skills between the participants. The activities that were given to the teachers during each CoP session focused on enhancing the discussion of topics in the small groups and providing feedback to the bigger group. In this interactive learning process, participants had the opportunity to help each other and learn from one another.

Different forms of technology were integrated during the sessions such as Mimio-interactive technology, the document reader, data projector and the laptop to help teachers make use of technology in the classroom. Built into the CoP sessions were demonstrations of how to make use of internet platforms such as YouTube and Google to present Natural Sciences more visually and therefore more understandable for the learners. In the CoPs sessions, videos were made of the experiments completed and afterwards these were shared electronically with the participating teachers. By doing this, the teachers had the electronic visual support of experiments, which they had conducted in the CoP session with their specific small groups.

Teachers that still needed help were supported by the researcher at their schools in their classroom context. By doing this, the researcher could support them more effectively as their classroom context played a crucial role in the teaching strategies they are using.

4.5 Post-intervention questionnaire

The purpose of the post-intervention questionnaire was to determine the participants' experience after the ten CoP sessions. This is considered helpful to determine whether such a CoP platform could be used to enhance CPTD. The post-intervention questionnaire was constructed in such a way as to determine how the participants' engagement in the completed CoP sessions could help them to develop professionally. In this post-intervention questionnaire, the participants were asked to respond according to a Likert scale. Comparisons were made concerning teacher experience, categorised into beginner, senior and veteran teachers, as well as qualified and underqualified teachers.

4.5.1 The contribution of CoPs to CPTD

Question 1: Indicate to what extent you have participated in the activities organised in the CoP that enhanced your professional development.

Response: One senior participant indicated that he/she had minor participation in the activities organised in the CoP that enhanced his/her professional development (Figure 4.25). Moreover, three beginners and one veteran indicated they had moderate participation. Furthermore, three beginners indicated they had major participation, and lastly one senior and one veteran indicated that they had significantly participated. One qualified participant indicated that he/she had participated in a minor manner. Moreover, three qualified and one underqualified participants participated moderately. Furthermore, two qualified and one underqualified participant indicated major participation while one qualified and one underqualified participant indicated significant participation. In summary, most participants indicated moderate to significant participation in CoP activities.

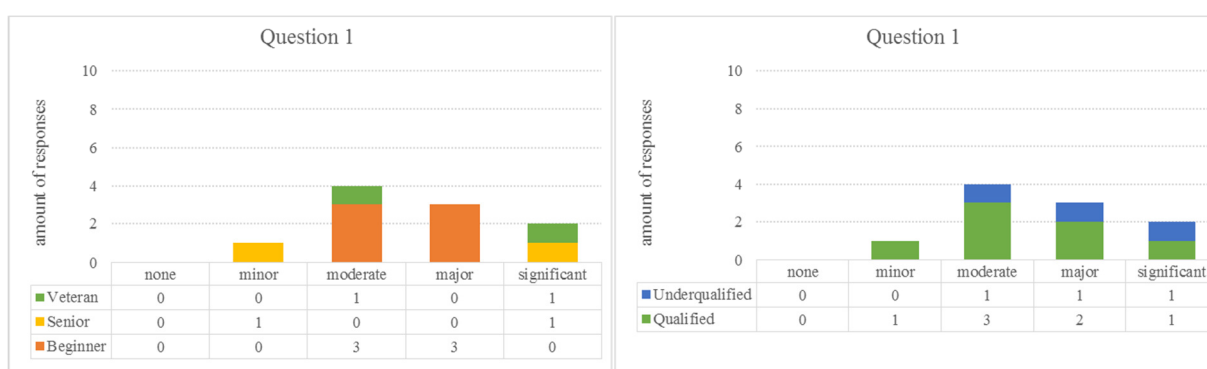


Figure 4.25 Graphic presentation of participants' responses about their participation in the CoP activities.

Question 2: Indicate your experience of your participation in the CoP sessions.

Response: Two beginner, one senior and one veteran participant indicated that they had reasonable experience of CoP participation (Figure 4.26). Four beginners indicated that they had a good experience, while one senior and one veteran indicated excellent experience of their participation in a CoP. Three qualified and one underqualified participants indicated reasonable experience, whereas three qualified and one underqualified participants had a good experience. One qualified and one underqualified participant indicated excellent experience of their participation in a CoP. In summary, most participants indicated a reasonable to excellent experience of their participation in CoP sessions.

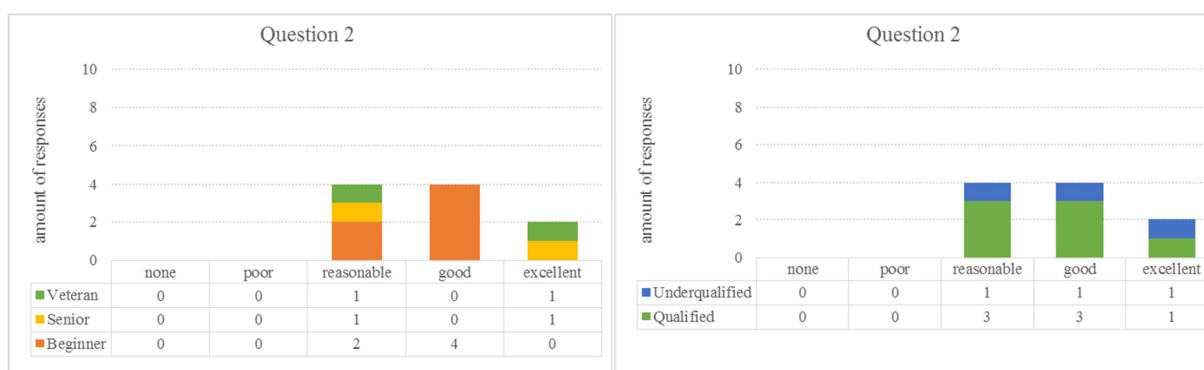


Figure 4.26 Graphic presentation of the responses of participants about their experience of participation in the CoP sessions.

Question 3: Indicate how the support given to the Senior Phase Natural Sciences teachers during the CoP sessions, contributed to your professional development as a teacher?

Response: Two beginners and one senior participant indicated that their participation in a CoP had moderately contributed to their professional development (Figure 4.27). Moreover, two beginners and one veteran participant indicated that their participation in the CoP had majorly contributed to their professional development. Furthermore, two beginners, one senior and one veteran indicated that their participation in the CoP had significantly contributed to their professional development. Two qualified and one underqualified participants indicated that their participation in the CoP had moderately contributed to their professional development, whereas three qualified participants indicated that their participation in the CoP had majorly contributed to their professional development. Furthermore, two qualified and two underqualified participants indicated that their participation in the CoP had significantly contributed to their professional development. In summary, most participants indicated a moderate to the significant contribution of the CoP to their professional development as a teacher.

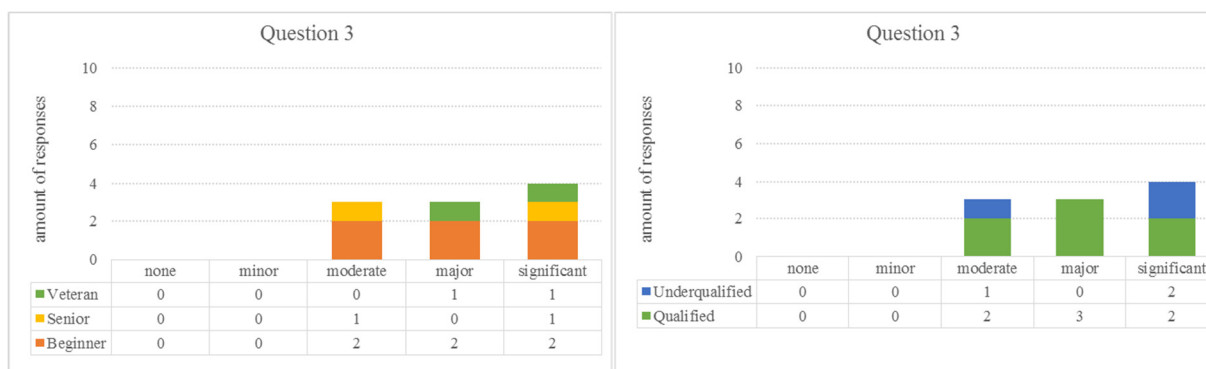


Figure 4.27 Graphic presentation of participants' responses to the contribution of CoP to their professional development as a teacher.

4.5.2 Understanding of knowledge strands

Question 4: Indicate to what extent your participation in the CoP had changed your attitude positively regarding the teaching of Natural Sciences.

Response: One beginner and one senior participant indicated that their participation in the CoP had moderately contributed to changing their attitude positively regarding the teaching of Natural Sciences (Figure 4.28). Three beginner, one senior and two veteran participants, indicated that their participation in the CoP had majorly contributed in changing their attitude positively about the teaching of Natural Sciences, whereas two beginners indicated that their participation in the CoP had significantly contributed in changing their attitude positively about the teaching of Natural Sciences.

Two qualified participants indicated that their participation in the CoP had moderately contributed to changing their attitude positively about the teaching of Natural Sciences. Three qualified and three underqualified participants indicated that their participation in the CoP had majorly contributed to changing their attitude positively about the teaching of Natural Sciences. Furthermore, two qualified participants indicated that their participation in a CoP had significantly contributed to changing their attitude positively about the teaching of Natural Sciences. In summary, most participants indicated a moderate to a significant contribution of a CoP in changing their attitude positively regarding the teaching of Natural Sciences.

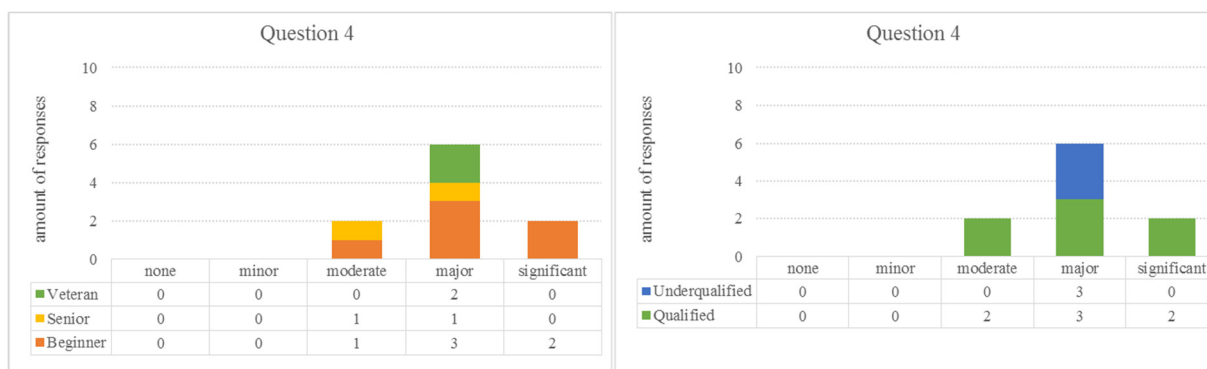


Figure 4.28 Graphic presentation of participants' responses indicating to what extent their participation in the CoP had changed their attitude positively regarding the teaching of Natural Sciences.

Question 5: Indicate to what extent the CoP sessions assisted you in teaching the different Natural Sciences knowledge strands Matter and Materials, Energy and Change, Earth and Beyond, Life and Living better.

Matter and Materials: One beginner participant indicated that his/her participation in the CoP did not assist with the better teaching of the knowledge strand Matter and Materials (Figure 4.29). Furthermore, one veteran indicated his/her participation in the CoP reasonably assisted with the better teaching of the knowledge strand Matter and Materials. Moreover, two beginners and one senior participant showed that their participation in the CoP had majorly assisted with the better teaching of the knowledge strand Matter and Materials. One underqualified participant indicated that his/her participation in a CoP had not assisted with the better teaching of the knowledge strand Matter and Materials.

Furthermore, one qualified participant indicated that his/her participation in the CoP had reasonably assisted with the better teaching of the knowledge strand Matter and Materials. Moreover, two qualified and one underqualified participant indicated that their participation in the CoP had majorly assist, while four qualified and one underqualified participants indicated that the CoP had significantly assisted with the better teaching of the knowledge strand Matter and Materials. In summary, most participants said their participation in the CoP assisted reasonably to significantly with the better teaching of the knowledge strand Matter and Materials.

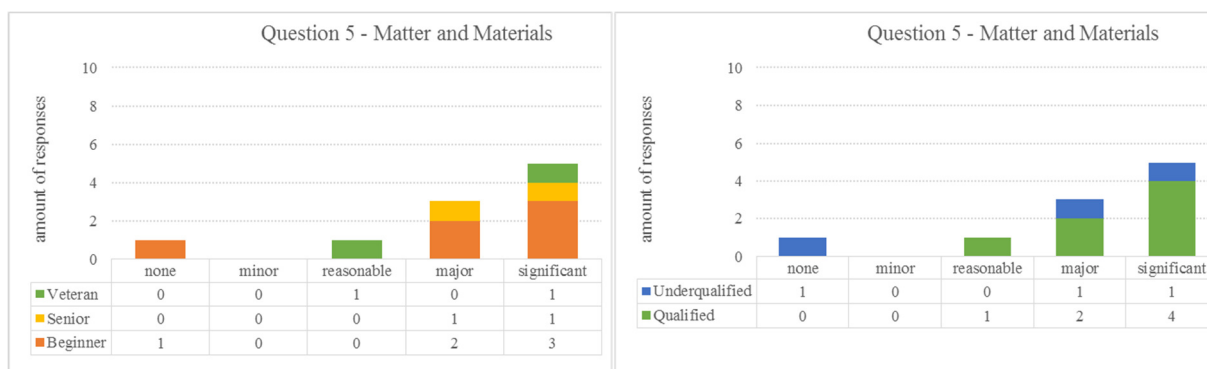


Figure 4.29 Graphic presentation of participants' responses to indicate to what extent the CoP sessions assist them to teach Matter and Materials better.

Energy and Change: One beginner and one veteran participant indicated that their participation in the CoP did not assist with the better teaching of the knowledge strand Energy and Change (Figure 4.30). Furthermore, two senior participants indicated that their participation in the CoP assisted in a minor way. Four beginners and one veteran indicated that their participation in the CoP assisted reasonably. Moreover, one beginner participant showed that his/her participation in the CoP had significantly assisted with the better teaching of the knowledge strand Energy and Change. Two qualified participants indicated that their participation in the CoP had not assisted with the better teaching of this knowledge strand. Furthermore, one qualified and one underqualified participant indicated that their participation in the CoP assisted in a minor manner with the better teaching of the knowledge strand Energy and Change. Moreover, three qualified and two underqualified indicated that their participation in the CoP assisted in a reasonable manner, while one qualified participant said his/her participation in the CoP significantly assisted with the better teaching of the knowledge strand Energy and Change. In summary, most participants said their participation in the CoP assisted reasonably with the better teaching of the knowledge strand Energy and Change.

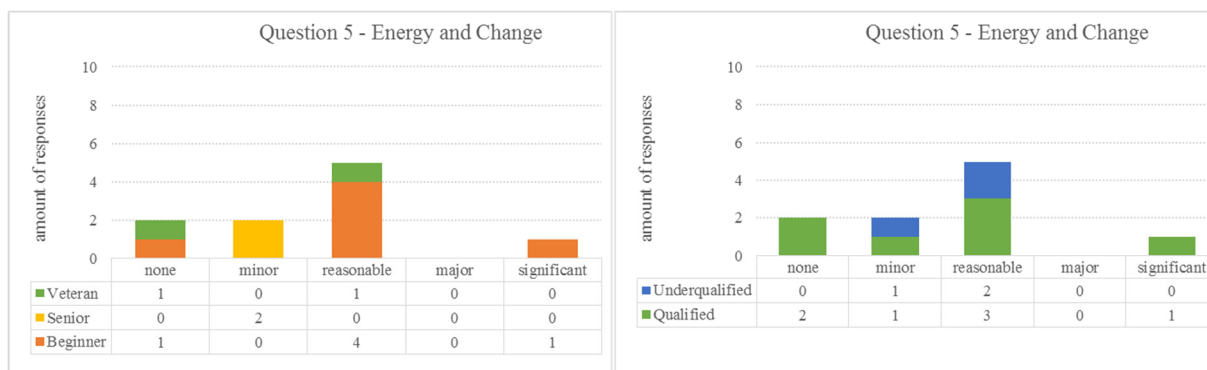


Figure 4.30 Graphic presentation of participants' responses to indicate to what extent the CoP sessions assist them in teaching Energy and changing better.

Earth and Beyond: One beginner, one senior and one veteran participant indicated that their participation in the CoP did not assist with the better teaching of the knowledge strand Earth and Beyond (Figure 4.31). Furthermore, one senior participant and one veteran indicated that their participation in the CoP assisted in a minor way with the better teaching of this knowledge strand. Three beginner participants indicated that their participation in the CoP reasonably assisted with the better teaching of the knowledge strand Earth and Beyond. One beginner participant showed that his/her participation in the CoP assisted majorly, whereas one beginner participant showed that he/she was significantly assisted with the better teaching of this knowledge strand. Three qualified participants indicated that their participation in the CoP did not assist with the better teaching of the knowledge strand Earth and Beyond.

Furthermore, one qualified and one underqualified participant indicated that their participation in the CoP assisted in a minor manner with the better teaching of this knowledge strand. Two qualified and one underqualified participants indicated that their participation in the CoP assisted in a reasonable manner, while one underqualified participant indicated that the participation had a major impact on his/her teaching. Lastly, one qualified participant indicated that the participation in the CoP had significantly assisted with the better teaching of the knowledge strand Earth and Beyond. In summary, most participants said their participation in the CoP had either no effect or a reasonable impact with the better teaching of this knowledge strand.

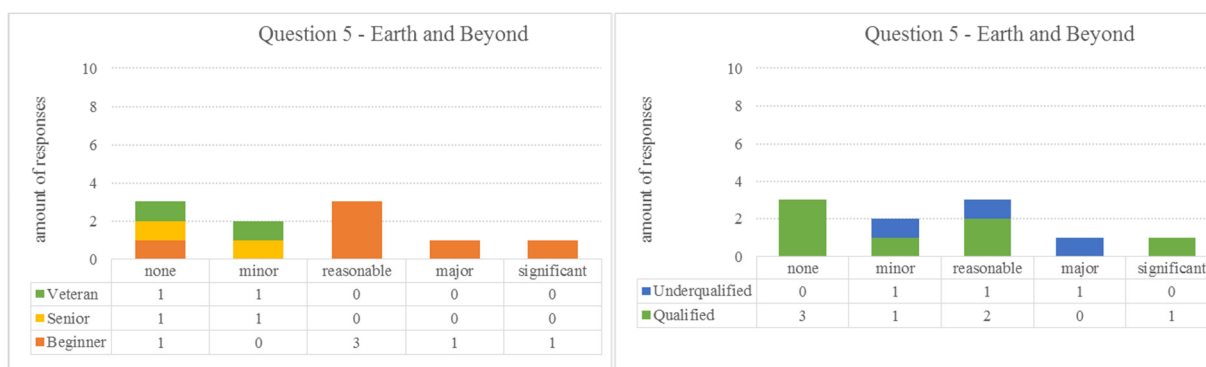


Figure 4.31 Graphic presentation of participants' responses to indicate to what extent the CoP sessions assist them to teach the Earth and Beyond better.

Life and Living: One beginner and one veteran participant indicated that their participation in the CoP did not assist with the better teaching of the knowledge strand Life and Living (Figure 4.32). Furthermore, one senior participant indicated that his/her participation in the CoP assisted in a minor way with the better teaching of this knowledge strand.

Three beginners and one senior participant indicated that their participation in the CoP reasonably assisted with the better teaching of the knowledge strand Life and Living. Moreover, one beginner participant and one veteran showed that the CoP assisted majorly with the better teaching of the knowledge strand Life and Living. Lastly, one beginner participant indicated that the participation in the CoP significantly assisted with the better teaching of this knowledge strand. Two qualified participants indicated that their participation in the CoP did not assist with the better teaching of the knowledge strand Life and Living. Furthermore, one underqualified participant indicated that the participation in the CoP assisted in a minor manner with the better teaching of this knowledge strand.

Moreover, two qualified and two underqualified participants indicated that their participation in the CoP assisted in a reasonable manner, while one underqualified indicated that the participation had a major impact on his/her teaching. Lastly, two qualified participants indicated that the participation in the CoP had a major effect and one qualified participant indicated that the participation in the CoP significantly assisted with the better teaching of this knowledge strand. In summary, most participants said their participation in the CoP had either no effect or a reasonable impact with the better teaching of the knowledge strand Life and Living.

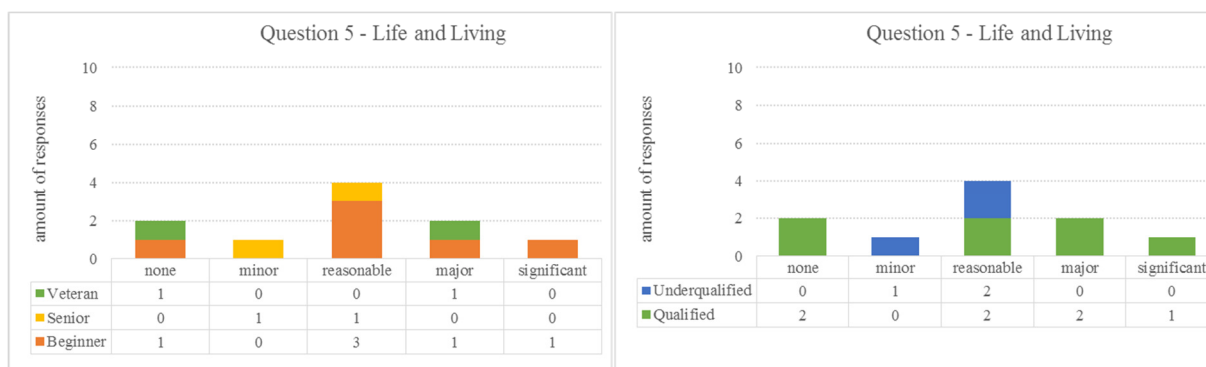


Figure 4.32 Graphic presentation of participants' responses to indicate to what extent the CoP sessions assist them to teach the Life and Living better.

4.5.3 Subject content knowledge

Question 6: Indicate to what extent your participation in the CoP helped you to teach Natural Sciences, more relevantly.

Response: Three beginners and one senior indicated that their participation in the CoP helped them reasonably to teach the subject more relevantly (Figure 4.33). One beginner and one veteran said that their participation in the CoP assisted in a reasonable way.

Two beginners, one senior and one veteran participant indicated that their participation in the CoP helped them significantly to teach the subject more relevantly. Three qualified and one underqualified participants said that their participation in the CoP assisted in a reasonable way while one qualified and one underqualified participant indicated that the participation in the CoP assisted in a major manner to teach the subject more relevantly. Three qualified and one underqualified participants indicated that their participation in the CoP assisted in a significant manner to teach the subject more relevantly. In summary, most participants said their participation in the CoP assisted them reasonably in teaching the subject more relevantly.

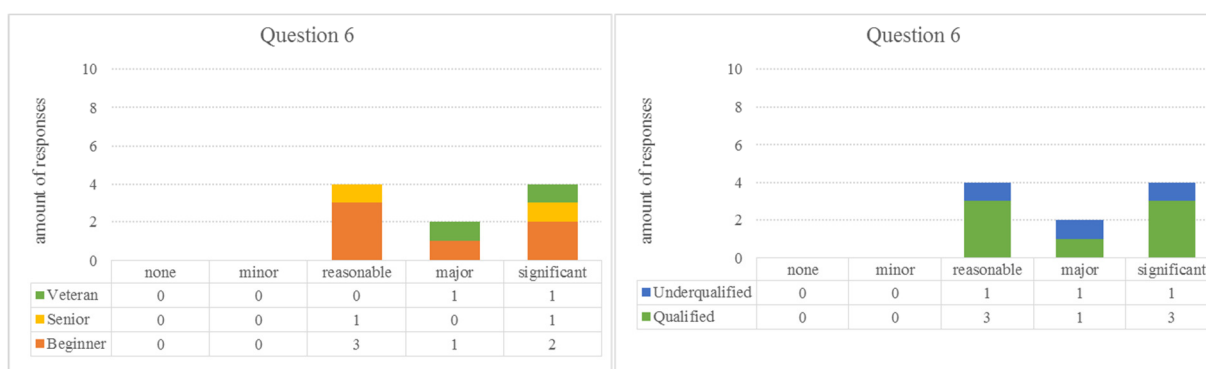


Figure 4.33 Graphic presentation participants' responses to how a CoP had helped them to teach Natural Sciences, more relevantly.

Question 7: Indicate to what extent the CoP helped you to teach the theory, which you have a clear understanding of, effectively and in a more understandable manner to the learners.

Response: Three beginners, one senior and one veteran participant indicated that their participation in the CoP helped them reasonably to teach the theory, which they have a clear understanding of, effectively and in a more understandable manner to the learners (Figure 4.34). Furthermore, one veteran participant indicated that his/her participation in the CoP assisted in a major manner to teach the theory, which he/she had a clear understanding of, effectively and in a more understandable manner to the learners. Lastly, three beginners and one senior participant indicated that their participation in the CoP helped them significantly to teach the theory, which they had a clear understanding of, effectively and in a more understandable manner to the learners. Three qualified and two underqualified participants indicated that their participation in a CoP assisted in a reasonable way to teach the theory, which they had a clear understanding of, effectively and in a more understandable manner to the learners. Furthermore, one qualified participant indicated that the participation in the CoP assisted in a major manner to teach the theory, which they had a clear understanding of, effectively and in a more understandable manner to the learners.

Moreover, three qualified and one underqualified participants indicated that their participation in the CoP assisted in a significant manner to teach Natural Sciences, more relevantly. In summary, most participants said their participation in the CoP had assisted them reasonably in teaching the theory to the learners significantly, effectively and in a more understandable manner.

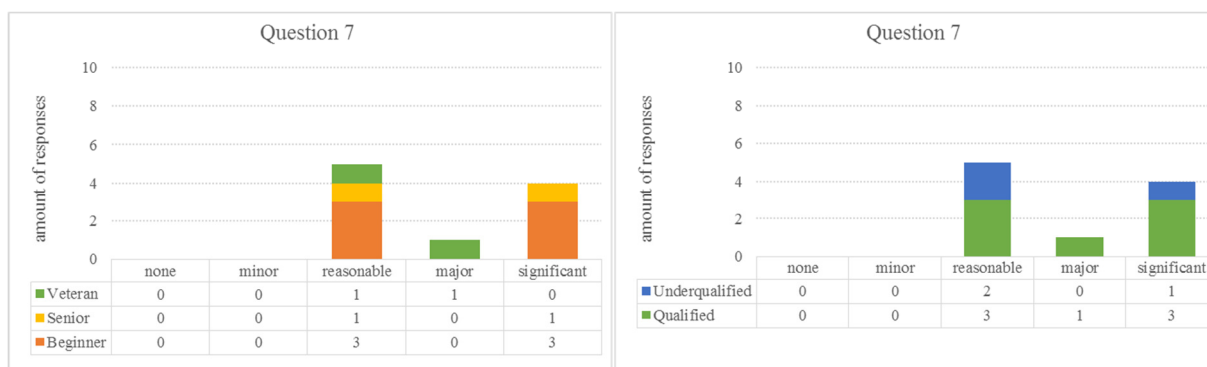


Figure 4.34 Graphic presentation of the responses of how a CoP had help participants to teach Natural Sciences, effectively and in a more understandable manner to the learners.

Question 8: Indicate to what extent your participation in the CoP helped to improve your skills to conduct Natural Sciences demonstrations.

Response: One beginner and one veteran participant indicated that their participation in the CoP assisted them reasonably to improve their skills to conduct Natural Sciences demonstrations (Figure 4.35). Furthermore, two beginners and one senior participant indicated that their participation in the CoP assisted in a major manner to improve their skills to conduct Natural Sciences demonstrations. Lastly, three beginner, one senior and one veteran participant indicated that their participation in the CoP helped them significantly to improve their skills to conduct Natural Sciences demonstrations. One qualified and one underqualified participant indicated that their participation in the CoP assisted in a reasonable way to improve their skills to conduct Natural Sciences demonstrations.

Furthermore, two qualified and one underqualified participant indicated that their participation in the CoP assisted in a major manner to improve their skills to conduct Natural Sciences demonstrations. Moreover, four qualified and one underqualified participants indicated that their participation in the CoP assisted in a significant manner to improve their skills to conduct Natural Sciences demonstrations. In summary, most participants said their participation in the CoP assisted them reasonably to significantly in improving their skills to conduct Natural Sciences demonstrations.

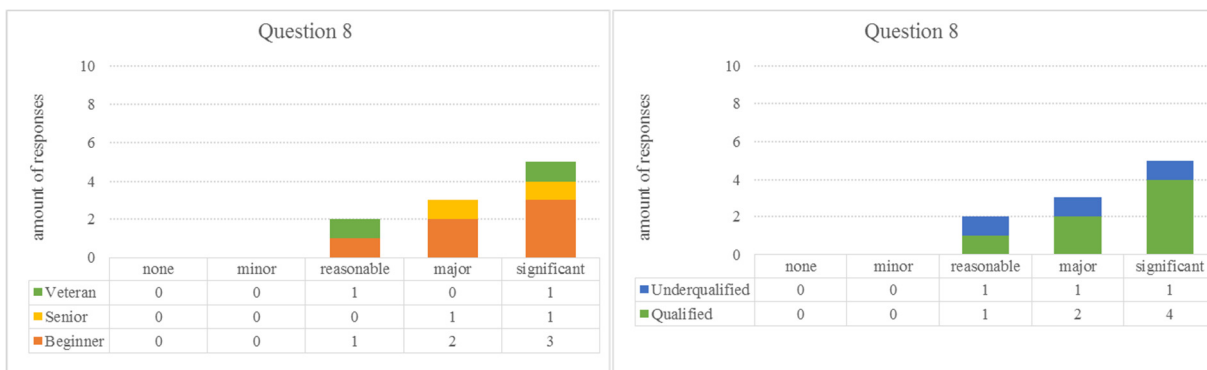


Figure 4.35 Graphic presentation of the responses of how a CoP helped to improve participants’ skills to conduct Natural Sciences demonstrations.

Question 9: Indicate how your participation in the CoP helps you to conduct practical work better.

Response: One beginner participant indicated that his/her participation in the CoP assisted reasonably in conducting practical work better (Figure 4.36). Furthermore, two beginners, one senior and one veteran participant indicated that their participation in the CoP assisted in a major manner to improve their skills to conduct practical work better. Lastly, three beginner, one senior and one veteran participants indicated that their participation in the CoP helped them significantly to improve their skills to conduct practical work better. One underqualified participant indicated that his/her participation to a CoP assisted in a reasonable way to improve his/her skills to conduct practical work better. Furthermore, three qualified and one underqualified participants indicated that their participation in the CoP assisted in a major manner to better conduct practical work. Moreover, four qualified and one underqualified participants indicated that their participation in the CoP assisted in a significant manner to better conduct practical work. In summary, most participants said their participation in the CoP had reasonable to significant impact on them improving their skills to conduct practical work better.

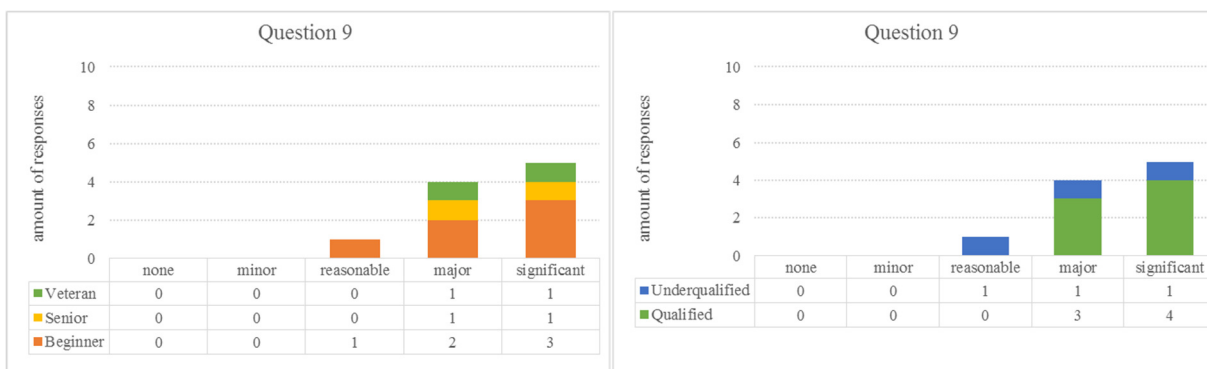


Figure 4.36 Graphic presentation of the responses of how a CoP helped to conduct Natural Sciences practical work.

Question 10: Indicate how your level of professional development had been improved through your participation to the CoP.

Response: One beginner and one senior participant indicated that their participation in the CoP assisted reasonably to improve their level of professional development (Figure 4.37). Furthermore, three beginner, one senior and two veteran participants indicated that their participation in the CoP had assisted in a major manner to improve their level of professional development. Lastly, two beginner participants indicated that their participation in the CoP helped them significantly to improve their level of professional development. Two qualified participants indicated that their participation in the CoP assisted in a reasonable way to improve their level of professional development. Furthermore, qualified and three underqualified participants indicated that their participation in the CoP had assisted in a major manner to improve their level of professional development. Moreover, two qualified participants indicated that their participation in the CoP assisted in a significant manner to improve their level of professional development. In summary, most participants said their participation in the CoP assisted reasonably to significantly in improving their level of professional development.

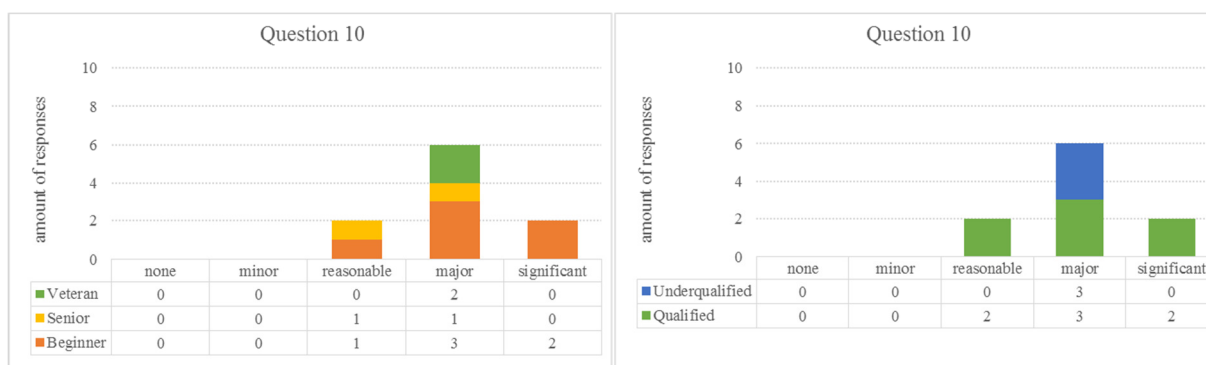


Figure 4.37 Graphic presentation of the responses of how a CoP had helped to improve participants' professional development.

4.5.4 Aspects of an effective CoP

Question 11: In your opinion, what are the most important factors that influenced the successful operation of the CoP?

Response: The participants' responded very well to this question, and valuable information was given about the factors that influence the effective operation of a CoP. The information obtained from the participants was translated from Afrikaans to English, and the transcriptions are in (Addendum L). The discussion of the main themes named is given in the section that follows.

Many participants are of the opinion that for a CoP to be successful, it has to address teacher-related needs. Therefore, thorough planning is needed to address those needs effectively during the CoP sessions. They suggested that a practical hands-on approach, inclusive of different CAPS-related experiments, could contribute significantly to the success of a CoP.

In our case, the hands-on practical sessions, which included different CAPS-related experiments made the sessions very successful. [T02]

Also, most participants are adamant that a CoP should exemplify a culture of learning, where teacher members feel comfortable and confident to share best practices, their strengths, their weaknesses about subject content knowledge as well as the conducting practical work. It is essential that CoP members are encouraged and kept accountable to participate in the activities in order to genuinely take ownership of the CoP. Thus, a sense of shared responsibility needs to develop.

It is important to create a culture of learning where everyone shares the responsibilities towards the group. [T06]

Furthermore, it is essential that CoP members feel comfortable to ask questions if they do not understand or if they need help. Equally important is to provide opportunities for feedback or reflection after each CoP session.

Feedback or reflection after each CoP session is very important, which included explanations why we were using specific procedures in a specific manner. [T08]

Furthermore, the establishment of trustworthy relationships during CoP sessions is paramount to help with better collaboration outside of the CoP in future. The participants indicated that the effective management of a CoP would be an excellent way to engage all the participants as time management is a significant challenge for them.

Effective planning of the activities for the CoP sessions plays an important role in the successful implementation of a CoP. [T07]

4.5.5 Overview

Most of the participants expressed a positive experience with the CoP interactions, saying that it changed their attitude to teach Natural Sciences more effectively, and it appreciably aided their professional development. There is a consensus among participants that the CoP sessions were helpful in better understanding and teaching of the knowledge strand Matter and Materials, which was actively supported in alignment with the WCED's work plan.

Similar positive responses were received by most of the participants, stating that the CoP intervention contributed by helping them to teach Natural Sciences theory more relevant to real-life situations. Participants stated that the CoP increased their skill level to conduct demonstrations and practicals more confidently.

The main factors linked to the successful operation of a CoP were identified. Participants indicated for a CoP to function effectively it has to address the work-related needs of teachers foremost, with a specific focus on practical hands-on approaches. Emphasis was also placed on the notion that a teacher CoP stands for a learning platform fundamentally, where collaboration is encouraged, and best practices are shared within a safe and comfortable setting. Other critical success factors refer to the early establishment of trust relationships among the membership, a call for collective ownership and accountability stemming from shared responsibilities, providing opportunities for feedback and reflection, and attending to effective time management.

4.6 Primary themes

This chapter aims to distil the findings and draw interpretations from the assimilated data gathered from pre- and post-intervention questionnaires, individual, semi-structured, face-to-face interviews and CoP observations recorded by teacher participants and the researcher as an observer-participant using coding strategies followed by thematic data analysis.

4.6.1 Methodology

Firstly, a pre-intervention questionnaire was used to determine the participants' current level of understanding and their needs relating to the general Natural Sciences subject content and specifically the prescribed CAPS knowledge strands, and previous experience of integrated aspects of CPTD and teacher CoPs. The pre-intervention questionnaire included 21 questions (Table 4-1), distributed into seven pre-determined categories, and provided participants' the opportunity to comment freely at the end.

Data collected from the pre-intervention questionnaires were used to formulate six interview questions split into two pre-determined categories dealing with 1) barriers and enablers to effective Natural Sciences teaching, and 2) the participants' views about teacher CoPs. Interviews aimed to follow up, and elaborate on participants' responses to the pre-intervention questionnaire, allowing more in-depth discussions about their responses.

Table 4-1. Pre-determined categories for pre- and post-intervention questionnaires, and interviews with the numbers of questions in each category.

Pre-determined category	Pre-intervention questionnaire	Post-intervention questionnaire	Interviews
1. Understanding of knowledge strands	2	5	-
2. Subject content knowledge	4	4	-
3. The contribution of CoPs to CPTD	4	3	-
4. Principles and aspects of an effective CoP	7	1	-
5. Use of computer-based technology	1	-	-
6. External CPTD support	2	-	-
7. Teacher collaboration	1	-	-
8. Barriers and enablers to effective science teaching	-	-	3
9. Views about CoPs	-	-	3

Subsequent CoP sessions aimed to address the concerns that the participants raised in their questionnaires and interviews. The CAPS prescribed knowledge strand Matter and Materials is utilised to address the concerns the participants highlighted previously. The observations from the CoP sessions were divided into four pre-determined categories, namely 1) the focus of the CoP sessions, 2) the researcher's observations of the participants' engagement and participation, 3) the participants' feedback on their experience with the CoP interactions, and 4) the response of the researcher to address the remaining needs of the participants. CoP observations were captured in the participants' diaries, and the researcher's field notes and reflective journal.

Primary data gathering concluded with the completion of a post-intervention questionnaire. In a typical "before-after" evaluation, the purpose of the post-intervention questionnaire was to establish the impact of the CoP sessions on the participants' subject content knowledge, and their newly acquired experience relating to integrated aspects of CPTD and teacher CoPs. The post-intervention questionnaire contained 13 questions, aligned to four of the pre-determined categories from the pre-intervention questionnaire (Table 4-1). The data of the pre- and post-intervention questionnaires are summarised in Figure 4.38.

In this study, the researcher used the Likert scale as a distinctive touch to depict how the experiences or feedback of the participants changed before and after they participated in the intervention.

Heiberger and Robbins (2014) documented powerful ways to visualise Likert data, which are suitably applicable to evaluate the impact of interventions, in a pre-intervention and post-intervention approach. Their “diverging stacked bar chart” (Heiberger & Robbins, 2014:29) was applied to the corresponding 12 pre- and post-intervention questionnaire responses from the ten CoP participants (Figure 4.38), and the findings are discussed later.

In the following step the nine pre-determined categories were reduced to three final categories, namely 1) effective Natural Sciences teaching, 2) effective teacher CoP functionality and 3) the impact of the CoP intervention. These final categories were separated into subcategories referring to barriers, enablers, initiatives and corrective actions (Figure 4.39, Figure 4.40). Using thematic analysis, several emerging themes developed from these subcategories, which are presented top to bottom in order of decreasing significance. For example, referring to “Effective Natural Sciences teaching”, “Lack of teacher competence” is declared the most important emerging theme underneath the subcategory “Barriers” (Figure 4.39).

The emerging themes were condensed into three primary themes, namely, 1) gaps in subject content knowledge, 2) lack of pedagogical skills, and 3) potential of the CoP intervention.

4.6.2 Gaps in subject content knowledge

All the participants, regardless of teacher experience, or qualification, indicated that they have a clear understanding of the knowledge strand Matter and Materials. However, the interviews and observations revealed that they need help to understand the content to teach it effectively clearly. It seems the underqualified participants by distinction experienced more problems with the understanding of the knowledge strand Matter and Materials compared to the qualified Natural Sciences teacher participants.

Underqualified Natural Sciences teachers are still one of the major concerns in rural school districts such as Vredendal, where teachers are expected to teach multiple subjects, regardless of their qualifications. Consequently, Natural Sciences is neglected as it is not a priority for the teachers because they are not knowledgeable about the subject content or they lack the confidence to teach the subject in a more motivating and creative manner.

Figure 4.38 shows that the CoP intervention improved the teacher participants’ subject content knowledge of all four knowledge strands, but notably more so for Matter and Materials, presumably because it was practically dealt with during the CoP sessions.

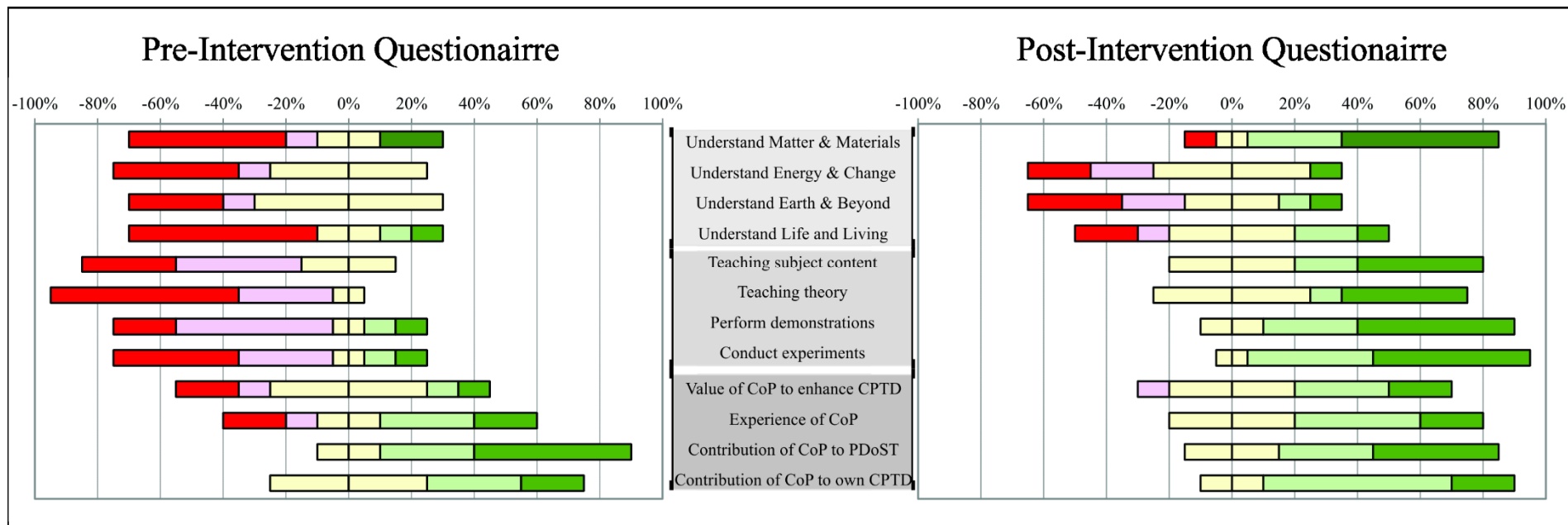
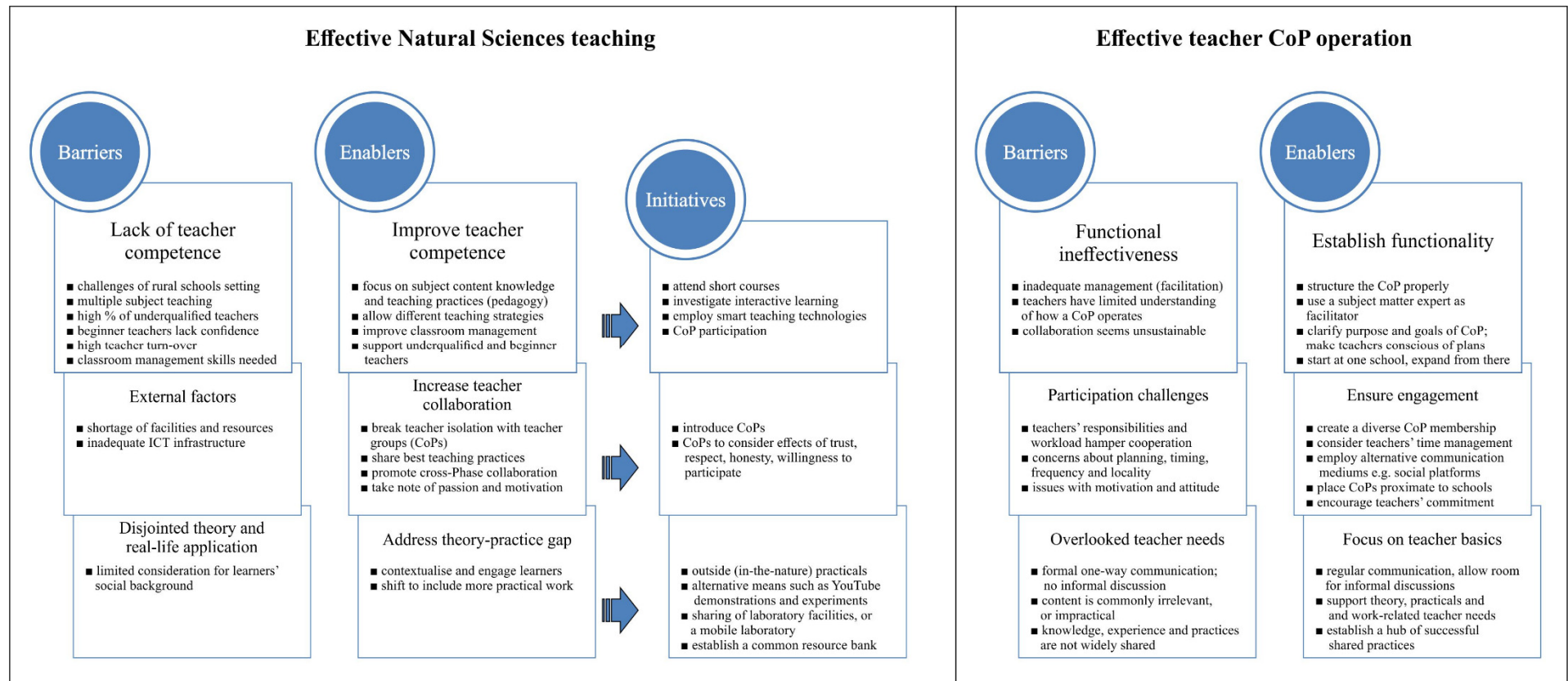


Figure 4.38 Graphic presentation of corresponding pre-intervention questionnaire and post-intervention questionnaire responses. Red indicates a strong negative response, pink a moderately negative response, yellow a neutral response, light green a moderately positive response and dark green a strong positive response.



Impact of the CoP intervention

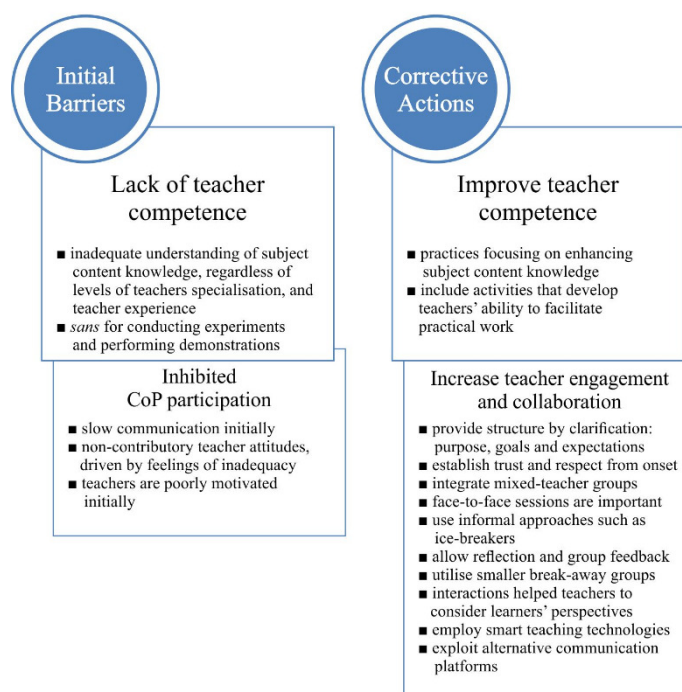


Figure 4.40 Emerging themes developed from the CoP observations related to the initial barriers and corrective actions.

4.6.3 Lack of pedagogical skills

Participants mentioned that they do not have serious issues to teach the subject content relevantly, convey the theory clearly, perform demonstrations and facilitate practicals, but the findings indicate otherwise. All the teacher participants, especially the underqualified teachers found the pedagogical aspects problematic. Initially, all participants displayed poor skills and lacked the confidence to perform experiments or demonstrations, and they seemed unfamiliar with applying Natural Sciences theory in real life of learners. Most participants were uncomfortable using the scientific apparatus at the beginning, which could be a sign that they were not used to conduct experiments alone or with peers in a group.

When the researcher prompted the participants about the discrepancy between the reality and their beliefs, they agreed that they are not adequately equipped to teach the subject, and need support with strategies to teach the content better. Beginner teachers, by comparison, expressed a greater need to improve their pedagogical skills.

Figure 4.38 indicates that the CoP intervention had the most impact on improving the pedagogical skills of the teacher participants, with specific attention pointed to the methods of teaching theory and demonstrating experimental work and conducting experiments.

During the CoP sessions, beginner teachers participated more actively with the facilitation of the experiments, while the more experienced teachers were prominent with their acquired class management skills. Beginner and experienced teacher participants derived value from sharing knowledge during their CoP interactions.

4.6.4 Potential of the CoP intervention

Few of the participants had previous experience of participating in CoPs by original definition *per se*, but the majority of them have had exposure to equivalent “teacher groups” that resulted in constructive involvement. However, even before the CoP intervention started, participating teachers all acknowledged the vital role that a teacher CoP could play in their professional development, considering a CoP to be an effective CPTD platform. In support, Figure 4.38 indicates that participants display a greater appreciation of the potential value and contribution of a CoP to their professional development after the CoP intervention.

There is overall agreement among participants that the CoP sessions were helpful in the better understanding and teaching of the knowledge strand Matter and Materials and to a lesser extent the other CAPS knowledge strands (Figure 4.38.) Overall, participants consider the CoP intervention a valued contributor in helping them to teach Natural Sciences theory more relevant to real life situations, and increasing their skill level to conduct demonstrations and practicals more confidently.

Noteworthy responses about the factors that could influence the effective operation and sustainability of a CoP were received from the participants. Participants are unequivocal in their views that for a CoP to function effectively it has to address the work-related needs of teachers principally. Equally, participants feel strongly that a teacher CoP represents a learning platform fundamentally, where collaboration is encouraged, and best practices are shared within a safe and comfortable setting.

Collaboration between the participants played a significant role in the successful operation of the CoP. Since not every teacher was on the same level of understanding of the subject content initially, a key barrier like trust restricted this co-operation, but as the sessions progressed a beneficial trust relationship developed between the participating teachers. This particular barrier had a significant influence on the co-operation among teachers; hence, these relationship dynamics need to be managed more effectively for the CoP to function successfully. Other critical success factors mentioned, refer to expectations of collective ownership and accountability stemming from shared membership responsibilities, feedback and reflection opportunities, and effective time management due to the demanding workload of teachers.

4.7 Conclusion

This chapter delivers the processed data, originally collected from pre- and post-intervention questionnaires, interviews and observations. The data were assimilated, iteratively coded and categorised, and subsequently, the thematic data analysis produced several emerging themes, which were condensed into three primary themes: gaps in subject content knowledge, lack of pedagogical skills and the potential of the CoP intervention.

Nearly all teacher participants, especially the beginner and underqualified teachers admitted that they are not adequately equipped to teach the CAPS related Senior Phase Natural Sciences knowledge strands effectively and required help to understand the relevant theory better and to teach it about everyday life. Initially, most participants also found it challenging to perform Natural Sciences demonstrations, practical work and experiments.

Participants agree that the CoP sessions helped to improve their understanding of all four knowledge strands, specifically Matter and Materials, probably because the latter was practically dealt with. The CoP intervention distinctly augmented the participants' teaching practices in this context. Participants in particular value the contributions of the CoP in assisting them to teach Natural Sciences theory more relevant to real life situations, and increasing their skill level to conduct demonstrations and practical work more confidently.

Participants highlighted the factors that could influence the effective operation of a teacher CoP. They are solitary in their views that for a CoP to function effectively it has to address the work-related needs of teachers principally. Participants are convinced that a teacher CoP stands for a learning platform fundamentally, where collaboration is encouraged, respectful, professional relationships are developed, and best practices are shared within a safe and comfortable setting. Other critical success factors mentioned, refer to expectations of collective ownership and accountability stemming from shared membership responsibilities, feedback and reflection opportunities, and consideration for the demanding workload of teachers.

The next chapter converges all the interim interpretations into summary findings to answer the research questions.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

This chapter construes the study by giving a summary of the motivation, research design, a discussion of the findings, self-reflection, limitations of the study, recommendations for future work and conclusions.

5.1 Introduction

In South Africa, the Department of Basic Education has duly acknowledged the relationship between teacher competence and learner performance (Koekemoer & Olivier, 2002:43; Randall, 2008:37; Kriek & Grayson, 2009:185; Steyn, 2010a:212; Geldenhuys & Oosthuizen, 2015), and in response has been pursuing global educational reform strategies that concentrate on continuing professional teacher development (CPTD). During the past decade, the DBE launched numerous initiatives in support of its CPTD objectives, such as a renewed focus on teacher competence under the umbrella of the National Policy Framework for Teacher Education and Development (DoE, 2007), the introduction of the Curriculum Assessment Policy Statement (CAPS; DBE, 2010), and most recently the rollout of the concept of Professional Learning Communities (PLCs; DBE, 2015).

The rationale from the researcher's point of view as an involved community teacher-facilitator and researcher to conduct this study was conversed in section 1.4 and expresses both the researcher's concern and passion for the development of Natural Sciences education, specifically in the context of the rural school district of Vredendal. This passion prompted the researcher to study the possibilities of a CoP for teachers, a relatively contemporary construct in South Africa. This dissident approach could potentially help to address CPTD concerns relating to Senior Phase Natural Sciences teachers. It is envisaged that the research findings of this study, although localised, could help to expand a developing knowledge base related to teacher development and teacher CoPs, in South Africa and abroad.

The study was steered by the main research question that explores the possibilities of a CoP approach to support the professional development of Natural Sciences teachers from the rural school district of Vredendal. Three sub-questions were derived from the main research question; firstly, considering the ways a CoP can contribute to the professional development of Natural Sciences teachers within the NPFTED.

Secondly, how a CoP can assist in facilitating the professional development of Natural Sciences teachers, and lastly, what principles and aspects can influence the effective operation of a CoP.

A constructivist ontology was found appropriate for investigating the CoP phenomenon as a potential platform to facilitate CPTD in this specific context. Subsequently, the researcher chose the lens of an interpretivist epistemology to address the research questions of this study as it relates to the richness and depth of data, generated from the teacher participants, making sense of their world with social interactions. This study is grounded in the theoretical framework of Wenger's (1998) original CoP model, but it also draws integrity from acknowledged teacher development models and selected South African education policies and guidelines. During a literature review in the earlier research process, it was established that teacher CoPs offer a useful alternative mechanism to traditional approaches for engaging CPTD effectively, and it also conforms to NPFTED objectives of cultivating teacher autonomy and teacher collaboration. The essence of educational legislation in South Africa was discussed, followed by a motivation why teacher CoPs have enticing merits to address the challenges of rural education.

A detailed discussion was presented explaining the appropriateness of a multi-method qualitative case study to investigate and answer the research questions. Explicit to this study is a specific group of Natural Sciences teachers from the rural school district of Vredendal being the case or the equivalent term "community" as per Wenger's (1998) theoretical framework. For a similar reason, CPTD represents the context or "domain". Different data collection methods, such as questionnaires, interviews, participant observations, field notes, participants' diaries and a researcher's reflective journal were utilised to obtain information. The construct of rigour was applied to ensure that the teacher participants' experiences reflect the study accurately, hence ensuring the quality, or integrity of the research design. Fair consideration and compliance are given to the ethical aspects of this study.

After the assimilated data were iteratively coded and categorised, the thematic data analysis produced several emerging themes, which were condensed into three primary themes in support of interim interpretations.

5.2 Findings

In answering the research questions, the researcher chose to construct three concluding themes from the key topics that surfaced from the literature review in conjunction with the various emerging and primary themes developed from extensive analysis of the multi-source research data. The three concluding themes, namely the professional identity of teachers, possibilities of a CoP to facilitate CPTD, and aspects of an effective CoP are discussed below.

5.2.1 Professional identity of teachers

Subquestion 1: In what ways can a community of practice contribute to the professional development of Natural Sciences teachers within the National Policy Framework for Teacher Education and Development in South Africa (NPFTED)?

The professional identity of teachers, which is formed by their attitudes, beliefs, competences and values (Avalos, 2011:10; Dharsey, 2015:114), forms a crucial aspect in their ability to teach with confidence and it plays a significant role in their professional development (Körkkö et al., 2016:199). This construct is considered key to their motivation and effectiveness, and the first few years in beginner teachers' careers are foundational to the development of their professional identity (Samuel, 2009:138; Izadinia, 2012:709; Williams et al., 2012:248; Mukeredzi, 2013:8; Mushayikwa, 2013:283; Samson, 2013:154; Nel, 2015:46; Robberts, 2017:117).

In South Africa, the professional identity of a teacher is defined and documented in the authoritative Norms and Standards for Educators (DoE, 2000), an underpinning of the NPFTED, which requires a teacher to assume extended roles and competences in their teaching duties. These competences refer to subject content knowledge and teaching practices (pedagogy): “teaching of primary science focuses in particular on support in the form of professional development, improving teacher confidence, science content knowledge, pedagogical content knowledge and instructional practice” (Smith, 2014:217).

Considering the compacted role that a teacher needs to fulfil, teachers have to acquire instructive, reflexive and collaborative competences in order to develop their professional identity in compliance with the NPFTED. A CoP presents a conducive platform to help build these required competences, and by doing so could support the development of a teacher's professional identity (Hofman & Dijkstra, 2010:1032; Simon et al., 2011:7; Brody & Hadar, 2015:248; Sobkin & Adamchuk, 2015; Admiraal et al., 2016:283). Therefore, to facilitate the professional development of teachers effectively, their professional identity needs to be considered primarily.

Commendably, participants in this study themselves admit that they are key role players in changing their attitudes about their professional development. Participants said that teachers need to become more enthusiastic or passionate about the subject and they need to acknowledge the importance of continuing professional development in their career.

If you as a teacher are not passionate about the subject, it influences the way you are teaching it. [T07]

Participants acknowledged that Natural Sciences teachers must be knowledgeable about the subject content and equipped with the necessary pedagogy. They were very articulate about teachers needing to make use of more creative pedagogical skills to teach Natural Sciences theory about everyday life but considering the learners' social background.

Learners need to experience the everyday application of the subject content; they need to be able to follow instructions and conduct experiments without the support of a teacher. [T04]

It was mentioned that underqualified and beginner teachers are especially vulnerable in this regard.

Beginner teachers or teachers who are not trained to teach Natural Sciences teachers lack the confidence to perform experiments or demonstrations. They also lack the skill to manage their learners while doing experiments, which then result in chaos. [T08]

Most teacher participants, especially the beginner teachers admitted that they are not adequately equipped to teach the CAPS related subject content effectively and expressed a need to understand the theory better and to teach Natural Sciences theory about everyday life. Initially, participants found it challenging to convey the relevant subject matter content in a clear and understandable manner so that the learners develop a better understanding of the content, concepts and principles of Natural Sciences. Consequently, the participants required help with understanding the subject content and the pedagogy of all four the CAPS related Senior Phase Natural Sciences knowledge strands. There are also clear indications that the participants found it problematic to perform Natural Sciences demonstrations and practicals.

As reflected in the composition of the study group, the current reality is that a meaningful proportion of the Natural Sciences teachers in the Vredendal schools district are classified beginner or underqualified teachers. A platform such as a CoP is ideal to help teachers acquire the necessary skills to develop into competent Natural Sciences teachers, assuming that formal training is needed for an accredited qualification.

Most participants found the CoP interactions useful, stating that it changed their attitude to teach Natural Sciences more effectively, and together with the support they got from the management teams of their schools, helped them to engage effectively in the practices of the CoP.

I have learned enormously through the CoP sessions, as it was very interactive and the best for me was the communication among the teachers. [T04]

There is general agreement among participants that the CoP was meaningful to help them better understand and teach the CAPS related knowledge strand Matter and Materials, which was actively supported in alignment with the WCED's work plan. The specific practices of the CoP, including hands-on practical sessions that included different CAPS-related experiments, made the sessions productive. Participants mentioned that the content of the CoP sessions was well structured and correspondingly the CAPS document links well with the topics that they were busy in class and with a few adjustments to the work presented in the sessions, they could use the activities in their school context.

Encouragingly the CoP intervention had a significant impact on improving the pedagogical skills of the teacher participants concerning the methods of teaching theory and demonstrating experimental work and conducting experiments (Figure 4.38). During the CoP sessions, beginner teachers participated more actively with the facilitation of the experiments, whereas the more experienced teachers were prominent with their acquired class management skills. Beginner and experienced teacher participants derived value from sharing knowledge during their CoP interactions.

Most of the participants noted that the CoP contributed by helping them to teach Natural Sciences theory more relevant to real-life situations. They consider a CoP a helpful platform where they could work together and exchange ideas on how to customise existing assessment tasks to make it more understandable for their learners. Participants showed that they had acquired useful ideas on how to teach the content knowledge more understandable.

The sessions were valuable as it helps me with practical ideas and knowledge about how to present the lessons to the learners more interestingly and understandably. [T01]

Furthermore, the CoP sessions helped the participants with methods on how to engage learners by using different methods such as asking leading questions in order for the learners to observe more attentively. Participants also agreed that the CoP increased their skill level to conduct demonstrations and practicals more confidently.

In our case, the hands-on practical sessions, which included different CAPS-related experiments made the sessions very successful. [T03]

I acquired useful ideas about how to teach the knowledge as well as to conduct the corresponding experiments more effectively. This helped me, in particular, to focus on more interesting ways to explain or introduce new content and concepts to the learners. [T09]

However, it appeared that only a couple of the teacher participants made use of technology as a teaching aid, a critical shortcoming that deserves further attention.

On the subject of the CAPS, which is based on educational principles originating from Australia, it is understood to overlook the educational challenges South Africa experiences (Singh, 2011:1632). The introduction of the CAPS locally invoked far-reaching criticism with serious concerns expressed about teachers being affected negatively, especially in context of their professional development (Ndlovu, 2011a:1406; Fataar, 2012:57; De Clercq, 2013:47; Phasha et al., 2016:69; Snyders, 2017:79). Feldman (2016:15) agrees unequivocally, stating that CAPS is a “pre-packaged curriculum that restricts teacher autonomy and professionalism”.

A teacher CoP allows a high degree of teacher autonomy, a critical endorsement contained in the NPFTED, which expects teachers to take ownership of their professional development (DoE, 2007:5). Increased teacher autonomy usually leads to positive changes in teaching practice (Kennedy, 2005:243; Little & Veugelers, 2005:285; McCarthy & Youens, 2005:152; Stoll et al., 2006:226; Watson & Manning, 2008:707; Steyn, 2009:117; Steyn, 2011:50; Stolk et al., 2012:1504; Dharsey, 2015:117; Hargreaves, 2015:23). This implies that teachers should be allowed to have constructive input into the CoP, which has been neglected with current CPTD approaches (Steyn, 2008:23; Steyn, 2009:117; Singh, 2011:1365; De Clercq, 2013:35; Geldenhuys & Oosthuizen, 2015:209).

In this study, the researcher engaged the teacher participants from an early stage to provide input into the design elements and operational aspects of the CoP intervention. During the CoP sessions, the researcher focused on promoting teacher autonomy by supporting an accommodating culture.

Teacher reflection is a critical aspect of CPTD because it directly affects teacher beliefs, experiences and practices (Luft & Patterson, 2002:270; Harrison et al., 2008:581; Antoniou et al., 2011:15; Avalos, 2011:2; Postholm, 2012:407; Roblin & Margalef, 2013:29; Geldenhuys & Oosthuizen, 2015:209). Reflexive competence defined as the “ability to integrate or connect performances and decision-making with understanding and with an ability to adapt to change and unforeseen circumstances and to explain the reasons behind these adaptations” in the Norms and Standards for Educators is a requirement to achieve professional teacher status in South Africa (DoE, 2000:4). CoPs are particularly useful in structuring opportunities for teacher reflection, which could help to develop teachers’ critical thinking skills (Butler et al., 2004:438; Wubbels, 2007:231; Levine & Marcus, 2010:389-398; Jimenez-Silva & Olson, 2012:342; Salleh, 2016:298).

Participants in this study were well aware of the importance of self-reflection, and many opportunities were created for teachers to give feedback from smaller break-away groups to the broad CoP group.

Feedback or reflection after each CoP session is very important, which included explanations why we were using specific procedures in a specific manner. [T08]

5.2.2 Possibilities of a CoP to facilitate CPTD

Subquestion 2: How can a community of practice assist in facilitating the professional development of Natural Sciences teachers?

The Norms and Standards for Educators (DoE, 2000) compels teachers to collaborate with their colleagues so that they could exchange ideas, share resources and reflect on their classroom practices, which is generally regarded as an essential cornerstone of effective CPTD (Levine & Marcus, 2010:396; Kgabo, 2011:59; Jita & Mokhele, 2012; Mphahlele, 2014:218; Abdella, 2015:43). In South Africa teacher isolation is one of the major barriers that impede CPTD in rural school environments, therefore an approach that could mitigate teacher isolation is considered decisive (Ndlalane, 2006:100; Musanti & Pence, 2010:79; Mukeredzi, 2013:12; Smith, 2014:232; Owen, 2016:406).

Following a global trend, South African researchers are increasingly asserting that collaborative CPTD models need to replace the current low-impact transmissionist CPTD approaches (Steyn & Van Niekerk, 2005:131-132; Levine & Marcus, 2010:389; Kennedy, 2011:27; Forte & Flores, 2014:93-94; Geldenhuys & Oosthuizen, 2015:209; Ngcoza & Southwood, 2015:9).

A teacher CoP, which by design fosters teacher collaboration, transpires when people are engaged in collective learning in a shared domain of human endeavour where teachers can share experiences, skills, and problems (Wenger, 2011). It has design characteristics appealing to break down teacher isolation, aiming to “move from isolation to collaboration” (Patton & Parker, 2017:358).

During the interviews, Natural Sciences teacher participants corroborated their pre-intervention questionnaire responses, re-affirming that CoPs could enable their professional development, and improve teachers’ collegial interaction. This earlier expectation of believing their participation in a CoP would be beneficial to their professional development, materialised by their testimony (Figure 4.38). Participants in this study were particularly positive about the interaction and collaboration in the CoP sessions and approved of its enabling contribution to their professional development.

I have learnt enormously through the CoP-sessions, as it was very interactive and the best for me was the communication among the teachers. With a few adjustments to the work presented in the session, I could use the activities in my school context. [T03]

Participants agreed uniformly that a teacher CoP is a learning platform fundamentally (Wenger et al.,2002; McKay, 2007:14), providing a framework that embraces trust, sharing, collaboration, ownership and accountability in a culture where teachers create knowledge and develop skills, and share and reflect on best practices, which are critical elements to cultivate CPTD.

It is important to create a culture of learning where everyone shares the responsibilities towards the group. [T06]

At the request of the participants, the CoP allowed a conducive space of learning where the participants felt safe, comfortable and confident to share experiences among diverse group members regarding the subject content, concepts and conducting practical work.

The atmosphere in the CoP-sessions was not stressful, and this helped me to participate more passionately, which enhanced learning that is more effective. [T09]

However, participants mentioned that it was difficult to work together in the group initially since not everyone was on the same level of understanding of the subject content and at that stage, the trust had not been established between the participants.

Also, many participants had to overcome their feelings of inadequacy, which notably dampened their participation and engagement in the CoP sessions in the beginning.

It will be so lovely if you have teachers with whom you can work together and ask for support without feeling insecure. New teachers could benefit a lot from such collaboration between teachers. [T02]

As the sessions progressed and vulnerable trust among the participants settled in, respectful relationships developed between them, and as they became more at ease, their collaboration in the CoP sessions improved. This type of interaction is crucial for the development of practical investigative skills.

Furthermore, the CoP helped to develop a collaborative culture of learning where everyone shares responsibilities towards the group members, which required them to accept accountability and ownership towards the CoP. Thus, a sense of shared responsibility developed.

It is important that the participants are encouraged and kept accountable to participate in the activities in order to develop ownership for the CoP. [T07]

The CoP intervention made it possible for a diverse teacher group to learn from observing, asking questions and participating alongside others who have either more experience or different experiences. The participants experienced the less administered, and more collaborative nature of the CoP intervention as positive to motivate teachers, especially to the benefit of beginner teachers.

For me, in these CoP sessions, one can learn from the more experienced teachers and the occurrence of these meetings will depend on the participating teachers' needs and availability. [T04]

Similarly, as there were teachers in the group that are teaching the subjects outside of their fields of training, the CoP helped to equip them with the necessary content knowledge and pedagogy in order to develop them into better Natural Sciences teachers. Therefore, CoPs could play a vital role in supporting underqualified and beginner teachers who still need guidance, or help them to adapt to the school system, or by sharing of best practices and pedagogy.

The collaborative and interactive nature of the sessions contributed to their positive experience as it promoted the sharing of ideas, skills and knowledge among them, which could be useful in the better understanding of the subject content.

Through the activities presented in the CoP-sessions, I have learned a lot through the group interaction. That sharing of ideas and experience among teachers were very valuable and helped me to understand the content much better. These group interactions help me to think of alternative ways to teach the content to make it more understandable for the learners. [T02]

Beginner teachers' repeated request for greater collegial collaboration is a sign that they feel more isolated than their more experienced colleagues do. Also, participants were keen to mention several physical factors that are characteristic of teacher isolation, such as vast distances between schools, a poor telecommunications network, lack of finances, and inadequate infrastructure, facilities and equipment. The time spent during the CoP sessions aiming to address these physical aspects of teacher isolation resulted in participants producing innovative ideas as countermeasures.

I think if there is a mobile laboratory, which can alternate between schools, it can address the problem of inadequately equipped school laboratories. With the mobile laboratory, a qualified person who is trained well can facilitate the experiments. [T05]

5.2.3 Aspects of an effective CoP

Subquestion 3: What principles and aspects can influence the effective operation of a community of practice?

Literature holds voluminous references of success factors linked to effective CPTD in general, and some of these have a bearing on teacher CoPs, but very few studies have highlighted the principles and aspects that could affect the effective operation of teacher CoPs specifically (Stoll et al., 2006:243). Only a couple of CoP studies were found relevant, and the most common denominator implicates the teacher, either as an individual or within group dynamics (Richmond & Manokore, 2010:565; McAlister, 2016:131).

The beliefs and attitudes of teachers are vital to the success of CoPs, because teachers are principally responsible for their professional development (Opfer & Pedder, 2011:5), hence their reluctance to participate, unwillingness to collaborate with other teachers and failure to self-reflect could derail a CoP (Roberts, 2006:629; Wong, 2010:131; Macheng, 2014:62; Geldenhuys & Oosthuizen, 2015:209; Snyders, 2017:38; Trust & Horrocks, 2017:653).

Building and supporting professional relationships in teacher CoPs, where members mutually respect and trust each other, and continuing with a prominent level of commitment towards each other is considered a good counter practice (Patton & Parker, 2017:357).

Teacher participants in this study were entirely forthcoming to cite factors that could influence the effective operation of a teacher CoP. Making sense of their pre-intervention questionnaire responses, the follow-up interviews, and the researcher's observations, returned three key aspects essential to operate a teacher CoP effectively, namely an inclusive CoP structure, established professional relationships among the CoP membership and a motivated CoP membership.

The principal factor that participants highlighted for a CoP to function effectively is that a teacher CoP has to address the needs of teachers penultimate, and accommodate their work-related conditions (cf. Steyn, 2008:23; Steyn, 2009:117; Geldenhuys & Oosthuizen, 2015:209; Singh, 2011:1365).

Furthermore, the CoP needs to have a specific focus, co-determined by the teachers, directing what they are doing during the CoP sessions. Similarly, the participants indicated that teachers should be included with the design and operational aspects of their CoP because they know their individual development needs the best (cf. Singh, 2011:1365).

Effective planning of the activities for the CoP sessions plays an important role in the successful implementation of a CoP. [T07]

Another key enabling factor embraces the structure of the CoP. By original design, a CoP is partially structured, it operates informally and autonomously without a leading character (Wenger, 1998:2). However, this study found otherwise, suggesting that an effective teacher CoP is dependent on a knowledgeable, competent and experienced facilitator taking charge of the operational aspects inclusive of administration, planning, coordination, communication and facilitation.

Participants profiled an ideal facilitator as an education practitioner such as an ex-teacher, assigned full-time to support teachers in- and out of school. The researcher agrees with this but supports the view that the facilitator ideally should be an education specialist with practical experience of collaborative teacher development.

A corresponding success factor emphasised by the participants refers to the composition of the CoP, which should include both beginner and experienced teachers (cf. Fick & Kapp, 2007:444; Geldenhuys & Oosthuizen, 2015:201), as well as teachers with diverse ideas as these differences could pose a significant advantage to teacher CoPs.

I trust that working together in CoP could work considerably well if the teachers are not at the same knowledge and competence level as this could help with exchanging knowledge and experience in a CoP. [T04]

It must be a diverse group so that the beginner teachers and those teachers like me who have extensive teaching experience. [T06]

The participants consider mutual engagement as instrumental to the effective operation of a CoP. They prefer the physical face-face contact sessions because it creates a trustworthy environment in which participants could overcome their emotional incompetence and the stigma of feeling incapable.

I preferred these physical get-together sessions as it helped me to communicate better with my colleagues from other schools about subject-related issues. [T01]

These physical contact sessions are a powerful means to improve teachers' understanding of each other's circumstances, which could lead to the sharing of good practices among teachers. However, participants highlighted the importance of taking into consideration teachers' demanding school-related responsibilities when planning the frequency of CoP engagement sessions.

I think it will be good if the CoP can happen once a month or it does not have to be once a month, maybe once a term, or maybe a day during a holiday. When and how often it happens, will depend on the teachers' work-related program. [T05]

Alternative ways of communication such as electronic platforms become a possibility, once the teacher members had an opportunity to get to know each other and started to build professional relationships (cf. Hou, 2015:528).

A get-together session at the beginning of the year is very important because it will give teachers a chance to meet each other and to exchange contact information. Further communication can then occur through electronic platforms such as WhatsApp groups, e-mail or websites. [T06]

The participants mentioned that informal, regular communication among the participating teachers in a CoP is also crucial, as it determines how the sharing of knowledge and teaching practices could occur.

Regular communication is one of how you can enhance better collaboration between teachers, ensuring a strong and established basis at school. [T07]

Another possibility mentioned is to progress the CoP to social media platforms in the form of a discussion group where effective practices could be shared among teachers (cf. Macia & Garcia, 2016).

The electronic platforms particularly help me to ask for assistance about questions of which I do not know the answers, as well as other work-related concerns. Through using these electronic platforms, we as teachers could support each other better. [T10]

The second key aspect essential to effectively operate a teacher CoP considers motivated teachers. Self-motivation usually stems from a teacher's own beliefs and attitudes (cf. Opfer & Pedder, 2011:5), but the participants in this study recommend that the facilitator should play a leading role to encourage the enthusiasm of teachers and keep them motivated about the CoP. Participants said that it is particularly challenging to keep teachers committed to and motivated about a CoP.

If some teachers are not committed to completing the tasks allocated to them, there is no motivation for the rest to complete the tasks assigned to them in CoP meetings. [T07]

It is therefore essential that members joining the CoP understand the foundational construct of a CoP about "membership implies a commitment to the domain of interest, and as a result, a shared competence" (Wenger, 2015:1).

This brings about a culture of collaborative learning where the participants keep a sense of shared responsibility and feel comfortable and confident to share best practices (cf. Mckay, 2007:3; Levine & Marcus, 2010:389-398; Macheng, 2014:62-71).

It is important to create a culture of learning in which everyone shares the responsibilities towards the group members and not only for themselves. It is important that the participants be encouraged and kept accountable to participate in the activities in order to develop ownership for the CoP. [T07]

The participants stated that the collaboration among the CoP members created a positive experience of participation in a CoP. The willingness of the teachers to participate in the CoP sessions helped with the effective operation of the CoP, which in turn motivated them to use the practices in their class context.

Teachers' teaching practices could be enhanced through the participation in the CoP as a platform where the exchanging of knowledge and practices can occur. This is especially the case for those teachers who are not confident in conducting experiments. [T08]

Lastly, the participants underlined the importance of feedback or reflection among themselves to improve the successful operation of the CoP. Feedback from teachers through teacher collaboration and co-learning could be seen as crucial components for improving the operation of CoPs (Puchner & Taylor, 2006; Lee, 2008; Daniel et al., 2013:161).

This study found that the professional relationships among the CoP members are the third aspect essential to operate a teacher CoP effectively. In the researcher's critical view, trust relationships, underpinned by open, honest communication, which were established between the participants, formed the basis on which the success of the CoP intervention in this study rests.

The CoP-sessions were a valuable experience as the co-operation between Natural Sciences teachers not only focus on one-directional communication, but time was allocated to discuss the problems that we are facing every day, which have an influence on the success of the work. [T05]

This is aligned to the original definition of the "community", which describes the relationships among members and the sense of belonging, where "members engage in joint activities and discussions, help each other, and share information", allowing them to "build relationships that enable them to learn from each other" (Wenger, 2015:2).

In this environment where honest, respectful, trust relationships prevail among the membership (community), their insecurities about the subject content knowledge as well as their teaching practices have a better chance to be resolved successfully (Buysse et al., 2003; Parker et al., 2012:313).

5.3 Limitations of the study

This single case study typically applies to a particular context, namely the single school district of Vredendal, located in the Western Cape, which is one of the nine provinces of South Africa. Only ten Senior Phase Natural Sciences teachers participated, which makes generalisation difficult because the study by design lacks transferability (section 3.6.2). However, the study may be universally applicable to similar other real-world settings as the participants gave thick (rich) descriptions as per naturalistic design, in addition to the purposive sampling approach. The fact that the study is embedded in existing theories of CPTD and Wenger's (1998) CoP model creates viable options for transferability.

The use of alternative, electronic-based communication mediums and teaching aids were not included in the study, but it turned out to be valuable tools that could help teachers to improve communication and share their teaching practices with colleagues effectively.

Only one of the four CAPS knowledge strand, i.e. Matter and Materials was presented because of the second term CAPS curriculum, but the plan is to present the other knowledge strands in future CoP sessions.

Irrespective of these limitations, the findings of the study highlighted the role that a CoP could play in facilitating the professional development of Natural Sciences teachers and identified the aspects that influence its effective operation.

5.4 Recommendations for future work

The researcher proposes that the traditional operation of Wenger's CoP model, which is partially structured, autonomous and legislatively unconstrained needs to be adapted for South African education purposes. Foremost, teacher participants in this study felt strongly that a knowledgeable, competent and experienced facilitator has to take charge of the operation of a CoP. The appointment of mentor teachers selected from the more experienced teacher pool is crucial to help those teacher members who still need extra help.

Teachers saw value in the face-to-face CoP contact sessions, but mentioned it was not always possible to meet in person, due to the vast distances between rural schools, constrained finances and work-life balance demands. As a result, a blended model (Hou, 2015:528) utilising alternative electronic communication platforms such as e-mail, WhatsApp group, Google Hangout and Adobe Connect could address communication issues in rural environments. These platforms, if managed correctly, could also help to share best practices among teachers (Macia & Garcia, 2016).

The widespread problem of poor, or limited internet connection, and the high incidence of technology impaired teachers create an opportunity to investigate the technology development as a new domain for a future CoP.

Critically reflecting on this study, the researcher would do a couple of things differently in a future study. A prime focus would be to support teachers of different grades separately because separate support sessions would be more effective as the researcher noted that facilitating teachers representing different grades simultaneously generally hindered the pace of CoP activities. Once the levels of subject content knowledge and pedagogical content knowledge are equalised between teachers representing different grades, advancing to integrated sessions could be considered. Smaller break-away groups consisting of teachers from the same grade could serve as an interim measure.

The researcher would in future be more conscious of teachers' feelings of inferiority, incompetence and their fears to be exposed due to a perceived lack of knowledge and skills in the presence of the facilitator (researcher) and other CoP members (colleagues).

As this study managed to set up collaborative relationships between most of the Senior Phase Natural Sciences teachers in the Vredendal schools district, the WCED could conveniently use the outcomes of this study as an introduction into their PLC rollout.

No private school participated in this study, despite invited to do so, which still is an unexplained concern and a worthwhile research question for a potential future study.

5.5 Self-reflection

By planning, organising and conducting this study all by myself, I as a researcher grew commendably by my standards. My understanding of research design and methodology, argumentative reasoning, the analysis and synthesis of rich, complex data, as well as my academic presentation and writing skills improved appreciably. I gained new skills by setting up a safe, trusted and respected teacher CoP, and I uncovered the factors that impact the effective operation of a CoP.

The engagement that I have had with the CoP participants during the study expounded my experience as an education specialist. I quickly recognised the vital role that the co-operation of the teacher participants would play in the success of this the study. Furthermore, I also realised how crucial teacher autonomy is in their professional development. An eye-opener for me was that teachers have individually-specific CPTD requirements, they approve of a formal structure, or entity to assist this facilitation.

My interaction with the teacher participants in their classrooms, and school context earned them my empathy and respect; teachers who continue to teach under challenging rural conditions, who are in spite expected to deliver quality teaching and positively affect learners.

In conclusion, the outcomes of this study keep me motivated to live my passion for teacher development, as it provides solid proof that CPTD interventions applying an inclusive, outward mindset towards resolving the needs of teachers are bound to succeed. I am also delighted that with this study I have contributed meaningfully to a sparsely researched, critical knowledge base.

5.6 Concluding remarks

This case study has successfully answered the research questions by demonstrating the potential a CoP approach has in practically facilitating the professional development of a select group of Natural Sciences teachers within legislative frameworks.

The CoP augmented the professional identity of teacher participants considerably by helping to build specific competences required by the authoritative norms set out in the NPFTEd. Participants improved their subject content knowledge, notably. They developed the ability to teach Natural Sciences theory relevant to real-life situations and raised their skill level to conduct demonstrations and practical work more confidently. Opportunities for self-reflection appeared instrumental in entrenching the newly acquired teaching practices. These positive changes are considered to have benefitted from fostering teacher autonomy by including the participants in key aspects of the design and operation of the CoP.

Teacher participants explicitly appreciated the constructive interaction and collaboration in the CoP sessions and approved of its enabling influences on their professional development. A contributory factor is that the CoP is a learning platform fundamentally where the participants felt safe, comfortable and confident to share experiences among diverse group members. Participants recommended several technology-based initiatives to address teacher isolation issues that impede CPTD locally.

An inclusive CoP structure, established professional relationships among the CoP membership, and a motivated CoP membership proved to be the key aspects essential to the effective operation of a teacher CoP. Teacher participants perceive an inclusive CoP structure as the most important enabler, motivating that a teacher CoP has to address the needs of teachers foremost, also, to accommodate their work-related conditions.

By contrast, the researcher considers the CoP structure subordinate to professional relationships, because it was found that professional relationships built on mutual respect and trust are the most significant enabler to accomplish successful teacher collaboration.

Stakeholders in education should take notice that the outcomes of this study emphasise the increasing call to abandon transmissionist CPTD approaches in favour of embracing more effective collaborative teacher development models. The design elements of a CoP make it highly suitable to promote teacher collaboration and correspondingly break down teacher isolation, which is especially prevalent in rural school environments.

However, the researcher recommends that the original construct of a CoP needs tailoring to potentially operationalise it in the South African education system, both as standalone initiative or integrated with endorsed professional learning communities (PLCs). In this context, a teacher CoP needs a formal, but an inclusive structure preferably with an education specialist as a facilitator in the leading role. A blended CoP approach, with its characteristic focus on deriving value from employing information and communications technologies and smart electronic teaching aids, could better support the effective operation of a teacher CoP.

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ADDENDUM A

WCED Research Approval Letter



Directorate: Research

Audrey.wyngaard@westerncape.gov.za
tel: +27 021 467 9272
Fax: 0865902282
Private Bag x9114, Cape Town, 8000
wced.wcape.gov.za

REFERENCE: 20150903-3020
ENQUIRIES: Dr A T Wyngaard

Mrs Christa Philander
PO Box 526
Vredendal
8160

Dear Mrs Christa Philander

**RESEARCH PROPOSAL: THE PROFESSIONAL DEVELOPMENT OF NATURAL SCIENCES TEACHERS:
POSSIBILITIES OF A COMMUNITY OF PRACTICE**

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **18 January 2016 till 30 September 2016**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number?
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:
**The Director: Research Services
Western Cape Education Department
Private Bag X9114
CAPE TOWN
8000**

We wish you success in your research.

Kind regards.
Signed: Dr Audrey T Wyngaard
Directorate: Research
DATE: 04 September 2015

Lower Parliament Street, Cape Town, 8001
tel: +27 21 467 9272 fax: 0865902282
Safe Schools: 0800 45 46 47

Private Bag X9114, Cape Town, 8000
Employment and salary enquiries: 0861 92 33 22
www.westerncape.gov.za

ADDENDUM B

Research Approval Letter with Stipulations



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jou kennisvenoot • your knowledge partner

Approved with Stipulations New Application

10-Feb-2016
Philander, Christa C

Proposal #: SU-HSD-001370

Title: The Professional Development of Natural Sciences Teachers: Possibilities of a Community of Practice.

Dear Mrs. Christa Philander,

Your **New Application** received on **16-Dec-2015**, was reviewed
Please note the following information about your approved research proposal:

Proposal Approval Period: **04-Feb-2016 -03-Feb-2017**

The following stipulations are relevant to the approval of your project and must be adhered to:

The researcher may proceed with the envisaged research provided that the following stipulations, relevant to the approval of your project are adhered to or addressed. Some of these stipulations may require your response. Where a response is required, you must respond to the REC within six (6) months of the date of this letter. Your approval would expire automatically should your response not be received by the REC within 6 months of the date of this letter.

If a response is required, please respond to the points raised in a separate cover letter titled "Response to REC stipulations" AND if requested, HIGHLIGHT or use the TRACK CHANGES function to indicate corrections / amendments of ATTACHED DOCUMENTATION, to allow rapid scrutiny and appraisal.

This is a well written PhD proposal to research the "Professional Development of Natural Science Teachers". The researcher's project is approved provided that she adheres to the below stipulations:

1) REC E-FORM

On page 2 of the application form the researcher has indicated that human participants will be used as well as information in the public domain that may be sensitive. It is not clear from the rest of the application or the attached documents what this information she is referring to that could be regarded as sensitive. The reviewer is of the opinion that this block does not need to be marked.

2) RESEARCH PROPOSAL [RESPONSE REQUIRED]

Although the application very shortly refers to the strategy for participant selection this is not addressed at all in the research proposal.

The proposal also does not sufficiently address how the participant's privacy and confidentiality will be protected. It is indicated that anonymity will be protected but it is unclear how this will be possible where the participant is required to provide full biographical data. The anonymity is also not viable where follow-up interviews will be done after the completion of the questionnaires since the researcher will require identifiable information in order to schedule follow-up interviews. It is suggested that the researcher address this more clearly in the

research proposal.

It is suggested that the researcher address the matter of data protection in more detail. It is not addressed in the proposal nor does she explain in the application form who will have access to the data, how long it will be kept or how it will be disposed of.

3) PROTECTION OF ANONYMITY [RESPONSE REQUIRED]

Regarding the biographical information collected in the questionnaire it is suggested that the researcher reconsiders the need for this information since it is not conducive for anonymity and does not seem that critical for making her findings. If biographical data is required, the researcher must ensure that participants are aware that although identifiable information is collected, that measures are in place to ensure that this information is protected and will not be divulged to a third party.

4) INFORMED CONSENT PROCESS/FORMS [RESPONSE REQUIRED]

The consent form should clearly indicate that the participant is consenting to completing the questionnaire and interview (which is addressed in the consent form) as well as consenting to the observation (which is not mentioned in the informed consent form). It should also be clearly stated in the form that the participant is consenting to video and or audio recording of the interview/observation. Since the observation will be done in the classroom, the researcher must ensure that parents are informed that their children's teacher will be observed during class time.

5) INTERVIEW SCHEDULE [RESPONSE REQUIRED]

The interview schedule was not attached for review- the questionnaire was attached instead. The researcher must confirm whether the questionnaire will be self-administered as well as whether a different set of questions will be asked during interviews.

Please provide a letter of response to all the points raised IN ADDITION to HIGHLIGHTING or using the TRACK CHANGES function to indicate ALL the corrections/amendments of ALL DOCUMENTS clearly in order to allow rapid scrutiny and appraisal.

Please take note of the general Investigator Responsibilities attached to this letter. You may commence with your research after complying fully with these guidelines.

Please remember to use your **proposal number (SU-HSD-001370)** on any documents or correspondence with the REC concerning your research proposal.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Also note that a progress report should be submitted to the Committee before the approval period has expired if a continuation is required. The Committee will then consider the continuation of the project for a further year (if necessary).

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki and the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health). Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) registration number REC-050411-032.

We wish you the best as you conduct your research.

If you have any questions or need further help, please contact the REC office at 218089183.

Included Documents:

REC: Humanities New Application

Sincerely,

Clarissa Graham
REC Coordinator
Research Ethics Committee: Human Research (Humanities)

Investigator Responsibilities

Protection of Human Research Participants

Some of the general responsibilities investigators have when conducting research involving human participants are listed below:

1. Conducting the Research. You are responsible for making sure that the research is conducted according to the REC approved research protocol. You are also responsible for the actions of all your co-investigators and research staff involved with this research. You must also ensure that the research is conducted within the standards of your field of research.

2. Participant Enrollment. You may not recruit or enroll participants prior to the REC approval date or after the expiration date of REC approval. All recruitment materials for any form of media must be approved by the REC prior to their use. If you need to recruit more participants than was noted in your REC approval letter, you must submit an amendment requesting an increase in the number of participants.

3. Informed Consent. You are responsible for obtaining and documenting effective informed consent using **only** the REC-approved consent documents, and for ensuring that no human participants are involved in research prior to obtaining their informed consent. Please give all participants copies of the signed informed consent documents. Keep the originals in your secured research files for at least five (5) years.

4. Continuing Review. The REC must review and approve all REC-approved research proposals at intervals appropriate to the degree of risk but not less than once per year. There is **no grace period**. Prior to the date on which the REC approval of the research expires, **it is your responsibility to submit the continuing review report in a timely fashion to ensure a lapse in REC approval does not occur**. If REC approval of your research lapses, you must stop new participant enrollment, and contact the REC office immediately.

5. Amendments and Changes. If you wish to amend or change any aspect of your research (such as research design, interventions or procedures, number of participants, participant population, informed consent document, instruments, surveys or recruiting material), you must submit the amendment to the REC for review using the current Amendment Form. You **may not initiate** any amendments or changes to your research without first obtaining written REC review and approval. The **only exception** is when it is necessary to eliminate apparent immediate hazards to participants and the REC should be immediately informed of this necessity.

6. Adverse or Unanticipated Events. Any serious adverse events, participant complaints, and all unanticipated problems that involve risks to participants or others, as well as any research related injuries, occurring at this institution or at other performance sites must be reported to Malene Fouch within **five (5) days** of discovery of the incident. You must also report any instances of serious or continuing problems, or non-compliance with the REC's requirements for protecting human research participants. The only exception to this policy is that the death of a research participant must be reported in accordance with the Stellenbosch University Research Ethics Committee Standard Operating Procedures. All reportable events should be submitted to the REC using the Serious Adverse Event Report Form.

7. Research Record Keeping. You must keep the following research related records, at a minimum, in a secure location for a minimum of five years: the REC approved research proposal and all amendments; all informed consent documents; recruiting materials; continuing review reports; adverse or unanticipated events; and all correspondence from the REC

8. Provision of Counselling or emergency support. When a dedicated counsellor or psychologist provides support to a participant without prior REC review and approval, to the extent permitted by law, such activities will not be recognised as research nor the data used in support of research. Such cases should be indicated in the progress report or final report.

9. Final reports. When you have completed (no further participant enrollment, interactions, interventions or data analysis) or stopped work on your research, you must submit a Final Report to the REC.

10. On-Site Evaluations, Inspections, or Audits. If you are notified that your research will be reviewed or audited by the sponsor or any other external agency or any internal group, you must inform the REC immediately of the impending audit/evaluation.

ADDENDUM C

Research Approval Letter Stipulations Approved



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jou kennisvenoot - your knowledge partner

Approval Notice
Stipulated documents/requirements

03-Mar-2016

Philander, Christa C

Proposal #: SU-HSD-001370

Title: The Professional Development of Natural Sciences Teachers: Possibilities of a Community of Practice.

Dear Mrs. Christa Philander,

Your Stipulated documents/requirements received on 15-Feb-2016, was reviewed and **accepted**.

Please note the following information about your approved research proposal:

Proposal Approval Period: 04-Feb-2016 - 03-Feb-2017

General comments:

Please take note of the general Investigator Responsibilities attached to this letter.

If the research deviates significantly from the undertaking that was made in the original application for research ethics clearance to the REC and/or alters the risk/benefit profile of the study, the researcher must undertake to notify the REC of these changes.

Please remember to use your **proposal number (SU-HSD-001370)** on any documents or correspondence with the REC concerning your research proposal.

Please note that the REC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki and the Guidelines for Ethical Research: Principles Structures and Processes 2015 (Department of Health). Annually a number of projects may be selected randomly for an external audit.

National Health Research Ethics Committee (NHREC) registration number REC-050411-032.

We wish you the best as you conduct your research.

If you have any questions or need further help, please contact the REC office at 0218089183.

Sincerely,

Clarissa Graham
REC Coordinator
Research Ethics Committee: Human Research (Humanities)

Investigator Responsibilities

Protection of Human Research Participants

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- 2. Participant Enrolment.** You may not recruit or enrol participants prior to the REC approval date or after the expiration date of REC approval. All recruitment materials for any form of media must be approved by the REC prior to their use. If you need to recruit more participants than was noted in your REC approval letter, you must submit an amendment requesting an increase in the number of participants.
- 3. Informed Consent.** You are responsible for obtaining and documenting effective informed consent using only the REC-approved consent documents, and for ensuring that no human participants are involved in research prior to obtaining their informed consent. Please give all participants copies of the signed informed consent documents. Keep the originals in your secured research files for at least five (5) years.
- 4. Continuing Review.** The REC must review and approve all REC-approved research proposals at intervals appropriate to the degree of risk but not less than once per year. There is **no grace period**. Prior to the date on which the REC approval of the research expires, **it is your responsibility to submit the continuing review report in a timely fashion to ensure a lapse in REC approval does not occur**. If REC approval of your research lapses, you must stop new participant enrolment, and contact the REC office immediately.
- 5. Amendments and Changes.** If you wish to amend or change any aspect of your research (such as research design, interventions or procedures, number of participants, participant population, informed consent document, instruments, surveys or recruiting material), you must submit the amendment to the REC for review using the current Amendment Form. You may not initiate any amendments or changes to your research without first obtaining written REC review and approval. The **only exception** is when it is necessary to eliminate apparent immediate hazards to participants and the REC should be immediately informed of this necessity.
- 6. Adverse or Unanticipated Events.** Any serious adverse events, participant complaints, and all unanticipated problems that involve risks to participants or others, as well as any research related injuries, occurring at this institution or at other performance sites must be reported to Malene Fouche within **five (5) days** of discovery of the incident. You must also report any instances of serious or continuing problems, or non-compliance with the REC's requirements for protecting human research participants. The only exception to this policy is that the death of a research participant must be reported in accordance with the Stellenbosch University Research Ethics Committee Standard Operating Procedures. All reportable events should be submitted to the REC using the Serious Adverse Event Report Form.
- 7. Research Record Keeping.** You must keep the following research related records, at a minimum, in a secure location for a minimum of five years: the REC approved research proposal and all amendments; all informed consent documents; recruiting materials; continuing review reports; adverse or unanticipated events; and all correspondence from the REC
- 8. Provision of Counselling or emergency support.** When a dedicated counsellor or psychologist provides support to a participant without prior REC review and approval, to the extent permitted by law, such activities will not be recognised as research nor the data used in support of research. Such cases should be indicated in the progress report or final report.
- 9. Final reports.** When you have completed (no further participant enrolment, interactions, interventions or data analysis) or stopped work on your research, you must submit a Final Report to the REC.
- 10. On-Site Evaluations, Inspections, or Audits.** If you are notified that your research will be reviewed or audited by the sponsor or any other external agency or any internal group, you must inform the REC immediately of the impending audit/evaluation.

ADDENDUM D

Pilot Pre-Intervention Questionnaire

**PROFESSIONELE ONDERWYSONTWIKKELING VAN NATUURWETENSKAP
ONDERWYSERS EN DIE ROL WAT GEMEENSKAPPRAKTYKE DAARBY KAN SPEEL.
DEPARTEMENT KURRIKULUMSTUDIES: UNIVERSITEIT VAN STELLENBOSCH**

A. Doelstellings met hierdie vraelys

Om ondersoek in te stel na die verskillende behoeftes wat:

- natuurwetenskappe-onderwysers het rakende die onderrig van die vak Natuurwetenskappe, Graad 7-9,
- onderwysers het om opleiding by te woon wat verdere professionele leer kan bevorder,
- natuurwetenskappe-onderwyser het met professionele leer programme wat in gemeenskapspraktyke plaasvind.

Lees asseblief die onderstaande instruksies noukeurig deur en beantwoord dan die vrae.

1. Hierdie vraelys vorm deel van 'n navorsingsprojek uitgevoer vir 'n PhD studie.
2. Die sukses van die projek hang af van u goedgeunstige en heelhartige samewerking.
3. Die persoonlike inligting wat ons van u verlang sal streng vertroulik hanteer word.
4. In die beantwoording van sommige vrae word van 'n skaal 1 tot 5 gebruik gemaak. Onthou **1 dui 'n lae- en 5 'n hoë waarde** aan, vul die syfer van u keuse in die gegewe blokkies in.

B. Organisasie en Persoonlike Inligting

Naam	
Skool	
Huidige Posvlak wat u beklee	
Jare onderwyservaring	
(Hoogste) Akademiese kwalifikasie	
Naam van Professionele Onderwys Ontwikkelingsessies bygewoon.	
Watter leerareas bied u aan?	
Bied u die leerarea aan waarvoor u opgelei is?	
Datum van voltooiing van die vraelys	

C. Vrae**1. Vrae ten opsigte van die Natuurwetenskap onderwyser om die vak aan te bied.**

- 1.1. 'n Groot persentasie van die Natuurwetenskappe-onderwysers voel nie voldoende toegerus om die vak te onderrig nie. Gebruik 'n X en toon aan tot watter mate u met die stelling saamstem.

1 = stem nie saam; 3 = stem geredelik saam; 5 = stem heeltemal saam

1	2	3	4	5
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1.2. Tot watter mate ervaar uself probleme met die volgende:

1.2.1. Die verstaan van sekere leerareas in Natuurwetenskappe?

1 = geen probleme; 3 = redelik; 5 = baie probleme

Leerarea	Aanduier
Materie en Materiale	
Energie en Verandering	
Die Aarde en die Ruimte	
Lewe en Lewende Dinge	

1.2.2. Om die vakinhoud(e) relevant vir die leerders te onderrig?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

1.2.3. Om die teorie wat uself goed verstaan, effektief aan die leerders te kan oordra op 'n verstaanbare wyse?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

1.2.4. Om demonstrasies vir u klas in Natuurwetenskappe te doen?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

1.2.5. Om praktiese werk te fasiliteer in u klas?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

1.2.6. Hoe gemaklik is u met die gebruik van rekenaargebaseerde tegnologie in die onderrigproses.

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

2. Vrae ten opsigte van ondersteuning vir Professionele Ontwikkeling van die onderwyser deur ander rolspelers.

2.1. Dui op die onderstaande skaal aan wat u mening is oor die betrokkenheid van tersiêre inrigtings op skoolvlak om onderwysers te ondersteun met hulle professionele ontwikkeling?

1 = nie betrokke; 3 = redelik; 5 = baie betrokke

1	2	3	4	5

2.2. Watter rol volgens u mening kan nie-regerings organisasies speel met die ondersteuning van die professionele ontwikkeling van 'n onderwyser?

1 = geen rol; 3 = redelik; 5 = groot rol

1	2	3	4	5

2.3. Dui aan die samewerking van onderwysers in dieselfde vakdepartement by u skool.

1 = geen; 3 = redelik; 5 = baie goed

1	2	3	4	5

3. Vrae ten opsigte van Professionele Ontwikkeling in Gemeenskapspraktyke.

In die vraelys word die term kluster gebruik as 'n gemeenskaplike groep tussen verskillende skole, waarbinne verskillende aktiwiteite aangebied word wat die professionele leer van onderwysers kan bevorder.

3.1. Dui op die onderstaande skaal aan in hoe 'n mate u al deelgeneem het aan gemeenskapspraktyke wat Professionele ontwikkeling van onderwysers bevorder het?

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

3.2. Indien u wel deelgeneem het, dui op die onderstaande skaal aan u belewenis van deelname aan die Gemeenskapspraktyke.

1 = slegte; 3 = redelik; 5 = baie goed

1	2	3	4	5

3.3. Watter waarde volgens u mening kan ondersteuning aan Seniorfase Natuurwetenskap-onderwysers in gemeenskapspraktyke, bydrae tot hulle professionele ontwikkeling?

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

3.4. Wat volgens u mening is van die belangrikste faktore wat bevordelik is vir die suksesvolle funksionering van 'n gemeenskapspraktyke?

1 = geen bydrae; 3 = redelik; 5 = baie belangrik

Faktor	Aanduier
Samestelling van die gemeenskapspraktyke	
Intelligensie vlak van die groep	
Persoonlike behoeftes van individuele gemeenskapspraktyk lede	
Die inhoud wat in die gemeenskapspraktyke aangebied word	
Aanbiedingswerkswyse gevolg vir gemeenskapspraktyke.	
Hoe gereeld gemeenskapspraktykebyeenkomste plaasvind	
Terugvoering na elke gemeenskapspraktyk byeenkomste	

3.5. Dui aan hoe u eie professionele ontwikkeling bevorder kan word deur deelname aan gemeenskapspraktyke.

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

3.6. Is daar enige iets anders wat u graag wil bespreek? Indien ja, brei uit asseblief.

Baie dankie vir u samewerking

ADDENDUM E

Pilot Post-Intervention Questionnaire

**NATUURWETENSKAP ONDERWYSERS SE BEHOEFTE EN MENINGS RAKENDE HULLE
VERMOË OM NATUURWETENSKAP OP SKOOLVLAK TE ONDERRIG ASOOK DIE ROL WT
KLUSTERS DAARBY KAN SPEEL.**

DEPARTEMENT KURRIKULUMSTUDIES: UNIVERSITEIT VAN STELLENBOSCH

A. Doelstellings met hierdie vraelys

Om ondersoek in te stel na die:

- Mening van die deelnemende onderwysers ten opsigte van die inhoud aangebied in die klustersessies,
- Onderwysers se ervaring ten opsigte van die werkswyse gevolg tydens klustersessies,
- Onderwysers se mening rakende die professionele leer wat in klusterverband plaasgevind.

Lees asseblief die onderstaande instruksies noukeurig deur en beantwoord dan die vrae.

1. Hierdie vraelys vorm deel van 'n navorsingsprojek uitgevoer vir 'n PhD studie.
2. Die sukses van die projek hang af van u goedgeunstige en heelhartige samewerking.
3. Die persoonlike inligting wat ons van u verlang sal streng vertroulik hanteer word.
4. In die beantwoording van sommige vrae word van 'n skaal 1 tot 5 gebruik gemaak. Onthou **1 dui 'n lae- en 5 'n hoë waarde** aan, vul die syfer van u keuse in die gegewe blokkies in.

B. Organisasie en Persoonlike Inligting

Naam	
Skool	
Huidige Posvlak wat u bekleed	
Jare onderwyservaring	
(Hoogste) Akademiese kwalifikasie	
Watter leerareas bied u aan?	
Bied u die leerarea aan waarvoor u opgelei is?	
Datum van voltooiing van die vraelys	

C. Vrae

1. Professionele leer van die onderwyser.

- 1.1. Dui op die onderstaande skaal aan in hoe 'n mate u deelgeneem het aan die klusteraktiwiteit wat Professionele leer van onderwysers kan bevorder?

1 = glad nie; 3 = redelik; 5 = baie

1	2	3	4	5

1.2. Indien u wel deelgeneem het, dui op die onderstaande skaal aan u belewenis van deelname aan die klusteraktiwiteite.

1 = slegte; 3 = redelik; 5 = baie goed

1	2	3	4	5

1.3. Watter waarde volgens u mening kan het die ondersteuning aan Seniorfase Natuurwetenskap- onderwysers in klusterverband, bydrae tot u professionele leer?

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

1.4. Dui op die onderstaande tabel aan in hoe 'n mate die klusteraktiwiteite u ingesteldheid ten opsigte van die onderrig van Natuurwetenskap positief beïnvloed het.

1 = glad nie; 3 = redelik; 5 = baie

1	2	3	4	5

1.5. Dui op die onderstaande tabel aan in hoe 'n mate die klusteraktiwiteite bygedra het tot u vermoë om die onderstaande leerareas in Natuurwetenskap beter te onderrig?

1 = glad nie 3 = redelik; 5 = baie

Leerarea	Aanduier
Materie en Materiale	
Energie en Verandering	
Die Aarde en die Ruimte	
Lewe en Lewende Dinge	

1.6. Dui aan in hoe 'n mate die klusteraktiwiteite bygedra het tot u vermoë om die Natuurwetenskap meer relevant te onderrig?

1 = geen bydra; 3 = redelik; 5 = baie bygedra

1	2	3	4	5

1.7. Dui aan in hoe 'n mate die klusteraktiwiteitegehelp het om die teorie wat uself goed verstaan, effektief aan die leerders te kan oordra op 'n verstaanbare wyse?

1 = geen bydra; 3 = redelik; 5 = baie bygedra

1	2	3	4	5

1.8. Dui aan in hoe 'n mate die klusteraktiwiteitegehelp het om die demonstrasies wat u vir u leerders aanbied in Natuurwetenskappe beter te doen?

1 = geen bydra; 3 = redelik; 5 = baie bygedra

1	2	3	4	5

1.9. Dui aan in hoe 'n mate die klusteraktiwiteitegehelp het om praktiese werk te fasiliteer in u klas?

1 = geen bydra; 3 = redelik; 5 = baie bygedra

1	2	3	4	5

1.10. Dui op die onderstaande skaal aan in hoe 'n mate u deelgeneem het aan die klusteraktiwiteite wat Professionele leer van onderwysers kan bevorder?

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

1.11. Dui aan hoe u eie professionele leer bevorder is deur deelname aan klusteraktiwiteite.

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

1.12. Wat volgens u mening is van die belangrikste faktore wat die suksesvolle funksionering van die kluster beïnvloed het?

1.13. Is daar enige iets anders wat u graag wil bespreek? Indien ja, brei uit asseblief.

Baie dankie vir u samewerking

ADDENDUM F

Pre-Intervention Questionnaire

PRE-DEELNAME VRAELYS

PROFESSIONELE ONDERWYSONTWIKKELING VAN NATUURWETENSKAP ONDERWYSERS:

DIE ROL WAT GEMEENSAPPE VAN PRAKTYK DAARBY KAN SPEEL.

DEPARTEMENT KURRIKULUMSTUDIES: UNIVERSITEIT VAN STELLENBOSCH

A. Doelstellings met hierdie vraelys

Om ondersoek in te stel na die verskillende behoeftes wat Natuurwetenskappe onderwysers het:

- rakende die onderrig van die vak Natuurwetenskappe Graad 7-9,
- om opleiding by te woon wat verdere professionele ontwikkeling kan bevorder,
- met professionele ontwikkeling programme wat in gemeenskappe van praktyk kan plaasvind.

Lees asseblief die onderstaande instruksies noukeurig deur en beantwoord dan die vrae.

- Hierdie vraelys vorm deel van 'n navorsingsprojek uitgevoer vir 'n PhD studie.
- Die sukses van die projek hang af van u goedgeunstige en heelhartige samewerking.
- Die persoonlike inligting wat ons van u verlang sal streng vertroulik hanteer word.
- In die beantwoording van sommige vrae word van 'n skaal 1 tot 5 gebruik gemaak. Onthou 1 dui 'n lae- en 5 'n hoë waarde aan, vul die syfer van u keuse in die gegewe blokkies in.

B. Organisasie en Persoonlike Inligting

Naam	
Skool	
Huidige Posvlak wat u bekleed.	
Jare onderwyservaring.	
Hoogste akademiese kwalifikasie.	
Naam van Professionele Onderwys Ontwikkelingsessies bygewoon.	
Watter leerareas bied u aan?	
Bied u die leerarea aan waarvoor u opgelei is?	
Datum van voltooiing van die vraelys.	

C. Vrae

1. Vrae ten opsigte van die Natuurwetenskap onderwyser om die vak aan te bied.

- 1.1. 'n Groot persentasie van die Natuurwetenskappe onderwysers voel nie voldoende toegerus om die vak te onderrig nie. Gebruik 'n X en toon aan tot watter mate u met die stelling saamstem.

1 = stem nie saam; 3 = stem geredelik saam; 5 = stem heeltemal saam

1	2	3	4	5

- 1.2. Tot watter mate ervaar uself probleme met die volgende:

- 1.2.1. Die verstaan van sekere leerareas in Natuurwetenskappe?

1 = geen probleme; 3 = redelik; 5 = baie probleme

Leerarea	Aanduider
Materie en Materiale	
Energie en Verandering	
Die Aarde en die Ruimte	
Lewe en Lewende Dinge	

- 1.2.2. Om die vakinhoud(e) relevant vir die leerders te onderrig?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

- 1.2.3. Om die teorie wat uself goed verstaan, effektief aan die leerders te kan oordra op 'n verstaanbare wyse?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

- 1.2.4. Om demonstrasies vir u klas in Natuurwetenskappe te doen?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

- 1.2.5. Om praktiese werk in u klas te fasiliteer?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

1.2.6. Hoe gemaklik is u met die gebruik van rekenaargebaseerde tegnologie in die onderrigproses?

1 = geen probleme; 3 = redelik; 5 = baie probleme

1	2	3	4	5

2. Vrae ten opsigte van ondersteuning vir professionele ontwikkeling van die onderwyser deur ander rolspeleers.

2.1. Dui op die onderstaande skaal u mening aan oor die betrokkenheid van tersiêre inrigtings om onderwysers met hulle professionele ontwikkeling op skoolvlak te ondersteun.

1 = nie betrokke; 3 = redelik; 5 = baie betrokke

1	2	3	4	5

2.2. Volgens u mening, watter rol kan nie-regerings organisasies met die ondersteuning van die professionele ontwikkeling van 'n onderwyser speel?

1 = geen rol; 3 = redelik; 5 = groot rol

1	2	3	4	5

2.3. Dui aan die samewerking van onderwysers in dieselfde vakdepartement by u skool.

1 = geen; 3 = redelik; 5 = baie goed

1	2	3	4	5

3. Vrae ten opsigte van die professionele ontwikkeling in gemeenskappe van praktyk.

In die vraelys word die term gemeenskappe van praktyk gebruik as 'n gemeenskaplike groep tussen verskillende skole, waarbinne verskillende aktiwiteite aangebied word wat die professionele ontwikkeling van onderwysers kan bevorder.

3.1. Dui op die onderstaande skaal aan in hoe 'n mate u al deelgeneem het aan gemeenskappe van praktyk wat professionele ontwikkeling van onderwysers bevorder het.

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

3.2. Indien u wel deelgeneem het, dui op die onderstaande skaal aan u belewenis van deelname aan die gemeenskappe van praktyk.

1 = swak; 3 = redelik; 5 = baie goed

1	2	3	4	5

- 3.3. Watter waarde volgens u mening kan ondersteuning aan Seniorfase Natuurwetenskap onderwysers in gemeenskappe van praktyk bydra tot hulle professionele ontwikkeling?

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

- 3.4. Wat volgens u mening is van die belangrikste faktore wat bevordelik is vir die suksesvolle funksionering van gemeenskappe van praktyk?

1 = geen bydrae; 3 = redelik; 5 = baie belangrik

Faktor	Aanduider
Samestelling van die gemeenskappe van praktyk.	
Intelligensie vlak van die groep.	
Persoonlike behoeftes van individuele gemeenskappe van praktyklede.	
Die inhoud wat in die gemeenskappe van praktyk aangebied word.	
Aanbiedingswerkswyse gevolg vir gemeenskappe van praktyk.	
Hoe gereeld gemeenskappe van praktyk byeenkomste plaasvind.	
Terugvoering na elke gemeenskappe van praktyk byeenkomste.	

- 3.5. Dui aan hoe u eie vlak van professionele ontwikkeling deur deelname aan gemeenskappe van praktyk bevorder kan word.

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

- 3.6. Is daar enige iets anders wat u graag wil bespreek? Indien ja, brei uit asseblief.

Baie dankie vir u samewerking.

ADDENDUM G

Post-Intervention Questionnaire

POST-DEELNAME VRAELYS

**PROFESSIONELE ONDERWYSONTWIKKELING VAN NATUURWETENSKAP ONDERWYSERS:
DIE ROL WAT GEMEENSAPPE VAN PRAKTYK DAARBY KAN SPEEL.
DEPARTEMENT KURRIKULUMSTUDIES: UNIVERSITEIT VAN STELLENBOSCH**

A. Doelstellings met hierdie vraelys

Om ondersoek in te stel na die verskillende behoeftes wat Natuurwetenskappe onderwysers het:

- rakende die onderrig van die vak Natuurwetenskappe Graad 7-9,
- om opleiding by te woon wat verdere professionele ontwikkeling kan bevorder,
- met professionele ontwikkeling programme wat in gemeenskappe van praktyk plaasvind.

Lees asseblief die onderstaande instruksies noukeurig deur en beantwoord dan die vrae.

- Hierdie vraelys vorm deel van 'n navorsingsprojek uitgevoer vir 'n PhD studie.
- Die sukses van die projek hang af van u goedgeunstige en heelhartige samewerking.
- Die persoonlike inligting wat ons van u verlang sal streng vertroulik hanteer word.
- In die beantwoording van sommige vrae word van 'n skaal 1 tot 5 gebruik gemaak. Onthou 1 dui 'n lae- en 5 'n hoë waarde aan, vul die syfer van u keuse in die gegewe blokkies in.

B. Organisasie en Persoonlike Inligting

Naam	
Skool	
Huidige Posvlak wat u bekleed.	
Jare onderwyservaring.	
Hoogste akademiese kwalifikasie.	
Naam van Professionele Onderwys Ontwikkelingsessies bygewoon.	
Watter leerareas bied u aan?	
Bied u die leerarea aan waarvoor u opgelei is?	
Datum van voltooiing van die vraelys.	

C. Vrae

Professionele ontwikkeling van die onderwyser.

1. Dui op die onderstaande skaal aan in hoe 'n mate u deelgeneem het aan die gemeenskappe van praktyk aktiwiteite wat professionele ontwikkeling van onderwysers kan bevorder.

1 = glad nie; 3 = redelik; 5 = baie

1	2	3	4	5

2. Indien u wel deelgeneem het, dui op die onderstaande skaal aan u belewenis van deelname aan die gemeenskappe van praktyk.

1 = swak; 3 = redelik; 5 = baie

1	2	3	4	5

3. Watter waarde volgens u mening het die ondersteuning aan Seniorfase Natuurwetenskap onderwysers in gemeenskappe van praktyk verband, bygedra tot u professionele ontwikkeling as onderwyser?

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

4. Dui op die onderstaande tabel aan in hoe 'n mate die gemeenskappe van praktyk u ingesteldheid ten opsigte van die onderrig van Natuurwetenskap positief beïnvloed het.

1 = glad nie; 3 = redelik; 5 = baie

1	2	3	4	5

5. Dui op die onderstaande tabel aan in hoe 'n mate die gemeenskappe van praktyk bygedra het tot u vermoë om die onderstaande leerareas in Natuurwetenskap beter te onderrig.

1 = glad nie; 3 = redelik; 5 = baie

Leerarea	Aanduiding
Materie en Materiale	
Energie en Verandering	
Die Aarde en die Ruimte	
Lewe en Lewende Dinge	

6. Dui aan in hoe 'n mate die gemeenskappe van praktyk bygedra het tot u vermoë om die Natuurwetenskap meer relevant te onderrig.

1 = glad nie; 3 = redelik; 5 = baie

1	2	3	4	5

7. Dui aan in hoe 'n mate die gemeenskappe van praktyk gehelp het om die teorie wat uself goed verstaan, effektief aan die leerders op 'n verstaanbare wyse te kan oordra.

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

8. Dui aan in hoe 'n mate die gemeenskappe van praktyk u gehelp het om die aanbied van demonstrasies in Natuurwetenskappe beter te doen.

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

9. Dui aan in hoe 'n mate die gemeenskappe van praktyk u gehelp het om praktiese werk beter aan te bied.

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

10. Dui aan hoe u eie vlak van professionele ontwikkeling deur deelname aan gemeenskappe van praktyk bevorder is.

1 = geen; 3 = redelik; 5 = baie

1	2	3	4	5

11. Wat volgens u mening is van die belangrikste faktore wat die suksesvolle funksionering van die gemeenskappe van praktyk beïnvloed het?

ADDENDUM H

Interview Schedule

INTERVIEW SCHEDULE

**THE PROFESSIONAL DEVELOPMENT OF NATURAL SCIENCES TEACHERS:
POSSIBILITIES OF A COMMUNITY OF PRACTICE
DEPARTEMENT CURRICULUM STUDIES: STELLENBOSCH UNIVERSITY**

1. What are your experiences regarding participation in a CoP?
2. Do you have any suggestions how such a CoP can function effectively?
3. Considering teachers' busy schedules as well as the far distances they need to travel in rural areas to attend meetings, it is sometimes difficult to arrange physical contact sessions successfully. Can you think of any alternative ways in how these sessions could function more successfully?
4. Considering your teaching experience the past years, do you have any suggestions regarding more effective teaching methods for Natural Sciences?
5. What factors are currently preventing the effective teaching of Natural Sciences at your school?
6. Do you have any suggestions on how the concerns mentioned in the previous question can be addressed?

ADDENDUM I

Principal Informed e-mail

Beste Skoolhoofde

Ek is tans besig met 'n navorsingstudie wat deel is van 'n PhD tesis onder toesig van Dr. M.L. Botha van die Departement Kurrikulumstudie aan die Universiteit Stellenbosch. Die onderwerp van my studie is **Professionele onderwysontwikkeling van Natuurwetenskappe onderwysers en die rol wat gemeenskappe van praktyk daarby kan speel** en die doel van hierdie navorsing is om te bepaal wat die moontlikheid van 'n gemeenskap van praktyk benadering is vir die konseptualisering van professionele ontwikkeling van Natuurwetenskappe onderwysers in plattelandse gebiede.

Op die stadium moet ek my veldstudie begin doen en die groep onderwysers wat ek beplan om te gebruik is die Seniorfase Natuurwetenskap Onderwysers uit die Vredendal Area. Ek rig dus 'n vriendelike versoek aan die onderwysers om deel te neem, die uiteensetting van wat die studie behels asook hulle betrokkenheid volg.

Doelwitte:

- Om te bepaal wat die huidige professionele status van onderwysers is.
- Om vas te stel of onderwysers reeds betrokke is by gemeenskappe van praktyk .
- Om vas te stel wat onderwysers se persoonlike ervaring is van die gemeenskap praktyke.
- Om in die klaskamer waar te neem hoe die onderwysers die ondervinding en kennis reeds opgedoen in gemeenskapspraktyke toe pas.

Indien u inwillig om aan die studie deel te neem, moet u ten alle tye onthou dat deelname daaraan vrywillig is en dat u enige tyd kan onttrek sou u wou.

- 1.'n Pre-vraelys sal deur elke deelnemer voltooi word.
- 2.Die voltooiing van vraelys sal opgevolg word met 'n onderhoud van ongeveer 1 tot 1½ uur wat sal plaasvind op 'n onderling ooreengekome plek en tyd om die inligting verskaf in die vraelys op te volg en/of verder uit te klaar.
- 3 Die persone sal deel vorm van 'n natuurwetenskappe seniorfase onderwyser gemeenskapspraktyk wat een keer per maand vir 4 keer vir die tydperk Maart – September 2016 op 'n onderlinge ooreengekome plek sal ontmoet.
- 4.Tydens groepbyeenkomste van deelnemers in gemeenskapspraktyke, asook klasbesoeke by die skole, sal die waarneming van die interaksie proses/e deur video-, stemopnames of veldnotas gemaak word. Geen leerders sal in die proses op video opgeneem word nie.
- 5.'n Post-vraelys sal voltooi word nadat die persoon deelgeneem het aan 'n gemeenskapspraktyk.

Aangeheg is die toestemmingsbrief verkry vanaf Dr. A. Wyngaard van die Direkoraat Navorsing; WKOD om vir die tydperk Januarie-September 2016 navorsing te mag doen in die Vredendal omgewing skole. Ek heg ook 'n inwilligheidsvorm aan wat die privaatheid van deelnemers se regte aandui asook die etiese kwessies uiteensit.

Die sukses van die navorsingsprojek hang in 'n groot mate af van die betrokkenheid van die onderwysers en sodoende sien ek uit na u goedgeunstige terugvoering.

Kontak my gerus indien u nog enige inligting benodig.

Groete

Christa Philander
M.Ed. Kurrikulum / Curriculum Studies
Olifantsrivier Projek-koördineerder / Olifantsrivier Project co-ordinator



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ADDENDUM J
Schools' Research Information Letter

UNIVERSITEIT VAN STELLENBOSCH

INLIGTING EN TOESTEMMINGSBRIEF TOT DEELNAME AAN 'n STUDIE

Datum: 7 September 2015

Geagte Heer/Dame,

Hierdie brief is 'n uitnodiging om deel te neem aan 'n studie wat tans deur die Departement Kurrikulumstudies van die Universiteit van Stellenbosch onderneem word as deel van 'n PhD studie onder toesig van Dr. M.L. Botha. Ons wil graag meer inligting oor die projek aan u verskaf en wat u betrokkenheid sal behels indien u besluit om deel te neem.

Die doel van hierdie navorsing is om te bepaal wat die moontlikheid van 'n gemeenskappe van praktyk benadering is vir die ondersteuning van die professionele ontwikkeling van Natuurwetenskaponderwysers in plattelandse gebiede. Die fokusgroep vir die navorsingsstudie is die Seniorfase Natuurwetenskap onderwysers en inligting sal vanaf hulle verkry word deur middel van vraelyste en onderhoude, aan die hand van navorsingsvrae en onderhoude.

Deelname aan die navorsing is vrywillig en dit sal die vorm aanneem van die voltooiing van vraelyste aan die begin en einde van die navorsing. Die eerste vraelyste sal opgevolg word deur 'n onderhoud/gesprek van ongeveer 1 tot 1½ uur, wat sal plaasvind op 'n onderling ooreengekome plek en tyd.

U mag ook weier om enige van die vrae gedurende die onderhoud te beantwoord as dit u wens is. Dit sal ook goed wees indien die onderwysers wat deelneem aan die navorsingsprojek, deel vorm van die gemeenskappe van praktyk. U mag ook te enige tyd onttrek van die navorsing deur die navorser in kennis te stel van u besluit. U besluit sal geen negatiewe gevolge inhou nie. Met u toestemming sal die onderhoud op oudioband opgeneem word, om die transkribering te fasiliteer vir latere analise.

Alle inligting deur u bekend gemaak sal deurentyd met die hoogste vertroulikheid behandel word. U identiteit sal nie bekend gemaak word in enige tesis, verslag of publikasie wat 'n produk van die navorsing mag wees nie. Die data wat deur die studie voortgebring word, sal in 'n kantoor weggesluit word vir 'n periode van 24 maande. Slegs navorsers wat geassosieer word met die projek sal toegang hê tot die data. Daar bestaan geen bekende of verwagte risikos of nadele vir die deelnemers aan die navorsing nie.

Indien daar enige vrae of onduidelikhede bestaan by u oor die navorsing en deelname daaraan, of as u addisionele inligting benodig om te help om 'n besluit te maak, kan u my gerus kontak by 082 896 7739 of e-pos by christap@sun.ac.za. U mag ook die projekteier Dr. M.L. Botha kontak by (021) 808 2293 of e-pos by lbot@sun.ac.za.

Ek hoop dat die uitsette van die navorsing die organisasies waarby u betrokke is tot voordeel sal wees, asook die breë navorsingsgemeenskap.

Die uwe,

Dr. Louise Botha

Studieleier

Christa Philander

PhD navorser

TOESTEMMINGSVORM

Ek het die inligtingsbrief oor die studie wat deur Dr. M.L. Botha en mev C.J. Philander van die Departement Kurrikulumstudie aan die Universiteit van Stellenbosch onderneem word, gelees en verstaan. Ek het die geleentheid gehad om enige vrae met betrekking tot hierdie studie te vra, om bevredigende antwoorde op my vrae te ontvang en enige bykomende inligting wat ek wou gehad het, te bekom.

Ek is bewus van my opsie dat 'n klank opname van my onderhoud gemaak kan word om 'n akkurate opname van my response te verseker. Ek is ook daarvan bewus dat uittreksels uit die onderhoud ingesluit kan word in 'n proefskrif en / of publikasies wat uit hierdie navorsing spruit, met die verstandhouding dat die aanhalings anoniem sal wees. Ek is ingelig dat ek my toestemming, sonder nagevolge ter enige tyd kan onttrek, deur die navorser in te lig.

Met volle kennis van alles voorafgaande, stem saam ek saam, uit my eie vrye wil om deel te neem in hierdie studie.

JA NEE

Ek stem in dat 'n klankopname van my onderhoud gemaak mag word.

JA NEE

Ek stem in dat anonieme aanhalings uit my onderhoud in enige tesis, of publikasie wat uit hierdie navorsing spruit, gebruik mag word.

JA NEE

Deelnemer

(voorletter/s en van)

(handtekening)

Getuie

(voorletter/s en van)

(handtekening)

Datum _____

ADDENDUM K

Informed Consent Form



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UNIVERSITEIT STELLENBOSCH
INWILLIGING OM DEEL TE NEEM AAN NAVORSING

Professionele onderwysontwikkeling van natuurwetenskap onderwysers: die rol wat gemeenskappe van praktyk daarby kan speel.

U word gevra om deel te neem aan 'n navorsingstudie wat uitgevoer word deur Christa Philander as deel van 'n PhD tesis onder toesig van Dr. M.L. Botha van die Departement Kurrikulumstudie aan die Universiteit Stellenbosch. U is as moontlike deelnemer aan die studie gekies omdat u 'n Seniorfase Natuurwetenskap onderwyser by 'n skool in 'n plattelandse gebied is.

1. DOEL VAN DIE STUDIE

Die doel van hierdie navorsing is om te bepaal wat die moontlikheid van gemeenskappe van praktyk benadering is vir die konseptualisering van professionele ontwikkeling van Natuurwetenskaponderwysers in plattelandse gebiede.

Doelwitte:

- Om te bepaal wat die huidige professionele status van onderwysers is.
- Om vas te stel of onderwysers reeds betrokke by gemeenskappe van praktyk is.
- Om vas te stel wat onderwysers se persoonlike ervaring is van die gemeenskappraktyke.
- Om in die klaskamer waar te neem hoe die onderwysers die ondervinding en kennis opgedoen in gemeenskapspraktyke toe pas.

2. PROSEDURES

Indien u inwillig om aan die studie deel te neem, moet u ten alle tye onthou dat deelname daaraan vrywillig is en dat u enige tyd kan onttrek sou u wou.

1. 'n pre-vraelys sal deur elke deelnemer voltooi word.
2. Die voltooi van vraelys sal opgevolg word met 'n onderhoud van ongeveer 1 tot 1½ uur, wat sal plaasvind op 'n onderling ooreengekome plek en tyd uitgevoer word om die inligting gegee in die vraelys op te volg of verder uit te klaar.
3. Die persone sal deel vorm van 'n natuurwetenskap seniorfase onderwyser gemeenskappraktyk wat een keer per maand vir 6 maande op 'n onderlinge ooreengekom plek en tyd vir een en 'n half uur per keer ontmoet.
4. Tydens die bymekaar kom van deelnemers in gemeenskapspraktyke asook klasbesoeke by die skole sal waarneming van die interaksie proses deur video, stem of veldnotas gemaak gemaak word, maar geen leerders sal in die proses op video opgeneem word nie.
5. Die laaste vraelys, die post-vraelys sal voltooi word nadat die persoon deel was van 'n gemeenskappraktyk.

3. MOONTLIKE RISIKO'S EN ONGEMAKLIKHEID

Hierdie is 'n navorsingsprojek waarin baie min indien enige risiko's vir u as deelnemer voorsien word. Indien u op enige stadium nie gemaklik voel met u deelname aan die projek nie, staan dit u vry om te onttre, met die versekering dat geen verdere eise aan u gestel word nie.

4. MOONTLIKE VOORDELE VIR PROEFPERSONE EN/OF VIR DIE SAMELEWING

Met die navorsing word gepoog om die moontlike van professionele onderwysontwikkeling te ondersoek en daar word ten doel gestel dat die uitsette van die navorsing die organisasies waarby u betrokke is, asook die breë navorsingsgemeenskap tot voordeel sal wees.

5. VERGOEDING VIR DEELNAME

Geen vergoeding sal gegee word vir deelname aan die navorsingsprojek nie.

6. VERTROULIKHEID

Enige inligting wat deur middel van die navorsing verkry word en wat met u in verband gebring kan word, sal vertroulik bly en slegs met u toestemming bekend gemaak word of soos deur die wet vereis. Vertroulikheid sal gehandhaaf word deur nie u identiteit bekend te maak in enige tesis, verslag of publikasie wat 'n produk van die navorsing mag wees nie. Die data wat deur die studie voortgebring word, sal op 'n hardeskyf wat in 'n kluis in 'n kantoor vir 'n periode van 24 maande weggesluit sal word, geberg word. Slegs navorsers wat geassosieer word met die projek sal toegang hê tot die data. Daar bestaan geen bekende of verwagte risiko's of nadele vir die deelnemers aan die navorsing nie.

7. DEELNAME EN ONTTREKING

U kan self besluit of u aan die studie wil deelneem of nie. Indien u inwillig om aan die studie deel te neem, kan u te eniger tyd u daaraan onttrek sonder enige nadelige gevolge. U kan ook weier om op bepaalde vrae te antwoord, maar steeds aan die studie deelneem. Die ondersoeker kan u aan die studie onttrek indien omstandighede dit noodsaaklik maak.

8. IDENTIFIKASIE VAN ONDERSOEKERS

Indien u enige vrae of besorgdheid omtrent die navorsing het, staan dit u vry om in verbinding te tree met PhD student (Hoofondersoeker): Christa Philander (082 896 7739) of e-pos by christap@sun.ac.za
Studieleier: Dr. M.L. Botha by (021) 808 2293 of e-pos by lbot@sun.ac.za.

9. REGTE VAN PROEFPERSONE

U kan te eniger tyd u inwilliging terugtrek en u deelname beëindig, sonder enige nadelige gevolge vir u. Deur deel te neem aan die navorsing doen u geensins afstand van enige wetlike regte, eise of regsmiddel nie. Indien u vrae het oor u regte as proefpersoon by navorsing, skakel met Me Maléne Fouché [mfouche@sun.ac.za; 021 808 4622] van die Afdeling Navorsingsontwikkeling.

VERKLARING DEUR PROEFPERSOON OF SY/HAAR REGSVERTREENWOORDIGER

Die bostaande inligting is aan my, [*naam van proefpersoon/deelnemer*], gegee en verduidelik deur [*naam van die betrokke persoon*] in Afrikaans en [*ek is/die proefpersoon is/die deelnemer is*] dié taal magtig of dit is bevredigend vir [*my/hom/haar*] verduidelik. [*Ek/die deelnemer/die proefpersoon*] is die geleentheid gebied om vrae te stel en my/sy/haar vrae is tot my/sy/haar bevrediging beantwoord.

[*Ek wil hiermee vrywillig in om deel te neem aan die studie/Ek gee hiermee my toestemming dat die proefpersoon/deelnemer aan die studie mag deelneem.*] 'n Afskrif van hierdie vorm is aan my gegee.

Naam van proefpersoon/deelnemer

Naam van regsverteenvoordiger (indien van toepassing)

Handtekening van proefpersoon/deelnemer of regsverteenvoordiger **Datum** _____

VERKLARING DEUR ONDERSOEKER

Ek verklaar dat ek die inligting in hierdie dokument vervat verduidelik het aan [*naam van die proefpersoon/deelnemer*] en/of sy/haar regsverteenvoordiger [*naam van die regsverteenvoordiger*]. Hy/sy is aangemoedig en oorgenoeg tyd gegee om vrae aan my te stel. Dié gesprek is in *Afrikaans* gevoer.

Handtekening van ondersoeker

Datum

ADDENDUM L

Transcriptions of Interviews

Transkripsie van onderhoud T 01

Datum: 15 Julie 2016

Plek: Privaat

Tipe van Onderhoud: Fisiese Bymekaarkom

Tyd: Skoolvakansie

Navorsers: Hierdie gesprek gaan spesifiek oor gemeenskapspraktyke, dis nou 'n term wat ons gebruik vir hierdie informele groepe tussen verskillende skole waar onderwysers dan bymekaarkom wat in dieselfde vakgebied is en in dieselfde fase is. wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

Vraag1

Navorsers: Wat is u ondervinding omtrent die samewerking van onderwysers indieselfde vakgebied en indieselfde fase in so 'n gemeenskapspraktyk?

Deelnemer: My ervaring is dat ons werk gewoonlik baie goed saam as ons bymekaar is, maar sodra jy jou in jou eie omgewing bevind, met al die verwagtinge wat die onderwys aan ons stel, kan daar later soort van 'n leemte begin ontstaan, en samewerking dis eintlik 'n indirekte samewerking wat nie plaasvind later nie. So die samerking kan goed aan die gang gehou word, as daar gedurige kontak met mekaar is en dit is my ervaring, in die verlede het ek agtergekom ons werk goed saam, maar dit is nie volhoubaar nie.

Vraag 2

Navorsers: Beslis wat ek hoor wat jy sê is beslis is daar 'n probleem met tyd, onderwysers het bsiige skedules en dit is die rede hoekom onderwysers dan nie meer deel wil wees van 'n gemeenskapspraktyk nie. Nou het jy enige idees uit jou ondervinding van gemeenskapspraktyke hoe om so 'n gemeenskapspraktyk effektief te laat funksioneer?

Deelnemer: My voorstel sal wees by die skool homself moet daar 'n groep gevestig word, 'n sterk groep wat saammet mekaar by die skool kan werk. In my skool se geval sal ons byvoorbeeld net 3 wees, dit verskil van skool tot skool maar ek glo as jy by jou eie skool eers 'n sterk groep vestig en die samewerking daar kan redelik gevestig word, dan gaan jy begin om uit te beweeg om vroe of enige vaardighede wat die groepie miskien ontbreek kan dan nou aangespreek word deur die groter groep. Hoe beter die samewerking by skool is, hoe beter sal die samewerking in die groter gemeenskapsgroep wees, want daar is sekere vroe in die Wetenskappe, ons is nie kundig almal op elke gebied nie, so hier kan ons mekaar kruisbestuif. So dis maar een manier hoe 'n mens die noue samewerking kan aanspreek waar jy stek basis vestig en daarvandaan is almal opgewonde en daai opgewondenheid gaan die groep verder laat ontwikkel.

Vraag3

Navorsers: So onmiddelik kom die volgende vraag op, fisiese bymekaarkom gaan nie altyd moontlik wees nie. So het jy enige ander voorstelle hoe so 'n gemeenskapspraktyk kan funksioneer dat mense nog steeds kan kommunikeer en dat hierdie kruisbestuiving nog steeds kan plaasvind?

Deelnemer: Ja kyk deesdae se tegnologie maar baie het 'n mens jy kom ook baie keer met verskonings, want jy kan nie voor jou rekenaar sit om eposse te lees of deesdae is daar die whatsapp groepe, chat groepe en die verskillende tegnologiese hulpmiddele wat 'n mens kan gebruikEk het gesien van die effektiwiteit van 'n whatsapp chatgroup, en hier kan 'n mens byvoorbeeld met wetenskapvroe of goeie praktyke wat

kan gedeel word, maar ek glo dat, al is dit een keer in 'n maand waar so 'n oog tot oog kontak kan plaasvind. Dit is baie belangrik, want hier kan jy nadat jy sekere dinge in die group chat gedeel het verder uitbrei. So byvoorbeeld dit is nou die begin van die derde kwartaal, dit is nou energie en veranderinge wat gedoen gaan word en so kwelvae kan uitgesorteer word, maar een keer of twee keer in die kwartaal kan nog steeds bymekaar gekom word. Om daagliks op jou foon te spring en skoolverwante praktyke te kan deel kan baie goed wees.

Vraag 4

Navorsers: Uit jou ondervinding as onderwyser die afgelope jare, het jy enige idees hoe om wetenskap onderwys effektief vir die leerders aan te bied?

Deelnemer: Hmm uit my ervaring uit om kinders eers opgewonde te kry. Nou baie van ons maak die fout dat ons demonstreer maar ons vergeet dat wetenskap is ook 'n vak van redeneer. Ons redeneer sekere aspekte of sekere konsepte kan uitgeredeneer word, maar dan ook prakties is nogals baie belangrik. Dat kinders self prakties doen, sommige tye dan is dit chaos, maar as 'n kind dit self dit gedoen het dan help dit baie. Dit maak hulle opgewonde, ek het ook geleer uit my ervaring uit, ek daag my kinders uit. As ek vandag dit geleer het, kom ek maak 'n voorbeeld materie en materiale. Ons het nou vandag sure en basiese gedoen en ek gaan daag hulle uit gaan doen hierdie eenvoudige eksperiment, natuurlik onder toesig. Nou kom die kind die volgende dag of 2 dae daarna baie opgewonde, nee mnr dit werk. Ek het al byvoorbeeld kinders ook wat nou al op Hoërskool is ook al gekry of kinders wat werk wat sê mnr daai dag toe jy vir my gesê het ek moet dit gaan doen het, ek is nou 'n metalurg, of ek is nou besig om te studeer vir dat of dat. So kinders moet ervaar, kinders moet geleer word maar hulle moet ook ervaar en hierdie idee van self uitprobeer, daar is natuurlik die stappe wat gevolg moet word want ons byvoorbeeld redeneer oor het jy die regte stappe gevolg. Byvoorbeeld die kind kan sê mnr by my was dit blou maar by u was dit groen, hoekom dan so en dan kan ons teruggaan en dit is vir my 'n manier van leer. Die kinders is excited, hulle leer daaruit uit en hulle kan dit gaan toepas in die werkswêreld en die grootmenswêreld. So die idee is kry jou kinders opgewonde, laat jou kinders foute maak, laat jou klas choaties wees, georganiseerde chaos as ek daai woord kan gebruik.

Vraag 5

Navorsers: Nou wat dink jy kan gedoen word om die faktore wat tans ondervind word by julle skool, om daai faktore aan te spreek?

Deelnemer: Jy weet ek het nou nie genoem van 'n faktor byvoorbeeld van 'n onderwyser wat nie die nodige selfvertroue het nie om die vak te onderrig nie. Veral by die kleiner skole kry jy so 'n geval die onderwyser moet maar nou die vak doen. Hy doen miskien klasonderrig. So hy gaan nou net die vak waarin hy kundig is of selfvertroue het om te onderrig. So hierdie gemeenskappe van praktyk veral vir die onderwysers wat nie selfvertroue het nie kan baie baatvind hieruit. So ons spreek sommer hierdie faktor aan deurdat daar gereeld met mekaar gekommunikeer word en hierdie onderwysers kan leiding kry. Sommige onderwysers ervaar ook dat hulle nie selfvertroue het om praktiese te doen nie of die man is kundig of het kan nie die nodige dissipline handhaaf in die klas nie. Daardeur laat hy maar sekere konsepte laat gaan omdat dit chaos in die klas kan skep. So in die gemeenskapspraktyke kan jy praktyke deel om prakties vir die onderwyser wat bang daarvoor is. Kan daar gedeel word goeie praktyke wat onderwysers wat nou al met selfvertroue prakties aanbied in hulle klasse, so hy het sy voordeel ook en daar is nog so enetjie wat ek aan gedink het..

Ons het nou op die onderwyser gefokus, die leerders self daai vorige enetjie wat ek genoem het laat kinders die goed begin doen, .

Navorsers: Dink jy dalk apparaat is dalk 'n probleem by julle skool?

Deelnemer: my verbasing ek gedink dat klein skole se apparaat nie sodanig beskikbaar is nie, maar klein skole word bevoorbeeld baie geborg met apparaat. So baie keer sit die apparaat daar, maar die man het nie selfvertroue nie. En werksinkels waar jy byvoorbeeld, ek kan byvoorbeeld onthou by my studies het ons op 'n jaar gedoen die people science gedeelte, waar jy 'n apparaat self gemaak het, juis om daai verskoning aan te spreek. Veral nuwe onderwysers wat met nuwe tegnologie kom en onderwysers wat byvoorbeeld net Natuur Wetenskappe net gegee is om aan te bied om net die rooster vol te maak, kan juis baie daaruit leer. Nou ek wil nou nie nuwe onderwysers, ek wil hulle nie afbreek nie, maar die kinders, as ek terug kan gaan na die kind toe. Ons sit met die wonderlike aparate by die skool, klein skole ook, jy kry die science kit, maar die kind sal hy die apparaat kan gebruik? Dit is waar die people's tools baie handig tot toepassing kom. Die goed wat kan gemaak word, bottels, plastic bottels, whatever. Nou kan die kind huistoe gaan, hy kan dit gaan practice. So ons seker meer beweeg nadit toe ook. Maar in Afrika self sit ons met kinders wat self met niks iets kan doen en hierdie kinders is in baie gevalle baie hoër gevorderd as ons Suid-Afrikaners so hy het sy voordeel ook.

Vraag 6

Navorsers: Wat dink jy kan gedoen word om die faktore genoem in voorafgaande vraag aan te spreek

Deelnemer: Ek sal sê om te summarise onderwysers moet eerstens opgewonde gemaak word oor die vak, jy moet dit sien watter uitdaging kan ek aan my kinders stel, of watter uitdaging kan ek aan myself stel? So maak onderwysers opgewonde, so die wat opleiding nodig het, of die wat net 'n hupstotie nodig het gee die nodige ondersteuning. Die persone wat kundig is by die skool gee vir hulle 'n meer verantwoordelike rol om te vervul en dan en dan as jou onderwysers aan board is en hulle begin voel vol selfvertroue, vat dieselfde metode na die kinders toe, kry die kinders aan board, dink byvoorbeeld aan 'n science klub, waar julle net kan gaan en net sekere goed kan bespreek. So kry jou kinders dat hulle begin opgewonde raak oor die wetenskappe.

Navorsers: Nou wil ek sommer aanhaak by jou, ons dink aan nuwe onderwysers, klein skole waar die onderwysers dalk nie opgelei is om die vak aan te bied nie en ons dink byvoorbeeld aan skole wat vër vanaf groot dorpe is. Het jy al gedink oor wat om te doen om daardie onderwysers ook te betrek by so 'n praktyk en vir hulle ook deel te maak van die ervaring en ondersteuning wat in so 'n praktyk kan plaasvind, deel te maak.

Deelnemer: Weet jy ek het nogal gedink daaraan al die goed wat ek nou genoem het tegnologie ensoaan, maar 'n baie belangrike ding wat ons wat hier is, ons wat nou in die beskawing is, baie kere hoekom ryk ons nie uit na hulle nie. Ons kan byvoorbeeld, ons maak 'n bussie op, twee voertuie op en ons gaan na hulle toe, once jy daai mense daai waardigheid gee, ons is ook mos belangrik. Hierdie mense kom na ons toe, dis amper soos reverse psychology wat jy nou toepas, want hulle nou waardevol en dan gaan mense nie omgee om op sy foon te klim, op skype te klim en beginne met jou kontak te maak nie want mense voel daarwas ook werklikheid uitgereik na my en mense voel ook deel van die gemeenskap. Dit is een ding wat ons kan doen. En onervare onderwysers, onderwysers wat nie kundig is nie, dis 'n eeu oue beginsel, jy moet vir hom vat letterlik vanaf A tot by Z, stap vir stap. Dit is waar ons led techers ook sterk moet deurkom, wat dit nie altyd dit kan doen nie. Maar mentorskapprogramme in klusterverband, nou kanons dit nou kleiner maak,

jy vat byvoorbeeld die Noorde kan 'n Vredendal skool 'n mentor wees van 'n klein skool ,klein skooltjie in die Vredendal Omgewing, maar op die manier vat jy daai persoon stap vir stap.

Bv daar is nog 'n ander ding wat ek aan dink, byvoorbeeld nuwe onderwysers gaan in hulle laaste jaar vir 6 maande na 'n skool toe. Nou moet hulle daar die praktyk leer wat eintlik nou 'n baie goeie ding is, maar my vraag is daai onderwysers wat nou volgende jaar moet gaan skool hou is nog nie baie gesit in programme om 'n klas self te manage nie, so miskien moet 'n mens verder dink daaraan om met opleidingskolleges te skakel of nog moet voorstelle as die onderwyser dit so geniet by 'n skool dat hy so selfvertroue het om sy klas te bestuur. Maar dan moet daar byvoorbeeld gesê word, die onderwysers wat byvoorbeeld 2016 klaarmaak 2017 en 2018 dis jou mentor vir die volgende 2 jaar en once jy na daai jaar is, is jy stapsgewys van Atot Z deurgevat.

Navorsers: Nou verstaan ek dit verkeerd, is dit nou nie dan nou nie by die skool die departementshoof se rol nie, dat die vakspan 'n mentor aanwys vir die nuwe onderwyser nie?

Deelnemer: Nou baie kere het daai onderwyser wat die mentor is het nie altyd die selfvertroue nie. Nou nog 'n ander ding wat ek uit my ervaring geleer het is is dat senior teachers is wat eintlik posvlak 1 onderwysers is, ,wat eintlik op 'n departementshoof se skaal is, is volgens die PAN dokument is een van die core duties van 'n senior teacher om as mentor op te tree. Nou dit is nou volgens wet, maar wat in die geskryf word dis nou volgens wet, die senior teacher moet as mentor optree, maar nou is die persoon miskien nie 'n Wetenskap onderwyser nie, verstaan so dis die ander probleem wat ons ook dan het, maar ek stem met jou saam by 'n skool self maar nou baie keer is dit so by die skool self en veral by kleiner skole die mono graad skole is soos by Mariana is groot skole daar kan jy 'n mentor wat 'n letterlike kundige is en daar waar ek netnou genoem het waar ons in die Lutzville kluster is daar 'n mentor onderwyser by Uitkyk wat byvoorbeeld vir Koekenaap en Lutzville Wes en Booyensdal kan vat. Wetenskap onderwysers en hulle leeterlik mentor deur die program.

Navorsers: Nou iets wat die departement nou doen is, sê maar die nuwe konsep is professionele learning communities wat hulle wil implementeer en ek dink die idee is nou juis om dan onderwysers professioneel te ontwikkel die nuwe ene of die een watnou lankal in die stelsel is maar nie noodwendig nou opgelei is om die vak aan te bied nie. Nou wat is jou gevoel rondom die nuwe konsep, Professional learning communities?

Deelnemer: Ek is bly dat ons en ek is deel van die onderwysdepartement, dat ons wakker geskrik het vir dit want dit is hoekom ons baie onderwysers verloor het en dit is hoekom ons baie onderwysers wat, kom ek vat vir my as voorbeeld, Biologie, skeinat wetenskap, aardrykskunde, jy sien ons verloor kundiges omdat die man nou later 'n jack of all trades moet word en vakke soos Fisiese Wetenskap gaan tot niet by baie skole omdat jou kundiges moet na 'n ander gebied toe gaan en dit wat die Departement nou doen is 'n goeie ding dit kan werk.

Navorsers: Nou edward baie dankie jy het nou 'n mondvul, is daar dalk nog enige iets anders wat jy wil byvoeg?

Deelnemer: Kyk vir my gaan dit oor die, kyk een van die taalonderwysers, hy is nou al afgetree al het die term volhoubaarheid gebruik. Dit wat ons nou bespreek die gemeenskapspraktyke dat 'n mens dat die vuur die kool aanmekaar blaas om dit aan die gang te hou. So dit is vir my 'n challenge ek vra myself altyd hoe kry 'n mens dat, ek is 'n wetenskap onderwyser, maar nou ek is ook 'n skoolhoof ook, jy gaan later so in bestuur en dat jy verloor en baie keer het dit te doen moet jou as persoon self, hoe is jou passie vir die Natuurwetenskappe. As jy 'n passie het dan sal jy sekere goed byvoorbeeld dryf by jou skool as jy nou in

bestuur is en baie keer ook dat jy jou tydsbestuur ook so moet uitwerk dat jy nog steeds daai passie kan uitleef. So dit is 'n challenge .

Transkripsie van onderhoud **T02**:

Datum: 23 Junie 2016

Plek: Skool

Tipe van Onderhoud: Fisiese Bymekaarkom

Tyd: Naskool

Navorsers: Hierdie gesprek gaan spesifiek oor gemeenskapspraktyke, dis nou 'n term wat ons gebruik vir hierdie informele groepe tussen verskillende skole waar onderwysers dan bymekaarkom wat in dieselfde vakgebied is en in dieselfde fase is. Wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

Vraag1

Navorsers: Wat is u ondervinding omtrent die samewerking van onderwysers in dieselfde vakgebied en in dieselfde fase in so 'n gemeenskapspraktyk?

Deelnemer:

Ja, om eerlik te wees te wees juffrou ek het 'n probleem met die ander skole, oor ons wat in dieselfde ou groepe is werk goed saam, maar ek het so 3 jaar terug probeer vra is daar nie hulp onder nie, chemicals gevra, maar dit is eenvoudig net nee ons het nie. So ek werk met my mense werk ek goed saam. Op die oomblik werk ek en Maxine Engelbrecht van Maskam werk ons lekker saam, mens kan maar sê ek is haar mentor, ek help vir haar want dit is maar haar 2^{de} jaar wat sy wetenskap gee. Met die ander skole het ek geen probleem nie, hulle help graag en dan is ons ook gelukkig om mnr Cleophas hier te hê, so hy gee vir ons goeie leiding.

Vraag 2

Navorsers: Ek het nou bietjie gehoor van u ondervind van gemeenskappraktyke. Het u enige idees / voorstelle hoe om so 'n gemeenskapspraktyk effektief te laat funksioneer?

Deelnemer: Onthou u daai een jaar het u hier vir ons hier IWWOUS vir ons Wetenskapklasse gehad waar al die skole uitgenooi was en dit het gewerk en ons het toe ook oor die kleurgrens saamgewerk. Ongelukkig is IWWOUS iets vandie verlede, maar in elke geval die samewerking is nie meer daar nie.

Vraag3

Navorsers: So as 'n mens na 'n ander probleem ook kyk, onderwyser 'n baie vol skedule, en fisies bymekaarkom van so 'n groep mense in 'n gemeenskapspraktyk gaan baie moeilik wees, nou het u dalk enige voorstelle hoe 'n mens daai probleem kan oorkom?.

Deelnemer: Juffrou die tegnologie hoekom gebruik ons dit nie? Soos ons se whatsapp groep hoekom gebruik ons dit nie op die oomblik soos u dit nou gebruik met ons nie. So dat ons nou definitief nou vir mekaar kan vra en raad gee, wenke gee vir mekaar. So hoekom gebruik ons nie tegnologie nie?

Navorsers: So die tegnologie is 'n opsie, maar voel u nog steeds dat maar voel u nog steeds dat fisiese bymekaarkom nog steeds belangrik is.

Deelnemer: So een of twee keer 'n jaar kwartaal of 'n jaar.

Navorsers: So wat ek hoor uit u kommentaar is dat daar definitief 'n behoefte is vir so 'n samekoms, maar moet daar spesifieke riglyne wees, hoe bepaal ons dan wat ons gaan doen in so 'n tipe bymekaarkom?

Deelnemer: Ons moet gebruik maak van die groepies telefonies en as ek optel dat daar ander mense is met dieselfde probleem dan sal ek baie makliker ook erken dat ek het ook 'n probleem. Maar as ons bymekaarkom en ek moet eerste sê dan is ek bietjie skaam. Ons het nog daai houding, wat gaan die onderwysers dink van my.

Navorsers: Ek tel iets interessant op daai tipe skaamheid dat ek kan dit nie doen nie, wat gaan my kollegas van my dink, dink u die tipe stigma of denkwysse kan afgebreek word in so 'n gemeenskapspraktyk? So langer mens mos met mekaar saamwerk so meer word die vertrouensverhouding gebou. So dink meneer dan hierdie probleem kan dan aangespreek word in so 'n gemeenskapspraktyk?

Deelnemer: Definitief want ons gaan mos mekaar dan face to face dan ontmoet.

Vraag 4

Navorsers: Uit u ondervinding as onderwyser die afgelope jare, het u enige idees hoe om wetenskap onderwys effektief vir die leerders aan te bied?

Deelnemer: Ek het uitgevind as jy nie daai praktiese ervaring met die kinders deel nie, vat nou die moeilike werk, as jy dit nie vir hulle prakties wys nie, hulle kan nie abstrak dink nie. En dan ek kom uit die ou skool nog, jy moet vir die kinders elke dag toetsies gee, Maar die belangrikste is as jy nie vir jou kinders toelaat om eksperimente te doen nie, ek praat nou van sommige eksperimente. Ek het nou selfs ervaar dat selfs die mense wat nulle kry, hulle is eerste daar by die praktiese, so ten minste kan hulle ook nou iets doen, maar gee hulle eenvoudige eksperimentjies. .

Navorsers: So om dit saam te vat, dit ingesteldheid van die onderwyser speel 'n groot rol in die ontwikkeling van 'n kind.

Deelnemer: Ek sal sê die jong onderwysers wat ook nou beginne, hulle moet definitief ok kyk na die agtergrond van die kinders, en dan uitvind wat verhinder hulle. Ons verwag so maklik kinders moet toegang het tot die internet, baie keer sê ek vir my kinders gaan kyk op youtube, maar dan vergeet ek baie van die leerders het nie rekekaars by die huis nie, het ook nie toegang tot internet nie.

Vraag 5

Navorsers: Nou u was by verskillende skole betrokke die afgelope jare, watter faktore dink u beïnvloed die meeste dat die vak Wetenskap nie effektief genoeg onderrig word nie?

Deelnemer: Hulpmiddele, hulpmiddele. Ek was gelukkig by 'n skool in X waar ek befondsing van Industrie gekry van R6000 gekry het, toe kon ek vir die Wetenskap goedere aankoop. Later toe kom die staat, hulle het seker skaam geword, toe gee die staat vir die skole sulke boksies, kabinette met 'n biekie chemikalieë wat hulle kon gebruik. So finansies ongelukkig van die klein skooltjies, as jy nie finansies het nie, dan kan jy nie data vir die kinders aankoop nie. So die klein skooltjies wat dail-up het en sukkel om by die internet in te kom. Die werksessies wat SUNSEP aanbied is baie goed, daar moet na befondsing gekyk word om weer van die ondersteuningswerksessies aan te bied.

Deelnemer: dit is maar jou gewone goed soos apparaat en dan jy moet die kinders kan prikkel om in te koop, want as jy nie pratiese gaan doen nie, dit wil sê eksperimente nie, dan gaan jy die kinders laat belangstelling laat verloor. Want Wetenskap is iets wat hy kan sien, wat hy moet waarneem, want jy kan nie net vir hom verduidelik wat in 'n eksperiment gaan plaasvind nie. Daar is ook eenvoudige eksperimente wat hulle kan doen, soos ek reeds gesê het ons kan die verskoning gebruik ons het nie apparaat nie, daar is boeke wat vir jou die eenvoudige doen van eksperimente verduidelike, wat aandui wat hulle van die huis af kan bring. En as ander opvoeders dit kan sien dan glo ek hulle sal ook meer gemakliker wees. As ons vat dat ons elke maand fisies bymekaar kan kom sal miskien nie so gemaklik wees nie, maar as jy eers sien dat ander mense ook foute maak en as jy daaruit gaan leer dan kan jy vir die kinders dit wys, en hulle kan ook iets probeer, dan sal dit werk. en die onderwysers sal vertrou kry en die kinders sal ook vertrou kry. Hulle sal ook besef dat eksperimente werk somtyds en somtyds werk dit nie.

Vraag 6

Navorsers: Wat dink jy kan gedoen word om die faktore genoem in voorafgaande vraag aan te spreek?

Deelnemer: As ons nou begin met die groepies bymekaarkom, of as ons telefonies of deur die whatsappgroepies kontak, want dan kan ons daarvandaan werk want dan kan ons ten minste eenkeer 'n kwartaal alle graad 7-9 onderwysers bymekaarkom en miskien laters selfs die hoër klasse. Want as skole wat nie so betrokke is nie sien dat die praktyk werk goed, dalk kan hulle dit motiveer om meer betrokke ook te raak.

Navorsers: As ek kan byvoeg, sy nou ons betrek ook die graad 10 onderwysers en die graad 5 en 7, sodoende het ons later 'n goed gevertegenwoordigende groep onderwysers van die fases. Sodoende kan inligting beter uitgeruil word en uitdagings aangespreek word.

Deelnemer: Ja kom ons sluit van die begin af die IF sowel as die VOO fase in. Sodoende verhoed of of kan ons daai konflik uitskakel waar onderwysers in die verskillende fases blameer dat die leerder nie reg voorberei is vir die fase waarnatoe hulle gaan nie.

Navorsers: Baie dankie meneer vir u deelname.

Transkripsie van onderhoud T03

Datum: 15 Julie 2016

Tipe van Onderhoud: Fisiese Bymekaarkom

Plek: Privaat

Navorser: Hierdie gesprek gaan spesifiek oor gemeenskapspraktyke, dis nou 'n term wat ons gebruik vir hierdie informele groepe tussen verskillende skole waar onderwysers dan bymekaarkom wat in dieselfde vakgebied is en in dieselfde fase is. wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

Vraag1

Navorser: Wat is u ondervinding omtrent die samewerking van onderwysers indieselfde vakgebied en indieselfde fase in so 'n gemeenskapspraktyk?

Deelnemer: Met ander onderwysers kon ons baie inligting deel met mekaar, ons kon idees uitruil en ons kan mekaar ondersteun om sodoende ons kinders se ervaring en kennis uit te brei.

Vraag 2

Navorser: U jou ondervinding van gemeenskapspraktyke het jy enige idees / voorstelle hoe om so 'n gemeenskapspraktyk effektief te laat funksioneer?

Deelnemer: Daar moet gereelde kommunikasie tussen die opvoeders wees, daar moet ondersteuning by die skole wees, almal moet kennis neem van wat jy byvoorbeeld beplan om sodoende samewerking op alle terreine te kry. Finansiëel wat apparaat betref, idees.

Vraag3

Navorser: So as 'n mens na 'n ander probleem ook kyk, onderwyser 'n baie vol skedule, en fisies bymekaarkom van so 'n groep mense in 'n gemeenskapspraktyk gaan baie moeilik wees, nou het u dalk enige voorstelle hoe 'n mens daai probleem kan oorkom?.

Deelnemer: Ons het mos deesdae onse eposse waarop ons met mekaar kan kommunikeer, telefonies en wat die kommunikasie middele betref het ons redelik vër gevorder so onderwysers moet maar net bybly, hulleself opskerp en tyd inruim omsodoende die kommunikasie gereeld na te gaan, om gereelde inligting te kry. Wat gereeld uitgeruil word tussen die onderwysers.

Navorser: Wat ek wil byvoeg by dit is, jy praat nou van sosiale platvorms, maar dink jy fisiese bymekaarkom is nog steeds belangrik of is dit nie so belangrik nie? So die tegnologie is 'n opsie, maar voel u nog steeds dat maar voel u nog steeds dat fisiese bymekaarkom nog steeds belangrik is.

Deelnemer: So een of 'n kwartaal ek sal verkies dat dit aan die begin van 'n kwartaal plaasvind sodat idees kan uitgeruil word vir die werk wat in die kwartaal gedoen moet word., programme en temas wat kinders moet doen om mekaar dan op so 'n manier te ondersteun.

Die praktiese werksinkels wat aangebied word is nogal 'n goeie hulpmiddel veral onderwysers wat vir die eerste keer skoolhou, vir die beginners opvoeders dit is nogal 'n goeie gedagte vir daai gereelde sessies persoonlike kontak.

Navorsers: Hoe dink jy nou die samestelling van so 'n praktyk, jy het nou iets interessants genoem, veral vir jong onderwysers, maar ek lei af uit jou gesprek dat so 'n groepie onderwysers moet divers wees. En in terme van fase moet dit net gefokus wees op Seniorfase of kan dit Intermediêre fase ook insluit, wat is jou gevoel?

Deelnemer: Ek dink dit kan gekombineer word, want kennis wat in die Intermediêrefase oorgedra word word mos net voortgesit of uitgebrei in die Seniorfase. So ek dink nogal die Senior- en Intermediêre fase kan saamwerk. Wat my ondervinding betref as vakhooft weet ons ook waar om te kyk, watter inligting uiters belangrik is, waarop onderwysers baie moet fokus vir deeglike vaslegging sodat leerders die kennis kan ken in die seniorfase en ook in die VOO band.

Navorsers: Iets anders wat ek nou aangedink het terwyl ons gesels het, 'n mesn groei mos in so 'n groep in, maar dit is 'n informele struktuur, was jy al deelgewees van so 'n groep of sal dit die eerste keer wees?

Deelnemer: Ek was al deel van so 'n groep.

Navorsers: Nou wat was die aanvanklike rede hoekom so 'n gemeenskappraktyk begin was?

Deelnemer: Dit was om praktiese aktiwiteite uit te voer, EXPO aktiwiteite saam te beplan en te doen, hierdie praktiese eksperimente vir die jaarlikse wetenskapweek te beplan en die samewerking was lekker. Jy het beskermd gevoel want jy kon inligting uitruil en ons kon leer van mekaar.

Navorsers: Wat was jou ervaring rakende die samewerking in so 'n gemeenskapspraktyk?

Deelnemer: My ervaring van die groepie waarin ek betrokke was, die onderwysers was baie entoesiasies. Ek moet sê daar was 'n lekker samewerkingsgees gewees en jy kon gedurig op iemand se knoppie druk indien jy hulp nodig het en jy kry die nodige ondersteuning en inligting wat jy verlang.

Vraag 4

Navorsers: Uit jou ondervinding as onderwyser die afgelope jare, het jy enige idees hoe om wetenskap onderwys effektief vir die leerders aan te bied?

Deelnemer: Wetenskap is 'n praktiese vak en ons moet dit so prakties as moontlik aanbied. Waar sekere skole mos nou nie die nodige hulpmiddels het nie, kan daar met mekaar gekommunikeer word en apparat en chemikalieë wat nodig is, kan uitgeruil word. Ek het ondervinding en ruil gereeld uit van skole, veral ons sekondêre skole, hulle is bereid om te help en dit moet net so prakties as moontlik gedoen word. En ons het mos deesdae die witbord en projektors so ons kan videos ook vir die leerders wys wat sekere werk demonstreer sodat jy meer effektief die leermateriaal kan gebruik in die klaskamer. Ons mentors ons vakadviseurs is meer as bereid om hulp aan te bied waar dit nodig is.

Navorsers: Dis vir my goed om dit te hoor, want soos ons weet by die skool is jy departementshoof en jy moet jou vakspan lei, maar soos jy nou genoem het die kurrikulum adviseur is ook daar om ondersteuning te bied. Nou 'n gemeenskapspraktyk is baie informeel, dink jy so 'n praktyk kan dalk help om probleme wat onderwysers by skole ondervind aan te spreek?

Deelnemer: As jy inligting nodig het moet jy mos nou praat en hoe meer kennis jy kan inwin hoe beter. En inligting jy kan met jou vakadviseur praat, jou groep praat en inligting probeer inkry en dit wat jy natuurlik in die groep geleer het kan jy weer toepas in jou klaskamer

Navorsers: Nou wat ek hoor is jy sê by so 'n informele groep/ struktuur kan'n mens kundiges van tyd tot tyd ook intrek, maar dit word dit meer informeel maar meer gestruktureerd wees soos dit vereis word deur die onderwys departement.

Vraag 5

Navorsers: Nou watter faktore beïnvloed tans dat Wetenskap nie effektief by julle skool onderrig word kan word nie?

Deelnemer: Ons se skool is een van die oudste geboue in die omgewing en ons het nie 'n wetenskap laboratorium met al fasiliteite om dit effektief aan te bied nie. Dit is een van die grootste redes.

Navorsers: Is daar al planne in plek om van die faktore aan te spreek of is dit iets wat nou nog nie enige voorstelle het om dit aan te spreek nie.

Deelnemer: Daar was 'n tyd gelede genoem van die moontlikheid dat ons 'n nuwe skool kan kry, met al hierdie toerusting wat daarmee gepaard gaan en dan het ons ook gesê ons moet een van die munisipale amptenare van die verwydering en die vernietiging van die sekere apparaat waarmee ons nog steeds sit in die laboratorium . So die ding is al aangespreek en dan het die skool in die begin van die jaar 'n science kit van R 15000 aangekoop veral vir hulpmiddels in die IF en Seniorfase en die tegnologieklas.

Transkripsie van onderhoud van T 04

Datum: 30 Julie 2016

Plek: Privaat

Tipe van Onderhoud: Fisiese Bymekaarkom

Tyd: Naskool

Vrae vir Onderhoud

Gemeenskappe van praktyk is die term wat gebruik word vir 'n informele groep tussen verskillende skole wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

1. Wat is jou ervaring omtrent die samewerking van onderwysers wat dieselfde vak aanbied in 'n gemeenskapspraktyk?

Onderwysers het nie altyd die tyd om bymekaar uit te kom om saam te werk nie. Hulle voorbereiding en buitemuurs hou hul baie besig. Een keer per kwartaal is haalbaar. Onderwysers kan baie hulp aan mekaar verskaf indien die ingesteldheid daar is en die bronne beskikbaar is. Almal soek eenvoudige goedkoop maniere om praktiese demonstrasies of take te kan uitvoer.

2. Uit jou ondervinding van gemeenskapspraktyke, het jy enige voorstelle hoe om so 'n gemeenskapspraktyk effektief te laat funksioneer?

E-portal stelsel is 'n goeie manier om vraestelle en praktiese take uit te ruil - onderwysers soek voorbeeld vraestelle en idees vir praktiese.

3. Onderwysers het 'n baie vol skedule en fisiese bymekaar tye gaan moeilik wees. Het jy enige voorstelle oor die wyse waarop die groep kan kommunikeer om sodoende nie onnodige tyd in beslag te neem nie.

Whatsapp group kan werk, of op die internet.

4. Uit jou ondervinding as onderwyser die afgelope jare, het jy enige idees hoe om wetenskap onderwys effektief vir die leerders aan te bied?

Kinders hou van visuele voorstellings en musiek. Videos werk om werk te "introduce" of iets te verduidelik wat nie fisies gewys kan word nie...bv. hart se werking. Oopsny van dier-organe is ook leersaam. Om self 'n stroombaan te bou is ook stimulerend en die seuns hou veral daarvan. Chemiese reaksies en "ontploffings" kry ook aftrek. Mindmaps werk vir opsommings en om werk te leer.

5. Watter faktore tans beïnvloed dat wetenskap onderrig nie effektief by jou skool kan plaasvind nie?

Die grootte van my klasse. Ideale klas sal 20-30 wees. OP hierdie stadium is dit 38-48 kinders per klas. Die ruimte om stasies op te stel vir prakties is heeltemal beperk en goeie dissipliene word gedemp deur die hoeveelheid kinders.

6. Wat dink jy kan gedoen word om die faktore genoem in voorafgaande vraag aan te spreek?

Departement kan hoeveelheid kinders per klas verminder, skole bou en meer onderwysers aanstel.

Transkripsie van onderhoud T05

Datum: 23 Junie 2016

Plek: Skool

Tipe van Onderhoud: Fisiese Bymekaarkom

Tyd: Naskool

Navorser: Gemeenskappe van praktyk is die term wat gebruik word vir 'n informele groep tussen verskillende skole wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

Vraag1

Navorser: Het meneer al ondervinding om in 'n gemeenskapspraktyk saam te werk in u vakgebied?

Ja met Werkswinkels en goed wat ons gehad het het ek nou al die geleentheid gehad om met verskillende onderwysers saam te werk, by ons skool plaaslik en met ander skole in die streek en met ander skole in die provinsie ook, so ek het redelik ervaring 'n gemeenskapspraktyk. .

Vraag 2

Navorser: Uit u ondervinding met so 'n gemeenskapspraktyk, het u enige voorstelle hoe om so 'n praktyk effektief dan te laat funksioneer?

Antwoord: Ja omdat die kurrikulum is basies dieselfde en hoe meer idees jy kry van verskillende onderwysers sal dit tot voordeel van almal wees, verskillende onderwysers hoe meer kan jy verseker dat almal werk op dieselfde vlak want jy weet almal werk na dieselfde doel om dit te bereik ja. .

Vraag3

Navorser: As 'n mens dink 'n onderwyser het 'n baie vol skedule, en fisies bymekaarkom van so 'n groep mense in 'n gemeenskapspraktyk gaan baie moeilik wees, nou het u enige voorstelle op watter wyse so 'n groep kan kommunikeer om sodoende nie onnodige tyd in beslag te neem nie.

Antwoord: Om daai probleem te oorkom is maar die tegnologie, met whatsapp en die groepe wat deesdae gevorm word moet 'n mens eers daar kyk of dit werklik nodig is om fisies bymekaar te kom en as dit nie nodig is nie, dan glo ek die tegnologie. . Omdat almal in die groep verbind is weet ons wat elkeen moet doen en dis net nodig wanneer dit nou praktiese goed wat gedoen moet word dat fisiese bymekaarkom dan nodig sal wees.

Navorser: Maar wat dink u is dit fisiese kontak wel belangrik, gaan dit 'n bepalende rol speel by die sukses van so 'n groep?

Deelnemer: Nee dit gaan beslis, nee kyk ons sit nie almal met ervare onderwysers nie, veral die wat nou nuut inkom wat nie so baie jare ondervinding het nie, sal baie kan leer by so 'n

groep en weer terug kan gaan skole toe om te kan sien hoe ervare mense werk en hulle werk ook saam so hulle kan dit in skole gaan toepas.

Navorsers: So wat ek hoor uit u kommentaar is dat daar definitief 'n behoefte is vir so 'n samekoms, maar dat daar spesifieke riglyne moet wees dat dit nie net so informeel moet wees nie en dat daar op spesifieke goed gefokus moet word.

Navorsers: U is in die gevorderde onderwysfase, dink u dat ons dit net so effektief in die fase kan toepas soos ons dit in die seniorsfase wil toepas

Deelnemer: Ek glo dit moet in die seniorfase gedoen word want kyk ons sukkel met ons graad 10'e, kinders wat nog nie basiese eksperimente wat hulle moes gedoen, het hulle glad nie gedoen nie. So dit sal vir hulle help veral met die praktiese in seniorfase, so so as ons nou kan begin en dan verder vir die diegene wat verder in die FET fase verder gaan met FW.

Navorsers: Wat ek hoor is dat so 'n groep nie spesifiek net op die seniorfase gemik moet wees nie, maar dat dit 'n vaktipe groep wees sodat mense van die Senior- sowel as IF daaraan kan deelneem. as persone van die VOO fase daaraan kan deelneem en dit gaan 'n persoon se eie keuse wees.

Navorsers: Wat ek wil vra ook, ek het nou al deur die onderhoude gehoor mense sê met praktiese onderrig is daar baie probleme, skole het bv probleme dat hulle nie voldoende apparaat het nie, party het weer die apparaat maar die onderwysers is nie weer kundig genoeg of van hulle is nog nie kundig genoeg om dit te gebruik nie, so voel u kan 'n mens daai tipe behoefte in ons omgewing aanspreek?

Deelnemer: Dit is omdat die mense bang is om die goed te doen, jy het nie duur apparaat nodig nie. As daai mense inkoop in hierdie idee en hulle sien watter huishoudelike apparaat kan gebruik word in die plek van gewone duur wetenskap apparaat. So dit is mos net dat mense moet inkoop en dan moet 'n mens kyk dat hoe ander mense dit doen en dan moet 'n mens self dit doen. Kyk ons almal was bang gewees om aan die chemikalieë te vat of aan die glasbekers te vat en met die vlamme te werk, maar as jy sien hoe ander mense dit doen en jy doen self meer dan sal jy meer vertrou het om die goed te gaan doen. So dit moet 'n hand-on wees, jy moet saamwerk en jy moet nie bang wees nie, dit is wetenskap eksperimente, dit sal nie altyd werk nie, maar soos jy aangaan behoort jy ondervinding op te doen so dit gaan baie help met die onderrig van die kinders veral in die wetenskap. .

Vraag 4

Navorsers: Uit jou ondervinding as onderwyser die afgelope jare, het jy enige idees hoe om wetenskap onderwys effektief vir die leerders aan te bied?

Deelnemer: Nou is dit makliker met die tegnologie, ek glo almal het 'n rekenaar, so goed kan gegoogel word, maar mens moet pasop om nie onnodige goed daaruit te kry nie. Jy moet ook gaan sif oor wat youtube en die ander platvorms belangrik is. Jy kan nie net gaan aflaai en vir die kinders gee nie want van die goed is glad nie getoetste wetenskap nie. So jy moet voor die tyd gaan om te kyk wat is feite en wat is fiksie, maar dit help om voor jy 'n les te bebin 'n toepaslike video te wys. Of jy kan vinnig google die betekenis van 'n wetenskap word en jy kan kyk wat mense daarvoor sê so die tegnologie kan ons baie help.

Navorsers: Nou om terug te kom na hierdie gemeenskapspraktyk, kan ons dit sien as hierdie hub of platvorm waar mense hierdie tipe tegnologie kan deel, so byvoorbeeld u het 'n redelik klomp goed al reeds deurgekyk en kan u vanaf die gemmenskapspraktyk platvorm vir ander kollegas nuttige inligting gee rakende die inligting wat u reeds deurgegaan het op youtube, wat is toepaslik en wat is nie. Dink u die gemeenskapspraktyk se rol kan ook wees om mense te help sodat hulle op die ou einde van die dag tyd bespaar.

Deelnemer: Ja dit is wat by die praktiese by die Fisiese bymekaarkom byeenkomste kan gebeur, dat ons kan sê hierdie persoon gaan dek vir ons daardie onderwerp en daai persoon die ander onderwerp en op die ou einde as jy met die 4 fokus areas in die vak sit dan het jy jou goed gedoen. So as elkeen sy deel doen sal dit effektief werk en dit beteken ek hoef nie heelnaag inligting te gaan soek nie, want die werkslas is nou opgedeel.

Vraag 5

Navorsers: Watter faktore tans beïnvloed dat wetenskap onderrig nie effektief by jou skool kan plaasvind nie?

Deelnemer: dit is maar jou gewone goed soos apparaat en dan jy moet die kinders kan prikkel om in te koop, want as jy nie pratiere gaan doen nie, dit wil sê eksperimente nie, dan gaan jy die kinders laat belangstelling laat verloor. Want Wetenskap is iets wat hy kan sien, wat hy moet waarneem, want jy kan nie net vir hom verduidelik wat in 'n eksperiment gaan plaasvind nie. Daar is ook eenvoudige eksperimente wat hulle kan doen, soos ek reeds gesê het ons kan die verskoning gebruik ons het nie apparaat nie, daar is boeke wat vir jou die eenvoudige doen van eksperimente verduidelike, wat aandui wat hulle van die huis af kan bring. En as ander opvoeders dit kan sien dan glo ek hulle sal ook meer gemakliker wees. As ons vat dat ons elke maand fisies bymekaar kan kom sal miskien nie so gemaklik wees nie, maar as jy eers sien dat ander mense ook foute maak en as jy daaruit gaan leer dan kan jy vir die kinders dit wys, en hulle kan ook iets probeer, dan sal dit werk. en die onderwysers sal vertrou kry en die kinders sal ook vertrou kry. Hulle sal ook besef dat eksperimente werk somtyds en somtyds werk dit nie.

Vraag 6

Navorsers: Wat dink jy kan gedoen word om die faktore genoem in voorafgaande vraag aan te spreek?

Deelnemer: Daar is meer probleme rakende tyd veral by graad 8 en 9. Vir my is die tyd te min. Die tale byvoorbeeld is daai mense elke dag met die tale in kontak en die Wetenskap is iets soos 3 periodes per week, wat vir my bietjie te min is as hulle daarna kan kyk en as hulle elke dag een periode wetenskap kan het dan behoort dit effektief te wees. En dat kinders se belangstelling moet geprikkel word vanaf die laerskool af, van die primêre skool af, sodat hy met gemak kan instap in die VOO, want daar verdwyn vir my kinders wat in graad 8 en 9 hoë punte kry, maar hulle kry nie daai hoë punte in graad 10 nie. Dit is wat ons wil hê as hy graad 8 of 9 goeddoen, dan moet hy outomaties deurkom na Fisiese en Lewens Wetenskappe in die VOO.

Navorsers: Baie dankie ek weet nie of u enige iets anders het om by te voeg nie,

Deelnemer: Baie dankie Christa, ek hoop dat hierdie ding gaan vir ons iets beteken, dat onderwysers gaan inkoop en dat dit 'n verskil gaan maak, veral in hierdie streek en in hierdie kring in.

Transkripsie van onderhoud T06

Datum: 20 Julie 2016

Plek: Privaat

Tipe van Onderhoud: Fisiese Bymekaarkom

Tyd: Naskool

Navorsers: Hierdie gesprek gaan spesifiek oor gemeenskapspraktyke, dis nou 'n term wat ons gebruik vir hierdie informele groepe tussen verskillende skole waar onderwysers dan bymekaarkom wat in dieselfde vakgebied is en in dieselfde fase is. wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

Vraag1

Navorsers: Wat is jou ervaring omtrent die samewerking van onderwysers in dieselfde vak gebied in 'n gemeenskapspraktyk?

Deelnemer: hmm wat kan ek sê in die 1 jaar en paar maande wat ek skoolgee is daar nie baie ander mense wat, sê nou die paar onderwysers wat altyd saammet my na die kursusse toe gaan soos juf Mariana en by die skool is ek op die oomblik alleen, wat Natuurwetenskap gee, ek mos vir die graad 9's en die graad 7's. Maar ek kan sê daai tyd wat ons op daai kursus was en toe ek en juf Mariana nou saamgewerk het was dit baie goed gewees.

Vraag 2

Navorsers: Jy het nou kortlik vraag 2 aangeraak oor jou ondervinding, jy het nog nie baie ondervinding nie, het jy nou enige voorstelle as jy dink hoe jy en Mariana begin het jy enige idees / voorstelle hoe om so 'n gemeenskapspraktyk effektief te laat funksioneer?

Deelnemer: Ek sal voorstel dat 'n mens hmm in kommunikasie moet bly as jy aanso 'n groep behoort. En dn mos nou nou en dan bymekaar uitkom om te gesels en so aan, dis mos maar moeilik, ek dink dit sal baie goed wees as jy tyd kan afstaan om bymekaar uit te kom. Ek sal voorstel dat mens moet tyd maak om gereeld in kontak te bly.

Vraag3

Navorsers: So as 'n mens na 'n ander probleem ook kyk, onderwyser 'n baie vol skedule, en fisies bymekaarkom van so 'n groep mense in 'n gemeenskapspraktyk gaan baie moeilik wees, nou het u dalk enige voorstelle hoe 'n mens daai probleem kan oorkom?.

Deelnemer: Daar is mos nou op die selfoon is whatsapp en dan voel ek mens kan van die emails ook gebruik maak dan kan jy vir mekaar goed stuur en soaan as jy nou iets gekry het dan kan jy dit vir die ander persone ook stuur omdat ons nou nie elke keer fisies bymekaar kan uitkom nie.

Navorsers: Hoe werk die kommunikasie op die whatsapp platform vir jou of nie net whatsapp nie ander groepe ook.

Deelnemer: Nee eintlik ek persoonlik hou van dat mens liewers bymekaar moet uitkom dis vir my beter, maar hmm maar ek was mos nou net deel van die een groep waar ons die NW kursus gehad het en hmm waar jy nou kan vragies vra op die group en dit het gehelp want somtyds het jy ook 'n vraag en jy kom dalk nie daarby uit om die vraag te vra nie en dan het iemand anders nou die vraag gevra en iemand anders het sommer op die vraag gereageer en gee sommer 'n link waarna jy kan gaan kyk. So dit was goed, dit werk ja.

Vraag 4

Navorsers: jy gee nog nie lank onderwys nie, maar uit jou ondervinding as onderwyser jy enige idees hoe om wetenskap onderwys effektief vir die leerders aan te bied?

Deelnemer: Om by ons skool dit meer effektief te onderrig is dit vir my om die fasiliteite te hê vir wetenskap, hmm ek nhet nou al 'n paar goedjies bymekaar gekry maar dit is nog nie effektief nie en dan gebruikmaak van videos ensovoorts. Hulle is besig om die klasse ook toe te rus met internet so as dit ook net kan lekker plaasvind sal dit ook al klaar help. As ek net nog iets kan sê die ontbreking van 'n lab speel 'n groot rol. Klasse toe ons byvoorbeeld was in Piketberg, daai klas en by Vredendal sekondêr ook is goed ingerig en die klas by ons is nie ingerig nie.

Vraag 5

Navorsers: Watter faktore dink jy beïnvloed die meeste dat die vak Wetenskap nie effektief genoeg onderrig word nie?

Deelnemer: Die prakties as mens vir elke kind die goed gee wat hulle nodig het vir die prakties, sal dit al klaar baie help al.

Navorsers: So 'n toegeruste lab gaan bydrae dat die kinders 'n beter van die vak gaan hê, die feit dat hulle dit self gaan doen en dit is nie noodwendig. En somtyds veral by die groepe sien 'n mens dat jy nie noodwendig die apparaat moet gebruik om spesifieke praktiese moet doen nie maar jy sien die alternatiewes ook dalk iets wat jy by die huis ook het. So dis hoekom ek sê die groepe sal ook daarmee help.

Vraag 6

Navorsers: Wat dink jy kan gedoen word om die faktore genoem in voorafgaande vraag aan te spreek?

Navorsers: Jy het nou by die vorige vraag genoem dat gemeenskapspraktyke kan die probleem aanspreek, is daar dalk nog ander maniere wat jy kan noem?

Deelnemer: Vir my is dit nou die ervaring wat bykom en dan die ouer onderwyser se kennis. Soos ek gesê het ek sal eintlik daarvan hou om bymekaar te kom want daar leer jy eintlik baie meer en jy leer bymekaar.

Navorsers: As ons terugaan na vraag 3, daar het ons genoem dat die onderwysers se tyd beperk is, nou lei ek uit ons gesprek af dat jy het 'n behoefte dat onderwysers fisies

bymekaar moet kom. Nou hoe dink jy hoe gereeld kan so 'n bymekaarkom dan plaasvind, hoe dit sal werk in jou spesifieke vol skedule?

Deelnemer: Ek dink wat vir my realities sal werk is een keer 'n maand, ek voel nie 'n klomp mense nie meer 'n klein groep mense wat daar wil betrokke by wees.

Navorsers : Wat dink jy moet die doel wees van sulke tipe sessies as 'n mens bymekaar kom, wat sal jy graag gedoen wil hê?

Deelnemer: Ek sal graag wil leer hoe om my klas meer effektief te bestuur sodat die kinders meer leersaam kan wees. Nie dat jy mos nou nie jou beste doen nie, maar dit is altyd goed om te hoor van ander mense wat ander idees het, veral ek wat nou nog jonk is in die onderwys.

Navorsers: baie dankie jou deelname is daar nog enige iets wat jy wil byvoeg? .

Deelnemer, ek het redelik alles gedek, so ek het niks om by te voeg nie.

Transkripsie van onderhoud T 07

Datum: 23 Junie 2017

Plek: Skool

Tipe van Onderhoud: Fisiese Bymekaarkom

Naskool

Navorsers: Gemeenskappe van praktyk is die term wat gebruik word vir 'n informele groep tussen verskillende skole wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

Vraag1

Navorsers: Het u al ondervinding om in 'n gemeenskapspraktyk saam te werk in u vakgebied?

Ja met Werkswinkels en goed wat ons gehad het het ek nou al die geleentheid gehad om met verskillende onderwysers saam te werk, by ons skool plaaslik en met ander skole in die streek en met ander skole in die provinsie ook, so ek het redelik ervaring 'n gemeenskapspraktyk. .

Vraag 2

Navorsers: Uit u ondervinding met so 'n gemeenskapspraktyk, het u enige voorstelle hoe om so 'n praktyk effektief dan te laat funksioneer?

Antwoord: Ja omdat die kurrikulum is basies dieselfde en hoe meer idees jy kry van verskillende onderwysers sal dit tot voordeel van almal wees, verskillende onderwysers hoe meer kan jy verseker dat almal werk op dieselfde vlak want jy weet almal werk na dieselfde doel om dit te bereik ja. .

Vraag3

Navorsers: As 'n mens dink 'n onderwyser het 'n baie vol skedule, en fisies bymekaarkom van so 'n groep mense in 'n gemeenskapspraktyk gaan baie moeilik wees, nou het u enige voorstelle op watter wyse so 'n groep kan kommunikeer om sodoende nie onnodige tyd in beslag te neem nie.

Antwoord: Om daai probleem te oorkom is maar die tegnologie, met whatsapp en die groepe wat deesdae gevorm word moet 'n mens eers daar kyk of dit werklik nodig is om fisies bymekaar te kom en as dit nie nodig is nie, dan glo ek die tegnologie. . Omdat almal in die groep verbind is weet ons wat elkeen moet doen en dis net nodig wanneer dit nou praktiese goed wat gedoen moet word dat fisiese bymekaarkom dan nodig sal wees.

Navorsers: Maar wat dink u is dit fisiese kontak wel belangrik, gaan dit 'n bepalende rol speel by die sukses van so 'n groep?

Deelnemer: Nee dit gaan beslis, nee kyk ons sit nie almal met ervare onderwysers nie, veral die wat nou nuut inklopm wat nie so baie jare ondervinding het nie, sal baie kan leer by so 'n

groep en weer terug kan gaan skole toe om te kan sien hoe ervare mense werk en hulle werk ook saam so hulle kan dit in skole gaan toepas.

Navorsers: So wat ek hoor uit u kommentaar is dat daar definitief 'n behoefte is vir so 'n samekoms, maar dat daar spesifieke riglyne moet wees dat dit nie net so informeel moet wees nie en dat daar op spesifieke goed gefokus moet word.

Navorsers: Dink u dat ons dit net so effektief in die fase kan toepas soos ons dit in die seniorsfase wil toepas

Deelnemer: Ek glo dit moet in die seniorsfase gedoen word want kyk ons sukkel met ons graad 10'e, kinders wat nog nie basiese eksperimente wat hulle moes gedoen, het hulle glad nie gedoen nie. So dit sal vir hulle help veral met die praktiese in seniorsfase, so so as ons nou kan begin en dan verder vir die diegene wat verder in die FET fase verder gaan met FW.

Navorsers: Wat ek hoor is dat so 'n groep nie spesifiek net op die seniorsfase gemik moet wees nie, maar dat dit 'n vaktipe groep wees sodat mense van die Senior- sowel as IF daaraan kan deelneem. as persone van die VOO fase daaraan kan deelneem en dit gaan 'n persoon se eie keuse wees.

Navorsers: Wat ek wil vra ook, ek het nou al deur die onderhoude gehoor mense sê met praktiese onderrig is daar baie probleme, skole het bv probleme dat hulle nie voldoende apparaat het nie, party het weer die apparaat maar die onderwysers is nie weer kundig genoeg of van hulle is nog nie kundig genoeg om dit te gebruik nie, so voel u kan 'n mens daai tipe behoefte in ons omgewing aanspreek?

Deelnemer: Dit is omdat die mense bang is om die goed te doen, jy het nie duur apparaat nodig nie. As daai mense inkoop in hierdie idee en hulle sien watter huishoudelike apparaat kan gebruik word in die plek van gewone duur wetenskap apparaat. So dit is mos net dat mense moet inkoop en dan moet 'n mens kyk dat hoe ander mense dit doen en dan moet 'n mens self dit doen. Kyk ons almal was bang gewees om aan die chemikalieë te vat of aan die glasbekers te vat en met die vlamme te werk, maar as jy sien hoe ander mense dit doen en jy doen self meer dan sal jy meer vertrou het om die goed te gaan doen. So dit moet 'n hand-on wees, jy moet saamwerk en jy moet nie bang wees nie, dit is wetenskap eksperimente, dit sal nie altyd werk nie, maar soos jy aangaan behoort jy ondervinding op te doen so dit gaan baie help met die onderrig van die kinders veral in die wetenskap. .

Vraag 4

Navorsers: Uit jou ondervinding as onderwyser die afgelope jare, het jy enige idees hoe om wetenskap onderwys effektief vir die leerders aan te bied?

Deelnemer: Nou is dit makliker met die tegnologie, ek glo almal het 'n rekenaar, so goed kan gegoogel word, maar mens moet pasop om nie onnodige goed daaruit te kry nie. Jy moet ook gaan sif oor wat youtube en die ander platvorms belangrik is. Jy kan nie net gaan aflaai en vir die kinders gee nie want van die goed is glad nie getoetste wetenskap nie. So jy moet voor die tyd gaan om te kyk wat is feite en wat is fiksie, maar dit help om voor jy 'n les te bebin 'n toepaslike video te wys. Of jy kan vinnig google die betekenis van 'n wetenskap word en jy kan kyk wat mense daarvoor sê so die tegnologie kan ons baie help.

Navorsers: Nou om terug te kom na hierdie gemeenskapspraktyk, kan ons dit sien as hierdie hub of platvorm waar mense hierdie tipe tegnologie kan deel, so byvoorbeeld u het 'n redelik klomp goed al reeds deurgekyk en kan u vanaf die gemmenskapspraktyk platvorm vir ander kollegas nuttige inligting gee rakende die inligting wat u reeds deurgegaan het op youtube, wat is toepaslik en wat is nie. Dink u die gemeenskapspraktyk se rol kan ook wees om mense te help sodat hulle op die ou einde van die dag tyd bespaar.

Deelnemer: Ja dit is wat by die praktiese by die Fisiese bymekaarkom byeenkomste kan gebeur, dat ons kan sê hierdie persoon gaan dek vir ons daardie onderwerp en daai persoon die ander onderwerp en op die ou einde as jy met die 4 fokus areas in die vak sit dan het jy jou goed gedoen. So as elkeen sy deel doen sal dit effektief werk en dit beteken ek hoef nie heelnaag inligting te gaan soek nie, want die werkslas is nou opgedeel.

Vraag 5

Navorsers: Watter faktore tans beïnvloed dat wetenskap onderrig nie effektief by jou skool kan plaasvind nie?

Deelnemer: dit is maar jou gewone goed soos apparaat en dan jy moet die kinders kan prikkel om in te koop, want as jy nie pratiese gaan doen nie, dit wil sê eksperimente nie, dan gaan jy die kinders laat belangstelling laat verloor. Want Wetenskap is iets wat hy kan sien, wat hy moet waarneem, want jy kan nie net vir hom verduidelik wat in 'n eksperiment gaan plaasvind nie. Daar is ook eenvoudige eksperimente wat hulle kan doen, soos ek reeds gesê het ons kan die verskoning gebruik ons het nie apparaat nie, daar is boeke wat vir jou die eenvoudige doen van eksperimente verduidelike, wat aandui wat hulle van die huis af kan bring. En as ander opvoeders dit kan sien dan glo ek hulle sal ook meer gemakliker wees. As ons vat dat ons elke maand fisies bymekaar kan kom sal miskien nie so gemaklik wees nie, maar as jy eers sien dat ander mense ook foute maak en as jy daaruit gaan leer dan kan jy vir die kinders dit wys, en hulle kan ook iets probeer, dan sal dit werk. en die onderwysers sal vertrou kry en die kinders sal ook vertrou kry. Hulle sal ook besef dat eksperimente werk somtyds en somtyds werk dit nie.

Vraag 6

Navorsers: Wat dink jy kan gedoen word om die faktore genoem in voorafgaande vraag aan te spreek?

Deelnemer: Daar is meer probleme rakende tyd veral by graad 8 en 9. Vir my is die tyd te min. Die tale byvoorbeeld is daai mense elke dag met die tale in kontak en die Wetenskap is iets soos 3 periodes per week, wat vir my bietjie te min is as hulle daarna kan kyk en as hulle elke dag een periode wetenskap kan het dan behoort dit effektief te wees. En dat kinders se belangstelling moet geprikkel word vanaf die laerskool af, van die primêre skool af, sodat hy met gemak kan instap in die VOO, want daar verdwyn vir my kinders wat in graad 8 en 9 hoë punte kry, maar hulle kry nie daai hoë punte in graad 10 nie. Dit is wat ons wil hê as hy graad 8 of 9 goeddoen, dan moet hy outomaties deurkom na Fisiese en Lewens Wetenskappe in die VOO.

Navorsers: Baie dankie ek weet nie of u enige iets anders het om by te voeg nie,

Deelnemer: Baie dankie Christa, ek hoop dat hierdie ding gaan vir ons iets beteken, dat onderwysers gaan inkoop en dat dit 'n verskil gaan maak, veral in hierdie streek en in hierdie kring in.

Transkripsie van onderhoud T08

Datum: 27 Julie 2016

Plek: Skool

Tipe van Onderhoud: Fisiese Bymekaarkom

Gedurende Skool

Navorsers: Hierdie gesprek gaan spesifiek oor gemeenskapspraktyke, dis nou 'n term wat ons gebruik vir hierdie informele groepe tussen verskillende skole waar onderwysers dan bymekaarkom wat in dieselfde vakgebied is en in dieselfde fase is. wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

Vraag1

Navorsers: Wat is jou ervaring omtrent die samewerking van onderwysers in dieselfde vak gebied in 'n gemeenskapspraktyk?

Deelnemer: Well, ek dink nie daar is genoeg samewerking tussen ons nie, kyk daar is maar een keer 'n kwartaal wat die vakadviseurs maar kom en dan sien ons mekaar net daar en dit stop daar, maar ons het nooit daai informele gesels rondom vakke nie, alles kom vanaf die vakadviseur, so moet ons maar aangaan met dit.

Vraag 2

Navorsers: Nou as ek luister na wat jy sê oor jou ondervinding van 'n gemeenskapspraktyk, het jy dalk voorstelle hoe dat so 'n gemeenskapspraktyk effektief kan funksioneer?

Deelnemer: Ek dink dit sal goed wees as ons wat die dieselfde vak gee een keer 'n maand, of dit hoef nie 'n maand te wees nie of dalk 'n dag in die vakansie waar ons lesplanne kan uitruil en net met mekaar gesels rondom hoe 'n onderwyser wat nou al baie lank die vak gee hoe mens kan maak op die gebied of wat ook al of wat jy kan maak om tyd te bespaar, want die admin oorval ons.

Vraag3

Navorsers: So ek luister na wat jy sê en in my agterkop hoor ek ook dit wat almal al gesê het, onderwysers het 'n geweldige vol skedule, en fisies bymekaarkom gereeld gaan nie altyd suksesvol geïmplementeer kan word nie. Nou watter ander voorstelle het jy om so 'n gemeenskapspraktyk laat plaasvind sonder dat daar baie bymekaarkom tye is?

Deelnemer: Soos ek sê een keer in 'n kwartaal behoort min genoeg te wees, maar om elke keer kontak te hê, soos ek sê mens kan mens gebruik maak van tegnologie, soos byvoorbeeld whatapps's groups, eposse stuur en dink daar is 'n ding wat hulle noem echa, maar ons kan so ook kommunikeer. Dat daar direkte kontak is veral vir ons jong onderwysers wat vrae het dat 'n mens dit sommer op die group vra. .

Navorsers: Ok ja ek hoor wat jy sê jong onderwysers veral tegnologie gedrewe gekombineer met die ouer een wat weer die ondervinding het maar bietjie tegnologie gestremd is. So as

'n mens daai probleem of as 'n mens julle twee bymekaar wil. Dink jy hierdie chat rooms, whatsapp groups en blogs, eposse is 'n meer moderne manier tesame met fisiese bymekaarkom eenmaal 'n kwartaal. .

Deelnemer: Ja ek dink dit sal baie goed wees.

Vraag 4

Navorsers: Nou as ons kyk jy het nog nie solank ondervinding as onderwyser in die skool nie want jy hou 4 jaar skool, maar het jy enige idees die afgelope 4 jaar opgedoen hoe om wetenskap onderwys meer effektief aan te bied?

Deelnemer: Ek dink 'n mens moet, kyk veral na graad 7, 6 en laer is dit baie teoreties georieenteerd en wat die kinders intereseer is die praktiese gedeeltes. Soos die Stellenbosch se science uitreike, ek dink die leerders vang daar baie meer op as wat hulle in die klas opvang. So meer praktiese lesse, dan sukkel ons met lokale wat nie geskik is vir wetenskap nie, want jy moet nou alles net so los en na die kraan toe loop, want jy kannie die kinders stuur met chemikalieë en dies meer om dit uit te spoel nie. So ek dink ons moet dinge meer prakties maak en die kinders meer buitekant wys wat daar buite gebeur en hoe dit inskakel

Navorsers: So jy dink ook in so 'n gemeenskappraktyk, as ek mooi na jou luister kan mens 'n gesamentlike ding aanbied by die vak nou. So die onderwyser met die goedtoegeruste lab kan die praktiese opneem en dit dan post.

Deelnemer: Ja kyk byvoorbeeld die lab by HS Vredendal dit is so geskik en laas toe wens ek ek kon so 'n lokaal hê.

Vraag 5

Navorsers: Watter faktore dink jy beïnvloed die meeste dat die vak Wetenskap nie effektief genoeg onderrig word nie?

Deelnemer: eerste een is die lokaal en dan tweedens ek dink nie dat alle onderwysers of ons kry nie die nodige hulp van onse seniors vir die aankoop van apparaat en dies meer nie. Dan die ander ding is die teorie is so baie, 'n mens kan nie lekker tyd inruim nie vir 'n praktiese les nie. Als moet net so vinnig gaan want ons moet aangaan die volgende dag. Dis hoekom ek is so baie dankbaar dat die Stellenbosch mense kom en dan hulle ten minste daaruit ook leer.

Navorsers: So jy het sopas vraag 6 vir my beantwoord en ek stem saammet jou mens moet kyk in so 'n groep hoe om die prakties meer te kan integreer in die besige program waar die teorie nou baie meer beklemtoon word.

Vraag 6

Navorsers: Het jy dalk nog ander idees en ek het geluister na die vakspan se ondersteuning, dink jy in so 'n gemeenskapspraktyk moet dit by 'n skool begin of moet dit net onderwysers wees van verskillende skole wees of hoe visialiseer jy so 'n gemeenskapspraktyk?

Deelnemer: Ek dink ons moet eerste by ons skool of by onself begin, want baie onderwysers dink mos kyk ek het nou te hard gewerk, ek weier om my lesplan met iemand anders te deel. So as ons net dat daardeur kan werk, kyk by die skool eers voordat ons in die kring kan saamwerk. Want hoe meer inligting hoe meer goed uitgeruil kan word hoe beter. As ons kyk na die nuwe onderwysers en die ou span die een bel die ander een, kyk met tegnologie is daar kontak.

Navorsers: Jy het nou by die vorige vraag genoem dat gemeenskapspraktyke kan die probleem aanspreek, is daar dalk nog ander maniere wat jy kan noem?

Deelnemer: Vir my is dit nou die ervaring wat bykom en dan die ouer onderwyser se kennis. Soos ek gesê het ek sal eintlik daarvan hou om bymekaar te kom want daar leer jy eintlik baie meer en jy leer bymekaar.

Navorsers: As ons terugaan na vraag 3, daar het ons genoem dat die onderwysers se tyd beperk is, nou lei ek uit ons gesprek af dat jy het 'n behoefte dat onderwysers fisies bymekaar moet kom. Nou hoe dink jy hoe gereeld kan so 'n bymekaarkom dan plaasvind, hoe dit sal werk in jou spesifieke vol skedule?

Deelnemer: Ek dink wat vir my realities sal werk is een keer 'n maand, ek voel nie 'n klomp mense nie meer 'n klein groep mense wat daar wil betrokke by wees.

Navorsers : Wat dink jy moet die doel wees van sulke tipe sessies as 'n mens bymekaar kom, wat sal jy graag gedoen wil hê?

Deelnemer: Ek sal graag wil leer hoe om my klas meer effektief te bestuur sodat die kinders meer leersaam kan wees. Nie dat jy mos nou nie jou beste doen nie, maar dit is altyd goed om te hoor van ander mense wat ander idees het, veral ek wat nou nog jonk is in die onderwys.

Navorsers: baie dankie jou deelname is daar nog enige iets wat jy wil byvoeg? .

Transkripsie van onderhoud van T09

Datum: 30 Julie 2016

Plek: Skool

Tyd: Naskool

Goeiemiddag, baie dankie dat jy ingestem het om die onderhoud te doen. Kan ons onmiddelik begin?

Vraag. 1

Navorser: Wat is jou ervaring omtrent die samewerking van onderwysers wat dieselfde vak aanbied in 'n gemeenskapspraktyk?

Deelnemer: in die wetenskap nie maar ook binne die wiskunde en so meer, dit is baie goed. Ook moet 'n mens ingedagte hou, veral waar daar take uitgedeel word, en nou hardloop ek seker na vraag 2 toe, elkeen gooi nie so lekker sy gewig in nie. Dit is goed 'n ou leer vanmekaar en jy kan ervaring deel. Argumentshalwe mens kan idees uitruil veral met die aanbied van werk wat moeilik is en wanneer jy terugkom in jou opset kan jy weer daai betrokke les met meer sukses aanbied en jy bereik die leerder daardeur.

Navorser: Soos jy terug opgemerk het het jy nou reeds van nr 2 aangeraak in jou beantwoording van vraag een. Maar wat ek nou aflei is dat 'n mens wil graag hê dat almal betrokke by so 'n gemeenskappraktyk moet hulle gewig ten volle ingooi.

Deelnemer: Presies, want sien dit gebeur baie kere en ons het dit opgetel al, hmmm, hmm, ek raak, kan ek nr 2 maar nou aanraak:

Vraag 2.

Navorser: Uit jou ondervinding van gemeenskapspraktyke, het jy enige voorstelle hoe om so 'n gemeenskapspraktyk effektief te laat funksioneer?

Kom ek verduidelik, byvoorbeeld waar jy jou assesseringstake uitwerk, die onderwysdepartement stuur mos nou daai takies uit, die verskillende formele assesseringstake, maar baie keer is daai take nie op die vlak van jy waqt hier byvoorbeeld van jou wat hier op liprant sit op die plaas nie en die taak is opgestel met 'n kind wie se ervaringsveld in die stad is argumentshalwe. So nou kom jy nou onderlings bymekaar en jy sê goed kom ons raak hierdie punte aan vir die eerste assesseringstake en die volgende ou vir die tweede ensomeer. En dan kom jy by waar die take moet nou uitgeruil word of hulle moet dit epos vir mekaar, dan is daai ou weg maar wat vir my sê hy het nie sy deel gedoen nie maar hy expect. Nou kyk, hmm soos ek gesê het die samewerking is goed maar sodra dit so is dat die persoon fisies fisies iets moet doen, dan kry jy dat sommige onderwysers verwag, dat jy jou take moet voltooi en inhandig soos bespreek, maar wanneer dit haar/ sy beurt is om te submit, is dit maar net hier te kort geskied en daar te kort geskied en jy sit onder druk van tyd en nou moet jy maar self dit doen en hy verwag of sy verwag dat jy maar jou deel maar elke deel moet doen, maar hierdie gemeenskapspraktyke werk vir ons. Maar afstande speel mos nou 'n rol en tyd speel 'n rol en dit is almal stremmende faktore wat mos nou inwerk, maar soos vir ons veral in die landelike gebiede waar jy met multigraadklasse sit, werk hierdie gemeenskapspraktyke want jy kan ook mos nou mos gaan en werk kombineer soos byvoorbeeld ek doen nou in die wetenskappe nou Lewe

en Lewenswyse, en ek kombineer byvoorbeeld nou die graad 4 en graad 5 werk omdat vir my te vergemaklik, so as ek byvoorbeeld praat oor die habitat van diere dan gesels ons abroad en dan kan ek dit byvoorbeeld so groot trek tot by graad 7 want almal gaan oor habitat en al wat jy doen as jy by graad 6 en 7 kom dan brei jy mos net verder uit want habitatte verskil mos nog onderling ook vanmekaar, want onder daai boomstomp is nog ander habitate vir nog ander diere.

Vraag 3

Navorsers: Onderwysers het 'n baie vol skedule en fisiese bymekaar tye gaan moeilik wees.

Het jy enige voorstelle oor die wyse waarop die groep kan kommunikeer om sodoende nie onnodige tyd in beslag te neem nie.

Deelnemer: Die hele kwessie oor die media wat ons kan gebruik, die whatsapp, ander platvorms asook die fisiese bymekaarkom om sessies te run mos nou, dit is mos nou ook 'n goeie ding want dit sluit mos eintlik aan by vraag 1 met die deel van goeie praktyke, want hier gaan dit nou dat jou beplanning moet nou lekker wees, maar ook jou voordeel wat jy het met die media byvoorbeeld as ek op whatsapp vir jou 'n vragie post, en jy is in die posisie dat jy online is, kyk ek gou nou hier 'n bietjie Kliprandt se engels tussenin, kan jy onmiddelik respond. Ek is byvoorbeeld in die klas en ek het al byvoorbeeld met 'n vragie oor energie, moes ek meer uitvind oor kilojoules en al die goeters, en dan ek nou so 'n vragie post en die ouens kan respond daarop, ook die media in die sin dat ek kan my vrae vir jou vooraf epos, en ekan dan sê ouens dis waarmee ek sukkel. Dit kan dan ook gestuur word na ander vriende ook, en hulle kan met hulle voorstelle kom. Maar dan het ons mos ook die webtuistes waarop jy kan gaan alle skole het nie die netwerke nie, veral ons skole in die landelike gebiede as ek dink aan my buurdorpe goed, hoe moeilik dit is vir daai ouens om net kontak te hê, ons het byvoorbeeld gister gesukkel net om 'n gewone telefoongesprek te hê. So hierdie netwerke is reg, maar dn moet die netwerke van so 'n aard wees, dat dit funksioneel is, dit baat nie jy sê 'n gebied het selfoonopvangs maar dan is dit swak argumentshalwe, maar die voordeel daarvan is dat daar kan onmiddelike respond word. So dit is 'n groot besparing in terme van tyd, maar soos ek sê, dan moet jou beplanning reg wees. So kyk ons hardloop nou vir hierdie kwartaal Lewe en Lewenswyse, ek het nou deurgehardloop deur my werk en ek het gesien hier is werk wat ek nie so baie van weet nie, so stuur solank daai goed vooraf dat ons dit vir jou kan gee, want jy sit met, hmm want vat nou in my geval ek het nog in Standaard 7 laas by Vredendal Senior Sekondêr, ek het nog nooit weer wetenskap gedoen nie laas wetenskap gedoen. Toe ek nou skool toe kom word ek mos verplig om wetenskap aan te bied tot in graad 7 so baie van hierdie goed moet jy oplees.

Vraag 4

Navorsers: Uit jou ondervinding as onderwyser die afgelope jare, het jy enige idees hoe om wetenskap onderwys effektief vir die leerders aan te bied?

Ons hardloop nou al na vraag 4 toe, maar ook saammet dit die effektiewe aanbieding, as jy as onderwyser nie 'n passie het vir die vak nie, en dit is baie keer wat vanaf die Universiteit Stellenbosch aan ons oorgedra word, as jy nie 'n passie het nie, dan moet jy maar los, dit help nie dit gaan oor die 15^{de} wanneer die selfoon afgaan nie. Behalwe die goeie voorbereiding wat jy moet het, moet jy maar gaan ekstra oplees, sodat as ons oor dit praat dan weet jy waaroor dit gaan. Want so die kind byvoorbeeld in die klas 'n vraag vra, dan moet jy as opvoeder die decency het om vir die kind te sê ek het

nou nie vir jou die antwoord nie, maar ek gaan vir jou die antwoord kry, want dit baat nie jy gaan vir die outjie 'n afgewaterde dink gee en dan expect jy dat die man moet by die eksamen die vraag reg beantwoord maar jy het aan die begin al 'n afgewaterde storie gegee. Neem die manmoedigheid en sê vir die outjie ek het nie nou hierdie antwoord nie, ek sal dit gaan oplees of ek gaan dit google en ek sal terugkom na jou toe. By my is dit, ek praat nou uit my ervaring uit, by my werk dit lekker want ek het die rekenaar in die klas, as ons vashaak stop ons daar en ons het toegang tot internet in die klaskamer so ons kan daar en dan stop en inligting soek en ek kan die moontlike opsies vir hulle op die interaktiewe witbord opgooi. Problem solved en dan gaan ons weer aan. Maar soos ek sê in ons landelike gebiede en selfs in ons groter dorpe, almal het nie die toegang tot al hierdie goeters nie, ,

Navorsers: Wat 'n mens ook moet byvoeg is dat baie mense is bang vir die tegnologie.

Deelnemer: Dit is mos nou so, scary tech, die man wil nie en hy sal nie en hoe langer jy gaan wegstroom raak jy heeltemal agter en verder verwyder van tegnologie en jy verloor later tred oor waarmee jy besig is, verstaan jy.

Vraag 5

Watter faktore tans beïnvloed dat wetenskap onderrig nie effektief by jou skool kan plaasvind nie?

Navorsers: Jy het nou redelik al genoem oor hoe om Wetenskap effektief te onderrig, is daar nog enige iets wat jy wil byvoeg

Deelnemer: Ek sal sê die hele kwessie oor praktiese aanbieding, doen met die kinders eksperimente, so byvoorbeeld ons het nou die afgelope 2 dae lekker reën gehad in die dorpie Z, amper 50mm, maar wat ek ook doen by ons byvoorbeeld, behalwe jou passie, wat ek dan doen met die kinders. Met die habitatte ek vat die graad 4-7's uit en ons skoolgrondjie is nou lekker groot, op die skoolgrond het ons sons groot klip, so hy moet nou gaan, natuurlik gee ons die veiligheidmaatreëls vooraf. Dat hy maar liefds 'n voorwerp moet gebruik om 'n klip op te lig om te sien watter diertjie daaronder is. Byvoorbeeld is daar 'n skerpioentjie is daar 'n spinnekop webjie, al daai goedjies. So ek vat hom op die skoolgrond en wys hom hoeveel diertjies lê verskuil onder die klip, onder die habitat en hoe dat hulle een habitat share met mekaar. So jy neem die kinders fisies uit en wat ek doen byvoorbeeld terwyl hulle daar buite is neem ek fotos van hulle en wanneer ons terug is in die klas- die een weet nie wat die ander een gekry het nie, want hulle is mos op verskillende terreine onder my toesig.

Bepaalde resources beïnvloed ook die effektiwiteit, so byvoorbeeld ons het nie 'n wetenskap laboratrium by ons skool nie, met al die fancy goed, krane en opwasbakke nie, maar doen die basics. So nou die dag werk ek nou saam met die graad 6 en 7's waar ek vir hulle wys die toets van stysel toe sê een van die leerders by hulle huis is byvoorbeeld nie aartappels nie. So toe sê ek dan vat ons maar die ander man se aartappel en sny dit in klein stukkie sodat elkeen sy eie stukkie het en jy neem die jodium, en jy gooi dit daarop en nou moet hulle mos gaan kyk wat gebeur met die aartappel of dit swart geraak het. Nou moet hulle nog 'n stukkie brood ook bring, stukkie droë brood daar moet nie jam en botter op wees nie. In namakwalands praat ons van 'n "koytjie" 'n "so verstaan jy dat wanneer jy nie die liefde het vir dit wat jy doen nie, moet jy dit los. so ons moet nie vasstaan by die beperkte bronne wat ons het by ons skole nie soos jy wat gewerk het met die wiskunde, jy het na besighede gegaan wat belê in opleiding deur die kort kursusse wat ons gedoen het. Maar ons ons geval, ons het mos nou nie groot besighede hier nie, ons moet maar netwerk met groter netwerke soos

byvoorbeeld met die Universiteite en jy moet kyk binne jou beperkte resources om die workshops en werkwinkels by te woon. . Jy kan byvoorbeeld met eenvoudige goedjies met eksperimente vir die kinders vra byvoorbeeld in die eerste kwartaal het ons energie gedoen en ek het byvoorbeeld vir die kinders prakties gewys. Baie van hulle het nie plugs gehad nie en ons het plugs aangekoop en jy bring sommer jou eie stukkie elektriese kabel van die huis af en jy wys vir hom prakties waar is die ertha, die neutral en die live. So dat hy later self fisies die plug bedraad en vasdraai en dan toets jy dit 'n balpie want jy kan mos nie bekostig dat die fotostaatmasjien blaas nie. So as die balpie brand dan weet daai outjie hy het die drade korrek gekoppel. Maar jy moet die ding live maak in die klas vir die kind, dat hy sodat jy 'n liefde by hom/haar aan te kweek en nou gebeur dit nou so dat die kids gaan weg van jou af en die volgende ou bou voort op wat jy gedoen het en die ander man sê hy het nie tyd daarvoor nie.

Vraag 6

Wat dink jy kan gedoen word om die faktore genoem in voorafgaande vraag aan te spreek

Navorsers : So ek lei af uit dit wat jy gesê dat by vraag 6 'n mens 'n hands-on benadering moet volg

Deelnemer: Dit is wat dit moet wees

Navorsers: Veral omdat ons kinders baie visueel ingestel is, hulle leer mos baie visueel, en om dit vir hulle te laat sien en te laat ervaar.

Deelnemer: Yes, yes yes, hy sien die bruin draadjie, hy sien die geel en groen draadjie hy sien die bloue, en jy leer vir hom baie dinge en jy sê vir hom luister as jy die plug in jou hand hou, aan die linkerkant is die live een, en dan moet die bruin aan jou neutrale een wees en die geel en grond is jou aard jy koppel daai puntjies met mekaar. Dit is maar hoe ek dit doen, dis ook die manier hoe 'n mens kinders stimuleer aan die einde van die dag. Ek het ook nog 'n paar goed wat ek wil noem om die faktore in vraag 5 genoem aan te spreek, bv die shortages kan aangespreek word deur die bywoning van kortkursusse ons het byvoorbeeld by die AHEC program wat die Universiteit Stellenbosch aangebied het het ek mos die wiskunde gedoen maar die ander manne wat mos die wetenskap gedoen het. Besighede wat jy kan kry om te belê, hmm, en Dan voelers uit te steek en praat met ander mense en luister hoe hulle die ding aangebied het of gebeneder het. Maar soos ek sê hands-on in die sin dit baat nie ons gaan praat van bome en bosse en die habitat van diere nie, gaan wys vir die kind waar daar 'n spinnekop web is, iewers gaan daar 'n spinnekop in wees. Maar ook let op die veiligheidsaspekte. Maar wat ek ook doen is baie van die goed record ek byvoorbeeld van die National Geographics program, baie van die goed bring ek ook vir hulle na die klas toe. So hoe meer lewendig jy die aktiwiteite vir die kind in die klas maak, hoe meer suksesse bereik jy aan die einde van die dag, want as daai outjie net elke keer hoor van iets, maar hy ervaar dit nie fisies nie, dan gaan dit oor hy net daai short term memory wat hy het, ons idee is mos dat om hom te neem na 'n meer longterm memory, sodat hy die goed weer daar buite kan gaan toepas.

Navorsers: Okay, jy het nou 'n mondvul gepraat, maar ek is baie bly dat jy vandag ingestem het, ek gaan luister of my recording baie goed is en as dit nou nie sal jy omgee om dit vir my per epos te stuur.

Transkripsie van onderhoud T 10

Datum: 23 Junie 2016

Plek :Skool

Naskool

Gemeenskappe van praktyk is die term wat gebruik word vir 'n informele groep tussen verskillende skole wat ontstaan het agv 'n gemeenskaplike doelwit of behoefte.

1. Wat is jou ervaring omtrent die samewerking van onderwysers wat dieselfde vak aanbied in 'n gemeenskapspraktyk?

Kyk ek het nie, is nog nie solank in die omgewing nie, ek nou eers 3 jaar hier, een jaar by die laerskool en 2 jaar by die hoërskool en al waar ek ander onderwysers sien is in die begin van die jaar waar ons bymekaarkom, wanneer ons die jaar se werk bespreek wat voorlê, maar verder kom ons nie eintlik, ek wil amper sê daar is nie hierdie informele gesprek rondom die vak nie. Al waar informeel gesprek plaasgevind het is in my geval 2 keer hierdie jaar, eerstens by atletiek waar ek en die mede beampte by spiesgooi toevallig agtergekom het ons albei gee lewenswetenskap en toe praat ons bietjie daarvoor en die ander dag was by die netbal op Lutzville en waar ek die Fisiese Wetenskap onderwyser ontmoet het en ons het toe nommers uitgeruil. Verder is daar nie tans 'n struktuur wat 'n mens ek kan amper sê tap uit ander mense se ervaring uit nie.

Navorsers: Vraag : Louise jy is gee nog nie lank skool nie, maar uit jou vorige antwoord lei ek af dat daar beslis 'n behoefte is vir 'n gemeenskapspraktyk, dink jy as 'n meer moderne onderwyser kan baatvind by so 'n gemeenskapspraktyk?

Ja beslis, jy as opvoeder het nou hierdie boeke kennis, maar jy het nog nie die ondervinding/ervaring nie, ek weet die kurrikulum het al 'n paar keer verander maar hierdie ou hande weet presies watter werk om op te beklemtoon, want dit is wat die kinders nodig het vorentoe. Okay na vyf jaar weet ek nou al, maar ek praat nou van 'n nuwe onderwyser waar by so 'n gemeenskapspraktyk kan 'n mens intap in ander mense se poel van ervaring en kennis. 'n ander simpel voorbeeld is vraestelle, bv. Ek wil nie ander mense se vraestelle hê nie, maar as ek nuut is in 'n vakgebied, dan wil ek net 'n voorbeeld hê en ek wil sê oaky dit is die formaat, dis hoe 'n mens merk, maar nou sien jy oaky, sê maar nou fisiese wetenskap wat bietjie moeiliker is, dis die vraag wat jy nou vra, dit tel 5 punte maar waarvoor gee jy die punte? So dit sal so nice wees as jy mense het met wie jy kan praat en jy voel nie sleg omdat jy vir hulle sulke tipe vrae vra nie. So vir 'n nuwe onderwyser kan dit nogals baie help.

2. Uit jou ondervinding van gemeenskapspraktyke, het jy enige voorstelle hoe om so 'n gemeenskapspraktyk effektief te laat funksioneer?

3. Ek luister na jou insette, maar beklemtoon net weer dat onderwysers het 'n verskriklike besige program, dis nie net die akademiesnie dis nog buitemuurse aktiwiteite ook, so fisiese bymekaarkom gaan dalk nie altyd moontlik wees nie vir sommige onderwysers nie, het jy al gedink aan moontlike maniere hoe 'n mens daai probleem kan oorkom?

Kyk nou dat ons die whatsapp groep het is dit nice, maar jy byvoorbeeld nie op die whatsapp groep vra soos bv van die vraestelle nie want dan dink ander mense jy kan bv nie 'n vraelys opstel nie, maar die whatapp groep is nice om jou in kontak te bring met ander mense en daarvandaan af kan jy mos nou persoonlik werk. Maar ek dink as mens, ek wil amper sê in die begin van 'n jaar definitief so bymekaar kom. Dit sal dan die kans gee vir mense om mekaar te ontmoet, inligting uit te ruil en verdere kommunikasie kan dan plaasvind deur elektroniese platvorms. Bv whatsapp groepe, email of websites. Dit sal wonderlik wees indien mens kan videos of vraestelle oplaai, maar dit is seker bo ons vuurmaakplek. Ek het bv nou die dag 'n website gekry waar mens vraestelle kon aflaai, by mens betaal R10 vir enige vak van afrikaans regdeur tot by Xhosa. So nou moet jy dit met ander mense kan deel want hulle soek weer die informasie. Ek meen Whatsapp is 'n vinnige manier om nou informasie by mense te kry, maar iets soos facebook kan jy ook gebruik.

Vraag: Navorser So beslis beweeg ons in 'n ander rigting. So dis nou hoekom ek aan die begin gesê het jy is nog lekker jonk en jy is vertrouwd met tegnologie en hoe gaan jy nou die ouer tipe onderwyser, want jy sal definitief sien die een wat langer in die onderwys is, het die ervaring maar hulle is weer skrikkerig vir die tegnologie. Het jy al gedink aan maniere hoe om die persone bewus te maak dat tegnologie kan dit vir ons makliker maak.

Antwoord: Ek het toevallig vir ons onderwysers almal hier 'n smart class demonstrasieles gegee, want ek het die training bygewoon en hier het mos nou baie ouer mense gesit en vandag byvoorbeeld het hulle weer na my toe gekomen gevra of ek hulle weer kan wys. So dit help nie net om vir die persoon te sê wat om te doen nie, jy moet vir die persoon leer soos jy vir jou ma sal leer, gaan sit langs die persoon en vir hulle geduldig stp vir stap gaan wys dat dit nie so moeilik is nie. As 'n mens kyk na die moontlikhede bv in Lewens Wetenskap en Fisiese wetenskappe bv met hierdie smart class kan ek 'n prentjie van die hart daar sit, en nou kan ek byskrifte daarby sit en die byskrifte ssuffle, die kind kan dan die byskrifte op die regte plekke kom byvoeg en dit is soos die kinders leer, kinders leer nie meer soos ons geleer het met net boeke nie, hulle wil sien want hulle word heeltyd visueel gestimuleer en dis hoe ons hulle in die klas moet stimuleer. So vir die ouer mense ons sal dit vir hulle moet sit en dit makliker maak. Nie net sê gaan op die fb groep nie, want hy weet nie wat die facebook groep is nie.

Vraag: Navorser: Ek hoor uit jou respons van die vorige twee vrae, daar is beslis behoefte vir fisies bymekaarkom, so 'n bietjie struktuur aan die informele groep en dat daar spesifieke goed geïdentifiseer moet word waaraan gewerk moet word.

Dit hang mos nou af van die geval, bv as ons in hierdie smartclass is, kan jy 'n prentjie van die hart opsit, wat die inhoud betref, LW is ek reg, NW is ek reg maar wat FW betref het ek

nog ondersteuning nodig want dis nou 'n nuwe vak wat ek aanbied, ek sal weer moet gaan oplees/ gaan soek wat ek gedoen het doerie jare, so FW is nou vir my 'n uitdaging, ek sit maar elke dag en maak seker dit is nou weer waaroor dit gaan dit is nog die uitdaging en dit is waar ek nog baie hulp sal wil hê.

Vraag: Navorser : In jou opset by die skool dink jy wetenskap word effektief onderrig? En indien nie kan jy dalk faktore noem hoekom dit nie effektief kan onderrig word nie.

Ek dink die seniors word effektief onderrig, want die mense sit in die regte klasse, hulle het die apparaat en okay ons het nie altyd al die chemicals nie want die goed verslaan. Juniors se probleem is, baie keer kry iemand die vak en dit is nog net een van sy vakpakket, baie keer so 'n persoon se ingesteldheid asy nou engels, afrikaans gee en hy moet nog NW gee dan gaan hy dit afskeep, dan is dit nie sy prioriteit om dit interessant te maak, eksperiment te doen en someer nie, want hy moet dit net klaarkry want sy ander werk is baie meer. So dit hang af watse onderwysers dit kry.

Vraag Navorser:

Het jy dalk enige voorstelle hoe 'n mens hierdie probleem kan aanspreek of hoe 'n mens dit geleidelik in 'n positiewe rigting kan verander?

Antwoord: "humoristies oomblik" Die oplossing is altyd nog onderwysers maar ons kan dit nie kry nie, ek wil amper sê dat dit jou keuse is, jy hou nie van wetenskap nie en nou word jy geforseer om die vak te onderrig, as jy nie jou eie kop gaan swaai nie, dan gaan jy mos nie die klas lekker aanbied nie en daai mense moet baie ondersteun word.

Vraag: Navorser : Die volgende vraag wat ek by jou wil los is of jou brain tease, hoe dink jy kan so 'n gemeenskappraktyk by die skool vir 'n vakspan help om daai mense wat partykeer nie opgelei is om die vak aantebied nie,

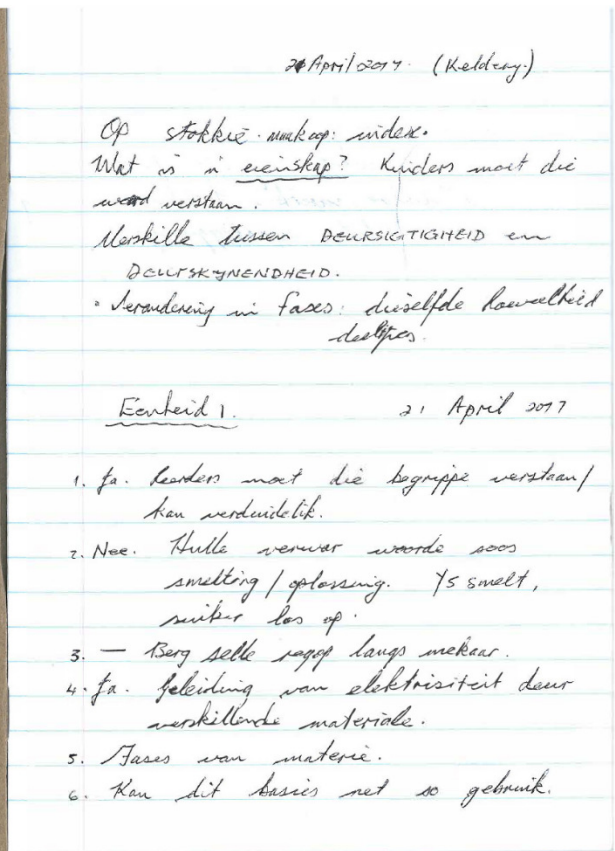
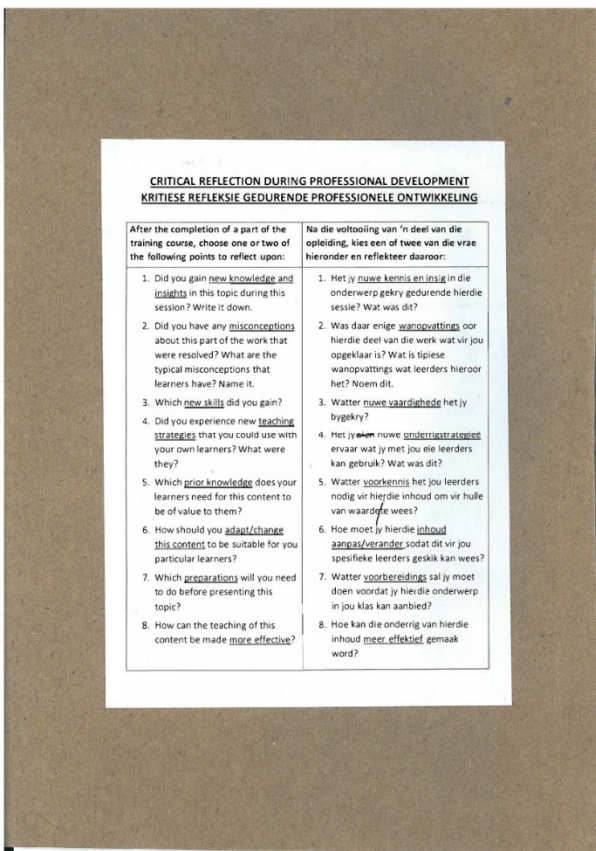
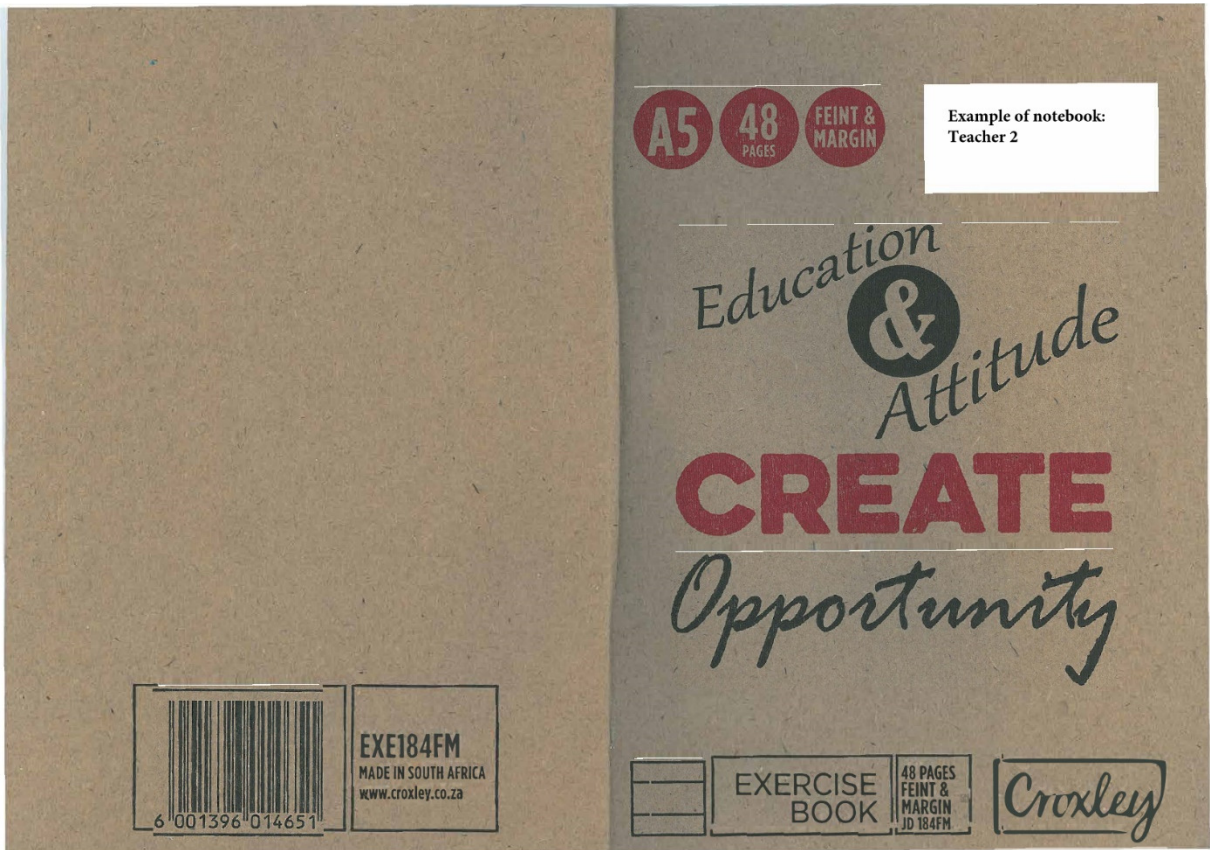
Antwoord

Wel ek het nie eintlik daai antwoord nie, maar wat ek al byvoorbeeld gedoen het, ons het 'n juffrou hier laas kwartaal gehad maar sy is alweer weg, en al wat ek op daai stadium kon dink om vir haar te help is, ek het haar slide shows vir haar gegee, want sy het mos nou die handboek en sy kan sien hoe het ek dit opgesom, die kinders kry wat hulle moet kry so sy hoef nie ongemaklik te wees met wat sy vir hulle gee nie omdat met dit wat sy vir hulle gee is reg. Maar dis maar hoe ek probeer help het, ek weet ek het haar nie probeer visvang nie maar as sy sien ek het bev hierdie werk op die manier opgesom dan kan sy agterkom dis hoe ek dit benader het, dalk kan sy die volgende keer ook daai benadering volg. So

4. Wat dink jy kan gedoen word om die faktore genoem in voorafgaande vraag aan te spreek?

ADDENDUM M

Participant Diary Template



7. Oefen/Toets apparaat wat jy gaan gebruik vooraf.
8. Leerders moet self doen/ervaar hoe dinge werk. Praktiese ervaring verseker beter vaslegging.

Eenheid 2.

21 April.

1. emulsië -
2. -
3. gebruik van hebigkeeler - distilasie.

22 April

- NB: teorie + praktyk moet mekaar in die klas ontmoet.
3. gebruik in skeitregter.
 4. Manier om in stof te ruk. Waaie dampe/reuke na jou neus met jou hand.
 5. Olie en water meng nie - hul digthede verskil.
 6. Kan net so gebruik.
 7. Stel apparaat op. Toets eers self.
 8. Voorwerp terug na terme soos: lewings-tigheid, deurskynbaarheid, ens. Veiligheidsmaatreëls moet nagekom word. Leerders moet weet wat die reëls is.

Akt 2.

22 April.

Metodes van skeiding.

Wat gaan prakties die beste werk.

Watter kenmerke van materiale gaan help om stowwe te skei? Heiligheid!!

Eenheid 3.

22 April.

1. Dimitri Mendeleew - een van 17 kinders in Rus, Skepper van Periodeske Tabel.

Periodeske \rightarrow in periode / afgewete stukke.

Mendeleewium - element na Dimitri vernoem.

Die hele ry is 1 periode.
Verhouding van protone, elektrone en neutrone beme elke element.

2. Nee.

3. Ervarende maniere om begrippe aan leerders te verduidelik.
4. Hoe om chemiese begrippe op die leerders se vlak te verduidelik.
5. Kleinige voor kennis - dis in nuwe fase met nuwe werk + begrippe.
6. Bied slegs werk aan wat volgens KATV nie GR7. voorgeskryf is.
7. Meerkeer dat ek oor voldoende kennis van die inhoud beskik om leerders se moontlike vrae te kan beantwoord.
8. Maak dit so prakties moontlik sodat leerders dit kan sien/ervaar.

MIDDAGETE: Heerlik!!



Eenheid 4.

1. Ja. Die manier waarop elemente met mekaar verbind. Almal wil soos hul naaste edelgas wees.
2. Dit is myne werk vir leerders - weet nie of hulle enige wanopvatting sal hê nie.
3. Vermoeste kennis is weer afgetof.
4. Die voorstelling van hoe elke element se elektron samestelling lyk.
5. -
6. -
7. Meers op hoogte van inhoud. Opvol van teke/ hulpmiddels.

8. Laat leerders prakties met kaartjies/ hulpmiddels speel om te sien hoe ditge werk.

5 Mei 2017

Eenheid 5. - Erika.

- leerders moet verstaan dat:
- daar ruimtes tussen molekules is.
 - die ruimtes tussen watermolekules nie lug bevat nie; daarom kan jy in teelepels in water drink.
 - deeltjies nie groter raak as hulle energie bykom nie. Dit beweeg vinniger en spasies tussenin raak groter.
 - jy vir elke fase dieselfde aantal deeltjies gebruik om die deeltjies samestelling voor te stel.

 $H_2O(l)$

ca

Normaalweg sal in vastestof die kleinste ruimte beslaan, dan die vloeistof, dan die gas.

Water is in uitsondering - ys beslaan meer ruimte as water.

* in versadigde oplossing is wanneer die spasies tussenin gevul is.

1. Diffusie
2. Deeltjies of molekules raak nie groter as dit meer energie oortruyg nie.
3. Samestelling van $H_2O(l)$ en $KMnO_4$.
4. gebruik gekleurde ysblokkies om in water te smelt om die begrip "diffusie" te demonstree.
5. Kartikel - samestelling/ rangskikking in fases.
6. Meer graad 8 - werk as gr. 7.

.am

7. Doen eksperimente vooraf om te verseker dat dit sal werk.
8. Doen soveel prakties as moontlik. Leerders moet sien waaraan hulle leer.

Eenheid 7.

$$1 \text{ ml} = 1 \text{ cm}^3$$

$$1 \text{ g/cm}^3$$

$$= 1 \text{ g/ml}$$

$$= 1000 \text{ g/1000 ml}$$

$$= 1 \text{ kg/1 l.}$$

$$= 1 \text{ kg/dm}^3$$

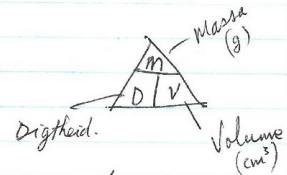
Digtheid is 'n aanduiding van die hoeveelheid materiaal in 'n bepaalde volume.

ys se digtheid = $0,92 \text{ g/cm}^3$.

1. Ou kennis is weer reënis.
2. -
3. Ring + bal-apparaat, 2 soorte.
4. -
5. Nie gr. 7-stak nie.
6. -

6 Mei:

Digtheid = $\frac{M}{V}$



Druk die een toe wat jy wil bereken.

$$D = \frac{M}{V} \quad M = D \times V$$

$$V = \frac{M}{D}$$

Deeltjie model. - kinders in groepe - fibrees, vaste stof, vloeistof, gas.

-273°C laagste temp. waarby molekules kan beweeg/fibrees)

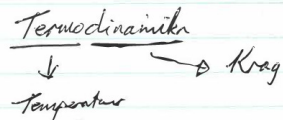
Druk = $\frac{\text{Krag}}{\text{oppervlakte}}$

Druk \propto Krag (as krag groter word, raak druk ook groter)

Druk $\propto \frac{1}{\text{opp.}}$ (as opp. groter word, word druk af.)

1. Druk = $\frac{\text{Krag}}{\text{opp.}}$ Ou kennis afgestof.
2. -
3. Driehoek voorstelling om verhouding tussen 3 veranderlikes te bepaal.
4. ↑ sien bo.
5. -
6. -
7. Praktiese toerusting voorberei/bekom.
8. -

Eenheid 4 - Christa.



$Mg \rightarrow Mg^{2+} + 2e^{-}$
 $O \rightarrow O + 2e^{-} \rightarrow O^{2-}$
 protone 8 8 protone
 elektrone 8 10 elektrone

negatiewe ion = anion

$Mg + O_2 = MgO_2$

O is 'n diatommiese molekule

mono = 1	Grades
di/bi = 2	
tri = 3	

Natrium $\rightarrow Na^{+} + e^{-}$
 Chlor $\rightarrow Cl + e^{-} \rightarrow Cl^{-}$

Natrium $Na \rightarrow Na^{+} + e^{-}$
 Chlor $Cl + e^{-} \rightarrow Cl^{-}$

$Na \rightarrow Na^{+} + e^{-}$ (Neutral \rightarrow Kation, verloor 'n elektron)
 $Cl + e^{-} \rightarrow Cl^{-}$ (Neutral \leftarrow , neem een elektron op, anion)

Begin altyd by die atoom en beweeg na die ion.
 Natrium + Chlor = Natriumchloried.
 $Na^{+} + Cl^{-} = NaCl$

↓ ↓
 Metaal Nie-metaal (Halogeen)
 Groep 1 Groep 17

$Cl + e^{-} = Cl^{-}$
 17e⁻ 18e⁻
 17p⁺ 17p⁺

Reagentie Produk.
~~Na~~ + Cl \rightarrow NaCl

* gebruik 'n skaal om balans te verduidelik: AIA

19 Mei 2017.

Graspraktiwiteit - (hangers)

- Konsulteer + beplan
- Duidelike instruksies
- Sit 1 praat (geen versamling)
- Observasie - van alle kante.
- samewerking.
- verstaan almal terme?

"IF YOU FAIL TO PLAN, YOU PLAN TO FAIL."

Eenheid 9: Suwe, basisse, neutrale stowwe.

$Asyn = CH_3COOH$ \rightarrow magnesiumhidroksied
 $Mg(OH)_2$ - milk of magnesium
 $CaCO_3$ - Kalsiumkarbonaat

Suurlemens: plasvervanger vir roll on / dooierant
 Suurlemens + suiker - pasta - geigstrap.

proton \rightarrow p kleinletter PH \rightarrow H = hoofletter Hydrogen

~~tit~~

aanbeiding by skool:

suur + basisse.

1. Leerders moet basiese begrippe leer en verstaan.
2. Kleurkaart vir indikatore wat gebruik gaan word. (google)
3. Kry die produkte wat gebruik gaan word. (asyn, jik, suurlemensap, koeksoda, natriumkarbonaat, natriumwaterstofkoolstof, tartariese suur, seep.)
4. gebruik glashouers (proefbuis) om produkte te toets.
5. Jets jik onmiddellik - dit verslaan.
6. Veiligheid - moenie laat proe nie.
7. Merkkaart met duidelike instruksies.
8. Klein groepe - stantes = leiers.
9. Elke groep gebruik 'n ander indikator.

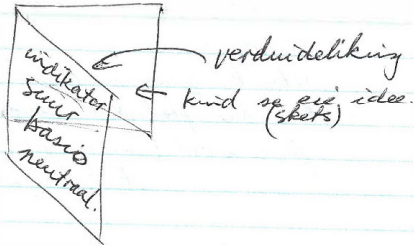
Hulpbron.

Interactive notebook.

A4 helfte van.

Beide 5 konsepte.

Beweis - definisie



PHET klik op no 5. Merk op alle rekenars.

Seei Eenh. 9. Akt. 2B.

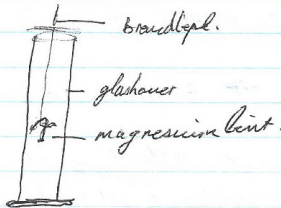
Eenhed 10. - Christa.

Akt. 1. punt 3 - gooi meer kookada in om oplossing sterker te maak. of verduin die rogn. (PH is te laag (2))

20 Mei

Metale se reaksie met suurstof.

Steg: vuurhoufje per groep + beide deel van aksie.



Alkalisiese oplossing is 'n opgeloste basis.

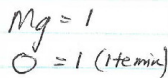
Eenhed 11.

Maaners magnesium brand, verbind dit met suurstof.

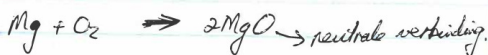
Magnesium + suurstof. → Magnesiumoksied.



Magnesiumioon. het 2 elektrone te min.

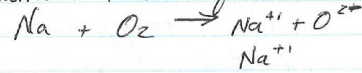


1 Mg verbind met 1 O.

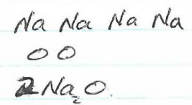
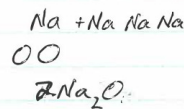


Maaners enige metaal met suurstof verbind, word 'n oksied gevorm.

Natrium + suurstof → natriumoksied.

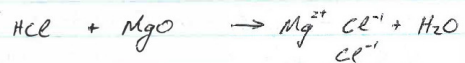


Na₂O → neutrale verbinding

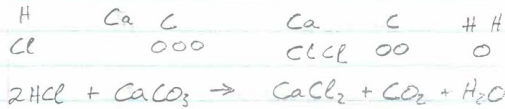


Suur + metaal oksied → sout + water.

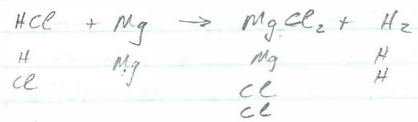
Sout suur + Magnesiumoksied → Magnesiumchloried + Water.



Akt. 3B. $HCl + NaOH$
 $HCl =$ pienk / rooi
 $NaOH =$ blou/pers
 $NaCl =$ groen (lêre groen)
 \rightarrow Neutral.

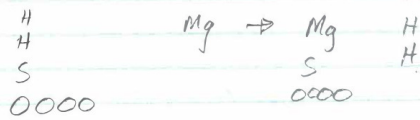


HCl - Soutsuur (waterstofchloried)
 HNO_3 - salpetersuur (waterstoftriërat)
 H_2SO_4 - swawelsuur (waterstofsulfaat)



Suurstof en Waterstof is altyd diatomies
 $O_2 + H_2$.

Swawelsuur + Magnesium \rightarrow Magnesium
 $H_2SO_4 + Mg \rightarrow MgSO_4 + H_2$ sulfat + waterstof



ADDENDUM N

Participant Diaries

Participants reflection: feedback regarding their experiences of the CoP-sessions.

Participants' had written their feedback in their reflection journals. This feedback of sessions three to ten, was translated from Afrikaans to English and will be given in the section below.

The sessions were valuable as it help me with practical ideas and knowledge regarding how to present the lessons to the learners in a more interesting and understandable manner. [Teacher 9].

I have learned through the interaction in the sessions that there are many practical ways to present topics and the corresponding content and concepts, in order to make it more interesting to the learners. My experience of the group sessions was that, with proper lesson planning, you could effectively integrate the use of technology when it is not possible to demonstrate dangerous experiments to the learners, especially when it is conducted in a normal classroom setup. The discussion about class management in the group sessions helped me to manage my classes better as it prepared me and make me aware of the different ways in which to transfer the knowledge of the subject to the learners in a more understandable and effective manner. [Teacher 4].

All the CoP-sessions were useful and of great value, but the density demonstration was especially fascinating and help me to understand the fundamental theory much better. I acquired workable ideas regarding how to teach the knowledge as well as to conduct the corresponding experiments more effectively. This helped me in particular to focus on more interesting ways to explain or introduce new content and concepts to the learners. [Teacher 3].

For me it was the first time that I experienced how to connect a Liebig condenser and how it works. The discussion in the small groups as well as the bigger group helped me to understand the content knowledge much better. In these discussions, we shared valuable information amongst each other and this allows me to demonstrate this separation method to my learners with more confidence. In the CoPs session, they also showed us what equipment to use when you do not have a working water tap in your class. [Teacher 6].

When we discussed the different separating methods for mixtures, the significance to know the different characteristics of the components of the mixtures was emphasised as it play a significant role in the selection of an appropriate separation method. [Teacher 10].

I have learnt enormously through the CoP-sessions, as it was very interactive and the best for me was the communication amongst the teachers. With a few adjustments to the work presented in the session, I could use the activities in my school context. [Teacher 3].

The presentation and content of the CoP-sessions were well structured and it correspond with the CAPS document as it link with the topics we were busy with, in class. The presentation of each session was every time interesting and creative, consequently, I learned a lot, and that motivated me to participate in the forthcoming CoP-sessions. [Teacher 8].

Through the activities presented in the CoP-sessions, I have learned a lot through the group interaction. That sharing of ideas and experience amongst teachers were very valuable and help me to understand the content much better. These group interactions help me to think of alternative ways to teach the content to make it more understandable for the learners. [Teacher 2].

Each of the practical demonstrations as well as the experiments that were conducted in the CoP-sessions help to demonstrate the content in a visual manner. In the group, supported with methods how to actively engaged your learners and it was discuss in the group, which questions to ask or methods how you can actively involve your learners to observe more attentively with asking relative questions beforehand. [Teacher 1].

In connection with the CoP-sessions, firstly it was shocking to see how teachers teaching the subjects outside their fields of training and how this lack of experienced, trained natural sciences teachers is specifically a problem in the lower grades. For me the CoP-sessions were valuable and I have learned how to make use of different strategies to teach the subject more effectively. In the group interaction valuable information were shared regarding and in my case as a trained natural sciences teacher, I have learned how, I do understand the theory, but not necessary know which teaching method to teach it in my learners' context. Especially with the more difficult chemistry, more sessions should be conducted to address the difficult content thus, helping teachers to understand difficult concepts. [Teacher 4].

Group work in the CoP-sessions were very effective. There was an opportunity to listen to other participants' ideas and to respond and learn through this sharing of knowledge and experiences. In my case, the CoP-session, which focus on the particle, model matter help me to teach this topic in a more understandable way to my learners. The demonstration of the experiments as well as the showing of the video clips help to explained this difficult chemistry concept in a much more understandable way to the learners. [Teacher 10].

For the first time I as a teacher understand how different factors like the temperature, the space between the particle and their position determines the different phases of matter, as this was demonstrate to us with the use of video clips. The discussion, which follow the video clips, help me to understand better the process. I also understands the concepts of melting- and point and boiling point and what changes happen at these temperatures, much better now. [Teacher 1].

The atmosphere in the CoP-sessions was not stressful and this help me to participate more passionately, which enhanced learning that is more effective. Everyone participated in the discussions and from the group discussion, the importance of knowing the properties of a substance follows which plays a significant role in the appropriate separation method you can used. Difficult concepts such as density and pressure were explained visually with the conducting of experiments and the showing of video clips. This help me a lot, as it show me different ways how to address these difficult concepts to my learners. [Teacher 9].

The using alternative resources such as video clips, which were shown to us in the CoP-sessions, can help to give the learners a better understanding of the concepts, as the visual presentation is an interesting way of showing learners where the theory is apply in everyday life. [Teacher 6].

Many concepts had become more understandable when it was practically demonstrated. With the writing of chemical equations and the balancing of it, I was so was so confused during the theoretical explanation but when these concepts were shown with the use of a visual demonstration, I understood it much more. [Teacher 1].

All the CoP-sessions were of great help to me; although the content was familiar to me, my subject knowledge was refreshed and definitely sharpen-up. The timing of the different CoP-sessions was spot-on, it was aligned what the CAPS document and the Natural sciences senior phase pacesetter. The group work as well as and interactive learning were very valuable. I also learned to know the other teachers in my group better, which helped to establish a valuable relationship between the participating teachers. [Teacher 7].

The practical applications excellently encapsulated the theory of the content of the topics and the worksheets, tools that were given to us were very useful as you can use it in class. The videos that were shown help to make the make the subject alive and more understandable for the learners. The highlight of all the CoP-sessions was the one where we have tested various domestic solutions to identify its acidity or basicity. Different indicators were used which shown with colour changes whether the substance is an acid or a basis. [Teacher 10].

During the CoP-sessions, we have learned to work together in a small as well as in a big group. During these group activities, I was especially motivated and exposed to different laboratory as well as household substances, which can be used to test the pH of a solution. I have enjoyed the group activities, because we as teachers cooperated and supported each other. The information in each CoP-session can be used in our class context as it is aligned with CAPS document and educators have adequate material, which they can use as enrichment activities. [Teacher 6].

The icebreaker with the hangers, help us as a group to plan our strategy and to choose the role of each one in the group. [Teacher 9].

The CoP-sessions were a valuable experience as the cooperation amongst natural sciences teachers not only focus on one directional communication, but time was allocated to discuss problems that we are facing every day, which have an influenced on the success of the work. [Teacher 5].

All the work that was presented in the CoP-sessions could benefit all the participants. I never have realised the backlog we as teachers have learning and support of the subject. The CoP-sessions were valuable but I believe there are many of the content and concepts that we still need more assistance to enhance effective application of learner centered learning. [Teacher 10].

The CoP-sessions were structured in such a way that teachers work together in all the activities that were conducted. At first, it was very difficult to work together in the group, because not everyone were on the same level of understanding of the subject knowledge; consequently, influencing the participation of the teachers in the group activities. As the sessions progressed from the first to the last one, the cooperation amongst teachers improved. I wish that we as the participants had known each other better before the sessions as this would have made a substantial difference in the type of cooperation amongst the teachers in the group. [Teacher 4].

The most important factor that plays a significant role in the successful functioning of a CoP, is the possibility of it to address the skills that we as teachers need. In our case the hands-on practical sessions, which included different CAPS-related experiments made the sessions very successful, especially as it focus on how to conduct the practical work more effectively in the classroom. [Teacher 3].

Effective planning of the activities for the CoP-sessions plays an important role in the successful implementation of a CoP. Therefore, if group work is managed effectively, it can be an excellent way to engage all the participants, consequently, influence the effectiveness of the CoP. [Teacher 8].

One of the key factors for me is to present the CoP-sessions in first language of the participants. Furthermore, thorough planning is needed in order to address participants' needs in the CoP-sessions. [Teacher 6].

There must be an environment of learning where the participants feel comfortable and confident to share with the other group members their strengths and their weaknesses regarding the subject content and concepts as well as the conducting of practical work. [Teacher 4].

During the CoP-sessions best practices need to be share amongst participants especially ways how to conduct practical work in your class with using inexpensive materials or equipment. [Teacher 1].

Feedback or reflection after each CoP-sessions is very important, which included explanations why we were using specific procedures in a specific manner. It is important to create a culture of learning in which everyone share the responsibilities towards the group members and not only for themselves. It is important that the participants are encouraged and kept accountable to participate in the activities in order to develop ownership for the CoP. [Teacher 7].

The group sessions were excellently prepared the conducting of the experiments and the group work kept me actively involved practical's and demonstrations kept me actively involved with the group activities. [Teacher 9].

Time management is a major challenge for me, I have to manage my involvement with the non-curriculum activities such as the netball and the curriculum work such as intervention for the learners that are not on standard of their specific grade. In addition to it, I have also my own kids whom are still young and need currently lots of attention. Thus making my participation in in the CoPs sessions very difficult. The meetings were very positive and very good ideas for practical I appreciate very much. If the meetings are for less than 90 minutes, it can work for me. At this stage, I still need help with the strand energy and change, specifically with the practical work. [Teacher 5].

It was not a large group and everyone was comfortable with each other, therefore most people felt comfortable to ask questions if they do not understand or if they need help. The sessions help us to conduct practical work easier, although in some cases the teachers lack the laboratory equipment, alternative ways were shown to us such as the use of household materials and substances. [Teacher 10].

The CoP-sessions helped to better my explanation skills of the theory to my learners. The practical approach, which was used during the sessions help to improve my confidence to conduct practical work. We have established good relations between the participants in the group, which would help with the better communication in future, between the colleagues should we need assistance in any way. [Teacher 3].

The motivation and willingness of the teachers to participate in the CoP-sessions to enhance effective learning in their class. Attitude of the school principals, teachers and school management teams. Time management of educators. Effective planning of schools to professional development of educators to accommodate. Cooperation, generosity of educators in terms of resources and human resources. Sustainability of professional development. [Teacher 8].

I have only worked for three years in the Vredendal area of which I taught one year at a primary school and two years at a high school. The only time when I had contact with Natural sciences teachers of other schools, was in the beginning of the year at the meeting which the curriculum advisor had arranged. At this meeting, the planning of the year's work is reviewed, but our needs regarding subject-related challenges are not addressed. [Teacher 4].

I do not think there is enough cooperation between the teachers; once a term, meetings are organized by the subject advisors where all communication are focused on the formal curriculum work. Therefore, no time is available for informal communication regarding subject-related issues. [Teacher 1].

In my case, this informal discussion regarding the subject occurred twice last year. Firstly, at the athletics meeting and, secondly, at the netball game where both a fellow teacher and I discovered that we are teaching the same subject. In an informal way, we exchanged contact details and have since stayed in contact. Moreover, there is currently no structured CoP where we as colleagues can tap from each other's knowledge and experiences. [Teacher 9].

I would say that teachers need to be excited about the subject in order for them to transfer this excitement to their learners. [Teacher 2].

If you get teachers on board in the CoP and they develop confidence with the natural sciences context, they will apply the information and methods obtained from the group discussions into their own class context. [Teacher 1].

In some situations the teacher does not have a choice to teach natural sciences; this is especially the case at smaller schools where teachers need to teach the subject regardless of whether they are trained natural sciences teachers or not. Consequently, this has a major influence on the way they teach the subject. [Teacher 4].

Not only do novice teachers have to teach subjects that they are unfamiliar with but they also have to "learn the ropes". Although they have been exposed to the teaching practice while undergoing training, novice teachers still need a mentor to support them with their adjustment to the new school context. [Teacher 8].

As a novice teacher I still lack the skill of effective classroom management and that has an influence on the learning process in my class, not that I do not try my best, but the more experienced teachers can mentor us in order to guide us to better adapt to the new school context. [Teacher 6].

In my specific case at school, we had a new teacher last term to whom I gave all my lesson plans as well as power point lessons which are based on the CAPS document. This helped her with the teaching of the subject. I know I could have done more, but due to full work program I could not more fully support her. [Teacher 10].

According to the PAM document, one of the core duties of a senior teacher is to act as a mentor, this implied that mentoring is legal, but perhaps the senior teachers is not a qualified natural sciences teacher. [Teacher 1].

I think we as teachers need to start with ourselves; are we willing to work together with other teachers in the CoP? If so, we first need to work together with our colleagues in the same department and school. If this co-operation is working, we can expand this concept with other colleagues from other schools who are teaching the same subject. Experience has taught me that not everyone is committed; therefore, I am honest when I say I do not want to share my lesson plans and formal assessment tasks with other teachers. [Teacher 2].

There may be many approaches that one can use to address the issues that influence the effective teaching of the subject at the school. My suggestion will simply be the incorporation of CoPs, as this platform creates an environment of sharing experiences and knowledge amongst teachers. In this context, interactive learning can be ensured. [Teacher 4].

If we can meet monthly, it will help build confidence between the participating teachers. In the beginning, it will not be so easy, but once you get used to the other teachers and learn that they also experience problems in the class context, which you can learn from, it will give you confidence to share your own apprehensions in the group. [Teacher 8].

For me, in these CoP-sessions, one can learn from the more experienced teachers and the occurrence of these meetings will depend on the participating teachers' needs and availability. It can occur once a month or once every second month but it is important to keep the group small to ensure effective support. [Teacher 9].

We can invite grade 7-9 natural sciences teachers to participate in CoP; first to a meeting and afterwards through an electronic platform like a WhatsApp group. Those teachers who are not used to working in a 'group context' are not always keen to work with other colleagues, but as they got more expose to working with colleagues, they will get used to the 'CoP- context'. [Teacher 10].

As the CoP develop, it can include grades 5 to 7 as well as grade 10 teachers. This diverse group will help to establish a more realistic representation of the different phases in the school system. In this context, teachers could be aware of the needs of the different phases and therefore in this collaboration a more sustainable method can be formulated. With this approach, conflict can be eliminated where teachers in the different phases blame each other for the insufficient preparation of learners regarding the next phase of natural sciences. [Teacher 3].

If we as the teachers are explaining habitats to the learners, you need to show them in their local environment what it is or where they can find it. For example if you explain the habitat of a spider, take them out to the school ground, lift up a stone and show them how different insects are sharing the same habitat; just make sure that you are complying with the Department of Education's safety legislation. This will make the learning process much more meaningful as it links these concepts to their world of understanding. [Teacher 1].

When you demonstrate to the learners how to wire a plug, you need to show them the three different wires that a plug consists of -the brown, the yellow-green and the blue wire-, and within that context, you can explain to them how to wire a plug correctly. [Teacher 2].

Many of the learners learn more effectively when they are visually stimulated; therefore, visual presentation can help them to develop a better understanding of the subject. [Teacher 3].

Depending on your circumstances at school, you can determine what methods to use to make the theory more understandable. In my situation, I have a smart board in my class, and I can use that technology to explain practical's which are otherwise not possible to conduct in the class context, like the dissection of a human heart. [Teacher 10].

Learners do not always have access to a library or the internet. We as teachers can establish a good resource bank at school; you can involve learners to bring magazines to school, such as the National Geographic, Popular Mechanics and many others, that they can use in class when they need to conduct research regarding a specific topic. [Teacher 8].

ADDENDUM O

Participant Reflections of the CoP

Terugvoering van Sessie 6 Mei 2017

✚ Effektiwiteit van aanbiedingswyse.

Die wyse waarop die aanbieding gedoen is- deur alle aanbieders- was effektief. Dit was 'n ontspanne atmosfeer waarin leer aangemoedig is. Almal is aangemoedig om deel te neem- nie net aan besprekings nie, maar aan prakties ook. Foute is begaan en saam reggestel. Dit was nie net "onderwyser-gesentreerd" nie, maar ook "leerder-gesentreerd". 'n Goeie kombinasie van die twee het plaasgevind. Inligting, kennis en ervaring was welkom van albei kante af.

✚ Effektiwiteit van groepwerk.

Groepwerk in hierdie sessie was baie effektief. Dit het die geleentheid gebied om na ander te luister en hulle idees en insigte te kon waarneem. Nie net kon ek hierdeur alternatiewe inligting bekom nie, maar ek kon ook vaardighede aanleer oor hoe om sekere situasies te benader. Groepwerk het my ook die geleentheid gebied om my kennis en ervaringe met ander te kon deel en sodoende myself meer selfvertroue gee oor die inligting wat ek alreeds besit het. Hierdie was 'n goeie kombinasie waarin effektiewe leer kon plaasvind.

✚ Tempo waarteen inligting aangebied is.

Inligting was teen 'n redelike tempo aangebied. Herhaling het plaasgevind sodat begrippe beter vasgelê kon word. Vir elke afdeling was daar oorgenoeg tyd om teorie te kon inneem en ook hierdie teorie op 'n praktiese wyse te kon interpreteer. Persoonlik het ek gevoel te veel tyd was spandeer aan die teorie van balansering van chemiese vergelykings. Dit is 'n baie komplekse onderwerp, maar meer praktiese voorstellings sou my aandag meer vasgevang hou- aangesien ek later verlore gevoel het met die herhaling van die teorie.

✚ Begrip van teorie na werksessie.

Na hierdie sessie is ek baie meer gemaklik om my kennis oor die teorie met ander en veral die leerders in my klas te deel. Ek het baie nuwe teorie aangeleer, sekere teorie kon vasgelê word wat nog in my kop "rondgehang het" en die gedeeltes wat ek goed onder die knie gehad het, het net meer voiding gekry. Dit was voorwaar 'n gulde geleentheid om kennis te verbreed en opgewonde te wees daarvoor om meer te wil leer.

ADDENDUM P

Researcher's Reflective Journal

Researchers Diary and Reflection

Observations Discussion

During the first session, I, the researcher, observed that participants were more enthusiastically involved in the discussion that helped to improve the interaction amongst the group significantly. The session started with informal conversations where the participants had the opportunity to share their experiences; this was used as an icebreaker to put them at ease. Therefore, their participation became more active during the group discussions, which were directed by suggestions that could enhance even more active participation amongst the participants. These suggestions resulted in obtaining very valuable information with reference to a CoP.

In the second session, the participants mentioned the possibility of the CoP as a platform to address the concerns mentioned during the interviews such as ensuring effective teaching. The participants suggested that, to increase the effectiveness of the CoP sessions, teachers of the Further Education and Training Phase, the Senior Phase as well as the intermediate phase need to be included. According to these participants, the CoP platform could be used to assist those teachers who are qualified, but not trained Natural Sciences teachers to understand sciences better. Therefore, the underqualified Natural Sciences teachers can be supported in the CoP sessions and, as a result, better their understanding of the theory and the development of practical skills. This support and subsequent improvement of the teachers are therefore vital for the better performing of experiments or demonstrations

Participants pointed out that a more practical approach towards teaching could accomplish a more effective teaching method. Underqualified Natural Sciences teachers as well as beginner science teachers, both specifically mentioned that they need guidance on how to facilitate practicals for bigger classes. This is especially the case when arranging and managing workstations in the class in a manner that ensures effective teaching. Teachers, who is teaching at schools that have a limited budget, and therefore cannot afford expensive equipment and chemicals, need advice regarding how to conduct experiments that are less expensive.

The participants are of the opinion that the CoP platform can be used to support teachers with teaching strategies that they can use to demonstrate the application of Natural Sciences in real life. Similarly, participants emphasise the role that technology can play to improve effective teaching and the impact that a reliable internet connection can have, specifically for those schools that are situated in areas where there is no reliable internet connection.

The eight CoP sessions that followed, took place during the second term of the school year when the knowledge strand Matter and Materials, as prescribed in the Natural Sciences Senior Phase CAPS curriculum was dealt with. Therefore, this strand was used as a means to address the concerns discussed in the above section. Different topics and concepts of the strand were used to demonstrate the pedagogy, i.e. teaching practices that can be used to teach the different topics of the strand.

CoP sessions 3-10

The focus and functioning of CoP sessions was to observe how teachers with different experience and post levels, qualified natural sciences and unequalled natural science teachers work together in the CoP.

During the CoP sessions, certain topics of the strand Matter and Materials were discussed, such as properties of materials, various separating mixtures, the periodic table, chemical substances, the

particle model of matter, the reaction of metals and non-metals with oxygen, acids, bases and neutrals, the reactions of acids with bases and the reactions of acids with metals, metal oxides and metal carbonates. These topics included the content and concepts as well as the suggested activities as specified by the CAPS document.

The agenda used in each of the CoP sessions was the same, commenced with a short introduction of the activities of the session, which the participants received prior to the session via email. Thereafter, a detailed discussion of the topic, followed with its related content and concepts as well as corresponding experiments that can be used to better learners' understanding of the theory. Thereafter the participants were divided into small groups that consisted of three or four Natural Sciences teachers. In these small groups, they planned the strategy for conducting experiments, thereafter, the execution of experiments followed, which was concluded with an in-depth discussion of the results. This specific approach, which was used for each session, helps to create structure and assisted in the enhancement of the collaboration amongst the participants in a CoP. The observations that I as the observer made during the CoP sessions will be discussed in the section that follows.

The researcher's observation of participants' interaction in the CoP sessions.

I, the researcher, observed that not all the participants had a clear understanding of the content and concepts they need to know in order to teach the strand Matter and Materials effectively. This I observed during the group sessions, which occurred before the experiments were conducted. Although the underqualified Natural Sciences teachers specifically had problems, regarding the understanding of the Natural Sciences content, the qualified Natural Sciences teachers also experienced minor problems with it. The content included the topics density, pressure, chemical substances, chemical bonding, as well as the writing and the balancing of the corresponding chemical equations.

I also observed that the collaboration between the participants played a significant role in the successful functioning of the CoP. In this specific case, the participants had to overcome their feelings of inadequacy firstly, which had a significant influence on their participation in the sessions. As they became more at ease, however, their participation in the CoP sessions improved. This interaction is crucial for the development of practical investigative skills amongst the participants. These skills included the reading and following of instructions, the selecting the most appropriate method for experiments, how to collect the data, how to note the observations of the experiments, the interpretation of these observations, the analysis of the data as well as its interpretation.

I, also observed that both the experienced (senior and veteran), as well as the beginner teachers, were not confident with using the scientific apparatus, which could be an indication that they were not used to conducting experiments alone or with peers in a group. In the group interaction, the participants exchanged ideas about how to conduct the experiments and in this interaction, the sharing of knowledge amongst the experienced teachers as well as the beginner teachers occurred. The beginner teachers participated more actively with the facilitation of the experiments, which is an indication that they had more confidence to conduct experiments in a group; or that they are comfortable to conduct experiments in general. This could be a result of their newly acquired skills as they had finished their tertiary studies recently. However, the teachers who had extensive teaching experience, had the advantage of skills to address issues such as class management, especially when conducting experiments or when doing demonstrations that they shared with the rest of the group.

Feedback of the teachers concerning their experiences of the CoP sessions.

The participants mentioned that the CoP sessions were valuable as it introduced various teaching strategies; it equipped them with workable ideas about how to teach the content knowledge in a more understandable manner with the use of the corresponding experiments.

Furthermore, the collaborative and interactive nature of the sessions contributed to their valuable experience as it enhanced the sharing of ideas, skills and knowledge amongst the participants, which could be valuable in the better understanding of the content.

They stated that the collaboration amongst the participants had not only focused on one directional communication, but also on active collaboration, which enhanced the sharing of knowledge, experiences, ideas, and problems from their teaching context, which had to help them to generate possible solutions.

The presentation and content of the CoP sessions were well structured as it was aligned what the CAPS document and the Natural Sciences Senior Phase pacesetter that made it easier for them to use the material in their class context. Furthermore, the group interactions helped the participants to think of alternative ways to teach the content in order to engage learners actively and to make the content more understandable for them.

They have indicated the important role that proper lesson planning play with the integration of alternative teaching methods, such as technology that included applicable video clips and the interactive whiteboard.

These alternative methods could be used to demonstrate the everyday application of Natural Sciences and specifically the showing of dangerous experiments, of which they are not allowed to be conducted in a normal classroom set-up. They acknowledged the valuable role that practical demonstrations, as well as the conducting of experiments, play in learners' better understanding of the theory.

Moreover, they mentioned that practical applications of the theory included in the material of the CoP, help them to understand the theory much better, therefore, they are better equipped them to teach the content with more confidence in their class context.

The participants underlined the important role that the CoP could play to help those teachers who are teaching Natural Sciences but are not qualified Natural Sciences teachers.

They acknowledged their need for help to teach theory in a more understandable manner to their learners and the significant role the CoP could play to refresh and improved their knowledge and pedagogy. Likewise, they stated that all the participants could benefit from the work that was presented in the CoP sessions. Although the CoP sessions were valuable they still need help with the content and concepts of Energy and change as well as Earth and Beyond.

I acquired workable ideas regarding how to teach the knowledge as well as to conduct the corresponding experiments more effectively. This helped me, in particular, to focus on more interesting ways to explain or introduce new content and concepts to the learners. [Teacher 9].

In conclusion, the participants said that with the beginning CoP sessions, it was difficult to work together in the group, since not everyone was on the same level of understanding of the subject knowledge and at that stage trust had not been established between the participants. Consequently, the participation between the participants influenced the success of the group activities, but as the sessions progressed from the first to the last one, a valuable relationship between the participating

teachers develop and this had a significant influence on the improved cooperation amongst teachers.

What I have done to address the needs / lack that were observed during the sessions.

I, the researcher focused on the theory and experiments on topics within Matter and Material, namely, density, pressure, chemical substances, and the particle model of matter, chemical bonding and the writing of the chemical equations, as I observed that the teachers still struggle with the mentioned topics. In order to assist teachers to better understand the difficult or challenging topics, content as well as concepts, more time was allocated in the CoPs sessions to address these topics helping teachers to develop a better understanding of the topics that they need to teach their learners.

The sessions happened after school, the teachers were tired after a day at school and to address that, I used icebreakers in the beginning of each session. This informal way of starting the session had a major influence on the cooperation of the teachers for the duration thereof. To ensure more effective cooperative learning in the group, the bigger group was divided into smaller groups, which were structured in such a way that it consisted of a combination of experienced, beginner and underqualified Natural Sciences teachers. This helped to improve the sharing of knowledge, experience, and skills between the participants. The activities that were given to the teachers during each CoP session focused on enhancing the discussion of the topics in the small groups and the giving of feedback to the bigger group. In this interactive learning process, they had the opportunity to help each other and learn from one another.

To help teachers to make use of technology in the classroom, different forms of technology was integrated during the sessions such as Mimio-interactive technology, the document reader, data projector and the laptop. Built into the sessions were demonstrations of how making use of the internet such as YouTube and Google as platforms to make Natural Sciences learn more visually and therefore more understandable for the learners. In the CoPs context, videos were made of the experiments done and were shared electronically with the participating teachers. By doing this, the teachers had visual, electronic support of experiments, which they had conducted in the CoP session with their specific groups. Teachers that still needed help, was supported by myself, the researcher, at their schools in their own class context. By doing this, I could support them more effectively as their class context played a key role in their teaching strategies they are using.

ADDENDUM Q

Writing Lab Consultation Letter



TAALSENTRUM
LANGUAGE CENTRE
IZIKO LEELWIMI



UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

3 August 2017

To Whom It May Concern

The Writing Laboratory of the Stellenbosch University Language Centre offers free writing consultations to students and staff. Students come to the Writing Lab with their writing assignments to get advice on how to improve their writing. They are welcome to come at any stage of the writing process.

During a consultation students have the opportunity to discuss their writing individually with a trained consultant. Writing issues, for example, the analysis of the assignment, logical reasoning and argumentation, coherence and cohesion of paragraphs and sentences, academic writing style, and referencing, could be discussed. Students could also come for follow-up consultations to check their progress and to identify where they could improve further.

The Writing Lab will not edit a student's text, but will advise them on how to edit and improve their own writing. The Writing Lab also advises that students have their manuscripts proofread and edited professionally once they have finalised the text.

Ms Christa Joline Philander (11039833) is registered for her PhD in Educational Curriculum Studies. She visited the SU Language Centre's Writing Lab for writing consultations. As a distance student she also arranged and attended consultations via Skype to discuss her thesis writing.

Ms Philander attended 17 consultations in 2016 and 23 consultations from January until the end of July 2017. An attendance report drawn from the Writing Lab's electronic booking system is attached as she requested.

Kind regards

Ms Anne-Mari Lackay

Koördineerder: Konsultasies | Coordinator: Consultations

Skryflaboratorium | Writing Laboratory

US Taalentrum | SU Language Centre | IZIKO leelwimi lase-SU

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amlackay@sun.ac.za/☎ +27 21 808 2989

ADDENDUM R

Writing Lab Consultations Schedules

WRITING LAB CONSULTATIONS SCHEDULE

THE PROFESSIONAL DEVELOPMENT OF NATURAL SCIENCES TEACHERS:

POSSIBILITIES OF A COMMUNITY OF PRACTICE

DEPARTEMENT CURRICULUM STUDIES: STELLENBOSCH UNIVERSITY

Consultations from 1 January until 31 December 2016

Student Number	Student Name	Booking Date	Start Time	End Time	Student Attendance	Purpose
11039833	Philander, Christa Joline	2016/09/09	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/09/09	11:00	12:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/09/09	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/09/09	15:00	16:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/10/04	11:00	12:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/10/04	12:00	13:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/10/07	11:00	12:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/10/28	15:00	16:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/10/28	09:00	10:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/11/08	09:00	10:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/11/09	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/11/10	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/11/17	14:00	15:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/11/17	15:00	16:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/11/22	11:00	12:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/11/23	11:00	12:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2016/11/24	11:00	12:00	Attended	Thesis/Dissertation

Total consultations from 1 January to 31 December 2016: 17

WRITING LAB CONSULTATIONS SCHEDULE
THE PROFESSIONAL DEVELOPMENT OF NATURAL SCIENCES TEACHERS:
POSSIBILITIES OF A COMMUNITY OF PRACTICE
DEPARTEMENT CURRICULUM STUDIES: STELLENBOSCH UNIVERSITY

Consultations from 1 January until 31 July 2017

Student Number	Student Name	Booking Date	Start Time	End Time	Student Attendance	Purpose
11039833	Philander, Christa Joline	2017/03/22	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/03/23	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/03/27	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/03/28	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/03/29	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/03/30	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/04/05	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/04/06	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/04/12	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/04/18	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/04/20	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/04/24	11:00	12:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/04/25	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/04/26	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/05/03	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/05/04	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/05/09	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/05/10	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/05/11	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/05/22	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/05/24	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/05/25	10:00	11:00	Attended	Thesis/Dissertation
11039833	Philander, Christa Joline	2017/06/08	10:00	11:00	Attended	Thesis/Dissertation

Total consultations from 1 January until 31 July 2017: 23

ADDENDUM S

Literature Writing Review Workshop



UNIVERSITEIT·STELLENBOSCH-UNIVERSITY
jou kennisvenoot • your knowledge partner

**TAALSENTRUM
LANGUAGE CENTRE
IZIKO LEELWIMI**

Hiermee word gesertifiseer dat
It is hereby certified that

Christa Philander

die volgende kursus bygewoon het
attended the following course

WRITING A LITERATURE REVIEW

NQF Level 6

Vir die periode
Over the period

05 - 06 October 2016


Director


Head


Head

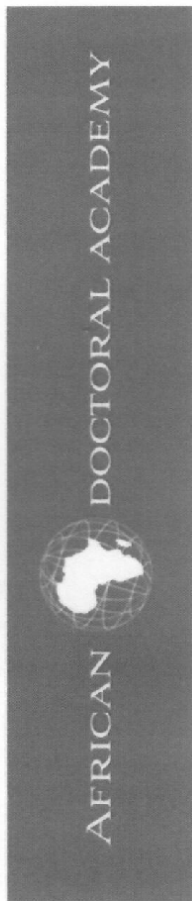


TAALSENTRUM
LANGUAGE CENTRE
IZIKO LEELWIMI



UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

ADDENDUM T
African Doctoral Academy Certificate



This serves to confirm that

Christa Joline Philander

attended the following course(s) during the *5th annual Summer School in Research Methods* offered by the *African Doctoral Academy of Stellenbosch University*

Methodological preparation for your PhD from 13-17 January 2014

24 January 2014



Prof Johann Mouton

Director

ADDENDUM U

PhD Study Timeline

Activity	Dates
1. Embarking on a research degree, planning & first steps, complete course registration form.	23 March 2012
2. Attending workshop on a strategic plan and approach for the writing an article.	24 April 2012
3. Apply formally to the Stellenbosch University (SU) to do PhD.	14 November 2013
4. Submit a motivation to the research committee why endeavoring a PhD at SU.	15 November 2013
5. Attend a course, preparation for your PhD, presented by African Doctoral Academy, SU.	13-17 January 2014
6. Constructing of the pilot pre- and post-intervention questionnaires.	March - June 2014
7. Apply for approval to WCED to conduct research study.	10 September 2015
8. Received approval from the Directorate Research WCED to conduct research study.	04 September 2015
9. Receive approval of DESC to conduct study.	12 February 2016
10. Conduct pilot study to test the pre- and post-intervention questionnaires.	February 2016
11. Completion of literature study.	September 2015 - July 2016
12. Planning and writing of the research design of the study.	November 2015 - March 2016
13. Communication to Circuit 5: 38 school principals, circuit team manager informing them about the information letter, consent form as well as the pre-intervention questionnaire.	29 February 2016
14. Contact potential participants via WhatsApp.	February - March 2016
15. Individual meeting with participants: discussion and signing off on consent forms.	24 February - 10 March 2016
16. Meeting with potential participants as a group	April 2016
17. Return of pre-intervention questionnaires.	April - June 2016
18. Conducting of interviews with the 10 participants who agreed to take part in the study.	June - July 2016
19. Meeting with prospective participants agreed to form part of the CoP group.	July 2016
20. CoP observations: researcher as observer-participant and teacher participants.	July 2016 - September 2017
21. Completion of post-intervention questionnaire by teacher participants.	June - August 2017
22. Data assimilation, illustration, analysis and interpretation.	October 2016 - June 2017
23. Constructing the findings and conclusions.	June 2017 - December 2017
24. Submission of thesis.	August 2017
25. Feedback from three examiners: <ul style="list-style-type: none"> • Implement the feedback of 1st and 2nd examiners, and re-submit thesis. • Feedback from the 3rd examiner. • Work on feedback of 3rd examiner. • Re-submit thesis for examination to 3rd examiner. • Complete thesis by incorporating suggested changes and corrections. 	October 2017 November 2017 November - July 2018 August 2018 September – October 2018