ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

BY

BAAS NKWENYANA SOLOMON

STD (TSHIYA COLLEGE), FDE (UNIVERSITY OF PRETORIA), ACE AGRICULTURE (UFS), B. Ed. Hons (UFS)

DISSERTATION SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

MAGISTER EDUCATIONIS

(MASTER'S IN EDUCATION)

IN THE

SCHOOL OF POLICY STUDIES AND GOVERNANCE IN EDUCATION

FACULTY OF EDUCATION

AT THE

UNIVERSITY OF THE FREE STATE

QWAQWA CAMPUS

OCTOBER 2018

SUPERVISOR: DOCTOR CT TSOTETSI

CO-SUPERVISOR: PROFESSOR LIPANE HLALELE

DECLARATION

I, BAAS NKWENYANA SOLOMON, declare that the Master's Degree research dissertation that I herewith submit for the Master's Degree qualification in Education at the University of the Free State is my independent work, and that I have not submitted it in the past for a qualification at another educational institution of higher learning.

I, BAAS NKWENYANA SOLOMON, hereby declare that I am aware that the copyright is reserved by the University of the Free State.

I, BAAS NKWENYANA SOLOMON, hereby declare that all royalties with respect to the intellectual property that were generated during the course in relation to the study at the University of the Free State, will accrue to the University.

_____

N. S BAAS

OCTOBER 2018

DEDICATION

This study is dedicated to Makhothatso Ntsheuwa Aletta Baas, who continued to provide me family support through the course of the study. You always had to cope alone at home while I was out in pursuit of this study. You have always been my inspiration to prosper. I dedicate this quest to you for your undivided attention and motivation for me to move on. I would like you to be proud of the effort we both took to make it all work out for both of us.

ACKNOWLEDGEMENTS

I would like to forward my sincere word of gratitude to God, the Almighty for keeping me alive and energetic throughout the course of study.

To my supervisor, Dr Cias T. Tsotetsi, thank you for the questions, comments and critique that you offered to me during the course of this study.

To my co-supervisor, Professor Lipane Hlalele, I am now well accustomed to the idea that I need to focus the study on problematic educational issues and not people. You always reminded me that people come and go while issues are here to stay.

I herewith acknowledge the space created for me to solve my own problems by Doctor Tshele Moloi, even when conditions did not allow. It was difficult for me to withdraw when things went tough, because you always reminded me that the university programme has not closed for us to rest instead of working on our studies.

To the entire family of sustainable rural learning ecologies, SuRLEc and SuLE, I acknowledge your unwavering support. You never turned your backs on us, particularly when we needed you most.

Thank you to the Ethical Clearance Committee for considering my application for the clearance certificate.

It pleases me to acknowledge the support of the Department of Basic Education for giving me permission to conduct research in their schools to fulfil purposes of this study.

I also wish to advance a word of gratitude to the language editors and proof readers. I could not do it without you playing this pivotal role in my work.

My acknowledgement is forwarded to the UFS Faculty of Education for offering me a study bursary to pursue my studies.

I herewith send my special words of gratitude to Doctor Letsie (UFS) for encouraging me to take on the study. I had already given up studying until I met you. You always asked how far I had proceeded with the study, thereafter made me realise it was do-able and that things finally would add up.

ABSTRACT

The study aimed at enhancing teacher development in the teaching of Agricultural Sciences at school. The need to address the aim of the study existed because the integration of the subject agricultural sciences with other subjects in the school curriculum remains a challenge for some teachers because they have not specialized in Mathematics, Physical Sciences, Life Sciences, Technology, Economics, Geography and other subjects which are needed as additional approaches to teaching and learning the subject Agricultural Sciences. This ensues in frustrations in teachers. The interest in enhancing teacher development in the specified subject was raised by the lack of teachers who specialized in teaching Agricultural Sciences at school. Some school-based departmental heads take no interest in providing school-based continuous teacher development and support since they are not employed to manage the allocated subject at school. The problem under study was enlarged by an inadequate number of subject advisors who are expected to provide continuous teacher development and support to a high number of schools that offer Agricultural Sciences.

The theoretical framework used in the study was Critical theory. The study used Teacher development as a conceptual framework. Critical theory helped us to dig deeper, through questions, comments and critique, in determining further possibilities of transforming the current efforts in the Agricultural Sciences teacher development programmes. Teacher development is a process and, therefore, different training and support is needed at different stages of this continuum. The education that teachers receive has the potential to make a difference to children's learning and therefore warrants careful attention.

Participatory action research (PAR) was used for generating data that helped to achieve the aim of the study. The research question was: How can we enhance teacher development in the teaching of agricultural sciences? Three schools in the Thabo-Mofutsanyana district, the subject advisor, and the farm manager participated in the study. The study used critical discourse analysis (CDA) as a means to analyse, interpret and eventually report the data. The three levels of CDA, namely textual analysis, discourse analysis and socio-cultural analysis assisted to expose and eradicate the existence of power relations in our quest.

FINDINGS

Through the study it was found that teachers could not be assisted in creating lessons where agricultural sciences could be learned through the study of real-world issues that affect people's health and well-being. In addition, the study found that there was a discord between the self and external and school-based teacher development initiatives for Agricultural Sciences teachers. The study also found that breeder societies, organisations of agriculture educators and AgriSETA were not engaged in enhancing teacher development as alternatives to institutions of higher learning. Subsequent to the above was the finding that teacher development programmes were not assisting teachers to link home and school ontologies in the teaching of Agricultural Sciences. Ultimately the study found that some teacher development policies seldom enhanced epistemological needs of Agricultural Sciences teachers.

Keywords: critical theory (CT); teacher development (TD); participatory action research (PAR)**;** critical discourse analysis (CDA); clear and focused lessons; frequent monitoring and assessment; variety in teaching and assessment activities; reward and incentive system; agricultural sciences.

LIST OF ABBREVIATIONS AND ACRONYMS

AAI	Africa-America Institute
AET	Agricultural Education and Training
AgriSETA	Agriculture Sector Education Training Authority
ASD	Autism Spectrum Disorders
BELA	Basic Education Laws Amendment Act
BESD	Behavioural, Emotional and Social Difficulties
CAP	Collaborative Assessment Protocol
CAPS	Curriculum and Assessment Policy Statement
CBM	Curriculum-Based Measurement
CDA	Critical Discourse Analysis
CDE	Centre for Development and Enterprise
CIT	Culture Inclusive Theory
COP	Communities of Practice
CPD	Continuous Professional Development
CPTD	Continuing Professional Teacher Development
CRT	Critical Race Theory
DBE	Department of Basic Education
DHET	Department of Higher Education and Training
DOA	Department Of Agriculture
DOE	Department Of Education
DOE	Department Of Education
EC	European Commission
ERC's	Education Resources Centres
HOD	Head of Department
IBP's	Internet Broadcasting Programmes
ICT	Information and Communication Technology
IMF	International Monetary Fund
IQMS	Integrated Quality Management System
LET	Living Educational Theory

MDGs	Millennium Development Goals
MLD	Moderate Learning Difficulties
NCSALL	National Centre for the Study of Adult Learning and Literacy
NGOs	Non-Governmental Organisations
OBE	Outcomes-Based Education
ODL	Open Distance Learning
OTPD	Online Teacher Professional Development Programmes
PAM	Personnel Administration Measures
PAR	Participatory Action Research
PD	Professional Development
PDP	Professional Development Portfolio
PEDs	Provincial Education Departments
PLC	Professional Learning Community
PTA	Parent Teachers Association
SACE	South African Council of Educators
SANDOA	South African National Department of Agriculture
SBA	School-Based Assessment
SBS	Social Problem Solving
SDTs	School Development Teams
SES	Subject Education Specialist
SGB	School Governing Body
SLCN	Speech, Language and Communication Needs
SMB	School Management Board
SMTs	School Management Teams
SPLD	Specific Learning Difficulties
STEM	Science, Technology, Engineering, and Mathematics
SURLEC	Sustainable Rural Learning Ecologies
SWOT	Strengths, Weaknesses, Opportunities and Threats
TMED	Thabo-Mofutsanyana Education District
UNICEF	United Nations Children’s Fund

VDOE	Virginia Department of Education
WEF	World Economic Forum

LIST OF FIGURES

Figure 4.1 Extract requiring a strong mathematical background (NSC Exam 2016)

Figure 4.2 Extract requiring a background of accounting (NSC Exam 2016)

Figure 4.3 Extract depicting learner enrolment and learner performance (Taken from NSC exam diagnostic report)

Figure 4.4 Lesson on wool course in progress

Figure 4.5 Dorne merino sheep ready for wool shearing process

Figure 4.6 Classification of wool

Figure 4.7 Baling devise for wool

Figure 5.1 The process of participatory action research

Figure 5.2 A template for period planning in Agricultural Sciences

Figure 5.3 Period planner suggested by this study for teaching agricultural sciences at school

Figure 5.4 A sample Grade 12 paper 1 question item requiring practical support from sheep breeder societies. Taken from DBE in RSA 2016 November agricultural sciences exam paper.

Figure 5.5 Sheep breeds picture taken during a teacher development event organised by an agricultural sciences teacher organisation.

Figure 5.6 Picture of a livestock disease called foot rot.

LIST OF TABLES

3.1 Action plan: IQMS policy review

3.2 Action plan: CPTD policy review

3.3 Action plan: enhancing teacher development in the teaching of

Agricultural sciences at school

CONTENTS **PAGE**

DECLARATION **ii**

DEDICATION **iii**

ACKNOWLEDGEMENTS **iv**

ABSTRACT **v**

FINDINGS **vi**

LIST OF ABBREVIATIONS AND ACRONYMS **vii**

LIST OF FIGURES **x**

LIST OF TABLES **xi**

CONTENTS PAGE **xii**

CHAPTER 1 ORIENTATION TO THE STUDY 1

ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL 1

1.1 Introduction, background to the research problem and relevant Literature review 1
1.2 Research interest, focus or problem 3
1.3 Paradigmatic, disciplinary and/or theoretical (or conceptual) Framework for the study 4
1.4 Research questions 5
1.5 Research aim and objectives/hypotheses (as applicable) 5
1.6 Research design, methodology and/or method(s) (as applicable) 6
1.7 Data collection 6
1.8 Selection of co-researchers 7
1.9 Data analysis, interpretation and reporting 7
1.10 Value of the proposed research 8
1.11 Ethical considerations 8
1.12 Layout of chapters 8
1.13 Summary 8

CHAPTER 2 9

THEORETICAL FRAMEWORK AND RELATED LITERATURE TO ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL 9

2. 1 INTRODUCTION 9
2. 2 THEORETICAL FRAMEWORK 9
2. 2.1 Meaning of critical theory 9
2. 2.2 History of critical theory 10
2. 2. 3 Objectives of critical theory 11

2. 2. 4 Formats of critical theory 12

2. 2. 5 Principles of critical theory 13

2. 2. 6 Ontology of critical theory 14

2. 2. 7 Epistemology of critical theory 15

2. 2. 8 Role of researcher 16

2. 2. 9 Relationship between researcher and co-researchers 16

2. 2.10 The rhetorical perspectives of critical theory in the study 17

2. 3 CONCEPTUAL FRAMEWORK 17

2.3.1 The rationale for teacher development 17

2.3.2 Contemporary observations around teacher development 19

2.3.3 Reflective approaches towards mitigating teacher development shortfalls 20

2.3.4 The importance of rewarding progress made towards teacher development 24

2. 4 LEGISLATIVE IMPERATIVES ON ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL 25

2. 5 STRATEGIES TO MITIGATE UNDERPERFORMANCE IN ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL. 27

2. 6 DEFINITION OF OPERATIONAL CONCEPTS 29

2. 7 LITERATURE REVIEW ON ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL. 30

2. 7. 1 THE CHALLENGES FACINING TEACHER DEVELOPMENT PROGRAMMES IN THE TEACHING OF AGRICULTURAL SCIENCES 30

2.7.1.1 Meeting the curriculum requirements and aims of teaching Agricultural Sciences at school. 31

2.7.1.2 Reluctance in implementing Continuous Professional Teacher Development (CPTD) programmes for agricultural sciences teachers at school. 32

2.7.1.3 The influence of economic salary options between the private and public sector. 34

2.7.1.4 Lack of access to higher agriculture education programmes. 35

2.7.1.5 Inadequate supply of quality agricultural sciences teachers at school. 37

2. 7. 2 SOLUTIONS THAT WILL ADDRESS CHALLENGES EXPERIENCED DURING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES. 38

2.7.2.1 Determining approaches that meet the curriculum requirements and aims of teaching agricultural sciences at school. 38
2.7.2.2 Effective implementation of CPTD programmes for agricultural sciences teachers at school. 38
2.7.2.3 Determine approaches towards retaining agricultural sciences teachers within the public sector. 39
2.7.2.4 Maximizing teacher participation in alternatives to higher agriculture education. 39
2.7.2.5 Creating partnerships between agricultural sciences teachers and professionals with unique skills for support teaching. 40

2. 7. 3 THE CONDITIONS THAT MUST EXIST IN ORDER TO MAKE SOLUTIONS, SET ABOVE WORK TOWARDS REALIZING THE AIM OF THE STUDY. 40

2.7.3.1 Understanding the agricultural sciences subject curriculum. 40

2.7.3.2 Organising and assessment of data generated during developmental workshops. 41
2.7.3.3 Holding regular reflection sessions between agricultural sciences teachers and agri-business partners in education. 42

2. 7. 4 **POSSIBLE THREATS AND WAYS TO CIRCUMVENT THESE THREATS TO TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES.** 43

2.7.4.1 Lack of teacher motivation sessions for agricultural sciences teachers. 43

2.7.4.2 Lack of access on the use of ICT facilities at school. 44

2.7.4.3 Misappropriation of school funds allocated to enhancing the teaching of agricultural sciences at school. 44

2. 7. 5 INDICATORS OF SUCCESS TOWARDS ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL 45

2.7.5.1 Successful compilation and assessment of the CPTD, IQMS and subject related files for each agricultural sciences teacher. 45

2.7.5.2 Successful organisation; regular update and marketing of the agricultural sciences website for the agricultural sciences teacher. 46

2.7.5.3 Successful establishment and management of effective PLCs, communities of practice and culture responsive educational programmes for Agricultural sciences teachers. 46

2. 8 SUMMARY 47

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY FOR ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL 48

3.1 INTRODUCTION 48

3.2 PARTICIPATORY ACTION RESEARCH 48
3.2.1 Meaning of participatory action research 48
3.2.2 History of participatory action research 49
3.2.3 Objectives of participatory action research 49
3.2.4 Formats of participatory action research 50
3.2.5 Steps in participatory action research 51
3.2.6 Ontology of participatory action research 51
3.2.7 Epistemology of participatory action research 53
3.2.8 Role of the researcher in participatory action research 55
3.2.9 Relationship between researcher and co-researchers 56

3.3 ETHICAL CONSIDERATIONS 57

3.4 RESEARCH SITE PROFILE 57
3.5 THE CO-RESEARCHERS 58
3.5.1 The study coordinator 59
3.5.2 Agricultural sciences teachers 59
3.5.3 Departmental heads of agricultural sciences 60
3.5.4 Subject education specialist for agricultural sciences 60

3.6 INVOLVEMENT OF CO-RESEARCHERS IN ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL 61
3.6.1 Brainstorming session 61
3.6.2 Swot analysis 62
3.6.3 Prioritising activities 63

3.6.4 Planning for enhancement of teacher development 64

3.7 PROGRAMME FOR ENHANCING TEACHER DEVELOPMENT 65

3.8 DATA ANALYSIS 74

3. 9 SUMMARY 75

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND INTERPRETATION IN ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL. 77

4. 1 INTRODUCTION 77

4.2 THE CHALLENGES FACING TEACHER DEVELOPMENT PROGRAMMES IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL. 77

4. 2. 1 Inability to meet the curriculum requirements and aims of teaching Agricultural sciences at school. 77

4. 2. 2 Reluctance in implementing Continuous Professional Teacher Development (CPTD) programmes for agricultural sciences teachers at school. 83

4. 2. 3 The influence of economic salary options between the private and public sector. 85

4. 2. 4 Lack of access to higher agriculture education programmes. 88

4. 2. 5 Inadequate supply of quality agricultural sciences teachers at school. 90

4. 3 **SOLUTIONS THAT WILL ADDRESS CHALLENGES EXPERIENCED DURING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES 92**

4. 3. 1 Determining approaches that enable teachers to meet the curriculum requirements and aims of teaching agricultural sciences at school. 92

4. 3. 2 Effective implementation of CPTD programmes for agricultural sciences teachers at school. 95

4. 3. 3 Determining teacher development approaches that will assist towards retaining agricultural sciences teachers within the public sector. 98

4. 3. 4 Maximizing teacher participation in alternatives to higher agriculture education. 100

4. 3. 5 Creating partnerships between agricultural sciences teachers and professionals

with unique skills for support teaching. 102

4. 4 THE CONDITIONS THAT MUST EXIST IN ORDER TO MAKE SOLUTIONS, SET ABOVE WORK TOWARDS REALIZING THE AIM OF THE STUDY. 106

4.4.1 Understanding the agricultural sciences subject curriculum 106

4.4.2 Organising and assessment of data generated during developmental workshops. 108

4.4.3 Holding regular reflection sessions between agricultural sciences teachers and agri-business partners in education. 109

4. 5 POSSIBLE THREATS AND WAYS TO CIRCUMVENT THESE THREATS TO TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES. 111

4.5.1 Lack of teacher motivation sessions for agricultural sciences teachers. 111

4.5.2 Lack of access on the use of ICT facilities at school. 113

4.5.3 Misappropriation of school funds allocated to enhancing the teaching of agricultural sciences at school. 115

4. 6 INDICATORS OF SUCCESS TOWARDS ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL 117

4.6.1 Successful compilation and assessment of the CPTD, IQMS and subject related files for each agricultural sciences teacher. 117

4.6.2 Successful organisation; regular update and marketing of the agricultural sciences website for the agricultural sciences teacher. 119

4.6.3 Successful establishment and management of effective PLCs, communities of practice and culture responsive educational programmes for Agricultural sciences teachers.121

4. 7 SUMMARY 122

CHAPTER 5 124

FINDINGS AND RECOMMENDATIONS ON ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL 124

5.1 INTRODUCTION 124

5.2 BACKGROUND OF THE STUDY 124

5.2.1 Theoretical framework 127

5.2.2 Problem statement 128
5.2.3 RESEARCH QUESTION 128
5.2.4 THE AIM OF THE STUDY 128
5.2.5 THE OBJECTIVES OF THE STUDY 128
5.2.5.1 The challenges facing teacher development programmes in the teaching of agricultural sciences 128
5.2.5.2 Solutions that will address challenges experienced during teacher development in the teaching of agricultural sciences. 129
5.2.5.3 The conditions that must exist in order to make solutions, set above work towards realizing the aim of the study. 130
5.2.5.4 Possible threats and ways to circumvent these threats to teacher development in the teaching of agricultural sciences. 131
5.2.5.5 Indicators of success towards enhancing teacher development in the teaching of agricultural sciences at school. 131
5.2.6 RESEARCH DESIGN AND METHODOLOGY 132
5.2.7 DATA ANALYSIS 133
5.3 FINDINGS AND RECOMMENDATIONS 134
5.4 CONTRIBUTION OF THE STUDY IN THE EXISTING BODY OF KNOWLEDGE 156
5.5 LIMITATIONS OF THE STUDY 158
5.6 RECOMMENDATIONS FOR FURTHER RESEARCH 158
5.7 SUMMARY 158
LIST OF REFERENCES 160
APPENDIX A ETHICAL CLEARANCE LETTER 184
APPENDIX B APPLICATION TO CONDUCT RESEARCH FROM EDUCATION FDOE 185
APPENDIX C APPROVAL TO CONDUCT RESEARCH 192
APPENDIX D CONSENT FORM FOR THE FARM MANAGER 192
APPENDIX E CONSENT FORM TO EACH OF THREE HOD'S OF AGRICULTURAL SCIENCES 197
APPENDIX F CONSENT FORM TO SUBJECT ADVISOR 201
APPENDIX G CONSENT FORM FOR EACH OF THREE TEACHER'S OF AGRICULTURAL SCIENCES 205
APPENDIX H CONSENT FORM FOR PRINCIPAL 209

CHAPTER 1

ORIENTATION TO THE STUDY

ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

1.1 Introduction and background to the research problem and relevant literature

The problem identified that gave rise to this study was the shortage of well-trained teachers in agricultural science at school level, and the lack of development opportunities for these teachers.

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. The need to address the aim of the study existed because some teachers had not specialized in teaching agricultural sciences while in some schools agriculture was still used as a form of punishment. Nevertheless, George (2006:5) demonstrated that a lack of appropriate teacher education led to a lack of clear objectives, an over-emphasis on factual recall rather than on development of problem-solving skills, the use of passive observation rather than active participation of learners, and teaching being pitched at the wrong level of cognitive development. In the light of this, we could see that it has become a challenge for some teachers to meet the requirements outlined in the subject curriculum documents. Adding to the above, we discovered that integration of the subject agricultural sciences with other subjects in the school curriculum remained a challenge for some teachers because they had not specialized in mathematics, physical sciences, life sciences, technology, economics, geography and other subjects which are needed as additional approaches to teaching and learning the subject agricultural sciences, and this brought frustrations in teachers. Nevertheless, the Department of Education (DOE) (2007:1) indicates that all teachers require the knowledge, skills, values and attitudes, as well as the necessary support to integrate information and communication technology (ICT) into teaching and learning, and to support the students in their various roles as mediators of learning, interpreters and designers of learning programmes, leaders, administrators, scholars, assessors and subject specialists. However, I have noticed that methods of teaching the subject had not been broadcast on television by some countries, hence the need to enhance teacher development in the teaching of agricultural sciences through ICT as stated above. This study used Participatory Action Research (PAR) to enhance teacher development in the teaching of agricultural sciences at school. In support of the above, Grove (2008:4) warned that it was clear that greater collaboration was needed between teacher development programme providers and district support teams that provided field experience settings and support in order to identify factors for optimal allocation of teachers so that they would learn to teach effectively in digital classrooms.

According to the Curriculum and Assessment Policy Statement(CAPS), Grades 10-12(DBE, 2011:8), Agricultural Sciences is the study of the relationship between soils, plants and animals in the production and processing of food, fibre, fuel and other agricultural commodities that have an economic, aesthetic and cultural value. However, Chen (2016: 429) argues that at present the fundamental development way of agricultural production lies in science and technology to achieve the sustainable and stable agricultural development and ensure the effective supply of agricultural products for a long time.

In view of the above, Bateman (2016: 12) posits that all life on earth, as we know it, from bacteria to whales, is dependent upon photosynthesis. It is through this process that plants process light into things we can eat and produce the air we breathe. Nevertheless, the aims of teaching Agricultural Sciences learners from grade 10 to 12, as stipulated in CAPS (DBE, 2011: 8), includes developing an awareness of the management and care of the environment, natural resources and the humane treatment of animals through application of science and related technology; developing problem-solving mechanisms within the contexts of agricultural production, processing and marketing practices; developing awareness of the social and economic development of the society at large through personal development in commercial and subsistence farming enterprises; to ensure that learners are informed and responsible citizens in the production of agricultural commodities, to inculcate caring for the environment and addressing social justice issues; and to enhance awareness of agricultural indigenous knowledge and practices through understanding agricultural sciences in historical and social contexts. Goldstein (2016:57), for example, stated that workers in agriculture had been disempowered systematically. At the behest of agribusiness, government policy had filled the farm labour force with vulnerable people. We could agree that the aims above could only be espoused through enhanced teacher development programmes in the teaching of agricultural sciences at school.

Helen, Richard and du Plessis (1998:19) alludes that teacher development is a process and, therefore, different training and support are required at different stages of this continuum. The education that teachers receive has the potential to make a difference to children's learning and therefore warrants careful attention. According to Helen et al (1998:19), the constructs of a capable teaching force; adequate support; positive teacher attitudes; time and efficiency; classroom management; high expectations; student-teacher interactions; organized curriculum; clear and focused lessons; frequent monitoring and assessment, teaching and assessing; variety in teaching and assessment strategies; and reward and incentive system are associated with effective teaching and are critical when planning and implementing enhanced support for teachers. While only a few of these features might be addressed in the early stages of some teacher development programmes, small first steps are important beginnings in the process of improving teacher quality. In support of the above, Karadeniz (2017:172) maintains that agricultural science activities are given more weight in schools; students are familiarized with activities and raise the awareness of teachers and prospective teachers regarding integrated activities inherent to the subject. Activities in the updated curriculum and textbooks might be enriched in a way that all agricultural gains from primary education level to secondary education level are emphasized. Nevertheless, Mukeredzi (2014:142) demonstrates that there is a need to recognize occasions when agricultural sciences teacher frustrations and difficulties with the process of development might create non-educative experiences, thus alternative approaches might proffer them educative experiences that would benefit their professional and personal growth.

As JA'Afar-Furo, Abdullahi, and Badgal (2014:173) posited, there were better methods of learning than through the conventional ways of instruction. Post-secondary institutions and specifically universities were beginning to realise the relevance of utilisation of appropriate methods through which students could learn. Muhamad et al. also suggested that several methods of teaching had been proved to be relatively ineffective on students' ability to master and then retain important concepts. Muhamad et al. clearly indicated a need to enhance teacher

development in the teaching of agricultural sciences at school. Babalola (2007:111) posited conditions that needed to exist in order to address developmental challenges that school-based teachers were facing in Nigeria and the weak political will of the Government to address the problematic issues. This author further suggested that the Parent-Teachers' Association (PTA) in each school should enter into partnership with the School Management Board (SMB), the state agency that oversaw the running of schools in each state, to procure the necessary funds to put a video infrastructure in place. The structure included both institutional organizations and video equipment.

However, Dormody (1993:69) outlined threats that could discourage some agricultural science teachers to participate fully in teacher development programmes by stating that whether or not science credit was pursued, agricultural science teachers could work closely with science departments when developing, implementing, and evaluating agricultural science courses. Nevertheless, some states developed core curricula to circumvent state requirements for science credit. In the light of the above, this author demonstrated that agricultural science teachers needed to consider courses in agricultural mechanics and engineering, agricultural processing, and resource management for science credit. Hence, the teachers had been encouraged to expand their concept of agricultural science to include the physical sciences. In support of the above view, Ullrich, Mahler, Forstner, J., Szecsenyi, J and Wensing, M (2017:7) argued that this would help to produce agricultural sciences teachers who have knowledge and skills that would contribute to reducing the gap between research and practice in basic education in order to understand and explain why curriculum coverage succeeded or failed. Erol (2015:261) added that there was a necessity to adopt different approaches apart from the existing teaching and learning methodologies that were anticipated to increase the learners' interest in and curiosity about the agricultural sciences content.

Tesch (2006:102) posited that enhancing teacher development in the teaching of agricultural science could be a success by stating that there was room for expansion of agricultural education in the rural school structure. This opened up doors for rural school districts to offer science in agricultural education classes if the teacher was qualified. However, metropolitan schools saw the value of producing food, of agriculture, and of natural resources and the environment as a context for learning. Hence, agricultural education programmes were functioning in Chicago, Indianapolis, New York, Los Angeles, and other metropolitan areas across the USA. In the light of the above, Wielewska, Gliniak and Sobczyk (2017:250) demonstrated that issues of agricultural sciences education for sustainable development in rural areas did concern the teachers, especially in terms of the environmental aspect. These sentiments were strongly supported by Alabi (2017:26), who alluded that opportunities for professional teacher development could be improved through linking agri-business and schools, which in turn could supplement infrastructural facilities and entrepreneurial education for skills acquisition in rural schools. In conclusion, Gewertz (2017:58) emphasised that the importance of developing practical skills of rural agricultural sciences teachers was evident in that this empowered them to provide veterinary services that were scarce, while it also boosted the employability, confidence, and future wage earnings of their learners and their access to agricultural institutions of higher learning.

It was in view of the background provided above that we unpacked the problem investigated in this study in the forthcoming paragraph.

1.2 Research interest, focus or problem

The interest in enhancing teacher development in the specified subject was raised by the lack of teachers who specialised in teaching agricultural sciences at school, as well as the challenge agricultural sciences teaching held for some teachers regarding meeting the curriculum requirements, and achieving the aims of teaching the specific subject. Szeto (2017:346) maintains that teachers' pedagogical patterns vary, depending on their instructional decisions which are affected by individual preferences, various subject cultures, and individual school settings. My interest in the study was also raised by the possibility of integrating agricultural sciences with other subjects such as life sciences, economics, physical sciences, mathematics, engineering and social sciences. However, Evagorou (2017:121) indicated that elementary pre-service teachers, before engaging with a socio-scientific issue, did not understand the social aspects of agricultural sciences, and they only focused on the content and skills of the subject. Subsequent to taking note of Evagorou's (2017:121) opinion, I observed that some school-based departmental heads displayed no interest in providing school-based continuous teacher development and support, since they were not employed to manage the allocated subject at school. Parsons and Felisha (2017:55), however, advised that to bring about change that would produce a more inclusive, empathic, and agriculturally sensitive school environment, teachers needed to reflect on institutional, instructional, and personal dimensions underlying the aforementioned salient factors. The problem under study, in my view, was enlarged by an inadequate number of subject education specialists who were expected to provide continuous teacher development and support to a high number of schools that offered agricultural sciences.

The lens through which we look at the means to address the problem explained is discussed in the next paragraph below.

1.3 Paradigmatic, disciplinary and/or theoretical (or conceptual) framework of the study

The theoretical framework that was used in the study was critical theory. I chose this framework because critical theory provides excellent tools that not only display our world and ourselves through new and valuable lenses, but also can strengthen our ability to think logically, creatively, and with a good deal of insight, as posited by Tyson (2006:3). In amplification of the above, Dauer (2017:135) added that the background of the teacher would more likely assist to predict their stances when engaging in informal reasoning, whereas change in the overall stance towards a subject matter would possibly be influenced by formal reasoning experience in the teaching of agricultural sciences. Another dimension of enhancing teacher development was highly influenced by the practice of Soltaninejad, Keshtiaray and Vaezi (2017:173) idea of globalization, which was described as a multi-dimensional phenomenon as it led to high mobility in professional teacher development, political, economic and value fields and which, besides the reduction of the gap between time and place, presented new interpretations of politics, economy, teaching, government, authority and social security. However, Emine and Dikkartin (2016:10) concluded that the development of a teacher needed to be critically taken into estimate so that practical sessions could be presented in ways and formats that would be potentially meaningful for them.

Keeling (2014:686) supported the views of the authors mentioned, by arguing that there were various ways of thinking and producing knowledge. A popular educational method of gaining an understanding of how various sentient beings know what they know in order to invent ways of going beyond existing knowledge, emphasize that knowledge and its production could take

a variety of forms. In the light of the above I formulated the research questions guiding this study.

1.4 Research questions

Primary research question

The primary research question that guided this study was: How can the development of teachers teaching agricultural sciences at school be enhanced? Based on this question, the aim of the study was to enhance the development of teachers of agricultural sciences at school.

Secondary research questions

In order to resolve the above stated problem, the study was geared to answer the following secondary research questions:

- Which challenges do teacher development programmes face in the teaching of agricultural sciences in South Africa and foreign countries?
- How can we find solutions that will address challenges experienced during teacher development in the teaching of agricultural sciences?
- How can we determine conditions that must exist in order to make the solutions, set above, work towards realizing the aim of the study?
- What are the possible threats and ways to circumvent these threats to teacher development in the teaching of agricultural sciences?
- What are the indicators of success in enhancing teacher development in the teaching of agricultural sciences at school?

To address the research questions the following research aims and objectives were stated.

1.5 Research aim and objectives/hypotheses (as applicable)

Primary research aim

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school.

Research objectives

In order to achieve the above aim, the following research objectives had to be pursued:

1.5.1 To study the challenges facing teacher development programmes in the teaching of agricultural sciences in South Africa and foreign countries so as to indicate the need for the study.

1.5.2 To find solutions that will address challenges experienced during teacher development in the teaching of agricultural sciences.

1.5.3 To determine the conditions that must exist in order to make the solutions found work towards realizing the aim of the study.

1.5.4 To identify possible threats and ways to circumvent these threats to teacher development in the teaching of agricultural sciences.

1.5.5 To find indicators of success in enhancing teacher development in the teaching of agricultural sciences at school.

In order to pursue the objectives stated above, the following research design and methods of generating data appropriate for this study were selected.

1.6 Research design, methodology and/or method(s) (as applicable)

In order to achieve the aim of the study, a PAR (Participatory Action Research) design was applied for conducting the research. According to Kemmis and McTaggart (2007:273), participatory action research is an alternative philosophy used in social research and social life, often associated with social transformation in the Third World. It had its roots in liberation theology and neo-Marxist approaches to community development, but also had rather liberal origins in human rights activism. Three particular attributes often are used to distinguish participatory action research from conventional research (i) shared ownership of research projects; (ii) community-based analysis of social problems, and (iii) an orientation toward community action. However, Crane (2011: 3) believes that participatory action research combines getting a better understanding of a context we have been part of with while trying to improve aspects of it. In support of Crane's view, Rogers, Cooper, Cooper, Tingley, Braithwaite, Moreno, Rodrigues, and Salvia (2015:547) posits that sharing ownership of research projects traditionally has been conducted between co-researchers or by hiring equipment, but modern communication systems and social media may increase the opportunities to share skills in the teaching of agricultural sciences at school. The above-mentioned authors add that participatory action research starts where one has been and develops as one, in dialogue with others, tries to understand and improve one's practices and the situations of people.

In view of the above, we then looked into the collection of data generated through participatory action research collaborations as described below.

1.7 Data collection

The study used participatory action research (PAR) for generating data that would help to achieve the aim of the study. We had meetings, focus groups and discussions as tools to generate data. Data generated were recorded on scripts and through the use of electronic voice recording devices and other multimedia devices such as photo cameras and short video clips during participatory action research sessions at a chosen point of contact, since these tools correlated strongly with critical discourse analysis which was used to analyse the data generated. As Chaleunvong (2009:11) posited, tape recording was suitable for use with both those who were intellectually fortunate and those who were not, as it permitted clarification of questions and had higher response rates than written questionnaires. The methods of generating and recording data were particularly appropriate for the action research design that did not follow the positivist approaches that seemed not to be allowing the researcher to access visual contact with the co-researchers. However, Yigit and Bagceci (2017:250) indicated that PAR helped the teachers to share positive ideas, make common plans, and proffered an opportunity to self-criticism, to improve communication with fellow colleagues, and to increase their level of awareness. Yigit further added that PAR was seen to increase teachers' knowledge, ensure more active involvement of the other agricultural sciences teachers in the lessons, and had a positive impact on teacher development programmes. However, Khan, Khan, Zia-Ul-Islam and Khan (2017:20) alluded that the communication skills of a teacher had a significant role to play

in the academic success of the agricultural sciences learners. He further added that, therefore, it was necessary for a teacher to master the use of effective communication skills while teaching the learners. In this regard Okoli (2017:150) argued that teacher education should emphasize both content knowledge and communication skills instead of relegating communication skills, because one cannot be achieved without the other. In view of the sentiments stated above, Djordjevic (2017:435) advised that changes were needed at all levels of education to provide teachers of agricultural sciences with a better and more modern environment in education to apply information and communication technology(ICT), both in their teaching and their scientific research.

In the paragraph below, attention is based on selection of co-researchers who will assist to find solutions to challenges under this study.

1.8 Selection of co-researchers

In order to achieve the specified aim of our quest, three schools in the Thabo-Mofutsanyana district participated in the study. From each school two agricultural science educators and one departmental head of agricultural sciences were involved. From one of the three schools, the farm manager was involved too. The study also engaged one subject education specialist in agricultural sciences. In total eleven co-researchers, inclusive of the study coordinator, were involved in the study.

As Amin (2008: 365) argued, knowing in action within professional or high creativity collaborations drew upon a mixture of virtual interaction, temporary local coalitions, and institutional and professional ties that were not reducible to local space. Gutman (2014:195) posited that service users should be involved where possible, from the outset of the research process, and decisions had to be made jointly regarding the extent of participation and the duties and responsibilities for each participant. According to Gutman (2014:195), further opportunities for involving stakeholders in various aspects of educational research have been developed and evaluated to enable their application to other service-user groups.

There always is a risk that school programmes might clash with timeframes set aside for participatory action research sessions; however, flexible timeframes were set in consultation with co-researchers to reduce study limitations associated with the time constraints.

1.9 Data analysis, interpretation and reporting

Critical discourse analysis (CDA) was used as a means to analyse, interpret and eventually report the recorded data generated during PAR sessions. The rationale with respect to this choice was drawn from Bukhari's (2013:15) argument that CDA was useful to investigate the relationships among the teaching, learning and curriculum, and the school and community roles, as well as ideologies and power and their impact on the classroom process of the teaching and learning activity. In this regard Burns (2005:10) alluded to CDA as a tool offering tremendous potential for training teachers, for effecting policy conversations, and for transforming classroom instruction to facilitate the literacy empowerment of our most marginalized populations. I fully concur with Maposa (2015:72), who concluded that CDA could still be applied with worthwhile effect in the analysis of teacher development texts if it was adapted fittingly and justifiably to this study.

1.10 Value of the proposed research

The outcome of the study, enhancing teacher development in the teaching of agricultural sciences at school, was anticipated to benefit the school-based agricultural sciences teachers; office-based educators; learners and their parents; non-governmental organisations with an interest in education; the department of education; commerce and industry; educational researchers (locally and abroad) and, finally, the communities within which agricultural schools were based around the world. It was in view of this aim that, as a member of the sustainable rural learning ecologies (SuRlec), I believed that we were all there to think about the practice of education, knowledge and where meaning was made to link our approaches to education and life in support of the community we served and its future (Ross, 2010:3). In the same vein, Oakleaf (2010:11) posited that parents and teachers expected higher education to enhance teachers' collegiate experience, as well as to propel their career placement and earning potential.

1.11 Ethical considerations

Before undertaking the empirical component of the study to enhance teacher development in the teaching of agricultural sciences at school, I first applied for an ethical clearance certificate (Appendix A) by following processes prescribed by the ethical committee of the Faculty of Education at the University of the Free State. I then used the ethical clearance certificate to request permission from the Department (Appendix B) of Basic Education (DBE) for conducting the research in the public schools. Consent forms (Appendix D to Appendix H) were given to participants to fill out, and participants were told that they were free to participate and that they could withdraw at any stage of the research process, and they were ensured that they would remain anonymous during the process. Georghiou (2015:10) maintains that research makes a direct contribution to societal challenges; therefore, research is a part of the nations' culture and should be valued for its role in creating a critical and reflexive society.

1.12 LAYOUT OF CHAPTERS

This study report consists of five chapters as outlined below:

Chapter 1: Introduction and background

Chapter 2: Theoretical framework and related literature

Chapter 3: Methodology and design

Chapter 4: Data analysis

Chapter 5: Findings and recommendations

1.13 SUMMARY

The purpose of this chapter mainly was to orientate the reader to the study which is reported in this dissertation, therefore I gave an overview of the background to the study, stated the problem, aim and objectives and briefly introduced the design and methodology. I also paid attention to ethics, introduced the co-researchers and mentioned what will be addressed in the remainder of the chapters. The next chapter is devoted to more detail with respect to the lens that guided the study.

CHAPTER 2

THEORETICAL FRAMEWORK OF AND LITERATURE RELATED TO ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

2. 1 INTRODUCTION

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. The researcher used critical theory as a theoretical framework to achieve the aim of the study. In order to achieve the aim of the study chapter two is devoted to a study of critical theory as a theoretical framework in terms of the meaning, history, objectives, formats, steps for use, ontology, epistemology, role of the researcher and the relationship between the researcher and co-researchers, as well as the rhetoric which guided interactions among co-researchers . In order to enhance teacher development in the teaching of agricultural sciences, Chapter two also was geared to building a conceptual framework around teacher development, legislative imperatives, strategies to mitigate underperformance, definition of operational concepts and a review of the literature on teacher development. At the end of Chapter two a brief summary of the findings with respect to the theoretical framework and related literature will be provided done.

2. 2 THEORETICAL FRAMEWORK

The theoretical framework used in the study was critical theory. I have chosen this framework because critical theory provides excellent tools that not only show our world and ourselves through new and valuable lenses, but also strengthens our ability to think logically, creatively, and with a good deal of insight, as posited by Tyson (2006:3).

2. 2. 1 Meaning of critical theory

According to a dictionary of cultural and critical theory (Barbera, 2010:153), critical theory is a general term under which research projects in the social sciences and humanities attempt to bring truth and political involvement into alignment. It is an offspring of the Kantian tradition of thought that prized self-knowledge. Critical theories are forms of knowledge. Critical theory believes that knowledge constitutes power. However, Thamarasseri (2016: 2) concurs with Barbera (2010) by stating that knowledge by acquaintance was another form of knowledge based on personal experience. Thamarasseri (2016) further adds that examples of this sort of knowledge could be places we have visited, books we have read, and people we have met and spoken to. Keeling (2014:686) supports this view by arguing that there are various ways of thinking and producing knowledge. She adds that a popular method of education, geared to gain an understanding of how various sentient beings know what they know in order to invent ways of going beyond existing knowledge, emphasises that knowledge and its production could take a variety of forms.

With specific reference to the views of the above-mentioned scholars, one comes to the understanding that critical theory focuses on studying the benchmarks on which our articulation of what we know, is built. We could agree that governance, in all its forms, has to serve the

needs of the societies under its care. We could also agree that any deviation from this reality might compel research projects to critique the status quo while supporting the need for transformation in the social ecologies, including the teaching and learning ecologies. It is in the light of this that I have chosen critical theory to support this study. I wanted to bring a balance between reality and human rights. I believe that teachers have a right to meaningful training, induction and continuous development within their place of work.

In the light of the above, Qi (2014:388) posited that the theoretical departures of critical teacher education limited the structure of critique and consequently impeded critical teacher education in its effort towards empowering educational actors. This scholar adds that these theoretical departures partly explain why critical teacher education has not been as empowering as many have theorized. As Qi posits, the purpose of teaching using the critical approach is not about teachers who are equipped with critical theories, trying to wake up uninformed educational actors by offering emancipating metacritiques which unmask dominance. This author further adds that educational realities can be shared in equal collaboration with the critical educational actors.

I concur with the above scholars in that critical theories become more meaningful when they focus on addressing educational issues like teacher development and not on teachers.

2. 2. 2 History of critical theory

According to Carr (2006: 01), critical theory was born in the trauma of the Weimar Republic, grew to maturity in expatriation, and achieved cultural currency on its return from exile. Passed on from its founding first generation, among others, were Max Horkheimer, Friedrich Pollock, Herbert Marcuse, and Theodor Adorno. To the leader, Jurgen Habermas, critical theory remained central to European philosophical, social, and political thought throughout the Cold War period. For the seven years from its founding in 1923 to the date of Horkheimer's address, the Institute was concerned almost exclusively with politically engaged empirical social sciences.

What we learned from the above excerpt was that research projects supported practical involvement of the people in political issues affecting them while in their countries and when in exile. We also learned that this practice grew from one generation to the next even during the period of war. It went without say that various forms of social support could give rise to various research-based critical theories.

As Antonio (2008:452) argued, the consolidation of transnational financial capital, the proliferation of planetary networks, diasporic histories, the threat of global catastrophes, and the advent of post-colonialism had all become predominant themes in cultural, political, literary, and post-colonial theory. The author further added that, in the humanities, especially in the field of comparative literature, the aforementioned themes figured largely in vigorous discussions about the relevance of the idea of world literature; meanwhile, within political theory some of these historical developments have been thematised in various adaptations of the idea of cosmopolitanism. In addition, the scholar demonstrated that the thematizations of these questions responded to the changing configurations of power, economics, culture, and politics in an increasingly planetary predicament. Perhaps this was one reason why post-colonial theorizations had so far eluded engagement with the critical theory associated with the Frankfurt School, known as critical theory, which is a philosophical and sociological movement spread across many universities around the world.

In light of the above perceptions on critical theory, I thematised the enhancing of teacher development in the teaching of agricultural sciences at school. I adopted critical theory to help me respond to the modern developmental needs of teachers in the teaching of agricultural sciences at school. The above views gave me reason to believe that critical theory of teacher development would support the research project of enhancing teacher development in the teaching of agricultural sciences at school.

LaCapra (2004:500) posited that intellectual history, in its close relations with cultural history, had undergone many mutations and variations in the recent past, including states of both near extinction and vigorous self-assertion. The scholar further indicated that there might be something like trans-historical or structural trauma which was variously figured as original sin, the passage from nature to culture, separation from the mother, and the entry into language, the Lacanian real and so forth. Nevertheless, Henry (2003: 5) demonstrated that different historical conditions posited different problems and demanded a range of diverse solutions. Politics could not be treated like a commodity that could supply all of the answers or tell those of us who do political work precisely what to do. Matters of historical contingency, context, and social transformation were both primary considerations in fashioning any viable form of cultural politics and are crucial to developing a language of critique and possibility that was as self-critical as it was socially responsible. According to LaCapra (2004), changing historical conditions posited new problems, defined different projects, and often demanded fresh discourses. In some cases, theories fashioned in one historical moment seemed hopelessly out of date, if not irrelevant, in another. The scholar added that any critical theory both defines and was defined by the problems posed by the contexts it attempted to address.

We would agree that the latter statement was also appropriate in the context of enhancing teacher development in the teaching of agricultural sciences at school, especially when viewed through a lens that aimed to bring support to the needs of agricultural sciences teachers. However, Bronner (2002:265) argued that the impudence of philosophical idealism on critical theory was often taken for granted, but it had rarely been the subject of scrutiny. Historical events and institutional constraints, movements and ideals of solidarity, apparently have ceased to generate interest for the partisans of critical theory. No longer was it clear what norms should inform the critique of injustice and oppression. There also was little sense regarding the salience of universal values independent of the philosophical framework through which they originally were justified. The scholar added that, if only for these reasons, without making any pretence of offering an exhaustive examination, it was perhaps useful to show the courage of the most important representatives of philosophical idealism on the development of critical theory.

In conclusion, historical views above demonstrated that we had to be brave enough to apply transformative approaches depicted in critical theory in our quest to enhance teacher development in the teaching of agricultural sciences at school. Below the focus of our attention will be on the objectives of critical theory.

2. 2. 3 Objectives of critical theory

As Joseph (2003: 449) demonstrated, rational choice theory lacked the resources to solve questions of order. He added that while the natural scientist employed symbolic means to grasp the world, the social world required interpretive processes. Nevertheless, Mistry, Li, Yoshikawa, Tseng, Tirrell, Kiang, and Wang (2016:1028) posited that in order to integrate interpretive meaning making in research, shared meaning-making frames, ideologies or

generalizations, as well as the interactive processes whereby individuals interpret, act upon, and transform developmental contexts, might be examined.

In support of what critical theory really requires in terms of mutual understanding, Hunter (2017:38) advised that teacher developers gauge teachers' understanding by listening to the language they use and the questions they ask. In light of the above view, Frantz, Filies, Jooste, Keim, Mlenzana, Laattoe, Roman, Schenck, Waggie and Rhoda (2016:236) maintained that the objectives of pedagogic learning are learning to know, learning to do, learning to collaborate with others, and learning to be the best teacher from lessons learned through enhanced teacher development programmes focusing on the teaching of agricultural sciences.

We could then agree that in order to bring balance between what the agricultural sciences curriculum required and what teacher developers provided, both teachers and teacher developers might reach a common understanding of what was meant in terms of enhancing teacher development in the teaching of agricultural sciences at school.

I had reason to believe that if this element of mutual understanding is missing, we only will be faced with a challenge to establish forms of support for realities in terms of teaching, management, leadership and governance at school. Nevertheless, in e-learning, for example, as Adnan (2017:33) suggested, it is essential to provide agricultural sciences teachers with a rich variety of well-organized materials that will serve their interests best and respond to their individual needs. However, Bognar (2015:35) warned that the use of e-learning had been recommended at all levels of the educational system, but it was often reduced to downloading teaching materials from the teachers' websites.

In my view the main tools that could help us reach a common interpretation of the social world we live in, are collaborative dialogues that we could critically reflect on, instead of questionnaires and checklists that often are used when monitoring, controlling and moderating teaching and learning strategies at school. Below we look at the formats of critical theory.

2.2.4 Formats of critical theory

Other related theories singing the same tune with the theoretical framework of the study are critical race theory (CRT), culture inclusive theory (CIT), and living educational theory(LET).

2.2.4.1 Critical race theory

According to Haskins and Singh (2015: 298), critical race theory was about viewing a perspective that was eclipsed by white hegemony and traditional counsellor educational models. Nevertheless, Gonzales (2017: 354) demonstrated that the manner in which evidence from the agricultural sciences teacher development programmes was applied determined the facts that were considered in deciding who an effective teacher was and who was not. However, Sleeter (2017:166) argued that much about teacher development could be transformed if race was confronted directly. Sleeter (2017) further indicated that engaging minority members in situating themselves within rather than outside an analysis of race could reduce barriers towards enhancing agricultural sciences teacher development.

2.2.4.2 Culture inclusive theory (CIT)

Hwang (2014:60) stated that culturally inclusive constructed theories could be used to challenge agricultural sciences teacher development programmes constructed on the presumption of individualism. In light of the above, Strong (2017:37) reminded us that the international education law community became increasingly diversified to reflect and respond to the demands of the globalized world, and then became a sophisticated and powerful influence in international policymaking circles. According to the latter scholar, representatives of teacher development projects, with the assistance of various epistemic communities, could frame various issues in integrative terms, and thereby sought to develop an international instrument that maximized benefits to all agricultural sciences educators rather than advantaging one group to the detriment of the other.

2.2.4.3 Living Educational Theory (LET)

With reference to the Living Educational Theory (LET), which supports the theoretical framework guiding this study, (Whitehead and Huxtable, 2016:6) posited that agricultural sciences educator developers working in continuing professional teacher development (CPTD) programmes needed to develop their talents, knowledge and expertise by researching their own practice in the same way as the agricultural sciences teachers they were supporting. In doing so they exemplified an educational pedagogy appropriate to providing gifted education internationally for students of any age. Subsequent to this opinion, Dehmlow (2017:5) advised that beginning to enhance teacher development in truly collaborative ways required shifting the narrative around our relationships from a teacher or developer model to one of a coalition.

In my view the above formats of critical theory could not be effective without grounded principles. In the light of this ideology I present the principles of critical theory in the paragraph below.

2.2.5 Principles of critical theory

According to Verovšek (2012:377), markets could not function independently of taxpayer support. The latter scholar further suggested that, instead of waiting to see what the people think world politicians should get up and lead collaborative dialogues that would ensue in common interpretation among stakeholders. In light of the above, Leitner and Sheppard (2015:228) alluded that as a matter of principle, stakeholders in teacher development had to move beyond current polarizations and disputes over the basis of urban theory, creating space to take seriously the principle suggesting that no single theory suffices to account for the variegated nature of teacher development across the world.

As we can see from the above views, critical theory requires stakeholder support in every attempt that deals with teacher development challenges.

Nevertheless, Ketch (2005:12), in support of the above opinions posited that conversation was a basic principle for critical theory. In addition to what already has been articulated above, Schenck and Cruickshank (2015:90) demonstrates that we need to inform ourselves better about the mind and brain processes that affect experiential teacher development.

I agreed with these scholars in that the only way to attract support while working on teacher development issues in the teaching of agricultural sciences is through the use of free, informed talks.

Gregoratto (2015:540) argued that the wisdom of democracy could be interpreted as a political order that was both just and well-functioning, while one could make sense of the failures by

relying on the information arrived at when examining the origin, nature, and course of challenges established with the aid of critical theory. In terms of critical theory, Rabbini (2016:361) suggests that agricultural sciences teachers be required to resort to an array of critical thinking applications, to skilfully conceptualize, analyse, evaluate, reflect and reason during and after every process of teacher development.

In conclusion, it became clear that critical theory used failure as one of the stages we were expected to encounter during teacher development processes. This is the reality we shall look at in greater detail in paragraphs to follow.

2. 2. 6 Ontology of critical theory

According to Maitlis (1986:334), critical theory would affect the structure and activities of the scientific community. Critical theory suggests that research, as a well-defined activity of the scientific community, should be the subject of more descriptive research. Specific avenues of inquiry might have included the role of the researcher's career in determining research, the role of academic status and hierarchy in determining research, the effects of competition and reward allocation, the social structure of different subgroups of organizational scientists, and the identification of the values and norms that underlie the scientific community. In view of the above there was an intimate relationship between methodology, as well as the criteria for what constitutes a valid scientific product, and the social structure of the scientific community within which this product was produced.

According to the Encyclopaedia Britannica (Hardy, 1973:976), the term “ontology” was introduced by the German philosopher Christian Wolff in the 18th century. It was intended to denote a particular branch of philosophy that dealt with the theory of what really existed in contrast with that which only seemed to exist; of what existed permanently in contrast with that which existed only temporarily, and of what existed independently and unconditionally in contrast with that which existed dependently and conditionally.

Nyirenda (1996:12) argued that the existing education systems in many African countries were designed by the ruling elite or experts, and attempted to adjust people to given societies. People were viewed and treated as scientific objects into which the ruling elite could or should pour knowledge. Africa required education systems in which people were viewed and treated as subjects who were capable of working to change their social reality.

According to Don and Paul (2010:5), one’s view of reality and being is called ontology. Ontology was the starting point which led to the theoretical framework of the study. Ontology is the study of claims and assumptions that are made about the nature of social reality, claims about what exists, what it looks like, what units it comprises, and how these units interact with each other. In other words, if someone studied ontology, he/she studied what we meant when we said something existed.

There are two ontological possibilities for human beings. We could view ourselves and our students as completed beings or uncompleted beings in the process of becoming. It is a choice between the ontology of being versus the ontology of becoming. The ontology of being is a way of looking at human beings as finished products with no hope of change or transformation. The ontology of becoming, on the other hand, views people as being in a constant process of becoming whatever it is that they want to become. If a student is poor or unruly, this is not a fixed condition. It is the teacher’s responsibility to work with the student toward change (Goering, Shudak, and Thomas, 2014:995).

However, Howarth (2006:65-79) added that critical theory had the potential to at least address contemporary social problems and thus invite practical engagement and intervention. Critical theory appears to have the conceptual tools to criticize the social order. Representations of critical theory have to be seen as alive and dynamic. The problem here is to define what is real related to our ongoing and contested identities, interests, and hopes. Cooperation gave social agents a common code to discuss, debate, and thus constitute social realities, while conflict gave them something to debate about as different interests and relations of power competed. Knowledge always was actively constructed by social agents who articulated from different positions and who had different social stakes in maintaining and challenging the hegemonic social representations that invaded their realities.

2.2.7 Epistemology of critical theory

Rodriguez (2006:1067-1069) argued that masking our inner selves served as defences against racist educational institutions in which people tried to manoeuvre through. These masks were steeped with self-hatred and other internalized oppressions. To decolonise minds, people needed to become critically conscious that they lived in a racist and white supremacist society, as well as use that particular knowledge to circumvent exploitation and oppression. For the marginalized, counter storytelling served as a powerful means of survival and liberation. Writing counter-stories also served as a tool for unmasking and challenging majoritarian stories that upheld racial privilege. Rodriguez (2006) further posited that stories also served as a means to destroy complacency and challenge the status quo. These counter-stories served several theoretical and methodological purposes. Storytelling could teach people about how one could construct knowledge that could be acquired through reading. Narrative that focuses on the marginalized, therefore, could empower the storyteller as well as those who listen. In that manner critical theory enables people to acquire knowledge through reading and listening.

What came to my mind in view of what is explicated above, is that critical theorists believe that knowledge can be socially constructed when people interact through collaborative dialogues. We then would be able to enhance teacher development in the teaching of agricultural sciences through collaborative dialogues.

According to the Encyclopaedia Britannica (Hardy, 1973:650-651), the term epistemology refers to that branch of philosophy which is concerned with problems of the nature, limits and validity of knowledge and belief. The term was first used in the 19th century as a synonym for "theory of knowledge".

The validity of critical methodologies founded on conscientization (the process of developing a critical awareness of one's social reality through reflection and action), and dialogue assumes a strong belief and faith in the need for equality and social justice. This implies acceptance of liberating education as a viable means for achieving freedom and change. Enhanced development of both individual teachers of agricultural sciences and the society needs to involve the creation of just social structures through the process of liberating education, as Nyirenda (1996:12) posited.

The view of how one acquires knowledge is termed epistemology. Epistemologist studies what we mean when we say we know something. Epistemology is the theory of knowledge embedded in the theoretical perspective and thereby in the methodology (Lindsay, Merrill, Sharon and Ibtissem, 2010:5).

Dialogue is a way of knowing with and through others. This is the kind of knowing in schools with which critical theory is concerned. Dialogue is epistemological when it is in relationship with objects of knowledge. Dialogue, then, is the process of knowing and learning that allows teachers to use experiences in and with the world, in concert with studying an object of knowledge, to learn more about the self, others, the world, and the object itself. This is the form of learning and knowing that is, for the most part, absent in schools. For dialogue to occur, people must have trust in each other. Dialogue through the ethic of trust is void of the oppressive and dehumanizing characteristics of manipulation, of over-generalizing truth claims for one's own benefit, and of relying on slogans and clichés as a substitute for thought (Shudak, 2014:996).

In line with the above-mentioned views, Zachariah and Moreno (2006:106-107) indicates that storylines contribute to dominant ways of thinking, acting, knowing and becoming, which constitute the complexities of inclusive practices in early childhood. Children draw upon storylines from religion and popular culture in order to create their own meaningful curriculum content. By problematising the cultural constructs which produce discrimination in our curriculum endeavours, we are better able to seek out possibilities for creating equity and living social justice in our classrooms. Developing practices based on post-structural and critical theory presents the educator with opportunities to understand and recognise the ways children perform identities that have been constructed as a currency, exchangeable in their play scripts. Learners' educational value systems may vary from ours and knowledge has varying levels of cultural capital. We might begin to recognise how this works, and act by engaging in the complexity of identity to work through respectful discussions. These actions could be tricky when children's cultural lives and curriculum conflict with our own beliefs, value systems and identities.

2.2.8 Role of researcher

The role of the educator or researcher in this regard is to enter into dialogue with co-researchers to clear roles in a way that would create opportunities for developing enhanced competence in the teaching of agricultural sciences. Lack of enhanced teacher development in the teaching of agricultural sciences continues to marginalize beneficiaries of education from great rewards of transformed social realities in many different ways. Some teachers are not aware of opportunities afforded teachers for teaching development that could be enhanced and thus are complacent about the status quo. Senior government officials should not regard enhancement of teacher development as subversive (Nyirenda, 1996: 55).

2. 2. 9 Relationship between researcher and co-researchers

The researcher may establish relations in the first instance by providing consent forms to co-researchers to fill. Co-researchers in this study were free to participate and as a result were allowed an opportunity to withdraw from the research process at any stage. Co-researchers remained anonymous during the process of the study. Like all other co-researchers in this study, the researcher was expected to contribute to data generated during the study with the sole purpose of achieving the aim of the study within a collective. All forms of power and

dominance were discouraged among the researcher and co-researchers throughout the process of the study.

2. 2.10 THE RHETORICAL PERSPECTIVES OF CRITICAL THEORY IN THE STUDY

I anticipated that the use of language in the study would be such that co-researchers would not judge one another during interactions in view of critical theory. In this regard, King (2015:131) maintains that co-researchers would always be mediators, translators, and interpreters of the discourse of the powerful. King (2015) further posits that critical theory assists in helping co-researchers take hold of their own fate by informing them what the powerful is doing, as was the case in this study,. However, Friedrich (2017:57) indicates that hegemonic masculinity will not go away; yet the failure to embody that standard that every co-researcher experiences makes them resistant to any social rhetoric that produces suppression of the views of other co-researchers. I expected that co-researchers would not feel to be less valued than others. However, Bennett (2016:13) warns that as long as inequity exists at the level it does, exacerbated by economic greed, sexism and xenophobia, cross-cultural contact would yield increased stereotyping and reduced tolerance in collaborative groups. Collaborative dialogues in this study were free from various forms of social exclusion. In this regard Teilanyo (2016: 251) posited thatthe use of rhetoric in rivalry is not new; rather, it has always been a pattern ingrained in all societies, whether rural or urban, literate or non-literate, democratic or non-democratic. Suggestions made by co-researchers were treated as confirmed information without any possibility for changes that were perceived to be assisting to find what still needed to be known.

2. 3 CONCEPTUAL FRAMEWORK

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. The conceptual framework underpinning the study is teacher development.

2.3.1 The rationale for teacher development

In this study teacher development was the essential and central element of the research design that guided not only researcher and co-researchers in what to do, but also guides a reader in what has been done and how (Ewnetu, 2016:51). Because the world that teachers are preparing young people to enter, is changing, and because the teaching skills required are evolving likewise. No initial course of teacher education could be sufficient to prepare a teacher for a career of more than thirty years, as posited by Ewnetu (2016:51).

Teacher development, based on constructivism, should be perceived as a long-term process; a process that takes place within a particular context; intimately linked to school reform; conceived as a collaborative process, but very different in diverse settings. The goal of teacher development is to develop teachers into reflective practitioners; who can make informed professional choices; who are prepared to be empowered professionals. Teacher development in this study resulted in active and participatory learning, as we employed a school-based model in which agricultural sciences teachers participated. The teacher development process was teacher facilitated with the aid of support materials. This approach highly took into account the

importance of teacher knowledge and the realities of classrooms, according to Ono and Ferreira (2010: 62).

Teacher development is a process and, therefore, different forms of training and support are needed at different stages of this continuum. The education that teachers receive has the potential to make a difference to children's learning and therefore warrants careful attention. The constructs, a capable teaching force; adequate support; positive teacher attitudes; time and efficiency; classroom management; high expectations; student–teacher interactions; organized curriculum; clear and focused lessons; frequent monitoring and assessment; variety in teaching and assessment strategies; and reward and incentive systems, which will be discussed in greater detail in the paragraphs below, are associated with effective teaching and are critical when planning and implementing enhanced support for teachers. While only a few of these features are addressed in the early stages of some teacher development programmes, small first steps are important beginnings in the process of improving teacher quality (Helen, Richard and du Plessis, 1998:19).

Good teaching does not happen by accident. While some teachers are more naturally gifted than others, all effective teaching is the result of study, reflection, practice, and hard work. A teacher can never know enough about how a student learns, what impedes the student's learning, and how the teacher's instruction might enhance students' learning. Teacher development is the only means for teachers to gain such knowledge. Whether students are high, low, or average achievers, they would learn more if their teachers regularly engaged in high-quality professional development. School leaders need to improve this professional development of teachers with study, reflection, practice, and hard work. Such development does not only support teachers' learning, but students learning as well. When leaders know how to engage teachers, support staff, and students in effective learning, the school will become the centre of learning for all adults and students (Hayes, 2010:18).

As Brown, Hawkins, Rhew, Shapiro, Abbott, Oesterle, Arthur, Briney, Catalano (2014:2) posits, mastery of the material refers to pedagogical content knowledge and strong evidence of impact on student outcomes. The most effective teachers have a deep knowledge of the subjects they teach, and when teachers' knowledge fell below a certain level, that leads to significant impediment to students' learning. Brown et al (2014) alludes to a profound understanding of the material being taught, understanding of the ways students think about the content, the ability to evaluate the thinking behind students' own methods, and identification of students' common misconceptions, added to the mastery of material as suggested above.

Relevant staff development activities are essential if a teaching force is to be effective; adequate time and resources must be set aside for teacher development, staff members need to have a say in the content of development activities, skills learned must be practised over time with follow-up sessions implemented where necessary, and staff members could be encouraged to share ideas and work together. Teacher learning arguably is the cornerstone to school reform and improvement. Without carefully considering teacher learning and providing structures to support the growth of teachers' understandings of their practices, school reform efforts are unlikely to be either effective or enduring (McDonell and Weatherford, 2000:37). Effective teachers have confidence in their ability to teach, care about teaching and their students, and cooperate with each other. These characteristics are reflected in the teachers' comfort in using learning materials and in trying out new ideas, low teacher absenteeism and tardiness, and a high level of group involvement in planning teaching and in resolving whole-school issues.

2.3.2 Contemporary observations around teacher development

In the light of what was said above, education in South Africa is facing great challenges, especially with regard to curriculum development. Teachers are principal role-players in the process of addressing these challenges. Curriculum change in South Africa does not only require new thinking on relevant curricula; it is also realized that the role of the teacher in this process has changed. The curriculum functions that presently are expected of teachers differ from those assigned to them in 1998, for example. Thus, curriculum change, therefore, not only should include new thinking and action concerning curriculum development, but also how it relates to the way teachers could be optimally involved in the process, making the outdated focus on the role of teachers as mere ’recipients’ redundant. By ignoring "the teacher's voice", the outcomes of new thinking on curriculum development might be thwarted, prolonging the dangerous situation that teachers, as potential curriculum agents, simply remained (Carl, 2005:228)

According to Hashmi (2014:83), lack of commitment led to poor implementation of education policy and the resultant weak performance in the education sector of Pakistan, and added that educational leaders needed to clearly define the job descriptions of their teachers and provide room for professional development. Teachers needed to be encouraged to contribute in quality enhancement of the managerial and academic processes at school, therefore a properly developed and managed staff performance management system was required. Teachers need to be provided an opportunity to suggest improvements in the way things are done in the school so that new knowledge and skills could be periodically imparted to the teachers which will help in enhancing their efficiency as Hashmi (2014) suggested.

In support of this view, Ersozlu (2016:145) found that the teachers’ dominance decreased in the classroom and teachers had more difficulty in maintaining discipline in the classrooms of schools in Turkey. Based on the research results, it was suggested that teachers needed prolonged teacher development programmes that were coordinated by experienced and successful mentors to become experts with better classroom management skills. Dilara (2016: 149) posits that the inclusion of technology in education helped teachers to pay more attention to the development programmes, but at the same time it adversely affected the cognitive and social skills of children who played with technological devices too much.

In this regard Patricia, Joshua, Jennifer, Regin, Sebrina, Damira, Anna, and Paul (2015: 4) suggested that cultivating awareness and resilience in education emphasized the teacher’s own development, which needed more attention in educational policy and research. This practice may help teachers establish supportive relationships with students at risk of school failure, thereby promoting school attachment and school climate. Cultivating awareness and resilience in education improved classroom climate, which resulted in improvements in students’ academic achievement, thus supporting initiatives and policy aimed at these outcomes.

McCormick (2014:1) supports the argument of Patricia et al (2015) by positing that the emotionally demanding events teachers typically face often involved interactions with children who are not well-regulated due to exposure to numerous risk factors and who are in great need of a supportive relationship with their teacher to develop their social and emotional competencies.

In the light of the above, the opinion of Patricia et al (2015) is relevant, namely that new ideas in education are being introduced daily, and as a result, current educational facilities require teachers who are able and willing to acquire the knowledge necessary to implement these new

strategies in a manner which will enhance and improve student learning. As Kariuki (2009: 6) states, teachers need continued practice to become comfortable with and to implement change. Professional development takes time and might need to be conducted over several years for significant change in educational practices to take place. The one-size-fits-all approach to professional development is not effective, for each level of teachers' needs differ from those at another level.

Johansen (2011: 9) supports Kariuki's argument stated above by suggesting that the way in which behaviour is perceived and managed by teachers could influence the classroom environment. However, burnout, emotional and mental exhaustion, and low efficacy of teachers impact on the relationship of teachers with their students and the quality of their teaching. Johansen's (2011) study indicated that teachers found managing behaviour one of the more challenging parts of their role, therefore, a review of formal teacher training and adequate ongoing support and training were considered essential for teachers. Consultants needed to be acutely aware of the limitations in terms of teacher knowledge, training and support for these types of interventions.

In view of the above stated arguments, it is clear that teachers need to pay attention to developing well-ordered classrooms, and constructively disciplined learners. School and classroom rules need to be clearly articulated and agreed upon by both teachers and students, and should be fairly and equitably maintained. Positive behaviour needs to be reinforced, and learners and teachers need to attend classes regularly according to an established school timetable in order to successfully enhance teacher development in the teaching of agricultural sciences at school.

2.3.3 Reflective approaches towards mitigating teacher development shortfalls

As Benard (1997:3) posited, teachers' high expectations could structure and guide behaviour, and could also challenge learners beyond what they believed they could do. It was further stated that turnaround teachers recognized learners' strengths, mirrored them, and helped them see where they were strong. They especially assisted overwhelmed youth, who have been labelled or oppressed by their families, schools, and communities, in using their personal power to grow from damaged victim to resilient survivor by helping them to not take personally the adversity in their lives; not see adversity as permanent; and not see setbacks as pervasive.

Benard's argument was strongly supported by Sullivan (1997:10) with a practical example that reported that when general mathematics was eliminated from the schedule, many North Laurel students in London, Kentucky needed extra help to meet the algebra requirements. That need gave rise to an after-school tutoring programme which was offered on Tuesdays and Thursdays from 15:00 to 16:30. The lesson we could draw from the above is that the scholar indicated that they had an educational programme that aimed to increase high school learners' academic skills and motivation to serve learners who had the potential to succeed in college, but whose educational performance did not reflect that potential.

I believe that high staff expectations for all students to do well contribute to making a school effective, for example, learners attending schools in the Free State province of South Africa were expected to obtain a pass rate of 90% and a 50% entrance to bachelor's degrees in the end of the year examinations of 2016.

Chezare (2014:129) posits that in today's urban school, the priority of teacher content knowledge and credentials above their ability to create a classroom environment that values individual student difference must be revisited. For six to eight hours a day students are engaged in countless interactions with one another, the classroom teacher, and many other school and community stakeholders. These interactions have the potential to put students on a firm trajectory toward high academic achievement or utter disillusion with school and learning. The interactions between teachers and the young people they teach, however, have a significant and important role in shaping each child's schooling experience. A kind glance, affirmation, or simply the willingness to listen attentively could make all the difference in the efficacy of school for a young person from a historically marginalized cultural group.

Susan (2014:129), however, confirmed that the application of empathy in the professional teaching context was central to establishing classroom norms and practices that allowed students the space to act out the totality of their various social identities, for example racial, ethnic, sexual, religious, and others. The use of empathy in stakeholder interactions with youth and families is about re-humanizing the profession, so that those who invest in urban education are reminded that the many Black and Latino students populating urban schools are more than a test score. In the study reported on in this article, empathy had been considered as a mechanism for helping urban educators think about their work and see it through students' eyes, and to consider the pertinence of developing a professional orientation that was built on the gifts, points of view, and cultural expertise of students.

As Courtney (2013:57) posited, the diversity of reasons students had for not discussing disappointing grades with instructors, and the possible implications of these reasons for students' educational experiences might contribute to the challenges instructors encounter when determining how to appropriately intervene in students' experiences of academic disappointment. Some students could gain an awareness of the cause(s) for disappointing academic performances and acquire strategies for improving through means other than meeting with the instructor. Two important conclusions may be drawn from this observation. First, instructors need not always intervene in students' experiences of academic disappointment, and second, students' decisions against discussing disappointing grades with instructors do not always reflect a failure of education as some scholars previously suggested. These conclusions, however, do not justify efforts to inhibit student-teacher interactions about grades.

As long back as 30 years ago Judy (1987:11) already posited that research-based problem-solving strategies appeared to be more effective than in-service programmes based on unsupported ideas of what might work. She recommended that between workshops, teachers should be encouraged to visit each other's classrooms, preferably with a simple, objective, student-centred observation instrument, and should provide opportunities for discussion of the observation. Newsletters could be an excellent way of institutionalizing staff development programmes. Not only would the newsletters provide information about upcoming in-service events, they also reminded readers that professional growth was an integral aspect of school life. Co-researchers needed a supportive, experienced adult educator in their classroom when they were trying things out. Individual consultation with trainers should be available on teacher request.

In the light of the above-mentioned ideas, Gloeckner (1992:56) alluded that the ideas posited by Judy were important in that skills held by youth entering the American workforce appeared

to be different from the skills they most needed. Basic skills; the ability to read, write, and compute even if developed to once satisfactory levels; were not sufficient to start workers off well in the workplace. A contemporary set of basic skills included the attitudes, knowledge, and behaviours needed to function in an increasingly self-directed, interpersonal, and technological workplace. These skills included: learning to learn; reading, writing, and computing; verbal and nonverbal communication; adaptability, including creative thinking and problem solving; personal management, including self-esteem, goal setting or motivation, and personal or career development; group effectiveness, including personal skills, negotiation, and teamwork; influence, including organizational effectiveness and leadership; the ability to use and understand technology; the ability to apply the knowledge of science to work situations; and the ability to balance and manage family and work. Planning and integration of basic skills in vocational education was a part of a larger demand. Training in these new basic skills was included in all aspects of the public school curriculum to ensure that students master these skills. Delivering integrated instruction effectively would require nothing less than a significant reshaping of how our schools and curricula are organized and how our administrative and teaching personnel think and teach.

Buettner (1996:6) argued that emergent readers were embarking on a life-long journey of discovery, including realizing the potential and limitations of the written word. They discovered that something was inherently unnatural about print, yet, as with all cultural achievements, learning to deal with print gave one power. Almost all young children want to learn to read when they enter school. While the large majority are successful, some few quickly become ambivalent about the process of learning to read when they discover the effort that it requires. With the most benign of intentions, we do these children a disservice when we pretend that all aspects of learning to read are fun, or assume that we know how to design instruction that would bypass these difficult aspects. The student who does not acquire appropriate control of text simply will not experience the full power of the written word, receptively or expressively.

According to Cooper (2000: 31), the first step in providing appropriate instructional support is identifying students who are falling behind. In his report it was also added that some institutions used scores on their gateway tests; other districts and states used early warning assessments to see which learners needed additional help. Governments then provided the resources for instructional support, after school, on weekends, or during the summer. Because the students who needed support were those who struggled in regular classrooms, the quality of instruction in the after-school and summer programmes was critical. Other basic education departments provided incentives for capable teachers to teach in those programmes, and considered the use of specially designed curricula. Teachers engaged in the actual implementation of norms and standards to provide clear imperatives for those charged with the formulation of educational policy and the design of teacher-preparation and professional-development programmes. Teachers were the primary agents of school reform; therefore, they were included as co-developers in all stages of the design, implementation, and continuous improvement of the standards-based system. It was highlighted that no reform could succeed without the co-operation and active participation of teachers.

Attempts to impose educational reforms from the top down, or from outside, obviously have failed. The countries where the process has been relatively successful are those that obtained a determined commitment from local communities, parents, and teachers, backed up by continuing dialogue and various forms of outside financial, technical, or professional assistance (Christine, Francoise and Karen, 2000:37).

Progress monitoring in an inclusive standards-based assessment and accountability system uses multiple measures. One method of progress monitoring is Curriculum-Based Measurement (CBM). Rachel, Martha, Ross, Sandra and Amanda (2004:14) reported that it was used in basic academic areas, such as maths, reading, writing, and spelling. Curriculum-Based Measurement was aligned with the curriculum content and the performance goals for the year. Commitment to just one measure could derail a well-intentioned effort and might cause harm. Principals, teachers, parents, and students needed the data on which instructional planning was based to be meaningful, understandable, and useful in making decisions on instructional interventions, services, and supports. Progress monitoring in a standards-based system could be the key to unlock powerful skills and knowledge for teachers and for learners and could result in success for the school, district, and state in inclusive standards-based assessment and accountability systems (Rachel et al, 2004:14).

In the light of the above, Reedy and Lacireno-Paquet (2015:1) suggested that systemic change was accomplished through the development of a coherent continuum of evidence-based, system-wide practices to support a rapid response to each learner's academic and behavioural needs, and featured frequent data-based monitoring for instructional decision making, effective intervention, fidelity of implementation, ongoing professional development, and leadership within an empowering school and district culture. Frequent monitoring and assessment substantially contributed to improved student outcomes at the local level as well as resulting in benefits to teachers, improved instruction, and school functioning.

We also need to do frequent monitoring of student progress in the teaching of agricultural sciences in conjunction with quick, constructive feedback in order to enhance student motivation and achievement. Monitoring student work helps teachers to diagnose what students know and where further instruction is needed.

Lopez and Schroeder (2008:32) recommends that teacher researchers should encourage students to identify their preferred learning styles in student surveys. Using differentiated instruction also may ensure student success. Tasks should be delivered based on ability. A lesson that is too difficult may cause frustration, hinder learning and encourage behaviour problems. Likewise, a remedial assignment may lead to behaviour problems. Using differentiated instruction, however, requires a great deal of time in planning. The planning time increases with differentiated instruction due to the accommodations and modifications of each assignment. Interventions encourage the researchers to be more aware of the interests of the students. The use of differentiated instruction encourages the teacher to identify and address the needs of the individual learners. Cooperative learning groups support positive interdependence, interpersonal skills, and develop social competence.

Despite a clear need for improvement in the quality of teachers' interactions with children, programmes and teachers remain uncertain about how to make systematic changes in the nature and quality of these classroom interactions. Teachers who have been in the classroom for a long time have more set ideas about what effective interactions look like, and thus have a harder time performing on tasks that ask of them to shift to thinking about new ways to interact in the classroom (Hamre, 2011:5).

However, student differences and learning needs could be better accommodated by teachers who employ a variety of teaching practices. These teaching practices include individual assignments with worksheets, class discussions, group work, explaining, drill-and-practice,

asking questions, and cross-age tutoring. When available, teachers may make use of interactive radio and television or programmed materials. We also need to take note of instruction methods such as drill and practice, and asking questions that stimulate student thinking. I have already suggested that giving constructive feedback could raise academic performance. When given the instructional and/or training materials by those responsible for teacher development, colleagues in even the most difficult of circumstances can provide students with a problem-solving, inquiry-based learning environment.

2.3.4 The importance of rewarding progress made towards teacher development

Daniel (2012:61) indicated that performance pay played a prominent part in policymakers' reform agendas, in part because of its common sense appeal of paying teachers on the basis of how well they taught and their students' academic achievement. The tendency among those charged with developing and supporting new performance pay projects was to identify the variety of implementation challenges and then develop lists of ways to overcome them. Planning, leadership, accurate and believable assessments of teaching and learning, communications, support to help educators earn incentive awards, the proper size of awards, the appropriate level of accomplishment to earn an award, and sustainability planning were of paramount importance in this regard.

In the above case (Daniel, 2012:61), allowing teachers to work within a dynamic work environment fostered creativity. There was freedom for teachers when given the latitude to design their own lessons. As a result, there was always something new and exciting to learn. Five areas where teachers felt they were most rewarded within their profession were: making a difference in the lives of their students, building relationships, working within a fulfilling occupation, being a lifelong learner, and working within a dynamic work environment. The common public perception often was extrinsic, pointing to weekends off and summer holidays as being the motivators for teaching. However, findings indicated that the rewards of teaching were the opposite of the public's perception, being intrinsic in nature, according to Cheryl (2014: 8).

However, rewards are a tandem, present in the activity of every member of the teaching staff. It is a pedagogical change which rewards the teacher qualities and should be applied as partner in the educational act. If pupils' desirable behaviour is rewarded immediately, then the probability is much greater that such behaviour would be repeated and increased. Offering rewards in a correct and fair manner makes the pupil to be an aware accomplice in the educative act. If pupils are made aware of the reason why, and understand what the teachers wish to do, they would correct their errors more readily. All these aspects may be mastered and transposed to practice by beginning teachers more successfully and in a shorter time period under the guidance of a mentoring teacher (Claudiu, 2014:11).

In a study Tran (2016) found that coping styles mediated the relationship between teachers' concerns about student misbehaviour and their use of classroom management techniques. Teachers who used passive avoidant strategies employed more aggression and punishment techniques towards student misbehaviour, and used less discussion, recognition and rewards, and hinting. Teachers who used more social problem solving (SBS) and relaxation strategies used more inclusive management techniques such as recognition and reward, discussion, and hinting. Teachers who employed poor management techniques, such as punishment and aggression contributed to their own problems by reacting with passive strategies that serve only to exacerbate the very problems they are intended to overcome or prevent (Tran, 2016: 8).

I concur with Anwaruddin (2015:17) who argued that governments around the world were calling on teachers to use research-based knowledge to inform and guide their practice. Though various initiatives have been taken to bring research-based knowledge to teachers' professional practice, as I have discussed in paragraphs above, most of them do not pay due attention to local contexts where research-based knowledge was applied. Teachers rather should work in locally-based interpretive communities in which they engage in dialogues with one another and come to understand university-based research in ways that would be supportive of their context-responsive praxis. Thus, working as locally-based interpretive communities, teachers and researchers might learn from one another and be able to contribute to the project of mending the research-practice split in education.

2. 4 LEGISLATIVE IMPERATIVES ON ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

I was aware that the Department of Basic Education used the integrated quality management system (IQMS) and Continuous Professional Teacher Development (CPTD) as policies to appraise teachers in South Africa. These were post-apartheid policies according to the continuous professional teacher development task team and South African Council of Educators (SACE, 2014).

However, Guo and Yong (2013:100) indicated that policies and opportunities of professional development provided an effective means by which to support professional identities, collegial relationships, and professional responsibilities of the early childhood teachers in China. Unfortunately, this competitive approach to teaching evaluation functioned to legitimize differences between the teachers' learning and the learning of children. It could be suggested, therefore, that a more useful approach to teacher evaluation would be to stress the impact of teachers' learning on children's learning.

Institutional approaches to teacher development are top-down, which cause teachers to have low levels of morale and high levels of stress, and lead to superficial cosmetic changes. The appropriateness of institutional approaches to teacher development may vary significantly from teacher to teacher. Certificates should not only serve as evidence of someone's ability to teach, for example, agricultural sciences, they also should serve as instruments of empowerment and as catalysts for further development. Some teachers may have the financial resources, institutional support, and academic skills to pursue qualifications, others may not be that fortunate. If this is the case, then certificates may pose the risk of widening the professional development (PD) gap between certified and uncertified teachers within an institution and among institutions (Mora, 2013:60).

In the light of the above opinions about approaches to and certification of PD activities, it is worthwhile to take note of the views of Birbirso (2014:17), who posited that for teachers in Ethiopia, the matter that was at stake was their holistic development in terms of the right to a relatively fair standard of living; for example, sufficient remuneration to buy the basics, such as food, housing and clothing, as well as books for themselves and their children, and fair treatment as free and social-critical citizens who were able to freely inquire, teach, write, and speak in whichever language. Indeed, no matter how many 'transformation' plans or 'training'

programmes are promoted, in a social context which suppresses these fundamental conditions, neither an effective level of language proficiency, nor professional competence can be realized.

However, in a study on multiple intelligences and teacher PD it was found that student failure in schools was commonly constructed as due to a lack of academic success in examinations, often resulting from a lack of participation, and was commonly understood within a framework for understanding educational disadvantages that identified social class, gender, ethnicity, and disability as agents of exclusion and oppression. The reflective enquiry, modified perspectives and changed practices of teachers who participated in the project also showed that the largely invisible but powerful hegemonic construct of intelligence underpinning Irish education, could not only be understood as an agent of educational failure, exclusion and oppression, but could be challenged and transformed (Hanafin, 2014:139).

Nevertheless, according to Christopher (2010:40), teachers with general education backgrounds have relatively little knowledge and understanding of the needs of special needs students. Many students are suspected of having learning or behavioural disabilities simply because they demonstrate 'unacceptable' behaviour or are struggling to learn. The process of including students with diverse abilities into general education classrooms provides opportunities for all students to access and succeed in their national curriculum. Challenges of how to best implement inclusive education will always exist, but examples exist which demonstrate that steps to confront these challenges should be carefully planned, and based on local considerations and contexts.

In the light of the above, a study of children in need of protection in Ontario, reports that children depend on many adults as they grow up, including parents, teachers and other community members. A child needs food, clothing, shelter, as well as love and attention. Children deserve to be safe and, if caregivers cannot provide that safety, educators must intervene in order to help vulnerable youth. The system has a responsibility to help children who are in need of protection. Teachers already are committed to improving the lives of the students in their classrooms and, with the proper training, teachers could do even more to support at-risk youth (Shewchuk, 2014:27).

Even though the above holds, Hardy (2009:86) argues that there is an educational policy field in Australia which promotes teachers as collaborative and innovative, but at the same time the outcomes of their work are under increased managerial scrutiny. Under these circumstances, it was perhaps not surprising that professional development has become heavily influenced by traditional dissemination approaches which seek to foster teaching as a regulated industry, even though there is discursive advocacy for a more autonomous teaching profession.

However, school leaders could make a difference in a school's and students' performance if they were granted the autonomy to make important decisions. To do this effectively, they need to be able to adapt teaching programmes to local needs, promote teamwork among teachers, and engage in teacher monitoring, evaluation and professional development. School leaders need discretion in setting strategic directions and must be able to develop school plans and goals and monitor progress, using data to improve practice. They also need to be able to influence teacher recruitment to improve the match between candidates and their school's needs. Leadership preparation and training are central, and building networks of schools to stimulate and spread innovation and to develop diverse curricula, extended services and professional support could bring substantial benefits (Schleicher, 2012:29).

As Hayes (2010:6) maintains, new teachers juggle an overwhelming number of unfamiliar issues, such as classroom management, instruction, curriculum, school culture and operations, test preparation and administration, state standards, parent relations, and interactions with other teachers. Left to themselves, they may develop counterproductive behaviours. With extra support through the use of teacher development policies, new teachers learn more effective practices to apply to daily challenges. Additional support also helps districts retain new teachers and set them on the path to becoming effective educators. Many school systems provide mentors and induction programmes for novice teachers. These programmes, according to Hayes (2010) are required in many states in Australia for teachers to earn a professional license. Most importantly, research indicates that new teachers who have received intensive mentoring have a significantly positive effect on student achievement after as little as two years, according to Hayes (2010).

2. 5 STRATEGIES TO MITIGATE UNDERPERFORMANCE BY ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

According to Cleland (2012:65), evidence suggested that learners with poor metacognitive strategies are more likely to underperform. Metacognition can be taught. It is suggested that subject advisors and other stakeholders should enhance teacher development by including clinical psychologists with skills to deal with challenges due to metacognition in the teaching of agricultural sciences. Metacognitive prompts may be one strategy for supporting underperforming students.

Greysen, Kind and Katherine (2010:42) disclosed that in Australia any teacher who does not identify and address student learning needs is regarded as unprofessional and unresponsive; such teachers' methods are associated with the default classroom teaching practice held responsible for having caused learner achievement disadvantages. Greysen et al (2010) posits that a remedy for this phenomenon is increased teacher surveillance, rather than critical appraisal of student- teacher constructions of the classroom environment. It would be fair of personnel responsible for teacher development to engage teachers in approaches in which they have a say in their own enhancement.

This view is supported by Bybee (2011:18), who suggests that influence does not mean a change in attitude toward an object, but rather a change in the definition and meaning of the object. Teachers need to consider the possibility that focusing on threats in terms of underperformance rather than on long-term opportunities to add value is less likely to position them to effectively sell their services as teachers.

It is clear that when the capability issue is raised, the teacher involved needs support as opposed to condemnation. This is particularly so when dealing with teachers whose performance may be affected by the stressful nature of the job, or older teachers suffering from burn-out. Research indicates that it is not helpful for heads/principals to shirk from confronting incapability, as only by addressing the issue support can be rallied. In order to encourage heads/principals, they in turn need development and training. Particularly in the case of head teacher incompetence, matters are not necessarily always handled effectively by, for example, simply applying a capability procedure. This may not result in improvement, or may result in a barely satisfactory level of competence, or, even worse, in teacher dismissal on the grounds

of incapability. There is a strong argument for heads and governors at schools to be provided with training and development opportunities, so that they feel able, on the one hand, to tackle matters at an early stage before they become intractable and, on the other, to operate capability procedures with confidence if individuals appear resistant to acknowledging their problems or to taking positive steps to remedy them (Donnie, McCuller, Bisesi, Tanamly, Sim, and Kavich, 2004:41-42).

Israel, Marino, Basham, and Spivak (2013:24) maintain that many educational researchers have written about the need for students to gain a strong foundational understanding in science, technology, engineering, and mathematics (STEM). Focusing either on inquiry or explicit instruction alone is short-sighted and provides a limited view of what diverse learners need to be successful in mastering rigorous STEM content. By integrating explicit instructions in authentic STEM activities, students will have opportunities to authentically engage in STEM learning, access content in a meaningful way, and have opportunities to improve their content-literacy skills.

Margaret (2012:542) refers to a cycle of rising stress between the pressures of managing underperforming learners and the clinical educators' conflicting roles and responsibilities. Rather than trying to do more within an already stretched system, it has become necessary to rethink the pedagogical approach to this complex issue. Educators may benefit from wider system and programme developments, such as learning contracts and nested assessment activities, to focus on providing effective learning opportunities within a practice environment.

Roux (2009:252-254) posits that there are areas in which females, on the average, excel, and areas in which males, on the average, excel. But differences are not deficiencies. The problem does not lie in the fact that people are different; it is found in the value that we attach to these differences. Educators should emphasize problem-solving in early education, and create a curriculum aimed at teaching young students to take mental risks, to try out their own ideas, to question processes, and to extract learning from their failed attempts at solutions, rather than view those attempted pathways as wrong. If all students were encouraged to be multi-strategic, many more might successfully grapple with unfamiliar problems, as well as be conscientious about schoolwork, drawing the benefits of both the problem-solving and strategic orientations.

Msila (2013:103) points out that a point on the agenda of the South African government is endeavours to close the gap between the poor and the affluent. This naturally is an endeavour that should start with the education of our youth. Some school leaders would engender a sense of purpose among staff members, as they promote the adoption of a working vision. Some of the good reforms, such as regarding school policies, however, proved to be ineffective, especially due to teachers at the implementation end being apathetic. The country needs passionate and committed teachers who know their objective. Their passion should always prompt them to realise the dreams of many families. Their presence should warm hopeful learners. The endeavours of hard-working school leaders cannot be realised without the stanchion of goal-oriented teachers. Teachers need to see the bigger picture and this they owe to the generations to come (Msila, 2013:103).

According to Carrie (2015: 1262), teacher development strategies hold tremendous potential for challenging the neo-liberalizing processes that permeate university classrooms. In South Africa such processes are good for neither the agricultural sciences teacher, nor the student. I adamantly believe in students' capacity to critically engage with their world in order to create more just and equitable futures. The neo-liberalization of the landscape of higher education

and of the South African life more broadly requires transformative approaches to teaching and learning of agricultural sciences, which emphasize critical thinking about our own roles in perpetuating systems of oppression. Education for social change necessitates a disruption of the ways of seeing other subjects as more important than others, an approach that requires analyses of oppression both within our classrooms, as well as throughout the university system more broadly.

The above discussion indicates that more needs to be done by all researchers with an interest in teacher development to mitigate underperformance in the teaching of agricultural sciences at school.

2. 6 DEFINITION OF OPERATIONAL CONCEPTS

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. It is deemed necessary here to define the concepts agricultural sciences and teacher development.

Agricultural Sciences, according to the (Oxford English dictionary, 2012:13), refers to a broad multidisciplinary field of biology that encompasses the parts of exact, natural, economic and social sciences that are used in the practice and understanding of agriculture.

According to the Encyclopaedia Britannica (Hardy, 1973:351), agricultural sciences include research and development on production techniques, improving production in terms of quantity and quality, minimizing the effects of pests on crop or animal production systems, transformation of primary products into end-consumer products, prevention and correction of adverse environmental effects, theoretical production ecology relating to crop production modelling, traditional production systems or subsistence agriculture which feeds most of the people in the world. These systems are of interest, as they sometimes retain a level of integration with natural ecological systems greater than that of industrial agriculture, which may be more sustainable than some modern agricultural systems. Agricultural sciences, as described in the Encyclopaedia Britannica, include research and development on food production and demand on a global basis with special attention paid to the major producers such as China, India, Brazil, the USA and the EU. Agricultural sciences also include research and development on various sciences related to agricultural resources and the environment; biology of agricultural crops and animals; such fields as agricultural economics and rural sociology, and various disciplines encompassed in agricultural engineering.

According to the CAPS Grades 10-12, Agricultural Sciences is the study of the relationship between soils, plants and animals in the production and processing of food, fibre, fuel and other agricultural commodities that have an economic, aesthetic and cultural value. The main topics in the Agricultural Sciences curriculum are Soil Science; Plant Studies; Animal Studies; Agricultural Economics; Basic Agricultural Chemistry; Basic Genetics and Biological Concepts; Sustainable Natural Resource Utilization; Agro-ecology (Department of Basic Education, 2011).

Teacher development, according to the (Oxford English Dictionary , 2012:609), is a process of improving and increasing capabilities of teachers through access to education and training opportunities in the workplace, through outside organizations, or through watching others

perform the job. Teacher development helps build and maintain morale of the teaching staff members, and is thought to attract higher quality teachers to the school as an organization.

Teacher development, according to the Encyclopaedia Britannica (Hardy, 1973:741), refers to the policies and procedures designed to equip prospective teachers with the knowledge, attitudes, behaviours and skills they require to perform their tasks effectively in the classroom, school and wider community. Teacher development is divided into (i) initial teacher training, which refers to a pre-service course before entering the classroom as a fully responsible teacher; (ii) an induction process of providing training and support during the first few years of teaching or the first year in a particular school; and (iii) teacher development or continuous professional development (CPD), which refers to an in-service process for practising teachers. The latter is the process by which teachers reflect upon their competencies, which keeps them up to date, and fosters further development. The encyclopaedia extends the meaning of teacher development by stating that continuous professional development activities should be spread over time; be collaborative; use active learning; be delivered to groups of teachers; include periods of practice, coaching, and follow-up; promote reflective practice; encourage experimentation; and respond to teachers' needs for them to be effective.

Wilmshurst and Linda (2002:131) suggests that teacher development refers to an ideologically, attitudinally, intellectually and epistemologically based stance on the part of an individual in relation to the practice of the profession to which s/he belongs, and which influences her/his professional practice. Teacher development thus is a process whereby teachers' professionality and professionalism may be considered to be enhanced. Development means change and growth. Teacher development is the process of becoming the best kind of teacher that one can be.

When people use the term 'teacher development', they usually mean a formal process such as a conference, seminar, or workshop; collaborative learning among members of a work team; or a course at a college or university. However, teacher development also can occur in informal contexts such as discussions among colleagues, independent reading and research, observations of a colleague's work, or other learning from a peer, as posited by Hayes (2010:5).

2. 7 LITERATURE REVIEW ON ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

As I have already stated, the aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. In order to achieve the aim of the study, it would be appropriate to observe the best practices around the world.

2. 7. 1 The challenges facing teacher development programmes in the teaching of agricultural sciences

Teacher development is a well-discussed topic in recent literature, but very little is said about the development of teachers responsible for agricultural sciences in schools, although unique challenges face these teachers. These challenges include curriculum requirements and aims of teaching, a certain reluctance to implement Continuous Professional Teacher Development in schools, remuneration issues, a lack of access to higher education programmes in agriculture, and the inadequate supply of quality agricultural sciences teachers at school.

,

2.7.1.1 Meeting the curriculum requirements and aims of teaching Agricultural Sciences at school.

According to Ono and Ferreira (2010:59), the introduction of Outcomes-Based Education (OBE) and Curriculum 2005 (C2005) was an unprecedented curriculum reform in the history of South African education. However, at the time, there was a huge gap between the aims of OBE and C2005 and what the majority of teachers had been trained for. Because OBE differs from previous practice, one would imagine that intensive and extensive professional development of teachers would be necessary to prepare teachers for the implementation of OBE, yet the training of teachers for OBE has been far from adequate. Rather than mount a costly and complex series of professional development actions, the Department of Education introduced a "cascade" model through which teachers were trained and in turn had to pass their knowledge on to their colleagues. Teachers frequently complained, though, that even the district trainers themselves did not always understand the curriculum, as suggested by Yumiko.

Balschweid (2008:25) highlights that when teaching a unique curriculum, any conclusions made should be carefully considered before transferring information to the learners. A challenging task in teaching an advanced science course is that teachers do not use much of the knowledge they learned in college, and it requires additional effort for them to review and brush up on the advanced science concepts related to agricultural sciences. However, Scales, Terry, and Torres (2006:110) posits that the profile of the typical agriculture instructor should be considered when designing and delivering pre-service and in-service programmes. Some teachers are not sufficiently confident to teach all the concepts of science that are related to agricultural education, as sometimes they have not had the required training. Therefore, this should be used as the premise and rationale for designing continuous professional teacher development (CPTD) programmes geared to increase the effectiveness of teachers teaching agricultural sciences.

It is clear, according to Parker, Kolle, Harris, Murdock, Harris and Artist (2011:77) that modern life and work environments require far more than thinking skills and content knowledge. The ability to navigate the complex life and work environments in the globally competitive information age requires teachers to pay rigorous attention to developing adequate life and career skills in the teaching of agricultural sciences. In support of this view, Mirra and Morrell (2011:57) argues that teaching, while historically not considered as scholarly as research, is complex and diverse. Myers, and Thompson (2009:120) indicates that teachers who have the ability to integrate science in their teaching, could experience an increase in enrolment of students in Agri-science. According to Myers, and Thompson (2009:120), enrolment of, specifically, high-achieving students in agricultural science, is the direct result of integrating science in the agricultural education curriculum.

In this regard, Foutz, Navarro, Hill, Miller and Thompson (2011: 30) recommends that agricultural sciences teachers could adopt the use of a farm subdivision theme to engage students in interdisciplinary activities and to help demonstrate the practical use of course material. The use of a workshop to help teachers develop lesson plans will help increase the teachers' content knowledge of accounting, mathematics and physical sciences as required in the teaching of agricultural sciences at school. The strategy of utilising agricultural engineering issues in enhancing teacher development through the integration of physical sciences and mathematics topics and for vertical and horizontal alignment of the accounting, physical sciences and mathematics curricula also might be successful.

Thomson (2007: 9) posits that teacher education programmes can have a dynamic impact on helping teachers develop the pedagogical and technical skills to increase the science content in the agricultural education curriculum. In his study a majority of the teachers indicated that teacher preparation programmes should provide instruction on how to integrate science both at the pre-service and in-service levels, and that student teachers should be placed with a cooperating teacher that ought to make concerted efforts to integrate science in the curriculum. The results of his study indicated that science and agriculture teachers were of the opinion that teacher education programmes in science and agriculture should model collaboration by teaching a course that would help future teachers in science and agriculture learn how to teach collaboratively.

In view of the above suggestions, it is worthwhile to take note of Thoron's (2011:103) observation that the transition from former teaching methods and to embrace innovative teaching strategies is a process that is experienced differently by teachers. This transition depends on teacher knowledge and their willingness to adapt, and to not being or wanting to be the central focus of the classroom. Agricultural sciences teachers can play an integrating role in their school community and perhaps then will be seen as an integral part of the school's success. Teacher education programmes should instil a desire for pre-service teachers to collaborate with their agricultural sciences teacher peers.

As indicated in Chapter one (*cf 1.2*), even after the inception of CAPS in 2011 by the Department of Education, South Africa still lacks teachers who have specialized in teaching agricultural sciences at school. A challenge still exists for some teachers to meet the curriculum requirements and aims of teaching the specified subjects. Some school-based departmental heads have no interest in providing school-based continuous teacher development and support, since they are not employed to manage the allocated subject at school (*cf 1.2*).

2.7.1.2 Reluctance in implementing Continuous Professional Teacher Development (CPTD) programmes for agricultural sciences teachers at school

The problem under study is exacerbated by an inadequate number of subject advisors who are expected to provide continuous teacher development and support to a large number of schools that offer agricultural sciences.

As stated by McCrickerd (2012:64), teaching effectiveness should be understood as a skill that needs to be developed through practice and working in a supportive environment. Schools can work towards establishing a campus atmosphere in which continual improvement in all areas is sought and not avoided. Madlela (2015:356) advises that Information and Communication Technology opportunities (ICT) should be utilized by supervisors to implement developmental programmes. These opportunities could be used to assess beginner teachers' teaching in class. I want to submit that some supervisors are reluctant to use these, especially when they are supposed to submit professional development (PD) points to the South African Council of Educators (SACE).

In this regard, Pool (2013:469) posits that the unique situation within the South African school system requires an equally unique and enhanced model for pre-service training of agricultural sciences teachers to be able to function effectively in a variety of contexts. She further

postulates that when one looks critically at the shortcomings; for example too much focus on theory and less focus in hands on practical; in training, a question can be asked as to whether the pre-service training programmes are fulfilling the purpose of agricultural sciences teacher training. Shortcomings in pre- and in-service training need to be addressed in order to improve agricultural sciences teacher training. I concur with Komba and Chiwamba (2016:107) who indicates that a congruency should exist between the contents student teachers cover during their studies at higher education institutions and the contents of the secondary school curricula. However, some student teachers maintain that the contents of some courses taught at the university do not have a link with what is taught in secondary schools, and hence are regarded inapplicable. Needs analyses in this regard will help determine if the existing programmes adequately address the needs of the teaching profession for which the student teachers are prepared.

With reference to the above opinion, Famiwole (2013:126) posits that teacher's perceptions play an important roles in the learning process and curricula implementation in schools. The teaching of agricultural science needs improvement; to this end evaluation is required to appraise vocational agricultural effectiveness. The contents related to agricultural experience programmes are found in the agricultural curriculum in Nigerian schools, but the teaching and learning of agricultural sciences has not as yet been vocationally oriented. Vocational agricultural education is not completed without a supervised agricultural experience programme. There is an urgent need to address these shortcomings in order to encourage learning by doing and skills development through the experiential activities of CPTD and IQMS.

According to Shaw (2016:1115), for generations things have remained the same; now education is moving at a swift pace with changes every year. This mirrors the way the world is changing and we need to be ready to adapt. For those who are training the professionals of the future this is a daunting task but in order to do it effectively, universities need to ensure that they successfully marry up the two worlds of academic study and professional craft. They need also to ensure that quality measures, devised to assess craft skills and reduce everything to simple numerical data, do not become the drivers of academic standards. Students need to be given clear sets of skills in order to become good practitioners; they also still need safe spaces to question transmitted information, challenge the status quo and continually reflect on how, when and where this is or is not acceptable.

However, Qing and Christopher (2013:40) argues that a central task for all concerned with enhancing quality and standards in schools, is not only to have a better understanding of what influences teachers' resilience over the course of a career, but also the means by which the required resilience can to be sustained, and may be nurtured and developed in the contexts in which they work and live. In view of the above, Mahon, Farrell, and McDonagh (2010:117) indicates that the approach to delivering participatory extension programmes in Ireland continued to be based on a top-down, goal-driven strategy. This has resulted in advisers' engagement in adaptive practices that have effectively precluded participatory methods. Failure to take account of the fundamentally different set of conditions required for a participatory model of extension thus has been instrumental in the implementation of developmental efforts in a way that was not intended. Mahon et al (2017) further argues that the apparent lack of clear and reliable paths of communication between senior management and advisors, which would have established the advisors' understanding of and reservations about participatory approaches. This also contributes to the challenges to be faced in instituting a participatory form of teacher development.

According to Zehetmeier (2014:193), when discussing and researching professional development programmes' sustainable impact, the fostering and hindering factors are playing the central role. Knowing these factors and being sensitive for them are prerequisite for any conceptualization, implementation and evaluation of future professional development programmes which aim at sustainable impact.

2.7.1.3 The influence of economic salary options between the private and public sector

According to the South African Council of Educators (SACE, 2010: 24), there is a combination of factors that lead to a skewed supply of teachers. These factors range from economic salary options where in business and industry salaries are more attractive for certain categories of teachers, level of participation in a subject area at school level from the pool of potential teachers, and working and living conditions in certain geographical areas or schools. This could lead to teachers being abundant in some learning areas, while there is demand in others like agricultural sciences. Many countries consistently experience shortages in agricultural sciences related learning areas, while experiencing an oversupply in humanities and social studies. Indicating that the South African challenge is not unique we just have to find innovative ways of dealing with excess demand in these learning areas, according to SACE.

According to the report of the World Economic Forum (WEF, 2015:15), public and private sectors alike should continue to look for partnership opportunities. There is also momentum now behind an agenda for change regarding how the global community will respond to educational challenges in the future. The challenge is to translate this passion and commitment into public-private collaboration models that are better prepared to engage collectively when the need arises. I think this collaboration may in future respond to the challenge above if we put all hands on deck.

Nevertheless, it is clearly explicated by the International Monetary Fund (IMF, 2016:5) that wage bill spending can impact the fiscal balance and the composition of government expenditures. If not effectively integrated in budget planning, high or increasing wage bills can undermine fiscal planning. In addition, raising government wages or boosting hiring during cyclical upturns can exacerbate output fluctuations by further stimulating demand, hindering the stabilizing role of fiscal policy and ratcheting up public debt during the downturn as compensation increases often are hard to reverse. High compensation spending also can crowd out priority spending on public infrastructure and social protection, crucial for economic growth and poverty reduction. We can see from this report that the challenge of remuneration could take longer to solve than it could be imagined to surface.

However, one is sensitized that in practice, calculating the job security premium is more involved because neither private nor public sector jobs have perfect job security (Biggs, 2014:52). In both cases there is the chance of dismissal, but state government employees have a significantly lower chance of becoming unemployed. According to ÄIJÄLÄ (2001:28-29), improving the image of the public sector is one of the most important challenges faced by countries. Public organizations must become attractive and desired workplaces. This requires a comprehensive investment in building a positive and credible image of public sector work and working conditions. The image of an old-fashioned and boring public service must be broken down. Since individuals generally respond more positively to individual agencies than to the public employer in evaluations, perhaps more emphasis should be placed on identifying

public sector employers to the public. There is a need for systems that take into account work requirements as well as individual capacity, competence and performance. New incentives also should be created in addition to salary. This is a new area, and one which requires particular attention, especially in South Africa.

In view of the above one tends to agree with Curristine (2007:33) who argues that functional and political decentralization to sub-national governments improves certain human resource management practices and increases the scale of operations which contributes to the improvement of efficiency. This information is essential for improving performance. Countries continue to struggle with aspects of these reforms, and a key issue is improving. There is a clearer understanding of the need to see public policy and government actions in terms of achieving results. As long as citizens demand results from their governments for their tax, there will be a continuing need for performance information, though a long-term approach and patience are necessary when countries go down this road.

2.7.1.4 Lack of access to higher agriculture education programmes

As indicated in the report issued by the Department of Agriculture, Forestry and Fisheries of South Africa (DOA, 2007:2), human capital in agriculture is especially important, as the shortage of trained human resources is a major limiting factor to development. One of the main challenges that constrain quality provision of Agricultural Education and Training (AET) in South Africa is a lack of access to training opportunities, mostly experienced by previously marginalized groups. The Department of Agriculture in South Africa maintains that recent studies in Agricultural Education and Training in Sub-Saharan Africa suggest that many agricultural education curricula have shortcomings as they are unresponsive to socio-economic, technological, physical and environmental changes in the rural sector and are inappropriate for their local contexts. Furthermore, many curricula for both formal and non-formal AET do not involve any form of systematic training needs analysis and often adopt delivery modes and mechanisms that fail to suit the reality of the situation of people in their community context. Generally the improvement of a country's human resource capacity for productivity is a prerequisite for social, economic and technological development. Thus both formal and non-formal education is essential for enhancing teacher development in the teaching of agricultural sciences and rural development.

According to the National Plan for Higher Education in South Africa (DOE, 2001:80), if the higher education system is to become a key engine for reconstruction and development, it is imperative that it be restructured to enable it to fulfil this critical role. The challenge of restructuring opens new possibilities and horizons for creativity and innovation. One of the main obstacles to implementation of the plan is the lack of capacity, both systemic and institutional. The challenge now is to secure the commitment of all the constituencies in higher education and the community more generally in support of this National Plan and to ensure calm and stability on our campuses, which is a precondition for the successful implementation of this National Plan.

To exacerbate this situation, the Department of Higher Education and Training, (DHET, 2012:48-49), reports that the current depressed global financial climate further reduces the options of policymakers and funders with regard to increasing the number of people, particularly from disadvantaged groups, with access to higher education. Free university education for the poor goes to the heart of social justice. In the South African society overall,

high unemployment, a widening gulf between the haves and the have nots, and rising levels of service delivery and other protests, make structural and institutional change imperative. A system of free university education for the poor could go a long way towards increasing both access to and the quality of higher education and in so doing would help to tackle unemployment and poverty, reduce inequality and deepen democracy. The above challenge is problematic, since households of poor students will not be able to share in any of the costs associated with university study, and even the households of slightly less poor students will be able to contribute only a small portion, as posited in the report. According to Manik (2015: 240), the ball will remain in the court of public higher education institutions who will have to continue in their quest to find creative ways to serve an ace or a series of aces that can work towards reducing student dropout and promoting higher throughput levels for which they will gain recognition as students graduate on time.

Gardiner (2008:29-30) points out that the same outcomes are expected from schools that operate under very different circumstances. Equal treatment of teachers from unequal work backgrounds is likely to maintain inequality. More thought should be given to priorities, and better policy direction is required to address the needs of teacher education programmes to ensure access in rural areas.

Africa is the world's most youthful continent with some 200 million young people between ages 15 and 24. Finding productive jobs for young people is critical to the continent's future. An educated and skilled population is attractive to many employers and investors. Many employers across Africa have been critical of the lack of basic, technical and transferable skills of graduates. Strong education systems are key drivers of economic growth in African nations. The quality of secondary, vocational or technical and higher education often is measured by the performance of workers in the labour market. That is why the African education system must be strengthened to absorb the entry of millions of African young people into the national and global workforce according to the Africa-America Institute report (AAI, 2015:13).

According to Dumm and Lenson (2009: 56), a simple explanation does not exist for the attainment and satisfaction gap between black teachers and their white peers, as it is a complex issue with a range of causal factors. Improving the experiences of black students and helping to close the attainment gap in education require commitment and a willingness to critically reflect on current practices, perceptions and thinking. It may take time to change everyday practices and adopt new policies and attitudes, but the satisfaction and attainment gaps will only be fully addressed by shifting the culture within an institution and tackling institutional racism.

We can conclude that a lack of access to higher education is problematic by adopting sentiments stated in the European Commission Report on new modes of learning and teaching in higher education (EC, 2014:34). This Report posits that the current models of higher education funding and tuition fee regimes in many European countries do not promote the development of online-delivered programmes and, in some cases, act as a barrier. This manifests in a number of ways. First, funding models in the majority of countries are predominantly linked to the numbers of traditional students in traditional courses. This means that an institution will not receive public funding for students taking an online course, giving the institution no financial incentive to increase its on-line offering. This has always been a disincentive for already established modes of distance and flexible learning, and even for part-time studies.

2.7.1.5 Inadequate supply of quality agricultural sciences teachers at school

As Pickett, and Wilkinson (2015:23) posits, few developing countries have implemented strong, effective policies, strategies or programmes that are aligned with the international evidence for attracting, recruiting, developing and retaining sufficient numbers of quality teachers. This is largely a fiscal problem, given that ensuring an adequate supply of quality teachers requires monetary resources that many countries do not presently have and are unlikely to get in the near future. In addition, policies of reform can be complicated in that reform may take many years to show results.

According to Darko, Offei-Ansah, Shouqi, and LIU, Jun-ping (2015:19) and supporting the above view, motivational factors such as one's own interest, having a role model, future ambitions and the supply of adequate textbooks positively affect the teaching and learning of agricultural science at school. For an effective and efficient delivery of agricultural science lessons, the support and facilitation of a teacher with a sound background is necessary. The teacher should be professionally trained and his/her area of expertise must be agricultural science. Darko, Offei-Ansah, Shouqi, and LIU, Jun-ping (2015:19) further maintains that teaching and learning agricultural science in the public senior high schools are facing challenges. These include frequent use of the lecturing method in teaching since teachers are under pressure to complete the syllabus, large class sizes, poor remuneration and little motivation for teachers. Other stumbling blocks include inadequate teaching and learning resources and their unavailability, difficulty in planning field trips, as well as laziness and absenteeism on the part teachers.

However, Lawrence (2015:86-87) indicates that most of the required instructional resources for teaching and learning of agricultural science may not be available, especially in animal production in both public and private secondary schools in the Ankpa zone in Kogi, Nigeria. Some simple farm tools, consumable resources and printed materials to some level could be utilized fairly well, others are underutilized. According to Lawrence (2015:86-87), it probably might be because of the inadequacies or unavailability and ineffective utilization of instructional resources in teaching that students of agricultural science exiting secondary schools are not sufficiently equipped for jobs in various areas of agriculture. This results in mass unemployment among the youth. Some factors could constrain the availability and utilization of instructional resources in public and private schools, yet certain measures such as improvisation, use of qualified teachers, organization of seminars and workshops, as well as adequate funding of schools could be used to improve the availability and utilization of these instructional resources in public and private schools.

In Kenya, Atieno (2014:74-75) indicates that in some schools physical facilities are inadequate, small and in poor condition, and inadequate recreational facilities are hampering adequate supply of high quality teachers. Poor facilities or a lack of facilities has a negative influence on teacher practices. Teaching and learning materials tend to be inadequate and minimally shared, especially in the compulsory subjects. Human resources also is a serious concern, since enrolment in the schools increases annually, leading to inadequate curriculum supervision and implementation in schools. Funds released by the government to finance free secondary education were inadequate, and also were not released on time; some school principals then are compelled to procure goods on credit or shelve some projects, which ensues in charging levies on parents to meet the costs of the purchase of school resources (Atieno, 2014).

In view of the above one can conclude that an inadequate supply of quality agricultural sciences teachers and facilities, as well as materials remains a problematic issue facing the teaching of agricultural sciences at school.

2.7.2 Solutions that will address challenges experienced during teacher development in the teaching of agricultural sciences

Studies reported in literature contain various recommendations on how to respond to the challenges facing agricultural education. To meet curriculum requirements and ensure that the aims of agricultural education are achieved, innovative approaches must be identified to improve facilities, enhance teachers' skills, support teacher development, and retain teachers are among some of the most urgent challenges. Possible solutions which may be applicable to agricultural education in South Africa require attention.

2.7.2.1 Approaches that meet the curriculum requirements and aims of teaching agricultural sciences at school

Curriculum requirements and the aims of teaching agricultural sciences need to include the use of integrated place-based institutions (Jordan, 2013:194). These, according to Jordan (2013), will support the coordinated innovation and enterprise development needed to increase agricultural outputs from existing lands, while meeting high performance standards in economic, environmental, and social terms. In this study on *Landlabs,* conducted in the USA, active engagement with a wide range of interested parties occurs via various marketing, learning, and outreach efforts. A group of individuals who are willing to provide ongoing organisation and integration is the key to this model. New approaches to agricultural science education will complement the deep knowledge of a scientific discipline that is the hallmark of skilled leaders in response to the challenges and opportunities of contemporary agriculture (Jordan, 2013).

Torrise (2010:20) states that school libraries can be used to create opportunities for teaching educators to learn 21st century skills. Teachers could be assisted to identify critical resources that would empower them to make meaningful, sustainable changes in their career. According to Torrise (2010:20), teachers should be assisted in creating lessons by means of which agricultural sciences could be learned through the study of real world issues that affect people's own health and well-being. The teaching of these skills could be integrated in ways that would allow teachers to create and share new knowledge that is meaningful, culturally relevant, and ultimately life changing.

2.7.2.2 Effective implementation of CPTD programmes for agricultural sciences teachers at school.

Holmes (2013:106-107) suggests that online learning communities are used to support groups of learners to collaborate, critically reflect and develop shared meaning with peers. Teachers' continuous professional development (CPD) is one area where such communities are seen as offering valuable opportunities for authentic and personalised learning, informal exchange of good practice and peer learning. Teachers' online learning communities have emerged as an attractive alternative to traditional face-to-face training courses. They allow teachers to apply what they are learning to their everyday teaching practice as they learn, and to discuss their

experiences with peers. However, Okseon and Choi (2015:622) argues that changes in teachers' practice depend on changes in their knowledge, beliefs, and attitudes, the effects of CPTD programmes may be different for teachers with different preconceived notions of responsibility, and different beliefs and attitudes regarding the empowerment based CPTD philosophy.

2.7.2.3 Approaches towards retaining agricultural sciences teachers within the public sector

Rhodes and Brundrett (2012:29) argues that retention as a key component of talent management is likely to be important in the management and maintenance of existing talent pools and hence in the continuing commitment of talented individuals within schools, as well as in efforts to develop and expand talent pools as a new source of candidates for vacant leadership roles. Bland (2014:7-8) warns that better screening of applicants will help schools to improve their workforce considerably. However, even districts which are extremely efficient in hiring will invariably from time to time hire some teachers who do not perform well in the classroom. Although it is politically and financially costly to dismiss existing teachers, it is easier to distinguish between effective and ineffective teachers once they start teaching than to predict which teachers will be effective. While money does talk, it is the entire quality of the work experience that ultimately tells a teacher whether to stay or go.

2.7.2.4 Maximizing teacher participation in alternatives to higher agriculture education

According to Coker and Porter (2015:70), each experiential learning opportunity should be delivered in a way that helps teachers develop a broad range of knowledge and skills in research, problem solving, communication, empathy, and so forth, and it should be described accordingly. This enables teachers of agricultural sciences to maximize their learning, transfer that learning to other situations, and frame their experiences for postgraduate opportunities. Chupp (2010: 206) adds that well-designed activities for reflection on their experiences, including individual reflection, group discussions, and intergroup discussions that ideally should include community members, should be available to these teachers. Service activities should be designed, not just for modest, one-time contributions of assistance, but for more sustained and impactful change.

As stated by Bartle (2015: 7), individuals will need to be able to navigate a rapidly shifting landscape and critically reflect on the knowledge and skills they need to adapt to multiple situations. Experiential education, which is focused on learning through connection and collaboration through constant critical reflection, lends itself to developing these skills in individuals. Palmon, Cathcart, Lembeck, and Peterson (2015: 7) argues that service learning and community service programmes in schools may promote teacher engagement and bolster attempts to reduce school drop-out, particularly for at-risk or struggling learners. Additional benefits include improved teacher leadership skills and increased appreciation for community needs and civic responsibility and engagement.

2.7.2.5 Creating partnerships between agricultural sciences teachers and professionals with unique skills in teaching support

According to Eleonora (2003:143), an alignment is needed between the content of teacher professional development programmes and their delivery. Traditional teaching methods have been proved to be less successful in teaching agricultural sciences. Memorization, lectures and teacher-centred classes are less effective than teaching for understanding, focusing instruction on the students and making teachers learn from each other. Nevertheless, most in-service teacher training programmes are taught in a traditional way, without obliging teachers to participate in the workshop and learn new pedagogy through group discussions. Staff development must model constructivist practices for teachers if those teachers are expected to be convinced of the validity of those practices and to understand them sufficiently well to make the practices an integral part of their classroom repertoires (Eleonora, 2003).

Agro-economy-based nations rarely experience food insecurity. Such nations have already set machinery in motion towards achieving one of the Millennium Development Goals (MDGs), which emphasizes eradicating extreme poverty and hunger. This could be the major reason why developing nations like Nigeria, that has been a mono-economy-based nation, is leaving no stones unturned to restore and reposition its agricultural sector. Introduction of agricultural sciences and effective teacher development programmes in secondary school curricula in Nigeria is a worthwhile effort towards adequate food security by equipping the greater percentage of their youth to become producers in the agricultural field (Modebelu and Nwakpadolu, 2013:161). Agriculture now seems sustainable, because everybody is involved, everybody has an interest and it appears to be everybody's major source of family sustenance. The unemployment figure is the lowest it has been for over a century, due to less interest in white collar jobs (Modebelu and Nwakpadolu, 2013).

2.7.3 Conditions required for realizing the aim of the study

In the paragraphs below this report will focus on the optimum conditions for enhancing teacher development for the teaching of agricultural sciences.

2.7.3.1 Understanding the agricultural sciences subject curriculum

According to Saunders, Brumm, Brooke, Mickelson and Freeman (2013:14), assisting learners to achieve learning outcomes requires that the curriculum, instruction, and assessment should be aligned. Collaborative assessment protocol (CAP) can assist with this alignment process. According to this protocol, teachers discuss pieces of learners' work, and notice integration and opportunities for growth. I fully concur with Saunders et al (2013) in this regard in view of the nature of the subject agricultural sciences. In the light of this notion, O'Siochru and Norton (2014:202-204) argues that epistemic match is an indicator of the balance between the learner and agricultural sciences and a reliable predictor of performance. Epistemic matches can make a valuable contribution towards helping learners to achieve their potential in terms of performance in higher education. These views are in concurrence with Thoron, Myers and Abrams' (2011: 96-102) opinion that the transition from former teaching methods is a process that is experienced differently by teachers. The transition must be based on knowledge and a

willingness to make the change from teaching by being, or wanting to be, the central focus of the classroom to student-centred teaching.

According to studies conducted on behalf of the United Nations Children's Fund (UNICEF) REAP project, the use of teacher-centred teaching should be discouraged. Teacher-centred methods imply limited participatory methods; rather a learner-centred pedagogy must be promoted that encourages student teachers to be active in their own learning process and to use experiential learning, interaction, group work or other forms of collaboration among learners, together with the use of methods that promote critical thinking, questioning and reflection on own experience. A teacher-centred approach often is linked to the fact that many university educators have limited experience themselves of working with these approaches, or working directly with children. Pedagogy is crucial to pre-service teachers and in-service teachers, and ought to include advanced skills covering support teachers in mainstream schools who wish to gain specialist skills for teaching pupils with special needs, such as autism spectrum disorders (ASD); dyslexia or specific learning difficulties (SpLD); speech, language and communication needs (SLCN); behavioural, emotional and social difficulties (BESD); and moderate learning difficulties (MLD). Such support should be available to leaders and teacher educators at all levels. It is the thread that links effective inclusive education with all children with disabilities (Richard, 2013:66).

2.7.3.2 Organising and assessment of data generated during developmental workshops

As Liakopoulou (2012:52-53) demonstrates, pre-service teachers find it difficult during their field experience to reflect on their teaching and when they do so, their reflection focuses on very specific topics. According to Liakopoulou (2012), most pre-service teachers are engaged in technocratic reflection about the planning and implementation of their teaching plans; some try to analyse their educational processes based on theory or interpretative reflection, and very few engage in critical reflection. Often students are not ready to accept criticism or engage in self-critique about their teaching, probably because it dissolves their self-esteem. However, Bozdogan (2015: 40) argues that some of the pre-service teachers have never participated in agricultural field trips, while others have joined these trips only during their university years. It is considered that with regard to professional development, such opportunities should occur based on their preferences for trip sites suitable to the content of the courses which they study at the developmental workshop. Dagenais (2017:10) recommends that post-workshop action plans should be developed based on concrete actions to be taken after the workshop. It also is added that teachers need to be offered the support of a knowledge broker after the workshop. Such a broker can help with organising district meetings, workshops or training sessions, and advocacy preparation.

It thus is necessary that data must be generated during teacher development workshops, and organised, analysed and assessed, in order for teachers to be able to apply all of the above identified forms of reflection. Collaboration, either in the form of teaching in pairs or collaboration between the student and the teacher in class, will contribute to the feedback required by students.

Van (2009:9) posits that the development of teachers in the teaching of agricultural sciences often is determined by their interest in and enthusiasm for the material used in the training workshops, the level of their persistence with the teaching tasks, and the level of their concentration and enjoyment. This type of involvement is something that cannot be imposed;

it must come from the materials and programmes that are implemented in the teacher training workshops.

As a teacher in South Africa, I observed that the South African Council for Educators (SACE), as statutory body for professional educators, has the overall responsibility for the implementation, management and quality assurance of the Continuous Professional Teacher Development (CPTD) Management System. In the light of this, SACE has started rolling out the CPTD Management System to the Principals and Deputy Principals as the first cohort from the beginning of 2014. During 2014 all school heads of departments (HODs) – who also constituted the second cohort – went through the CPTD orientation and sign-up process and started earning professional development points from self-initiated, school-initiated and externally initiated professional development programmes / activities from January 2015. SACE is phasing in the implementation of the CPTD Management System with the support of the Department of Basic Education, nine Provincial Education Departments (PEDs), all teacher unions, independent schools' associations/employing bodies, school governing bodies' associations, the higher education sector, providers of professional development programmes / activities and other stakeholders. However, there is observable reluctance in the implementation of CPTD by some schools. The PLC model currently is being adopted for the development of teachers in mathematics, especially those teaching from Grade four to Grade nine. But still this model is not yet used for enhancing teacher development in the teaching of agricultural sciences.

2.7.3.3 Regular reflection sessions between agricultural sciences teachers and agri-business partners in education

PAR (participatory action research) involves planning, performance, observation and reflection. For purposes of the study, these types of projects may take place in collaboration between agricultural sciences teachers and other partners in agricultural education. Teacher development programmes should instil a desire for pre-service teachers to collaborate with their science teacher peers. If this occurs regularly, the agricultural sciences curriculum would be understood better.

Abbasi (2013: 515) maintains that transformational leadership, organisational culture and organisational learning contribute greatly to enhancing the performance of agricultural businesses and aiding in leading them to become learning organisations for school-based teachers of agricultural sciences. Supervisors should motivate teachers, departmental members and other teachers to understand and realise internal and external complexities through creation and acquisition of new agricultural knowledge. Stakeholders should collectively define a transparent vision and share it with the teachers regularly, and assist with the dissemination, sharing and application of this knowledge along with improvement of the current activities of the school-based agricultural sciences departments. In support of these sentiments, Lewis, Oliver, R. and Oliver, M (2017: 35) indicates that agriculture is one of the most important export sectors in some countries, and as a result, it is critical to have local experts to work in the laboratory and field, and also a population that understands the issues faced by farmers. Lewis et al (2017) further posits that despite its economic importance, agricultural science is rarely taught by subject specialists in some schools.

The ontological perspectives discussed above dictate, as a condition for the support of teaching that reflection sessions should occur between those commissioned to proffer agricultural

sciences at school and agri-business partners in teacher development on a regular basis. It thus may be agreed that learning in an agri-business as a teacher makes sense in enhancing teacher development in the teaching of agricultural sciences.

As suggested by Caena (2011:9), teachers' empowerment through collaboration is important, as is the development of school cultures valuing shared responsibilities and values, revolving round the concept of a professional learning community (PLC) as happens in Europe. PLCs are characterized by dimensions such as a focus on student learning, as well as shared values, collective responsibility, reflective professional inquiry, collaboration, group and individual learning. The PLC model is based on the idea of knowledge and learning as embedded in social contexts and experiences, and promoted through interactive, reflective exchanges; the assumption that participation in a PLC leads to changes in teaching practices and enhancement of student learning. Participation in a PLC ensues in improvement in teaching practices, teaching culture, continuous teacher learning, and the focus on student learning, which seems to qualify as a key element of successful PLCs. PLCs are characterized by a cooperative climate and evaluation and feedback mechanisms. However, a need for more rigorous and robust evidence exists to prove claims that continuing professional development (CPD) in schools sustains improvement and student learning enhancement, since the knowledge base on conditions for teacher learning in the workplace appears fragmentary and heterogeneous. The reason for this is that concepts, methods and instruments used in PLCs are not standardised, thus increasing the difficulty of testing complex multi-level models about the impact of teacher learning. Such complex models is required to understand the dynamic, recursive links between conditions and effects in order to decide whether collaboration, leadership, teamwork and active participation in the PLC turn out to be input, throughput or outcomes of learning processes.

2.7.4 **Possible threats to teacher development in the teaching of agricultural sciences and ways to circumvent these**

Various factors pose a threat to teacher development or continuing professional development of teachers, especially teachers of agricultural sciences in schools in South Africa. Some of the factors impacting teacher development most are discussed with possible ways in which to overcome these hurdles.

2.7.4.1 Lack of teacher motivation sessions for agricultural sciences teachers

A notable threat to teacher development is a lack of motivation on the side of the teachers. However, an array of methods to turn this around or to prevent it from happening exists. As Tulbure, "Samfira, E. M and Samfira, I (2015:197) posits, by using the instruction and evaluation methodology, and by acknowledging teachers' personality traits and adapting the contents of development programmes to the individuals' specific needs, teacher developers can succeed in motivating the teachers of agricultural sciences to attend and participate in teacher development programmes and/or sessions. Meti (2013:411) explains that training is an important component of teacher development and it is only through systematic instruction by which the desired knowledge, proficiency, attitude and ideas can be inculcated and reinforced in schools. Training helps the teachers of agricultural sciences to acquire knowledge and required skills to perform their work and to make positive changes in their attitude towards performance. Training should support the school's vision and mission by ensuring that the right people with the right skills are in the right place at the right time. Tulbure (2015) explicates that institutions of higher learning should be involved during teacher development sessions organised for

schools by education districts, as these are specialists in the pre-service teacher training programmes.

In support of teachers' training as discussed, Beighton (2014:30-40) argues that because teacher performance is measured against a set of criteria which develops in line with performance itself, the process of measuring teacher performance never reaches the goals it sets itself as prescribed in some teacher development manuals. Application of this process to schools and systems is such that some schools and some education districts themselves are quick to make individual teachers responsible for learner performance, data and statistics, without realising that set criteria cannot be achieved without prior, appropriate and adequate training of the teacher who is expected to perform to the desired satisfaction. This form of humiliation accompanies the necessary failure of a Sisyphean task, installing the fear of criticism as the motive for self-introspection. Measuring performance in terms of a set of criteria simply turns teachers into machines. The criteria used to measure professionalism also ensure that the process of achieving these goals is never actually complete. Professionals, in this sense, are judged on the basis of criteria according to which they might be inadequate. According to many benchmarking practices, success is based on socially acceptable behaviours and technically unattainable.

2.7.4.2 Lack of access to the use of ICT facilities at school

Bozkurt (2016:463) argues that supportive attitudes alone are not sufficient to motivate teachers to participate in developmental activities. He further indicates that the challenge for training programmes and placement in schools is to ensure sufficient support and resources in order to provide agricultural sciences teachers with an appropriate context in which they can develop their ICT pedagogical skills and exploit ICT more fully. In support of this, Alemu (2015: no page) asserts that education is a very socially oriented activity and quality education has traditionally been associated with strong agricultural sciences teachers having high degrees of personal contact with learners and technologies. Information and Communication Technologies (ICTs) have become commonplace entities in all aspects of life. The use of ICT in education lends itself to more student-centred learning settings and often this creates some tension for some teachers and learners. Eze (2015:199) suggests that, understanding the skills needed by the next generation of professionals is a key topic with which both employers and educators need to engage.

2.7.4.3 Misappropriation of school funds allocated to enhancing the teaching of agricultural sciences at school

In one sense, it can be seen that problems of teacher quality in Australia begin and end in the schools themselves in a kind of vicious cycle. Poorly educated school students become poorly educated teachers, incapable of improving the learning of their students. This cycle can be broken if sufficient numbers of talented people are found and attracted to teach in schools (Elizabeth, 2015:23). Teaching often is seen as a second-class occupation for people whose academic results are not good enough to allow them entry to more prestigious careers like law or engineering. Teaching often fails to attract the right balance of men and women and find a good mix of applicants from disadvantaged backgrounds or conflict-affected areas (Hajer, Nilsson, Raworth, Bakker, Berkhout, De-Boer, Rockström, Ludwig, and Kok, 2015:23).

I think school leaders need to direct the financial resources of the school in teacher development programmes in amplification of the above situation.

An aspect that could threaten successful enhancement of teacher development in the teaching of agricultural sciences is indicated by Camilus (2014:13), who maintains that even when a government (for example, in Nigeria), as a stakeholder in education reform, establishes new school farms, equips libraries with adequate agricultural science textbooks and provides well-equipped laboratories, if the teachers are not motivated through an adequate financial reward structure which encompasses salaries and wages, such efforts may not yield required positive results. An adequate financial reward system for teachers of agricultural sciences in schools is an imperative for optimizing work role delivery.

From the time teachers begin with the initial preparation or teaching, provision needs to be made for ongoing development of their subject matter knowledge, concrete skills to teach, observe, assess, and reflect; incentives, and career growth. Effective teachers have different styles and personalities, and are considered effective for varying reasons. In many communities, teachers are considered effective if many of their students attain some of the following: sound academic achievement; an enjoyment of learning, and skills to continue to learn, solve problems, and functionally operate in and contribute to their societies. Effective teachers give students appropriate attention when needs arise (Timperley, 2008:12).

Some teachers are constantly looking for the one best way in which to teach a particular subject, just as states and districts are still after the elusive one best system as evidenced by the Common Core era in the United States. What teacher education students experience in their development programmes is an inordinate focus on procedural step-by-step methods, rather than focusing on conceptual understandings that lead to multiple and even competing forms of methodologies. Searching for the one best way unfortunately reduces critical teaching to prescriptive methodology. The difficulty of writing about critical teaching in terms of methodological practice is that any attempt is really the writing of what cannot be or should not be written. Critical teaching is a way of being in the classroom and not a method of teaching. Effective teaching strategies are necessary, but so is an understanding of the theoretical and political positions that make one outcome more worthy than others (Shudak, 2014:997).

2.7.5 Indicators of success in enhancing teacher development in the teaching of agricultural sciences at school

A myriad of teaching development methods and strategies exists, but how to determine whether they are successful is not always made clear. However, a number of indicators to this end are discussed in literature.

2.7.5.1 Successful compilation and assessment of the CPTD, IQMS and subject-related files for each agricultural sciences teacher

According to Engelbrecht (2016: 281), CPTD takes teachers' teaching environment as well as their experience and existing knowledge into account. Any contextual situation of CPTD should consist of a school perspective which includes material resources and support, and a teacher perspective which includes knowledge and experience. The process is teacher-, knowledge-, skill- and attitude-centred and community-focused. In the light of the above,

Adendorff (2016:141-142) indicates that while teachers have become technically skilled through continuous professional teacher development (CPTD), they also have begun to reflect more rigorously on constructivism as a learning theory. According to the scholarly dialogue among teachers, PLC allows the agricultural sciences teacher to play an active role in developing a personally constructed understanding of the agricultural sciences curriculum through a process of dialogic interchange.

2.7.5.2 Successful organisation; regular updates on and marketing of the agricultural sciences website for the agricultural sciences teacher

According to Nedanov and Žutinić (2015:113), one of the basic prerequisites for increasing the competitiveness of school-based agriculture is production and marketing of organized family farms. Nedanov and Žutinić (2015:113) further contends that experience has shown that cooperatives operate as a successful business model for farmers' organisations and contribute to their competitiveness in the global food market, strengthening the bargaining power in the food supply chain. The marketing proposed by Nedanov and Žutinić (2015) can be made possible through an agricultural sciences website from which teachers may tap to achieve their aims. In this regard, Fritsch (2012:46) suggests that Communities of Practice should be organised by topic areas, called communities, and each area should be overseen by a volunteer facilitator, usually an agricultural sciences educator, who has expertise in that area. Facilitators contribute materials to their communities, make sure questions are answered in a timely manner, and generally ensure their community is running smoothly through the use of the website.

2.7.5.3 Successful establishment and management of effective PLCs, communities of practice and culture-responsive educational programmes for agricultural sciences teachers

As Phiri (2015:95) maintains, a need exists for outside support to teachers involved in cluster teaching or for cluster teaching to interact and incorporate other forms of professional development. Institutions of higher learning could provide short courses on subject content knowledge for practising agricultural sciences teachers that would help other teachers' theoretical understandings of their teaching subjects and techniques to gain more knowledge and understanding of that which they teach and experience within the walls of their classrooms. The education system should play a more visible and supportive role to cluster teaching.

In highly critical classroom situations, teachers have to develop the types of literacy materials and practices that students can use outside school. During developmental processes in highly critical classrooms, teachers learn about issues of importance to individual students, as well as community issues (Jones, 2005:34).

Over a number of years in the teaching profession, I have observed that sustained improvement also depends on teachers developing professional, self-regulatory inquiry skills so that they can collect relevant evidence, use it to inquire into the effectiveness of their teaching, and make continuing adjustments to their practice. Teachers with these crucial self-regulatory skills are able to answer three vital questions: "Where am I going?", "How am I doing?", and "Where to next?" The answer to the "Where am I going?" question is sometimes referenced explicitly to national or state standards; more often it is found in, for example, improvement in students' problem solving or text comprehension. The answer to the question, "How am I doing?" is a

measure of how effective teaching is in terms of student progress. The answer to the "Where to next?" question is guided by a detailed and theoretically sophisticated knowledge of curriculum content and student progressions (Stain, 2008:24).

Based on the above views, I hope to find ways of making the best practices from other countries meet the South African teacher development needs in the teaching of agricultural sciences at school.

2. 8 SUMMARY

From the discussions above we can conclude that teacher development in the teaching of agricultural sciences can only be enhanced if the educational needs of various stakeholders involved in the process are addressed. We have also learned that the process of teacher development requires that individuals change their attitudes, perceptions and believes. It was also emphasized that not participating in developmental activities denies the learner and the educator the possibility of dialogue. Through exploring teacher development we learned to view people as being in a constant process of becoming whatever it is that they want to become. We also have seen that teacher development allows us to view dialogue as a legitimate way of knowing with and through others (Shudak, 2014:996).

We realized that the above-mentioned attributes can be achieved through enhancing teacher development processes that employ a school-based model in which all teachers participate. It also was clarified that the teacher development process should be teacher facilitated (with support materials); also, that this approach should seriously take into account the importance of "teacher knowledge" and realities of classrooms (Ono, and Ferreira, 2010: 62).

It has been indicated that in South Africa and other countries legal imperatives have been developed towards ensuring teacher development at public schools. Nevertheless, established strategies have proved to be not sufficiently adequate to mitigate underperformance in the implementation of teacher development policies. We adamantly believe in students' capacity to critically engage with their world in order to create more just and equitable futures (Carrie, 2015:1262). An alignment is needed between the content of teacher professional development programmes and their delivery (Eleonora, 2003:143). In the next chapter empirical data will be discussed which will ensure this alignment.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY FOR ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

3.1 INTRODUCTION

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. In order to achieve the aim of the study participatory action research (PAR) was used as research design and methodology. Chapter three is devoted to a discussion of the meaning, the history, the objectives, formats, steps in, and ontology and epistemology of participatory action research. The role of the researcher, the study coordinator, and the co-researchers in participatory action research, as well as the relationship between the researcher and co-researchers will be elucidated, and ethical considerations and the research site profile are determined. Other aspects of the study which will be addressed, are the roles of agricultural sciences teachers, departmental heads of agricultural sciences, subject education specialists for agricultural sciences, and the involvement of co-researchers in enhancing teacher development in the teaching of agricultural sciences at school. A brainstorming session, the swot analysis, and data analysis are discussed, followed by the prioritizing of activities, planning for enhancing teacher development, and a programme for enhancing teacher development.

3.2 PARTICIPATORY ACTION RESEARCH

Participatory action research (PAR) is a methodology widely used, especially for matters regarding social action. A feature of PAR is that those who are being studied, participate in the research process, and the focus of PAR is empowerment.

3.2.1 Meaning of participatory action research

According to the Oxford South African school dictionary (2006:439) the word ‘participate’ means to do something with other people; the word ‘action’ means doing things, especially for a particular purpose, while ‘research’ means the careful study of something to find out more about it. By careful study it is meant that one thinks about what one is doing, so that no mistake is made or any accident is incurred.

As Chen, Weiss, and Nicholson (2010: 236) posits, experiences with PAR validates the importance and value of working with co-researchers and of involving them in evaluating the organizations in which they are involved. It also is evident that a project with participatory action research is a promising evaluation tool to advance the understanding of researchers to improve programmes, and to promote positive development for those involved in the research. PAR provides a replicable model and practical insights for many other organizations interested in engaging those involved as evaluators and researchers. We can see that PeiYao’s meaning of PAR is similar to the dictionary meaning in that they both accentuate people working with other people.

In view of the above, (Pahl and Allan, 2011: 211) maintains that the use of participatory action research methods is the means to understand the ways participants use communication on their own terms; and to understand the connections they make between their everyday lives and

literacy more clearly. For young researchers in Kate's study, the library became a safe space during the implementation of PAR. The library was part of their future resources for literacy and life. PAR brought an understanding of literacies as connective, on and off line, between parent and child, such as the father, and linked to emotional and sensory experiences. PAR has taught them the importance of looking at the connections between the textual and material in community literacy studies.

In support of the above experiences, Cammarota and Romero (2016:503) posited that in his study PAR served as a funds-of-knowledge bridge between the classroom and the student teacher realities. Although transformation at the school level always was uncertain for students, personal changes did occur from their involvement in PAR. PAR represents the method for social justice such that student teacher inquiries and attendant actions could promote healthy, acceptable identities, community activism, and empathy for other teacher's struggles.

3.2.2 History of participatory action research

PAR became part of the educational scene, as teachers in the past were focused on more local concerns, namely how to enhance their practices in their specific school settings. Current approaches to teachers' development need to be replaced by enhanced teacher development programmes focused on improving the narrowly conceived regimes of basic skills, often in the context of national and international testing, and various templates to prove that mandated foci have been addressed. To maximize learning, it is necessary to consider teacher development as integral to student learning, and the circumstances under which such learning occurs. PAR fosters a culture of critical thinking, which challenges narrower articulations of student learning and education more generally (Hardy, 2009:469).

Galié (2013:89) maintains that the development of women teachers in the teaching of agricultural sciences has become important in countries where the feminization of agricultural sciences teaching is making women key participants in teacher development programmes. The adoption of a concept of enhancement as a process of self-determination transcended specific modes of life. Women provided opportunities and set in motion a process toward women's individual and group enhancement, based on their own definition of self-determination. In so doing, such efforts enhanced the relevance of PAR and its outputs. Enhancing teacher development was grounded in the contextual specifics of co-researchers and that facilitated the collective action of teachers which was less likely to result in failure. By including both effectiveness and equity concerns, PAR is able to reach more women who previously have been marginalized by conventional teacher development programmes.

3.2.3 Objectives of participatory action research

Imran (2012:18) argues that teachers always have been expected to grow and develop in their own profession not by studying their own practices or experiences, but by studying the findings of those who themselves are not school-based teachers. It was, therefore, very important that teachers took a lead and adopted active roles in their learning and development and created a different knowledge base by acting not just as objects of study, but also as architects of study and generators of knowledge. Participatory action research (PAR) transcended from the traditional line of evaluation approaches and presented itself as a way more befitting and more

coherent to attend to the issues of not only programme improvement, but also the needs of teacher growth, development and renewal in this challenging era. The procedures of PAR may be time consuming, costly, complicated, and challenging, but, for sure, the alternative to PAR will be less rewarding. The contribution that Imran brought to my study reminded me that subject advisors in South African education are office-based, while subject teachers are school-based, and that PAR is aimed at bridging the gap between the knowledge of the teacher and the expectations of the subject advisors. This gap, in my view, is in contradiction with the principle of high knowledge and high skills (DBE, 2011:4) expectations, as prescribed by the outcomes-based educational approach adopted by basic education in South Africa.

Somerville, and Green, (2012:13) posits that the objective of PAR is to bring place and teaching into relation with education for sustainability. Education for sustainability could be achieved when stakeholders in education begin by engaging themselves and the communities and places in which they live. Through PAR different understandings and insights about curriculum and pedagogy could be developed to supplement the main objective. PAR requires that children become knowledge holders. Participatory action research is a suitable model for curriculum change. Successful implementation of PAR requires that stakeholders move outside their comfort zones into the territory or place of the other. The argument posited by Somerville, and Green (2012) makes me think that enhancing teacher development in the teaching of agricultural sciences at school demands that stakeholders consider place, teaching and sustainability as valuable resources in the process of curriculum reform through the use of PAR.

3.2.4 Formats of participatory action research

Harvey (2013: 10) argues that as sessional staff provides the major part of teaching in our universities, they need to be supported and managed by their institutions to ensure quality learning and teaching. Benchmarking is a process by which organizations evaluate current practice against previously determined reference points or criteria. Repeated engagement and use of a bench marking tool make it possible to measure enhancement of teaching skills over time. It is clear that enhancing teacher development in the teaching of agricultural sciences at school requires adequate time. The development of an online interactive tool, for example, will demand time and effort, but eventually will provide the sector with a user-friendly interface that generates a summary report at the click of a button. Participatory action research engages participants in leadership by focusing on national standards with the potential to achieve "wholesale improvements" by developing, disseminating and embedding good individual and institutional practice in learning and teaching for sessional staff. The next step requires a sector-wide commitment to, and engagement with, the standards to realise their potential for quality learning and teaching.

Galletta (2010: 355), however, states that PAR offers youth, educators, community members, and partners such as university faculty members a means for studying and changing problems in communities and in schools. Although the methods and epistemological underpinnings of PAR serve as a window into possibilities for collaboration and transformative change, they also frequently introduce a series of intellectual and relational speedbumps.

According to Geraldine (2012:170), it is important to give students a stronger voice, to move them up the continuum of empowerment. The scholar further argued that PRA assisted, in particular, to strengthen the students' group voice. It was apparent that during the process the researcher had some success in making actions more transparent for the students and in

establishing forums that enhanced student empowerment, such as student curriculum groups. This was seen as the beginning of further shifts in students' involvement and in the staff's views of the students' potential. Geraldine (2012) recommends that using a broader range of PRA methods, further research should be carried out to strengthen the findings and revisit the action research cycle, for example, to involve more student and staff stakeholders. I have reason to believe that enhancing teacher development in the teaching of agricultural sciences at school serves to describe and evaluate a participatory action research process that others could use to empower students and strengthen their voice. However, we are conscious that we, as co-researchers, are at the beginning of a long process to widen the possibility of these enhancements.

3.2.5 Steps in participatory action research

According to Lucero, Maes and Pappas (2013:272), the moderate success of participatory action research training points to the need for creating work environments that are more supportive of change. In the past, teachers were not willing to risk doing anything outside of their prescribed duties due to the inconsistent levels of support for teacher development. The context for change requires that employees view past changes as successful, and therefore worthwhile. Communication for change, according to Elena, requires consistency, inclusivity, open discussion, and regular updates. Teacher leadership is the key to effective instructional teams. Effective supervision has been shown to promote employee engagement in work discussion groups like those used in participatory action research. For purposes of this study I think co-researchers need to find and use support we can depend on towards enhancing teacher development in the teaching of agricultural sciences at school.

Paula (2015: 95), in support of Lucero et al (2013), suggests that an extensive library should support the literacy development of the participants in PAR. Some individuals may not have had the privilege of using rich sources of literacy tools. For most of these individuals there was a lack of reading materials and occasions to use language to discuss what they were reading, both at home and at school. Technology, in the form of e-readers, is able to offer support for reversing to some extent the shortage of culture capital some participants have. The increased reading that some participants choose enthusiastically to do, their obvious enjoyment in doing so and also in other forms of literacy such as speaking, writing and listening will result in a propensity to pursue literacy activities more actively within the context of PAR and beyond. When it comes to literacy development, the uses of technology to support long-term solutions are the only ones that matter.

PAR thus entails the following steps: Participants collect and analyse data; they then determine what action should follow. The resultant action then is researched further and an iterative reflective cycle perpetuates data collection, reflection, and action.

3.2.6 Ontology of participatory action research

Mark (2005:50) states that communities are unlikely to invest in generating data on sustainability indicators unless monitoring provides immediate and clear benefits that they can see and feel. By linking indicators to community visions and goals, potentially in response to different future scenarios, communities are more likely to become actively engaged in the development and application of indicators. Goals may be articulated as targets or simply the

desire to move in a particular direction in relation to a baseline or reference condition. Local involvement can also ensure that indicators are dynamic, evolving over time as goals are met or circumstances change. In the context of goals, targets, or baselines, sustainability indicators can more effectively contribute to a process of development that matches local priorities and engages the interests of local people.

Maria (2010:96) argues that the study of human societies is compatible with the tenets and spirit of PAR. The value of PAR is the production of knowledge with marginalized groups for intervention and change. PAR offers opportunities to disrupt and change ideas, language, knowledge, and the material conditions that lead to prejudice, discrimination, and exclusion of teachers with developmental needs in society. In PAR individual and collective intervention and change are interrelated. On an individual level, intervention refers to ways that supervisors view and engage with teachers that lead to the personal empowerment of teachers. At a collective level, groups of teachers have the opportunity to meet, talk, share ideas, and work together on issues of concern to them in PAR projects. This re-positioning of teachers to influence change and decisions in research, practice, or policy has the potential to disrupt the discourse and social conditions that lead to their exclusion. A need exists to consider the power of ideas, the power of hearing the voices of marginalized people, or the power of collective action, no matter how small in scope, for catalysing social change.

According to Carr (2006:434), participatory action research should no longer be understood as a social science 'research paradigm' that can achieve what conventional social scientific research has conspicuously failed to achieve. Rather, it should be regarded as nothing other than a post-modern manifestation of the pre-modern tradition of practical philosophy. As such, it would be a mode of inquiry whose chief task is to reclaim the sphere of praxis from its modern assimilation to the sphere of technology by fostering the kind of dialogical communities in which open conversation can be protected from the domination of a research methodology. This is not an easy task to achieve. Within the dominant culture of modernity, the concepts of prognosis and praxis have been rendered marginal and now face something approaching total obliteration. But it is only by seeking to ensure that the void created by the demise of practical philosophy will not be filled by a research methodology that participatory action research will be able to defend the integrity of praxis against all those cultural tendencies that now undermine and degrade it.

According to Koen (2012:449), doing research is just a mere process such as administrative practice; administrative practice nowadays is best understood with a relational ontology and pragmatist epistemology. In the absence of final resolutions, public administration needs to engender among policy actors the democratic capacity to respond to the ongoing push and pull of these processes. The capturing or recording process, then, is a matter of generating actionable, usable, workable, meaningful knowledge, which emerges from the interactions among researchers, policy actors, and concrete situations. Participatory action researchers start from the needs of the problematic situation in practice, and of those in it, rather than from the needs of the research, and they constantly reposition themselves in response to the material, social, temporal, practical, and intellectual resistances and affordances that unfold during the research process. This is not an easy, clear task. The shape, meaning, and results that action researchers bring to bear on concrete situations will always be temporary and contingently evolving. Therefore, the task ahead is to generate actionable knowledge by being astutely aware of, and sensitive to, the procedural nature of doing research and the distinct type of work this does for responding to the needs of policy actors and problematic situations.

3.2.7 Epistemology of participatory action research

According to Khan (2013:170), the struggle between knowledge and action within research is the concept of change and how it is conceptualized, including seminal questions to be addressed: Who is going to change? and, How will change occur? The participatory nature of action research was teased out in relation to the concept of social change to shed light on the nature of PAR when it is performed. The oppressed are obviously the ones who need change the most. It is the right of the oppressed to be central players in bringing change. In developing countries PAR can be stipulated as a normative approach, if justice is to prevail. Social change then is not a matter of luck. Donors, whether local, regional or international, have a role to play which can become clear if they were to ask themselves: Is knowledge the primary goal of our being, or is it knowledge for action and change? Nothing that exists by nature can form a habit contrary to its nature. Neither by nature, then, nor contrary to nature do the virtues arise in us; rather we are adapted by nature to receive them, and are made perfect by habit. The question that warrants a response, is: Can PAR become a habit of institutions committed to knowledge and action? We can then briefly state that we acquire knowledge by constantly working with others based on the argument posited by the scholar.

I think that teachers of agricultural sciences are faced with oppression which avails itself in a number of ways throughout their teaching career. To state one example: These teachers often are blamed for the poor performance of the learners in some countries, and as a result they become exposed to a series of disciplinary measures by states and authorities that view poor learner performance as misconduct on the side of the teacher. This is one of the reasons why I believe that the oppressed teachers are the ones who most need change, and that such change can only be achieved when those responsible for teacher development appropriately work with the same teachers towards improving learner performance at school.

In this regard one should take note of Tran's (2016:15) opinion that research can engage and cultivate communities. Research and practice must be directed toward cultivating a collective capacity and should entail a movement that creates space for renewed thinking, acting, and being. In some communities, knowledge is constructed through culturally mediated experiences but individuals could also seek out and explore ideas and practices that disturb the cultural foundation of values and practices that may be recognized as destructive in the long term. According to Tran (2016:15), change cannot take place without acknowledging the settings, identities, constraints, and histories in which communities are situated. However, there is no linear path to shift from a cultural context that is not sustainable to one that is sustainable.

In my opinion we do not necessarily have to rely on one source of assistance to bring about the change we want to see in a society.

Tengo, Brondizio, Elqvist, Malmer and Spierenburg (2014: 1812) argues that research-based learning can provide a learning opportunity for the teacher. Teachers need to develop their self-understanding in which they will question the aims and objectives of their teaching and take-for-granted assumptions about science teaching and learning. There is a need for teachers to discuss with students their conceptions of scientific models, metaphors and analogies in order to become aware of students' difficulties in learning the specific content. Tengo et al(2014) further alludes that listening to students can enhance teachers' pedagogical content knowledge if teachers take the time to carefully consider the conceptions that the students either bring to

instruction or construct during instruction. Professional learning is not developed through simply gaining more knowledge; rather, professional learning is enhanced by one becoming more perceptive to the complexities, possibilities and nuances of teaching contexts. Participating in a learning study might be one way to help teachers develop knowledge of what makes a difference in their students' learning of science.

It becomes clear that if we, as teachers, listen to the learners - something that some of us seldom do due to the lecturing method – we also will learn. If we teach in a way that acknowledges our learners, taking cognisance of their needs and what they can add to the teaching-learning situation, and also share teaching approaches with our colleagues, our own methods of teaching will be enhanced. Teachers of agricultural sciences in the study area seldom meet to share teaching approaches in the subject, but often meet to be told what to teach and how.

According to Long, Robblee, Schaefer, Steeves, Wnuk, Pinnegar, and Clandinin (2012: 217), students will gain valuable research knowledge and skills through participatory virtual action research conducted outside of the classroom. In addition, such a programme benefits learners and creates a more research-oriented environment. The participatory action research approach and the virtual environment involve special management challenges. The challenges may be alleviated by preparing for them ahead of time by creating time boundaries for the project that fit the academic calendar; providing a screening device to determine participant needs for training purposes; paying attention to the socialization and technological needs of the group, especially at the beginning of the project, and recognizing that academic staff members are taking on an additional, time-consuming, albeit exciting, venture.

As Danilo (2014:470) posits, there is no one single way of knowing, as there will never be reached any definitive level in the production of knowledge. Participatory action research methodologies also should not be seen as a panacea for solving social problems, since they are not immune to co-optation. Research methodologies should not be seen as neutral tools, but as processes of knowledge creation embedded in political perspectives and struggles. What researchers may need is a place of resistance and rebellion. The role of research is to aseptically, from the outside, identify the causes, the feelings and the personal and social conditions of people in such a place. Participatory action research is not an amusement in a perfect world. Today the picture is different in the workplace and in schools; the political and ideological conflicts have different grounds and find different expressions; the local, national and the global problems are related in different ways. But they are also times pregnant with what Freire called untested feasibilities which are to be found in people's search for social justice, for a peaceful world and for a healthy environment (Danilo, 2014:470).

According to Mayida and John (2013:53), in support of Danilo's views, those engaged in PAR have opportunities to develop or practise skills that they may not otherwise have acquired within a teacher-centred classroom. Facing and overcoming barriers to the process of participatory action research will provide students with the impetus to solve problems. By finding adequate and appropriate solutions, students will acquire critical skills. Researchers will learn that their knowledge, their perspectives, and their contributions matter within their schools and communities. Engaging in PAR has significant epistemological effects on students, that is, an increased knowledge and awareness of what they can do and who they can be in the research process and in their communities. The effects of PAR in terms of the capacity of co-researchers to assess their own learning and abilities are mentioned seldom in the literature

studies that support the quest for information, and also are discussed in contexts different from the one in which my research will take place.

Lewis (2015: 430) maintains that by taking time to engage in reflexive practice, researchers have the opportunity to develop greater self-awareness and insight into how their values, beliefs, and assumptions affect the synthesis, dissemination, exchange, and application of research findings. Integrating reflexivity into a project-based environment may provide teams with the opportunity to move beyond mere problem solving to continually questioning whether their assumptions hinder the teacher development process.

3.2.8 Role of the researcher in participatory action research

Melters, , Bradnam, Young, Telis, May, Ruby, Sebra, Peluso, Eid, Rank, Garcia, DeRisi, , Smith, Tobias, Ibarra, Korf, , and Chan (2013:517) declares that the participatory action researcher must have a high degree of self-respect, confidence in themselves and the will to continue and not yield in the face of opposition. The researcher must be honest, to her/himself too, and emotionally receptive to impressions and expressions, thus functioning constructively in the exploratory partnership. The researcher must allow the work to be process driven and must be prepared for unexpected events. This means that the researcher will not have complete control over the process and what happens, but rather must accept surprises and listen with patience, and be open, creative and responsive. The researcher gains authority, influence and trust through competence.

In support of Melters et al (Yang, 2015:456) suggests that participants become self-reflexive through their involvement in research activities and use insights gained from the reflections when conducting data analyses and in group discussions that form part of their participatory inquiries. Self-reflection is essential, not only for data generation but also for group analysis of the data. The idea of participant reflexivity is useful in doing justice to what participants can uniquely offer in participatory action research inquiries. Reflexivity is an ability to notice one's responses to the world and to use that knowledge to inform one's actions. This may contribute not only to deepening the understanding of reflexivity, but also to enhancing participatory action research practices.

According to Timmis (2015:191), the activities described above require a restructuring of curricula and pedagogical encounters, and necessitate coming together in the educational space within and outside the classroom. Pursuing higher education has different meanings for each individual; education is not merely a means toward a better economic future, it is a means to deal with real life as experienced by each individual. Constructing a curriculum means to connect learning to the real lives of co-researchers in order to counteract the conflict between their lives and schooling. PAR projects founded on the notion of personal experience have the potential to radically transform educational encounters. In those experiences meaning is co-constructed by co-researchers through dialogue and openness. By handing the oppressed people pre-packaged meanings means to diminish the value of what they bring to learning environments and the world in general.

According to Vesterinen, Tolppanen and Aksela (2016:47), co-researchers are able to take an active, personal and purposeful role in changing the world. They see citizenship as a process of constant self-development. Co-researchers take action in various ways, but to get of an overview of co-researchers' pro-environmental and humanitarian actions through a limited

number of closed questions in a survey is a challenge (Vesterinen et al, 2016:47). Most of the existing questionnaire studies on teacher development do not measure the more proactive actions such as participation in community development projects. Education should include activities which provide the co-researcher with ways to participate in solving issues, as well as possibilities to discuss matters and issues from various perspectives.

3.2.9 Relationship between researcher and co-researchers

According to Carolyn (2015:195), service-user involvement in PAR has been incorporated in various facets of practice for many years. This involvement is viewed as emerging from top-down, traced to New Right political initiatives with an emphasis on a mixed economy and modernization as well as bottom-up - a commitment to the redistribution of power and control - and personal and political empowerment of marginalized groups. In some countries, service-user involvement in education and in social services tends to reflect the bottom-up approach. Decisions should be made jointly regarding the extent of participation and the division of duties and responsibilities for each side. Further opportunities for involving older persons in various aspects of social research should be developed and evaluated to enable their application to other service-user groups.

In this regard, Evelyn (2010:193) purports that PAR intervention in teacher development initiatives will demonstrate the gap between practice and theory in the school environment. Operational problems, time constraints and a lack of building trusting relationships often result in a top-down approach that is contradictory to the empowerment principles of PAR. Despite these challenges, the PAR projects do result in a helpful experience for co-researchers, the willingness of the teachers to reconsider incorporating PAR into their curriculum in the future and increased appreciation by the researchers of the importance of allocating sufficient time for ethnography prior to beginning an intervention.

According to Balakrishnan and Claiborne (2013:598), time spent developing a joint working agreement addresses several problematic areas in PAR, and such thoughtful preparatory work is a necessary precondition for the success of participatory action research. It is unethical to avoid the challenges presented by such preliminary work. The success of the PAR approach relies on the willingness of the researcher to listen carefully to participants, to address his/her own issues of power, and to encourage participants to continually refer to the working agreement throughout the research. The researcher needs to be vigilant in ensuring that co-researchers deal with the data they plan to share confidentially. To survive and flourish in a world fraught with uncertainty, we must learn to think and learn differently, and to develop a climate of trust and honesty, combined with the ethics of care and compassion between researcher and participants. The issue of power sharing is essential in implementing a workable working agreement. Each party should feel comfortable and confident that they have equal power and the privilege to voice their opinions, suggestions, and arguments.

3.3 ETHICAL CONSIDERATIONS

Before undertaking the practical component of the study aimed at enhancing teacher development in the teaching of agricultural sciences at school, I first applied for the ethical clearance certificate (*cf.* 1. 11) by following processes prescribed by the Ethical Committee of the Faculty of Education at the University of the Free State. I then used the ethical clearance certificate (Appendix A) to request permission from the Department of Basic Education (Appendix B) for conducting the research in public schools. Consent forms (Appendix D to Appendix H) were given to prospective participants to complete, and they were informed that participation was voluntary, that they could withdraw at any stage of the research process without negative consequence, and they were informed that they would remain anonymous during the process until the outcomes were achieved.

According to Hal, James, Caringi, Pyles, Janine, Jurkowski, and Bozlak (2015:642), reflections on the processes of power and participation are more important than ever if co-researchers and engaged scholars are to understand research areas as spaces where we can uncover the intersectionality of vulnerability, adopt sustainable recovery and human rights approaches, and engage in transformative social change work. PAR requires constant self-critique and PAR researchers tend to make a virtue of their observations about power and decision-making. The reflexive nature of such work may seem tiresome and never ending. In the same vein, where PAR in affected, transnational settings is concerned, it may be that the practice itself matters as much as the outcomes.

In connection with the ethical concerns mentioned above, Dennis (2013:749) maintains that the potential use of learner support material as teacher development tools should be explored in similar collaborative settings on a larger scale with more teachers. Teachers can collaboratively reflect upon progress made and identify further actions needed to overcome ethical challenges in the process. In this way, the combination of the learner support material and PAR could provide a vehicle to address some of the challenges that teachers face when enacting inquiry.

I think both scholars might be able to offer relevant teacher development to more of our agricultural sciences teachers by employing alternative and flexible teacher development tools in collaborative practices.

3.4 RESEARCH SITE PROFILE

The research site was in South Africa, in the Free State province in the Thabo-Mofutsanyana Education District (TMED). This area is situated in a rural community that is affected by a high rate of unemployment. The climate of the area does not favour the agricultural production of tropical crops, or farming with animals that are sensitive to low temperatures and strong winds. Due to global warming the research site sometimes experiences severe climatic conditions that include, amongst other problematic factors, the shortage of water and at times default in electricity supply due to strong winds. Not all schools offering agricultural sciences in the rural community are resourced with adequate buildings, equipment, tools, and implements, let alone livestock suitable for conducting practical experiments in the teaching of agricultural sciences.

Three schools (cf. 1.8) in the Thabo-Mofutsanyana district participated in the study. From each school two agricultural science educators and one departmental head of agricultural sciences were involved. From one of the three schools, the farm manager was involved too. The study also engaged one subject education specialist in agricultural sciences. In total eleven co-researchers, inclusive of the study coordinator, were involved in the study. The number of learners enrolled in the subject agricultural sciences in the three schools was 446 and the study was conducted during 2017. The number of teachers found to be offering agricultural sciences was only four. Two of the schools had just lost their departmental heads due to them being promoted to posts paying a better salary, even though these promotional posts were not related to the teaching of agricultural sciences at school. As a result agricultural sciences teachers were left without departmental heads in the schools indicated above, while only one school had a departmental head.

As indicated by Michael (2014:620), it should be the wish of every individual in society to make the necessary contribution to help overcome the impact of climate change. The students of agricultural science on the research site of the study need to be acquainted with the concept of climate change, its causes and effects, and mitigation or adaptation strategies. The teaching could help in disseminating the learned information to other members of the community but this can only be achieved if climate change is integrated in the senior secondary schools' agricultural sciences curriculum.

Troy (2013:78) explains that to bridge the cost of materials gap, specialized laboratory equipment needs to be given to co-researchers during PAR projects. This equipment should include digital carbon dioxide and temperature sensors, software, computer interfaces, and basic laboratory supplies. Such equipment will provide teachers with avenues to teach agricultural science concepts through hands-on activities. The teachers at both elementary and secondary levels need to find out if agricultural topics would enhance their curriculum and whether integration should occur at all grade levels. They also need to determine if a basic knowledge of agriculture and climate change issues would be important for students to be able to make socially responsible and healthy decisions on a daily basis.

I think co-researchers need to ensure that the context of research is well organized to realise the possible outcomes of the study.

3.5 THE CO-RESEARCHERS

The research team consisted of three teachers, three departmental heads of agricultural sciences (though two of them had no content or pedagogic background of agricultural sciences), a subject advisor and the study coordinator. One school had a farm manager, who also was engaged in the study. We also looked at the use of those involved in the business of agricultural production without necessarily including them in PAR projects, namely agricultural organizations, and agricultural extension officers in enhancing teacher development in the teaching of agricultural sciences at school. In paragraphs below, the profiles of co-researchers and their specific roles in the study are elucidated.

According to Iwan (2015:167), the farm manager has a significant use in participatory action research (PAR), particularly in teacher empowerment, rural social enterprise development, a

green campaign, agrarian advocacy, dissemination of non-vegetables agribusiness innovation, initiation of non-farm adaptive business innovation, ICT application, application of technology to substitute farm worker scarcity, and the initiation of private extension institution. The approach of agribusiness is pluralistic, integrating participatory rural appraisal, participatory learning action, participatory action research, cyber extension, and market information systems and community radio action. The content of extension is multidisciplinary, and related to complex adaptive systems and ecological agribusiness that integrate socio-eco-geo systems, including geological disaster mitigation. PAR in this regard is based on a professional learning community, which is integrated with academia, businessmen, the research site, non-governmental organisations (NGOs), and government.

For the ethical reasons guiding the study the co-researchers in the report are identified using pseudo names, namely the subject advisor for agricultural sciences as Mr Job; the three departmental heads of agricultural sciences as Mr Molinga, Mr Kgoroge and Mrs Sakhile; the school-based farm manager by the name of Mr Nzoko; and the three agricultural sciences educators as Mr Xhoxo, Mr Phahle and Mrs Sekharume.

3.5.1 The study coordinator

The study coordinator was a post-graduate student and is referred to as a coordinator throughout this report. I am a departmental head in the subject agricultural sciences. I had twenty years' experience in the teaching of agricultural sciences at the time of this study. The developmental needs of teachers of agricultural sciences triggered my interest in the study.

Tynan (2008:1064) suggests that study coordinators in research need to ensure that individualized and group professional development create energy and enthusiasm for attempting new ways of engaging and motivating co-researchers in finding what works best in enhancing teacher development. Through PAR it became a matter of academic staff leading their own conceptual change through engagement with the methodology and support from other stakeholders who could foster change. The project continued through two more cycles and further lessons would be drawn in the future about sustainability and scalability of the approach. The co-researchers in the study believed that this approach was useful for others intending to make significant contributions to enhancing student learning experiences in online learning environments.

The study coordinator used advertisements to recruit co-researchers to the study. I was responsible for the safe keeping of records of all the collaborative dialogues and reports throughout the research project.

3.5.2 Agricultural sciences teachers

The duties of teachers of agricultural sciences, as indicated in PAM (2016: A-18), are to engage in class teaching, including the academic, administrative, educational and disciplinary aspects and to organise extra and co-curricular activities so as to ensure that the education of the learners is promoted in a proper manner, and to act as mentor to less experienced teachers, students, and interns if and when applicable; to participate in and facilitate professional

development activities, and to provide management support to the management team of the school when and if required.

Four subject teachers from three different schools were involved in the study. Piercy, Franz, Donaldson and Richard (2011:826) argues that to enhance ownership, increase authenticity of the data, and make better use of the findings, teachers should be flexible with the collaborative protocol to allow themselves to explore nuances of the topics at hand; invest in co-learning with rather than maintaining the study-coordinator-as-expert model during the PAR process; set boundaries for co-researcher discussion that give flexibility but do not take the group too far from the intended topic or compromise the voice of any member of the research team; and learn to know when to let co-researchers wander from the topic and when to bring them back to the topic at hand. To improve the practice of agricultural education, educators used professional learning communities to not only gather data about a phenomenon but as a way to help farmers connect with each other; and to train farmers to conduct communities of practice with each other to better meet farmer needs.

3.5.3 Departmental heads of agricultural sciences

The duties of the departmental heads of agricultural sciences, according to PAM (2016: A-27), are aimed at engaging in class teaching, being responsible for the effective functioning of the department and to organise relevant or related extra-curricular activities so as to ensure that the subject, learning area or phase and the education of the learners are promoted in a proper manner.

Three departmental heads were involved during the participatory action research projects under study. However, Hendrik (2006:26) warns that it is challenging to design and implement a participatory action research process that lives beyond a project, once the funding and technological and human resource support is withdrawn. However, I believed that the involvement of departmental heads would contribute to such a process in schools. The outcomes of this involvement hopefully will provide a means to create a culture of learning that will allow teachers to be innovative and interactive and to change under changing circumstances, to bring individuals and groups with similar goals and values together, to change the behaviour of farmers, practitioners and politicians, and to collectively care and manage the highly threatened and degraded, but in some cases underutilized natural resources.

3.5.4 Subject education specialist for agricultural sciences

The duties of the subject education specialist, as stated in the PAM (2016: A-36) document, are to facilitate curriculum delivery through support in various ways.

There were only two subject advisors for agricultural sciences in the Thabo-Mofutsanyana district. Only one of them was invited to be part of the collaborative processes in the study because of working closer to the research site. Kabirizi (2007:129) posits that for researchers to plan and conduct cross-disciplinary and participatory action research it was important that the rules of the game for being part of the project be negotiated and agreed upon up front. It should be recognised that involvement in cross-disciplinary and participatory methodologies

demands an open and flexible attitude and willingness to transcend traditional professional boundaries in terms of methodologies, paradigms and disciplinary ideologies. It also should be recognised that cross-disciplinary and participatory methodologies are very time consuming. Projects should be designed in a flexible way allowing for shifts in focus, disciplines and participants as the project evolves. Subject advisors should strive to create an environment conducive to conducting the project, where information flows freely and co-researchers can interact in all phases. It was useful to liaise with the subject advisor who had experience with such research and who served as a facilitator.

According to the South African National Department of Agriculture (Aliber, 2003: 8), the rapidly changing landscape in agriculture, with increasing numbers of new entrants into agriculture, ensued in a critical lack of skills to cope with the range of support required by these new entrants. These skills cover such areas as agricultural extension, sustainable livelihoods, food security, resource management, agricultural law and policy, land care, and environmental management. Agricultural extension presents a special case in that it is increasingly urgent that all agriculturalists, including economists, engineers, and scientists at all levels are skilled in taking their speciality into the field, to the farmer. The skill of engaging teachers, farmers, producers and small-scale value-adders in technology development is a singular challenge to the agricultural education and training system. There is a need for the concept of agricultural extension to be expanded to issues not traditionally associated with agricultural extension. Specifically the need to provide the agricultural sciences teachers with capacity and skills to assist communities to deal with the effects of rural change, the impact of chronic ailments on the rural economic base and the growing vulnerability of household livelihood systems, which presently are not generally part of the formal and non-formal training of teachers by subject advisors.

3.6 INVOLVEMENT OF CO-RESEARCHERS IN ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

In this sub-section attention will be paid to ways in which the co-researchers were involved and made part of teacher development in the schools participating in the study.

3.6.1 Brainstorming session

During a brainstorming session the researcher and co-researchers prepared a list of issues to work on, identified the responsible persons who were going to take part in conducting this study, and then decided how frequently we needed to meet and what activities needed to be conducted between meetings. We thereafter appointed a facilitator to conduct meetings in an orderly fashion.

I concur with the perception of Bognar (2009:252) who posits that in order to reduce the gap between theory and practice it is important that we, as teachers, become not only the conductors of other people's ideas, but also creators of our own professional approaches. I also want to adopt the view of Hoover and Flexer (2007:11) who argues that there is a need in the field of enhancing teacher development to realize in practical terms the theoretical concepts and legal mandates for teams of professionals with scarce skills to develop and implement inclusive teacher development programmes and transition services and activities. Transition and special

education professionals need to take the collaborative role in making sure that all potential team participants are included in the process in a meaningful way.

In support of the ideas of Bognar and Hoover, Grove-White (2010:12) suggests that the context and intention of a group discussion is decisive in the way we structure our teaching, such that the intention be fulfilled. Seminars, group tutorials, and group critiques all have very important parts to play in a teacher's educational experience.

I strongly support brainstorming sessions, particularly during participatory action research projects. According to Krishnaveni (2008:122), there is a need for a systematic process for creating and sustaining improved performance that can react rapidly to changes in the environment. Many organizations undertake periodic assessment of their performance to ensure effective and efficient utilization of resources, to be in line with advances in technology, to meet societal needs and to ensure achievement of the organization's goals. Management experts have developed various tools that help organizations to evaluate their performance in their functional areas with respect to time, and benchmark their performance with industry standards.

3.6.2 SWOT analysis

A SWOT analysis is a useful tool to determine the strengths and weaknesses of a project, the opportunities it may offer and the threats that might be faced. Each of these will be discussed as they manifest in this study.

3.6.2.1 Strengths of PAR in the study

I think PAR will help to enhance teacher development in the teaching of agricultural sciences at school, especially in terms of the attention that is given when underperformance takes place.

According to Sonia (2012: 2583), research-action cycles are a self-reflexive spiral which serves as the base that carries out the changes in teaching practice. Through PAR, professionals will be able to review their professional practice and to identify areas that need improvement. They will create strategies based on research that they will carry out while recording what happens, the effects caused by the changes made in the situation and evaluating the results. Critical reflexion on the results will give meaning to the effects and the consequences of the strategies carried out, making it possible to modify teaching depending on the objectives reached.

3.6.2.2 Weaknesses of PAR in the study

Teacher development programmes in agricultural science face numerous difficulties, which need to be addressed. The first major stumbling block for teacher development through PAR concerns the size and scope of agricultural science programmes in the identified schools. Added to this is the small number of agricultural sciences teachers who are good in physical sciences, life sciences, social sciences, earth sciences, engineering, mathematics and economics**.** As PAR is a demanding research modus in terms of time and effort, teachers who already are overloaded might not be interested in honing their teaching skills as they are certain of their positions in a field with shortages in qualified staff. Jerlando (2014:14) maintains that in the case of the SWOT analysis he reports on, minimal evidence was found of collaboration

among professional learning communities (PLCs) offering subjects that integrate with agricultural sciences. Communication and transparency among PLCs are integral to the efforts of PAR to position itself as a critical educational activity; however, communication often is non-existent within and among the various schools and agricultural science and other science teachers. Thus a lack motivation on the side of co-researchers in the PAR process due to these factors is the main weakness in the PAR process used to develop agricultural science teachers.

3.6.2.3 Opportunities of participatory action research in the study

Using PAR in the study offers a possibility of increasing the demand for the enhancement of teacher development in the teaching of agricultural sciences. Other opportunities for PAR in this study entail making available more life-long learning programmes, since many teachers take part in national or international meetings, seminaries, conferences, and workshops ensuing from participatory action research projects. Student exchange programmes among universities stimulate the sharing of knowledge and laboratories among co-researchers (Tugba, 2012:273).

3.6.2.4 Threats of participatory action research in the study

Some authors are of the view that PAR may hold threats for co-researchers and their daily teaching practices. In support of this perception, Susan (2014: 151) warns that (i) expansion in curriculum roles of school-based teachers might have an effect on their roles during PAR projects; (ii) PAR projects cause time limitation and time management issues; (iii) the integrity and freedom to teach and to make decisions independently are threatened when there are attempts to exert external influence on teaching by authorities which may result in PAR being abandoned if teachers are unable to cope with enacting PAR plans, and (iv) some school-based teachers may perceive PAR to be an external influence that could lead them to comply with basic education standards.

3.6.3 Prioritising activities

As I indicated in earlier chapters, the aim of the study was to enhance teacher development through PAR, and drawing from it the implications for teaching agricultural sciences at school. Hamer (2013:200) suggests that in order to enhance teacher development, there should be a bridge between the community and the school. Teachers can become the bridge by using community resources in the classroom to foster the active participation of all students. Teachers need to provide activities through which students can access information about the issues and thus further develop motivation to address them, as well as a safe space for them to develop ways of addressing the issues, that is, to develop their self-confidence and independence. Teachers then need to provide authentic ways for them to share this knowledge with others in order to fulfil self-determination.

As a point of departure, thus, co-researchers needed to prioritise a capable teaching force. In order to achieve this, the following activities should be prioritised:

- Gaining adequate support;
- Fostering positive teacher attitudes;

- Ensuring sufficient time for and efficiency among teachers;
- Promoting good classroom management;
- Expressing high expectations;
- Promoting student-teacher interactions;
- Providing an organized curriculum;
- Enabling teachers to deliver clear and focused lessons;
- Ensuring frequent monitoring and assessment;
- Promoting variety in teaching and assessment strategies;
- Establishing a reward and incentive system for the perceived enhancement of teacher development.

In view of the above, Roni (2012:395) posits that teacher educators interested in improving their work must acknowledge that PAR activities that allow co-researchers to rethink content and methods of instruction require the time and space to meet, but more importantly, they require the willingness, patience, and humility of the co-researchers involved. I therefore concur with Livingstone (2014:302) in that, co-researchers need to prioritise on being committed to creating and sustaining an atmosphere in which all feel at ease, self-confident, and inspired to contribute freely and articulate their viewpoints.

Even though I support Livingstone's opinion, it needs be noted that evaluating teachers' needs, as well as comprehending the types of support teachers might require and concerns they might have put on developmental levels are required priorities - the focus on a single teacher's needs and progress cannot display all the criteria for success, as suggested by Melissa (2010:128).

In the next paragraph, I will identify the procedures that may be appropriate to prioritise in enhancing teacher development in the teaching of agricultural sciences at school.

3.6.4 **Planning for enhancement of teacher development**

Numerous strategies for teacher development in the education system of South Africa are in place; and training has always been prioritised and budgeted for, but the return on investment is not commensurate with the benefit from the trained teachers according to the annual performance plan of the Department of Basic Education (DBE, 2016-2017: 15).

However, Tulinius (2012:65) argues that a well-argued educational, theoretical set-up for general academic capacity building will always conflict with the academic agenda of knowledge production within a specific research profile. The teaching situation must accommodate individual teacher needs. A high degree of self-monitoring among the teachers is needed, together with room for dialogue regarding the development processes. I support the argument that continues to suggest that if the teachers are to develop in this way, continuous work with their understanding and insight into the teaching situations is necessary. Charlotte (2012) further argues that organisation of the teaching corps should be done not only prior to the teaching and for the teachers, but also in the actual situations and in collaboration with the teachers. To pursue this educational ethos, Charlotte (2012) suggests that the research training had to be developed within the premises of participatory action research (PAR); delivery of the programme cannot be separated from the next step in programme development, and those who created the learning situation - teachers and trainees - had to be involved in the development.

Regarding planning for the enhancement of teacher development in the teaching of agricultural sciences, Gordon (2012: 217) adds that teacher products and reflections will hopefully provide extensive evidence that they can gain valuable research knowledge and skills through participatory action research conducted outside in the agricultural production spaces. It is further posited that the PAR approach and the practical environment both involve special leadership and management challenges. The challenges may be alleviated by preparing for them ahead of time by creating time boundaries for the project that fit the teacher development programmes; providing a screening device to determine the needs of co-researchers for training purposes; and paying attention to the socialization and technological needs of the research team, especially at the beginning of the project.

I have reason to believe that the involvement of the farm manager in enhancing teacher development in the teaching of agricultural sciences through PAR projects would also benefit the rural communities. This plan was motivated by Kiran's (2016: 1783) view that there is great potential that needs to be tapped to eradicate poverty in the Thabo-Mofutsanyana region. It is further suggested that regional scale livelihood enhancement plans need to be developed considering the agro-ecology of the region. There is a potential to bring more land under agriculture and irrigation; however, the land use plan needs to be worked out based on the land typology. As there are gaps in the demand and supply, concentrated efforts on promotion and cultivation of pulses, oilseeds, cereals and vegetables need to be taken in consideration, along with productivity enhancement. It is further added that the focus needs to be on low water-requiring crops and improvement of water use efficiency. Considering the energy requirement, in addition to the traditional energy sector, non-conventional energy sources also need to be explored. I think the view of Kiran in this case relates directly to an enhanced teacher development plan in the light of the current global warming circumstances.

3.7 PROGRAMME FOR ENHANCING TEACHER DEVELOPMENT

As stated earlier PAR involves data collection, reflection, and action. In this section the action plan is discussed.

Okoro (2013: 88) suggests that information and communication technology (ICT) is an indispensable tool for enhancing effective teaching and learning in teacher development programmes. Based on this premise it is posited that it is important that all co-researchers should be acquainted with relevant skills and competencies that ICT provides to the recipient. In addition to this, adequate funding to purchase ICT facilities should be found by school-based authorities. Therefore these ideas were considered in designing enhanced teacher development programmes in the teaching of agricultural sciences at school.

The action plan in our quest for enhanced teacher development approaches in the teaching of agricultural sciences at school was threefold as indicated in the table (Table 3.1) below:

3.7.1 Action plan: IQMS policy review

The first step in the action plan was to do a policy review of the IQMS. The activities of this process are summarised in Table 3.1.

Table 3.1: Summary of activities, co-researchers involved, resources, indicators of success and time-frames

ACTIVITIES	CO-RESEARCHERS INVOLVED	RESOURCES	INDICATORS OF SUCCESS	TIME-FRAMES
REFLECTING ON IQMS	Teachers, Departmental heads, Subject education specialist	Pen, note pads, tape recording device	Attendance register, written materials, recorded voices of co-researchers	3 hours
OBSERVATION OF THE IQMS POLICY DOCUMENT	Teachers, Departmental heads, Subject education specialist	Copies of the IQMS Policy document, pen, note pads, tape recording device.	Attendance register, written materials, recorded voices of co-researchers	3 hours
PLANNING REQUIRED IN IQMS FOR TEACHER DEVELOPMENT	Teachers, Departmental heads, Subject education specialist	Pen, note pads, tape recording device,	Attendance register, written materials, recorded voices of co-researchers	3 hours
ACTION TOWARDS ENHANCING TEACHER DEVELOPMENT THROUGH THE USE OF THE IQMS POLICY	Teachers, Departmental heads, Subject education specialist	Copies of the IQMS Policy document, pen, note pads, tape recording device.	Attendance register, written materials, recorded voices of co-researchers	3 hours

3.7.1.1 Reflecting on IQMS

I think it is important for purposes of this study to first find if current teacher development systems are helping teachers to develop in the teaching of agricultural sciences at school.

We need to critically view the Integrated Quality Management System (IQMS) (http://www.ctpa.org.za/Documents/IQMS.pdf) for educators from the premise that the relations which teachers develop with particular kinds of knowledge through their education and the impact this has on their identities need to become central to definitions of what counts as a high-quality system of teacher development. This could be a way of bringing together a broader grouping of teachers from the basic education field in order to contest the dominant discourse of quality (Paul, 2015:620).

It is, however, contended that first time teachers are challenged by the time management of the performance standard completion, content of the teacher development programmes and assessment reflecting their individual performances in and out of classroom settings. More experienced educators may not have a problem with IQMS except for integration of theoretical and practical data generation and analysis. Collaborative efforts are needed to address the concerns of teachers regarding the integrated quality management system (Amena, 2013: 89).

3.7.1.2 Observing the IQMS policy document

A closer look at the IQMS policy document triggers many questions which need to be attended to during practice.

According to Bisschoff (2009: 488), professional development and training are critical to school improvement. He further posits that teachers should be inclined towards the implementation of IQMS. In order for the IQMS policy to be effective it should be well communicated and made understandable to teachers; it must be flexible enough to take into

account the different circumstances of South African schools, and internal and external support should be employed constructively to help schools improve. The Department of Education should provide appropriate training for all stakeholders in order for IQMS to be implemented effectively in schools. The school management team responsible for teachers' professional development in schools must encourage teachers to attend development programmes that will assist them in improving their knowledge, skills, values, and attitudes in order for them to become better equipped in the management of their classrooms.

According to a research report released by the Centre for Development and Enterprise (CDE, 2015:7), there is no evidence that the IQMS would be able to serve as an effective mechanism for accountability, because most teachers do not know how to conduct an effective analysis of teacher performance or how to prioritise teacher development needs, and the outcomes are heavily weighted in favour of the teachers' self-assessment. The report argues that the criteria for evaluating teacher performance do not include measures identified in the research literature as constituting effective teaching. It is also stated that the existing list of performance standards is cumbersome and time-consuming, generating considerable volumes of paperwork for heads of departments, and does not capture adequately the most important core function of schooling, namely the level of learning achieved by learners.

In view of the above, I think much has to be done in order to enhance teacher development in the teaching of agricultural sciences at school.

3.7.1.3 Planning required in IQMS for teacher development

According to Kim (2013:392), participatory action research for teachers provides a meaningful and collaborative professional development planning opportunity. Kim (2013) further argues that administrators, teacher educators, and teachers themselves should cultivate their disposition of mind that is for their own personal, moral, and spiritual development on a continual basis. In my view planning in IQMS does not allow a complete exercise of PAR at school. Based on my own teaching experience, it cannot be said that during the planning of IQMS at school, the visibility of teachers has burgeoned since the inception of IQMS in South Africa.

3.7.1.4 Action towards enhancing teacher development through the use of the IQMS policy

In my view, South Africa needs to refurbish its own teacher development policies prior to implementation, especially the integrated quality management system (IQMS), in order to realise the effectiveness thereof.

Nevertheless, according to Mhangani (2012:67-71), support which fosters effective implementation of IQMS was not adequately offered to educators and principals. Mhangani (2012:67-71) argues that some South African schools implemented the IQMS policy partially, and others implemented the policy poorly, even after all the years of training and conducting workshops. It is further alluded that the implementation of IQMS could not be realized, unless educators, SDTs, SMTs and principals have been properly trained and supported, and a sense of ownership of the process is developed. Mashawu (2012:67-71) found that, as there was no proper training for schools from the side of the department, the interpretations of the performance standards were not clear. As a result the principals and the SDT were not able to help fellow educators to implement IQMS properly.

I experienced the same state of affairs at the three schools that were engaged in the study from 31 May 2017 to 30 September 2017. I was even shocked to realise that in one of the schools I visited co-researchers knew nothing about Continuing Professional Teacher Development (CPTD).

3.7.2 Action plan: CPTD policy review

According to the action plan followed during the PAR process, the next step was to review the Continuing Professional Teacher Development policy. The review process is summarised in Table 3.2 below.

Table 3.2: Review process of CPTD policy

	CO-RESEARCHERS INVOLVED	**RESOURCES**	**INDICATORS OF SUCCESS**	**TIME-FRAMES**
REFLECTION ON CPTD	Teachers, Departmental heads, Subject education specialist	Pen, note pads, tape recording device.	Attendance register, Written materials, recorded voices of co-researchers	3 Hours
OBSERVATION OF THE CPTD POLICY DOCUMENTS	Teachers, Departmental heads, Subject education specialist	Copies of the CPTD Policy document, pen, note pads, tape recording device.	Attendance register, written materials, recorded voices of co-researchers	3 Hours
PLANNING REQUIRED IN CPTD FOR TEACHER DEVELOPMENT	Teachers, Departmental heads, Subject education specialist	Pen, note pads, tape recording device.	Attendance register, written materials, recorded voices of co-researchers	3 Hours
ACTION TOWARDS ENHANCING TEACHER DEVELOPMENT THROUGH CPTD POLICY	Teachers, Departmental heads, Subject education specialist	Pen, note pads, tape recording device.	Attendance register, written materials, recorded voices of co-researchers	3 Hours

3.7.2.1 Reflection on CPTD

According to Donohue (2014:12), there are many barriers to providing quality and inclusive education to learners with disabilities in South Africa. The situation is far from hopeless, though. Inevitably, obstacles to inclusion will thwart progress in both developing and developed countries. Fortunately these obstacles are not insurmountable, and the more children with disabilities are included in education and elsewhere in their communities, the sooner they can become productive and contributing members of society, showcasing their unique talents just like everyone else.

As already stated above I think more needs to be done by all stakeholders to ensure that teachers of agricultural sciences can also be able to provide inclusive education in South Africa.

In terms of the South African Council for Educators (SACE) Act, no 31 of 2000, as amended by the Basic Education Laws Amendment Act (BELA), no 15 of 2011, the continuing

professional teacher development (CPTD) management is a system aimed at realizing a more inclusive education system. All workers, including professionals, for example, teachers, doctors, and so forth must engage in lifelong learning to improve their knowledge and skills and to keep up to date with new research (SACE, 2016:1).

3.7.2.2 Observation of the CPTD policy documents

In scrutinising the CPTD documents we found that teachers have to monitor their own participation in professional development (PD) activities, guided by their personal Professional Development Portfolio (PDP). The principal and SMT in each school will monitor their teachers' PD participation and discuss improvements in departmental and staff meetings or with individual teachers. SACE will monitor a representative sample of teachers' PDPs each year to see how teachers are using the system, and will provide feedback on its findings to the teachers and schools concerned. SACE will use its CPTD information system to monitor how teachers are participating in the system. SACE will share its findings with the stakeholder community, the provider community, the Department of Basic Education, Provincial Education Departments and teachers themselves. SACE will commission a formal independent external evaluation of the CPTD Management System every few years and publish its results (SACE, 2013:15).

3.7.2.3 Planning required in CPTD for teacher development

The national policy framework on teacher education has been in preparation for a long time now, and is certainly overdue, given the state of our education system. It is the expectation of the Ministry of Education that the framework will bring about the necessary coherence and impetus to ensure a drive for more teachers, and for better teachers. The framework is not an end in itself, and seeks to ultimately impact upon the core business of education, which is to improve the learning achievements of children at school. Every element of this policy is intended to support this goal in the long-term interest of our nation, as posited by the DBE (2006:27).

3.7.2.4 Action towards enhancing teacher development through CPTD policy

As stated in the SACE (2008:34) report, the time available for professional development under the CPTD system may prove to be a contentious issue. Professional duties, including meetings, workshops, seminars and conferences, and professional development are among the core duties and part of the workload of state employed school-based educators, and these activities are to be conducted outside of the normal school day. In particular, educators may be required by the employer to attend programmes of ongoing professional development, up to a maximum of 80 hours per annum to be conducted outside the formal school day or during the vacations, and the employer is required to give at least one term's notice of programmes to be conducted during school vacations.

3.7.3 Action plan: Enhancing teacher development in the teaching of agricultural sciences at school

The action plan for the enhancement of teaching development of agricultural sciences teachers has been summarised in Table 3.3 below.

Table 3.3: Action plan for the enhancement of teaching development

	CO-RESEARCHERS INVOLVED	RESOURCES	INDICATORS OF SUCCESS	TIME-FRAMES
REFLECTION ON CHALLENGES TOWARDS TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL	Agricultural sciences Teachers, Departmental heads of agricultural sciences, Subject Education specialist for agricultural sciences	Pens, note pads, tape recording device.	Attendance register, written materials, recorded voices of co-researchers	2 hours
OBSERVATION OF PRACTICAL AGRICULTURAL SOLUTIONS TO TEACHER DEVELOPMENT THROUGH INVOLVEMENT OF AGRI-BUSINESS	Agricultural sciences Teachers, Departmental heads of agricultural sciences, Subject Education specialist for agricultural sciences, Agri-business owners.	Pens, note pads, tape recording device, agri-business space, agri-business assets.	Attendance register, written materials, recorded voices of co-researchers	4 hours
COMPREHENSIVE PLANNING FOR ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL	Agricultural sciences Teachers, Departmental heads of agricultural sciences, Subject Education specialist for agricultural sciences	Pens, note pads, tape recording device.	Attendance register, written materials, recorded voices of co-researchers	3 hours
COMPREHENSIVE ACTION TOWARDS ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL	Agricultural sciences Teachers, Departmental heads of agricultural sciences, Subject Education specialist for agricultural sciences	Pens, note pads, tape recording device.	Attendance register, written materials, recorded voices of co-researchers, awarding of certificates of attendance and participation.	4 hours

3.7.3.1 Reflection on problems towards teacher development in the teaching of agricultural sciences at school

This part of the action plan assisted us to think deeper about problems that impeded teacher development and possible building blocks upon which we would build an enhanced approach to teacher development in the teaching of agricultural sciences.

First we took note of Saleem's warning (2010:7) that an exclusive concentration on social equity and redress without adequate public funding and academic development initiatives to support underperforming teachers would have negative implications for quality, and would compromise the production of high quality personnel with the requisite knowledge, competencies and skills, and therefore would affect teacher development adversely.

According to Okechukwu (2015:11), most of the agricultural science teachers in Delta State, Nigeria are qualified to teach agricultural science. The schools have most of the required instructional materials to teach practical agriculture, except for electronic materials which are needed when the subject matter being taught is not readily available. Students in the schools view agricultural science as not as important as mathematics and English language, which they view as core subjects. This notion has affected the practical agriculture in schools negatively.

Komba (2015:79) reported that Tanzania started to implement a competence-based curriculum in secondary schools, but the findings of a study revealed that the majority of the teachers were not knowledgeable on what a competence-based curriculum meant. In addition, the practices exhibited by the majority of teachers in the selected schools did not indicate that they were effectively implementing the competence-based curriculum. Since teachers are the cornerstone in the implementation of any educational innovation, the implementation of a competence-based curriculum in Tanzanian schools essentially was dependent upon the teachers' knowledge and skills on what the competence-based curriculum entailed.

These examples made us aware of possible pitfalls in our endeavours to institute professional development for agricultural science teachers in South Africa.

3.7.3.2 Observation of practical agricultural solutions to teacher development through involvement of Agri-Business

This part of the plan assisted us with identifying the best practices applicable to the teaching of agricultural sciences in the 21st century in line with globalization.

According to Darko (2016:2610), agricultural science teachers should be encouraged to adopt more interactive teaching methods like discussions and demonstration, as these styles help students to get more involved in the teaching and learning process compared to the lecture method. The lecture usually causes students to be passive in the teaching and learning process - a situation which does not really promote students' understanding. The government, school governing body (SGB) and other stakeholders should help in providing the needed resources such as a school garden, animal farm, demonstration plots, and well-equipped laboratories, among others, to facilitate the teaching and learning of agricultural science at schools.

In South Africa there is a need to establish and appropriately resource laboratories and provide land for practical lessons in agricultural science in schools. The Department of Basic Education should allocate special grants to schools offering vocational subjects such as agriculture. This

will help to alleviate the problems faced by schools in terms of funding. Learners' interest in the subject should be sustained through the provision of agricultural science facilities and learning resources. The provision of these facilities and resources will create an environment conducive to the continuous development of interest and skills in agricultural science. According to Abdulhamid (2013:68) the demonstration method is not more or less effective than the discussion method in producing higher quality teachers in teaching agricultural sciences. Teachers exposed to the discussion method exhibit lower achievement loss than teachers taught by the demonstration method.

Konyango (2015:9) argues that in Nigeria no school can boast of even having a school farm to be used as a laboratory for teaching the subject. In schools where such farms do exist, they are used purely for commercial purposes under the management and control of the head-teacher and school bursar. This, according to Konyango's (2015) study has undermined the aspirations and philosophies behind the introduction of the subject. The support of teachers who are key stakeholders in curriculum implementation must be recognized. The impact of agriculture teachers implementing a practice-oriented agriculture curriculum has been insignificant as their worth and value as agriculture teachers are determined by the grades their students score in national examinations and not the skills, knowledge, values and attitudes their students acquire. Lessons which could be used for practicums, demonstrations and experiments have been converted to long hours of teacher-chalk talks as a result. A lack of a stable grouping of the subject existed between 1963 and 2012. This has made it difficult to refer to school agriculture as a science, a technical, or just a conventional subject such as a language, which has eroded the status of the subject in the curriculum, lowered the morale of teachers handling the subject and affected the choice of the subject by the students.

I fully concur with Dethier (2012: 26), who argued that agricultural growth has a huge capacity to reduce poverty, more so in the rural areas. Improving productivity in the agricultural sector in rural areas is critical and an essential step to reach the Millennium Development Goals. Teacher development and community-driven development could assist in this process. The most pressing issue is to make progress on food security and put in place effective coping mechanisms for poor people. The best instrument to protect small scale farming schools from income shocks is to increase agricultural productivity by enhancing teacher development in the teaching of agricultural sciences.

3.7.3.3 Comprehensive planning for enhancing teacher development in the teaching of agricultural sciences at school

Ndem (2016:15) suggests that if teachers could be provided with the basic incentives, given regular training and re-training, such as attending conferences and workshops, being properly supervised, provided with the adequate instructional materials, as well as employment of qualified and experienced teachers coupled with the application of the appropriate teaching methods, the implementation of a secondary school agricultural science curriculum by the teachers will be enhanced. In some countries poor performance of learners in agricultural science at the internal and external examinations has been attributed to ineffectiveness of the agricultural science teachers in the secondary schools, according to Ndem (2016). I suggest that teachers should not be blamed and, instead, all stakeholders should collaborate in designing the means to assist teachers in correcting the status quo in as far as learner performance at school is concerned. In addition, I put it to the government to review strategies that deal with poorly performing teachers at schools from the premise that some teacher development policies fail to address the needs of teachers at school.

The Virginia Department of Education (VDOE, 2013:31) in the USA maintains that with agribusiness and industry input, rigorous and relevant teacher development contributions in agriculture will address new and emerging fields. Working with the strong research entities and teacher preparation programmes in higher education institutions, teacher development will infuse the latest technology, teaching methodologies, and curricular content into its programme contributions. Rural areas must continue to prepare teachers for the many agriculture-related practices that exist, now and in the future. This is critical for the economic growth and well-being of personnel and their vital contributions to the ever-changing global economy.

3.7.3.4 Comprehensive action towards enhancing teacher development in the teaching of agricultural sciences at school

As indicated by Kyaruzi (2014:7-8), at all levels of education efforts are geared towards knowledge acquisition and the memorization of facts or rote learning to pass examinations with good grades and qualify for the next level or, alternatively, to enter the labour market as unskilled worker. This is contrary to the spirit of learning for self-reliance and the new reality of preparing pupils for jobs that demand marketable skills. Pupils of more affluent parents attend well-staffed, well-equipped, usually private schools while those with less affluent parents continue at understaffed, poorly equipped public schools. However, to keep up with policy requirements, they all have to sit for the same standard national examination, regardless of the quality of the education they have received. In practice, passing an examination is more highly valued and weighted in the learning process than developing knowledge, skills, and attitudes for and towards life (Kyaruzi, 2014:7-8). This demonstrates the paradoxical nature of the Tanzanian education system, which theoretically aspires to prepare learners to enter a world of work, but in practice, is a screening institution. Current pedagogies in Tanzania do not seem to enable learners to develop useful skills and knowledge.

Comparatively, I think the situation depicted above is a replica of the South African education system which could be refurbished through enhanced teacher development approaches that will hopefully prepare the country for the millennium development goals.

My perception is similar to that of Jacobs (2012: 26), who argues that other industries besides agriculture exist in rural areas, but the supply and demand for associated skills remain unclear. Obtaining access to post-school education in rural areas is problematic for a number of reasons, including the following: insufficient finances, access to institutions is constrained by the distances that have to be covered, education and training at many of these rural institutions are of a low quality, and the low quality of schooling in rural areas also prevents access to these institutions and can result in poor academic performance and increasing numbers of dropouts. While skills-biased technical change reflects industry demands for skilled workers, whether it is resource-based or in-service, the determinants of individual demand for and participation in agricultural training interventions also require attention. Investment in rural infrastructure has received more attention than skills development, but rural infrastructure does not automatically translate into rural skills development.

In amplification to the above, Cano (2005:26) states that active learning strategies provide highly effective opportunities for students to become involved in the classroom environment. When student interest and motivation are peaked, learning is inevitable. In smaller classrooms, not all active strategies can be successfully implemented. Teachers should plan lessons

according to the number of students, materials needed, and allocated time. In larger classes, classroom management, especially off-task behaviours, can pose concerns. Teachers should plan for increased lesson planning, evaluation, and student learning and participation. When agriculture teachers use active teaching strategies, every student is guaranteed the opportunity to increase their interest and motivation to learn.

On the other hand, Egun (2009:59) posits that agriculture and its various practices have been going through changes and are expected to change in future, especially with the increase in technological and scientific knowledge. Evaluation of learning processes and achievement by the use of written examinations by groups of learners should be avoided by teacher developers. A progressive assessment technique should rather be employed, which will be able to provide a comparative data basis of the individual's state at point of programme entry; so as to determine and interpret whatever changes have taken place over time. This technique may find a place in competency-based assessment and be encompassed in a *curriculum of affect*, which will not only affect the individual's perception of the world around him/her, but will bring about attitudinal change, off-setting of unnecessary cultural beliefs, home influence as it affects the choice of course of study, and the girl-child discrimination in access to education.

In view of the above, drawing on teachers' and students' perceptions, continuous assessment strategies used by teachers were found to have a positive effect on students' performance in the final examinations. Through continuous assessment, teachers tend to realize their own weaknesses in teaching and those of their students and strive to ameliorate them. Effective application of continuous assessment using different strategies would help in moving towards accomplishing learning objectives and restoring greater confidence in the class and school systems. Enhanced performance of students will culminate in the reduction of the incidences of examination malpractices, as students will have been well prepared for the final examinations through continuous assessment. However, the advantages of continuous assessment should not only be seen as improving student performance, but also as enabling teachers to determine students' current level of knowledge, skills, and understanding of content (Mwebaza, 2010:46).

3.8 DATA ANALYSIS

In this study critical discourse analysis (CDA) was applied as a means to analyse, interpret and eventually report the recorded data generated during the PAR sessions. Sections of previous question papers were used to generate data. We had meetings, focus groups and discussions as tools to generate data (*cf.* 1.7). Data generated were recorded on scripts and by using electronic voice recording devices, as well as other multimedia devices such as photo cameras and video cameras used during participatory action research sessions at a chosen venue, since these tools correlated strongly with critical discourse analysis, which was used to analyse generated data.

The importance of critical analysis is emphasised by Caballero (2015:52), who argues that critical discourse analysis (CDA) allows for the expression of knowledge as the premise of action and formative action that shapes reality, not only for the analysis of discursive practices but also as the basis of subsequent analysis of non-discursive practices. Caballero (2015:52) further alludes to the multi-methodological approach that is inherent to CDA and therefore necessary toward identifying inequality and social injustice. In this sense, a major advantage

of critical discourse analysis was that it facilitated, via the deconstruction of texts and analysis of language use, discovery of patterns of inequality and misrecognition in my study.

In my view critical discourse analysis pays attention to how social power relations are established and reinforced through language. This was looked at carefully to ensure that no voices become marginalized during data generation due to power relations. I used CDA to analyse all written texts, statements that were raised during collaborations, and actions taken throughout the PAR sessions.

3. 9 SUMMARY

Generating data on enhancing teacher development in the teaching of agricultural sciences proceeds well when co-researchers can speak knowledgeably about the problem that concerns them, the questions they have designed, the course of research they are pursuing, and any changes they have made because of what they are learning, as stated by Craig(2007:10).

I concur with Davids (2009:1), in support of Craig's opinion that South African education is not on par with international standards. Davids (2009:1) further maintains that restructuring the education system is a collaborative effort that requires input from all South Africans. The overall quality of education is determined by the quality of professional training offered to teachers. I am of the view that participatory action research (PAR) projects need to consider the above argument and the challenges facing the teaching of agricultural sciences in schools, which include the inadequacy of resources such as school farms, agricultural tools and agriculture classes. Problems learners experience in some topics, teacher workload and agriculture-related punishments given to students, which negatively affect their attitude towards the subject, exacerbate difficulties experienced with agriculture science education. Added to these are unreliable rainfall, high poverty levels, inadequate agricultural land, the fact that some students come from urban areas, agriculture being regarded as hard manual labour, thus few students take it, and the nature of the surrounding areas being arid (Kabugi, 2013: 72).

To add to the above-mentioned perspectives, (Mbajiorgu, 2014: 143-144) discusses other multifaceted factors that impact the teaching of agricultural sciences at some schools in South Africa. There are those factors that are educator-centred, which include the educator not being able to offer the new syllabus, and not being consistent with class attendance. Other factors are related to a lack of resources for effective teaching and learning to be realised. Besides that, there are factors that are associated with failure on the part of the government to provide the required resources timely in order to meaningfully impact on teaching and learning. Poor social skills on the part of the learners represent a factor which leads to poor time management, failure to handle negative peer pressure and extra-curricular activities and entertainment, such as watching television, that impact negatively on their studies. The parent-centred factors include lack of support and failure to provide an environment conducive to studying.

Through a close observation of ethical considerations, components of the research site, the appropriate composition of co-researchers and their contributions during brainstorming, a swot analysis, prioritizing activities and planning sessions we collectively managed to draft the action plan towards realising the possibility of enhancing teacher development in the teaching of agricultural sciences at school.

I fully concur with the inputs of experts involved in or whose opinions were used in this chapter. My observation of some tendencies displayed by some officials occupying supervisory

positions in the subject is that only the teachers are blamed for poor learner performance, while on the other hand, little is done to enhance teacher development in the teaching of agricultural sciences at school. In an attempt to achieve our goal we studied the role of participatory action research in detail while executing the action plan set above. All that stakeholders in education need to do, according to Dolin (2016: 11**),** is to continuously strive to work on creative modalities that increase the prospect of joint consultation, where necessary, joint decision-making and collaboration, all of which can only benefit the cause of education.

The next chapter presents a discussion of PAR and how it was used to generate data that eventually were analysed through critical discourse analysis (CDA).

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND INTERPRETATION FOR ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

4. 1 INTRODUCTION

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. In order to achieve the aim of the study critical discourse analysis (CDA) was used to analyse and interpret empirical data generated in this regard. In Chapter 4 data generated in response to the objectives of the study were presented, analysed and interpreted. The objectives of the study refer to the challenges facing teacher development programmes in the teaching of agricultural sciences in South Africa and foreign countries so as to indicate the need for the study. Solutions that will address these challenges are discussed, as well as the conditions that must exist in order to reach these solutions aimed at realizing the aim of the study. Possible threats to teacher development in the teaching of agricultural sciences and ways to circumvent these threats are elucidated together with indicators of success in enhancing teacher development in the teaching of agricultural sciences at school.

4.2 THE CHALLENGES FACING TEACHER DEVELOPMENT PROGRAMMES IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

Teacher development is a multi-faceted task that faces several challenges. Serious challenges in this regard are teachers' inability to meet the curriculum requirements and a reluctance to implement Continuous Professional Teacher Development (CPTD). Added to this is the reality of the salary disparities between the private and public sector, a lack of access to higher education programmes in agriculture, and the concomitant inadequate numbers of quality agricultural sciences teachers at school.

4.2.1 Inability to meet the curriculum requirements and aims of teaching agricultural sciences at school

It is strongly recommended in the DBE's (2011:8-9) subject curriculum and assessment policy statement that agricultural sciences should be combined with mathematics, physical sciences and life sciences. Agricultural science is an integrated science. It combines knowledge of and skills in physical sciences, life sciences, social sciences, earth sciences, engineering, mathematics and economics. The subject agricultural sciences must be seen within the holistic science framework rather than as an isolated science. The school should be equipped with an agricultural science laboratory where a variety of practical work or experiments can be carried out or demonstrated. The above perception is supported by Keiler, Jackson, Jaworski, Lopatto and Ades (2017:7) who posits that the integrated focus on the practice of agricultural sciences with the ethical and societal implications of the science allows teachers to see the connections

between their research, the concepts they learn in lectured courses, and the broader impact of the science on society. This author further indicates that this holistic view of agricultural sciences should improve the engagement of teachers who will need to understand and evaluate research as part of their jobs or lives, even if they do not become scientists, in addition to those who intend to have a career in research. Adding to the above best practices, Reddy (2017:84) indicates that respective levels of teacher development and the holistic science aspect could assist in establishing the unique experience in the agricultural sciences teacher career. The author further warns that even though consciousness is considered to be a phenomenal and primary trait, embracing the various aspects associated with agricultural sciences decide the intensity and extent of the PAR-based experience of the teacher's life.

During the start-up workshop organised by the subject advisor as one of the co-researchers, the following extracts were shared by co-researchers from the 2016 final agricultural sciences Grade 12 examination papers:

2.5 A balanced ration of maize meal with 14% DP and sunflower oilcake meal with 45% DP was prepared for a dairy herd. The feeds were mixed at a ratio of 12 : 19. The animals' digestible protein requirement is 26%.

2.5.1 Determine the amount of EACH feed needed to prepare 600 kg of the ration if maize meal is 61,29% and sunflower oilcake meal is 38,71%. (4)

2.5.2 Indicate the feed that will constitute 19 parts. (1)

Figure 4.1: Extract requiring a strong mathematical background (NSC Exam 2016)

In my view, the extract requires a strong mathematical background in order to be able to approach the question in Figure 4.1 above. For some teachers this might be a challenge due to inadequate mathematical skills.

An emerging broiler and egg farmer wants to draw up a cash flow budget for a month, opening from a zero balance. Workers' wages cost R4 000 per week. Chicken feed costs R7 000 per week, electricity is R2 500 per week and some other costs amount to R1 500 per week. The farmer's income consists of the following:

- Eggs sold for cash to local shops is R10 000 per week.
- Once a month broilers are sold to a slaughter house for R50 000.

3.4.1 Draw up a mini cash flow budget for ONE week. (4)

3.4.2 Determine the net cash income for ONE month. (3)

3.4.3 Explain whether the net income of this business can be guaranteed on the basis of its cash flow. (2)

Figure 4.2: Extract requiring a background of accounting (NSC Exam 2016)

As far as Figure 4.2 is concerned, I think a teacher will need a background of accounting to be able to respond to this examination question, and to teach learners the knowledge and skills required to successfully answer this question (more especially the ability to draw a mini cash-flow budget and to be able to transfer the skills to learners at school). The subject advisor has

not developed teachers in basic accounting skills in the past agricultural sciences meetings or workshops.

Co-researchers also shared this extract from the DBE 2016 diagnostic report:

CHAPTER 3: AGRICULTURAL SCIENCES

The following should be read in conjunction with the Agricultural Sciences question papers of the November 2016 NSC examination.

3.1. PERFORMANCE TRENDS (2013 – 2016)

The number of candidates has increased by 2 203 since 2015. The general performance of candidates has declined, as indicated by 75,4% of candidates' having achieved at 30% and above, with 44, 5% achieving at 40% and above.

Table 3.1.1 Overall achievement in Agricultural Sciences

YEAR	NO WROTE	NO. ACHIEVED AT 30% AND ABOVE	% ACHIEVED AT 30% AND ABOVE	NO. ACHIEVED AT 40% AND ABOVE	% ACHIEVED AT 40% AND ABOVE
2013	83 423	67 437	80,7	41 654	49,9
2014	78 063	64 486	82,6	41 280	52,9
2015	104 251	80 125	76,9	46 895	45,0
2016	106 386	80 184	75,4	47 332	44,5

Figure 4.3: Extract depicting learner enrolment and learner performance
(Taken from NSC 2016 exam diagnostic report)

When one looks at Figure 4.3, I realise that the number of learners enrolled for agricultural sciences has, increased but learner performance in the subject has decreased in 2016. This further implies that the basic education system is finding it problematic to meet curriculum requirements of the subject agricultural sciences at school.

During a participatory action research project held at school, co-researchers had this to say concerning the ability to meet the curriculum requirements and aims of teaching agricultural sciences at school:

> Mr Job*: Poor mathematical and accounting skills in some questions led to poor performance as indicated in the diagnostic report depicted. There are those topics that we as teachers deliberately skip or omit to teach. It is a fact that some of us did not do mathematics and accounting even in our basic education.*

I can see from Mr Job's comments that he is aware that some of the teachers under his supervision do not have a mathematics and accounting background, but he does not assist in curbing the need he himself has identified. Instead he is aware that teachers under his lead have taken a decision to skip the topics they are not confident with. His approach to the challenge does not assist to meet the curriculum needs of agricultural sciences.

> Mr Molinga*: I want to add that I have just been co-opted by the head of school to act as departmental head for agricultural sciences due to manpower shortages. I may not be able to assist the subject teacher in fulfilling the subject curriculum requirements. I do not have any background in as far as agricultural sciences are concerned.*

We can also see from Mr Molinga's viewpoint that he is simply doing the work to show respect to the head of school. He is exonerating himself from being blamed for poor results by clearly indicating his stance, but he is not indicating if he is prepared to undergo development in managing the subject allocated to him. This again does not assist to meet the curriculum needs of the subject under study.

> Mr Phahle*: I need help in terms of teaching topics that require a background of physical sciences, accounting and mathematics. I do not have any qualification to do any aspect that will require me any pre-knowledge on physics, accounting or mathematics.*

The comment from Mr Phahle, "I need help", indicates to us that he will easily undergo any form of development to gain the background necessary for meeting the curriculum needs of agricultural sciences at school.

> Mrs Sekharume*: I basically have no clue how the agricultural sciences laboratory looks like. I mainly rely on the textbook and past exam papers when planning, preparing, presenting and assessing agricultural sciences. Some of the apparatus displayed in last year's final exam paper do not appear in any of the textbooks and past papers that I used during teaching at school.*

From the comments of Mrs Sekharume, one can clearly see an example that the South African education department has left imbalances in terms of teacher training and development. She has never been exposed to an agricultural sciences laboratory as she alluded to us. Her reliance on learner textbooks and past exam papers is not encouraging a learner-centred approach in the teaching of agricultural sciences at school as one of the requirements in the CAPS document.

> Mr Nzoko, the farm manager: *It is my duty to prepare for practical experiments that will help to consolidate the teaching that is taking place in the classroom, but subject teachers must provide an annual plan of practical experiments that are appropriate to the subject assessment guidelines. In most cases some of the teachers who visit the school are not able to provide me with the annual plan of practical experiments. I end up doing what I think is relevant, but as teacher Y indicated, learners had to answer questions based on apparatus they were not familiar with.*

I think the main reasons why some teachers fail to provide the farm manager, Mr Nzoko, with their annual teaching plans are inclusive of the fact that they mainly might be confident in teaching theory and not in the practical part of the subject; the CAPS document, as well as the 2016 examination guidelines are silent in terms of practical activities to be done to supplement classroom teaching. This, in my view,only will lead to the inability to meet the curriculum needs of teaching agricultural sciences at school.

According to the diagnostic report released by the Department of Basic Education (DBE, 2016:20) in Q2.5, as depicted in Figure 4.1 of the first paper above, candidates showed a lack of mathematical skills in calculating an amount in kg from the percentage given. Some calculated the maize meal amount (kg) using the values of the sunflower oilcake meal. As a result, their responses affected performance in the subsequent question (Q2.5.2). The report further suggests that calculations form an integral part of animal nutrition. Teachers therefore should integrate calculations into the informal and formal assessment tasks. It is posited that teachers should emphasize the use of correct formulae which will help learners to develop their ability to make accurate calculations. Teachers further should inculcate in learners an understanding that agricultural sciences is a science subject and that all formulae should therefore be scientifically presented. In Figure 4.2 of the second paper, most candidates struggled with Q3.4.1 on the drawing of a minicash-flow budget to determine the net cash of different periods. They struggled to list income from expenditure and did not know the formula to be used in calculating net cash in Q3.4.2. In the teaching of net cash income, cash flow and all other accounting concepts, it is still highly recommended that there be co-operative teaching with the accounting teachers for better comprehension and understanding of these accounting concepts.

In my view, based on the literature review and subject policy as posited above, meeting the curriculum requirements and aims of teaching agricultural sciences at school is a challenge.

According to the theoretical framework (*cf.* 2.2.3) guiding the study, members of the social world also are interpreters of the world and teachers need to access these interpretations as fellow participants in the social world. Critical theory requires reference to our interpretive access to the world through mutual understanding. I think without mutual understanding it may seem a challenging task to meet the curriculum requirements and aims of teaching agricultural sciences at school.

I already have indicated in the conceptual framework (*cf.* 2. 3) that the world that teachers are preparing young people to enter is changing, and because the teaching skills required are evolving likewise, no initial course of teacher education can be sufficient to prepare a teacher for a career of more than thirty years. As a result it would not be practical for some teachers to meet the curriculum requirements and aims of teaching agricultural sciences at school without implementing continuous professional teacher development programmes at school.

As has been indicated in the discussion of the literature review (*cf.* 2.7.1. 1), when teaching a unique curriculum any conclusions made should be carefully considered before transferring information to the learners. I also indicated from literature that intensive and extensive professional development of teachers would be necessary to prepare teachers for the implementation of outcomes-based education. A challenging task in teaching agricultural sciences is that some teachers do not use much of the knowledge they learned in higher education institutions, and it requires additional effort for them to review and brush up on the concepts relating to agricultural sciences.

The implication that clearly comes to mind, according to the comments made by the above co-researchers, is that any pedagogic endeavour undertaken without teacher development makes it a challenging task to meet the curriculum requirements and aims of teaching agricultural sciences at school.

We also can see that there is no way in which co-researchers produce, maintain and reproduce social inequality in their comments. The "we" referred to by the subject advisor, Mr Job, indicates that the inability to meet the curriculum requirements and aims of teaching agricultural sciences at school is a challenge that not only affects school-based personnel, but also the subject advisors from whom more support in enhancing teacher development is expected.

The comments from co-researchers also indicate to us that there is a tendency towards excluding teachers of other subjects such as mathematics, physical sciences and accounting, as well as the school-based farm manager from the planning, preparation and presentation of agricultural sciences at school. This exclusion may have led to the decline of the general performance of learners as indicated by the diagnostic report of the DBE in the extracts depicted above. In our current educational scene teachers' formal qualifications are obtained without mathematics, physical sciences and accounting, and teachers skip topics that they do not know. In this way I do not see us meeting the curriculum needs of agricultural sciences in school.

In conclusion, I agree that some of the current teacher development programmes are not effective in helping teachers to meet the curriculum requirements and aims of teaching agricultural sciences at school.

Similarities between literature review and empirical data:

It was indicated in literature review that some school based departmental heads (cf. 2.7.1.1) have no interest in providing school based continuous teacher development and support since they are not employed to manage the allocated subject at school. We have seen that Mr. Molinga was quoted saying, "I have just been co-opted by the head of school to act as departmental head."

It was noted in literature review (*cf.* 2.7.1.1) that the majority of the teachers indicated that teacher preparation programmes should provide instructions on how to integrate science both at the pre-service and in-service levels. This is similar to what Mr Phahle said as noted in the empirical data: "I need help in terms of teaching topics that require a background of physical sciences, accounting and mathematics".

In literature review agricultural sciences teachers (cf. 2. 7. 1. 1) could adopt the use of a farm subdivision theme to engage students in interdisciplinary activities and to help demonstrate the practical use of course material. This is similar to what was found in empirical data when Mr. Nzoko, the farm manager, indicated that "It is my duty to prepare for practical experiments that will help to consolidate the teaching that is taking place in the classroom."

***Differences between literature review and empirical data*:**

Nowhere in the **literature** was it reported that teachers deliberately skip or omit to teach topics with which they were not confident, but in the **empirical data** such a case was found. This is the contribution that this study adds to the body of knowledge.

No indication was found in literature review concerning teachers who rely on textbooks and past exam papers as Mrs Sekharume alluded in the empirical data, namely that "I mainly rely

on the textbook and past exam papers when planning, preparing, presenting and assessing agricultural sciences*".* Thus is appears to be another point that this study adds to the body of knowledge.

4.2.2 Reluctance in implementing Continuous Professional Teacher Development (CPTD) programmes for agricultural sciences teachers at school

As a best practice, according to Hayes (2010:19), school system administrators must encourage and support each school in taking responsibility for professional development and must provide the time and facilitation for educators to learn what they need to know to address students' learning problems. The above is supported in the SACE (2013:4) CPTD policy handbook, which states that teaching requires deep knowledge which is continuously updated and widened, and it involves complex skills that need to be continually adapted to new circumstances.

In view of the above-mentioned best practices I think that CPTD programmes should be implemented at school. Note the following remarks made by co-researchers:

> Mr Job (SES): *Colleagues, I hope we all have professional development portfolios. How far are we with its contents?*

We can see from the subject advisor's contribution that reluctance in implementing CPTD programmes is stimulated by lack of planning from his side. He relies on "hope". This way he cannot effectively assist to minimize reluctance in the implementation of CPTD at school.

> Mr Molinga (HOD) made the following remark: *The last time I checked, we only managed to register for CPTD. However, I am still in the dark in terms of what needs to be done next.*

According to Mr Molinga, the head of department for agricultural sciences, no attempt is made by his office to look for information on what needs to be done after being enrolled for a CPTD programme. I think that by alluding to himself still being in the dark, he awaits assistance from those who are assumed to be having more information. As far as I can see, Mr Molinga only managed to register for CPTD and it ended there. Apparently, he is not ready for practical development through CPTD.

> Mr Phahle (teacher): *What is a professional development portfolio?*

The year 2016 was the year during which teachers working in South African public schools were supposed to be trained in organising and building their own professional development portfolios. The question raised by Mr Phahle indicates that some SMT members at the time had not started running CPTD programmes at school.

> Mrs. Sekharume (teacher): *I only know of the school-based assessment portfolio. If that is what you are asking for, mine is ready for submission, I only have to insert this year's assessment tasks written by learners.*

On the other hand, Mrs Sekharume gives us the idea that SMT's are not unwilling or unable to implement CPTD programmes. This again indicates to us that reluctance to implement CPTD really is a challenge that is calling for the means to enhance teacher development in the teaching of agricultural sciences at school.

> Mr Nzoko (farm manager): *I have registered with SACE many years ago and I have a SACE number. In my knowledge SACE never requested a portfolio from me at least for the past five years. What is the due day for handing in SBA Portfolios to SACE?*

The school-based farm manager is by virtue of his position a member of the school management team. We hardly expect him to be less informed of any teacher development programmes, particularly CPTD, the Integrated Quality Management System (IQMS) or Professional Learning Communities (PLC). This state of affairs also indicates to us that some school principals and some deputy principals are either unable or not willing to use CPTD to develop members of the SMT and the teachers of agricultural sciences at school.

I have already indicated (*cf.* 2.7.1.2) that according to the literature the environment at some schools does not support the implementation of CPTD. Available information communication technology (ICT) is not used to help improve implementation. Literature also highlights that reluctance to implementation is made worse by the shortcomings in teacher training due to the fact that some universities do not link their training programmes to what is taught in secondary schools. According to literature, an apparent lack of clear and reliable paths of communication between senior management and subject advisers exists. Teachers also lack a safe space to question received wisdom, challenge the status quo and continually reflect on how, when and where this is or is not acceptable.

According to the (Public Service Commission, 2007:16) of the Republic of South Africa, some school managers and supervisors are reluctant to ensure that employee performance be linked to the basic education department's overall objectives, ensure that employees understand what is expected of them, provide employees with constructive feedback on their performance, capacitate employees to perform their duties by facilitating and providing the necessary training and resources, conduct performance reviews, counsel employees on their performance, some managers do no communicate the big picture of the department's overall goals to employees and seldom show the relationship between their jobs and the success of the department; they seldom let employees know what is expected from them and why, and do not assist employees to establish challenging but realistic objectives, and never work with employees to help them achieve these objectives. Some supervisors are reluctant to identify appropriate behaviour needed for achieving quality results, and identify employee developmental needs and implement specific development strategies based on those needs. Some supervisors seldom create a climate that enhances employees' natural motivation. The commission also indicated that some managers are not aware of how their management styles impact the way it feels to work in their organizational units and thus are reluctant to conduct individual discussions with each employee on their experience of the work environment.

In the theoretical framework of the study (*cf.* 2.2.1) I have alluded to the importance of *aligning* the reality that occurs in public schools with what actually needs to happen in terms of teacher development. In my view, reluctance to implement the CPTD programme is brought by the

missing link between teacher development and the teaching of agricultural sciences at school. In view of the comments of co-researchers quoted above, reluctance to implement the CPTD programmes is a challenge that needs to be addressed at all schools offering agricultural science.

The comment of Mrs Sekharume, "If that is what you are asking for ..." clearly indicates inequality being maintained between the teacher and the subject advisor during a participatory action research meeting.

A hint of social exclusion is detected in the comment of the farm manager, namely "In my knowledge…" These words may suggest that fellow co-researchers are valued less and perhaps unimportant in what the farm manager knows about the policy of the South African Council of Educators (SACE). This comment only promotes the problem of reluctance in implementing CPTD at school.

Similarities between literature review and empirical data:

I have indicated (*cf.* 2.7.1.2) that some authors raised a lack of clear and reliable paths of communication between senior management and advisers as problematic in terms of teacher development. It is clearly observable from the comments of co-researchers quoted above that in some schools teachers are not made aware of the CPTD programme. Literature indicated that vocational agricultural education cannot be completed without supervised agricultural experience programmes. There is evidence of an attempt at such supervision found in the empirical data in the subject advisor's enquiry, "How far are we …?" regarding the contents of the professional development portfolio (PDP).

Differences between literature and empirical data:

It was also indicated by some scholars (*cf.* 2.7.1.2) that we need to discuss and research factors fostering and hindering the sustainable impact of professional development programmes as they play a central role in teacher development. There is no evidence in the comments raised by the co-researchers that we discussed such factors or raised them for future research. I would like to submit that literature reveals that teachers need to be given clear sets of skills in order to become good practitioners; they also still need safe spaces to question received information, challenge the status quo and continually reflect on how, when and where this is or is not acceptable. Empirical data generated by co-researchers do not indicate whether teachers were given sets of skills or an opportunity to question information that was provided.

4.2.3 The influence of salary options between the private and public sector

As I have indicated in the discussion of the literature reviewed (*cf.* 2.7.1.3), there was a combination of factors that led to a skewed supply of teachers in agricultural sciences. These factors ranged from economic (salary options - in business and industry salaries were more attractive for certain categories of teachers), to the level of participation in a subject area at school level among the pool of potential teachers, and working and living conditions in certain geographical areas or schools. Public schools need to be made more attractive and desired as workplaces. A need exists for school systems to take into account work requirements, as well

as individual capacity, competence and performance. Innovative remuneration and incentive initiatives are required to attract more teachers.

> Mr Job (SES): *We have to organise subject workshops, monitor, control and moderate SBA from your schools as we travel around the province. Yet, people who do the same duties in private schools earn more than us.*

I think what Mr Job, the subject advisor, implies is that subject advisors have to do more work though the reward for such hard work remains unsatisfactory. He argues that fellow subject advisors in private institutions earn extra money for the doing the same work.

> Mr Molinga (HOD): *Promotional posts for teachers who offer agricultural sciences are very scarce. The focus is currently on promoting colleagues who also do mathematics, accounting and physical sciences at school.*

The departmental head is not happy about the lack of promotional positions for teachers of agricultural sciences. Mr Molinga is concerned that only teachers who, in addition to teaching agricultural sciences, also offer mathematics, accounting and physical sciences.

> Mr Phahle (teacher): *I agree with Mr Molinga. That very fact is demotivating on its own. We also need progress in our careers.*

The implication of scarce promotional positions is experienced as demotivating by subject teachers. Itis clear that Mr Phahle is in need for potential progress in his career.

> Mrs Sekharume (teacher): *If you want to be promoted you have to apply for positions in primary schools. Otherwise, one will teach agricultural sciences until the day of retirement without any promotion. Else, study further and join the private agricultural sectors for financial progress in your career.*

The implication of Mrs Sekharume's remark is that a teacher has to give up teaching agricultural sciences and consider promotions in primary schools, which has no bearing on the development of agricultural sciences teachers. Alternatively she would consider working in the private sector for career development purposes.

> Mr Nzoko (farm manager): *Being a farm manager at school level channels one to earn a low salary all the time. The best way to earn more, one needs to look into starting one's own private agricultural firm and apply my experience to generate profits.*

The farm manager, Mr Nzoko also is not content with the salary he earns at a school. The implication behind his comments is that being one's own manager could attract satisfying returns in terms of income.

Apparently the influence of economic options (salary) between the private and public sector is problematic, as reflected in the comments of co-researchers, because teachers indicated that

they needed economic enhancement while their current state of affairs at the workplace was unable to provide to their satisfaction.

The comments of co-researchers referred to above articulate the existence of inequalities within and among the public education institutions. First, we see inequality between public and private sector employees in terms of salary options. Second, inequalities exist (or are experienced as such) between those who teach mathematics, accounting and physical sciences and those who teach agricultural sciences, and ultimately, inequalities between those who teach in primary public schools and those who teach in secondary public schools.

Literature reveals (*cf.* 2.7.1.3) that in practice, calculating the job security premium is more complex because neither private nor public sector jobs offer absolute job security. In both cases there is the chance of dismissal, but state government employees have a significantly smaller risk of becoming unemployed. Public organizations must be attractive and desired workplaces. This requires a comprehensive investment in building a positive and credible image of public sector work and working conditions.

The teacher development policies, such as the integrated quality management system (IQMS) and the continuous professional teacher development (CPTD) policy do not explicitly address the existing impact of the economic (salary) disparities between the private and public sector employees. Their main focus is on ways to enforce a productive human resource without augmenting changes in employee salaries.

I think disparities between the private and public sectors regarding salary options have a tendency to influence career development decisions facing the teachers at public schools. We also may agree that these disparities in the near future could create uncertainty in the teachers of agricultural sciences at school. Person power shortages might be awaiting if the challenge is not addressed soon in the best interest of the learners that we serve in public schools.

Similarities between literature reviewed and empirical data

Literature reviewed (*cf.* 2.7.1.3) revealed that in business and industry salaries are more attractive for certain categories of teachers and level of participation in a subject area at school level from the pool of potential teachers. This point is similar to what the subject advisor raised during empirical data collection when he said: "People who do the same duties in private schools earn more than us*".*

Differences between the literature reviewed and the empirical data

No reference was found in the literature of a comparison between the salaries of teachers who teach agricultural sciences and those who teach mathematics or physical sciences, but during data collection in the empirical study this point was raised. The literature is very silent about farm managers who want to open their own private businesses, but in the empirical data this notion was picked up. Issues around job security did not come to the fore in the empirical data, but were found during the literature review. These three points also add to what this study brings to the scholarly body of knowledge.

4.2.4 Lack of access to higher education agriculture programmes

Lack of access to higher education programmes in agriculture seems to be a major stumbling block for teachers in agricultural sciences.

> Mr Job (SES): *Bursaries available for skills development at tertiary level can only be accessed by those colleagues who also have mathematics and physical sciences besides offering agricultural sciences at school.*

The implication of Mr Job, the subject advisor's words is that teachers in agricultural sciences stand no chance to develop their skills at higher education level through financial assistance since this aid mainly is available for those who also teach physical sciences at school.

> Mr Molinga (HOD): *Adding to what you are saying, a teacher of agricultural sciences can only study for a teaching qualification in the subject up to the advanced certificate in agriculture education.*

It is obvious that some institutions of higher learning, according to Mr Molinga, do not assist in enhancing teacher development in the teaching of agricultural sciences because of limited teacher development programmes beyond the advanced certificate in agriculture.

> Mr Nzoko (Farm manager):*The best way to avoid frustration due to lack of access to registering with higher education institutions is by attending short courses provided by private agricultural organizations, even though what you get in the end is just an informal certificate that carries less weight when applying for promotional positions in teaching.*

The implication of the comments of the farm manager, Mr Nzoko, is that the only chance available for teachers' skills development is through attending informal teacher training programmes. One also may add that informal teacher development certificates are less valued when it comes to opportunities for promotional teaching posts.

> Mr Phahle (teacher): *I applied for admission to the master's degree in sustainable agriculture with one of the South African universities. Even though I submitted my honours degree in education, I was told that one could not be admitted to the master's since my honours degree is not an appropriate foundation for the desired master's degree in agriculture.*

I think it really pains the teachers, who want to be developed in the teaching of agricultural sciences, to realize that even an honours degree does not necessarily guarantee access to institutions of higher learning. It is clear that others, like Mr Phahle, are trying to engage themselves in self-development at institutions of higher learning. There is willingness to develop, but, equally so, there is minimal access.

> Mrs Sekharume (teacher): *How on earth can we improve our teaching skills given the barriers already mentioned by Phahle? This requires political intervention by teacher unions and organizations of agricultural sciences teachers, otherwise agricultural sciences will die a natural death.*

We are now made aware by Mrs Sekharume that unless all stakeholders collaborate in enhancing teacher development in the teaching of agricultural sciences, the subject will continue to experience a decline in terms of teachers who are interested in offering the subject at school and, subsequently, in learners who could attend classes of agricultural sciences at school. This, I think, is tantamount to the subject dying a natural death.

It is clear from the empirical data that a lack of access to higher education programmes in the teaching of agricultural sciences remains a problematic issue affecting teachers at school.

The empirical data generated clearly expose the inequality that continues to exist between agricultural sciences teachers and teachers of mathematics when issuing bursaries for further study. The subject advisor said:

> *Bursaries… can only be accessed by those colleagues who also have mathematics and physical sciences besides offering agricultural sciences at school.*

The comments made by co-researchers during data collection clearly indicate some form of social exclusion of agricultural sciences teachers, especial with regard to issuing bursaries. The exclusion is not necessarily done by the subject advisor, but by requirements applied when selecting teachers who deserve and those who do not deserve bursaries. This, according to me, may make teachers of agricultural sciences to feel less valued and unimportant compared to their colleagues who also offer mathematics and physical sciences.

Literature reviewed indicated (*cf.* 2.7.1.4) that one of the factors hampering quality provision of Agricultural Education and Training (AET) in South Africa is the lack of access to development programmes, mostly by previously marginalized groups. The challenge now, according to the literature, is to secure the commitment of all the constituencies in higher education, and the community more generally, in support of teachers of agricultural sciences. Clear priorities and policy direction are needed to address the needs of teacher education programmes to ensure access in rural areas.

According to the continuous professional teacher development (CPTD) policy (DBE 2011), a professional development portfolio affords an educator in agricultural sciences of an opportunity to be assisted by AgriSETA and other agricultural organisations so as to access support which cannot be found easily when depending on institutions of higher learning. The disadvantage may well be in the nature of qualifications obtained upon completion of the AgriSETA development programmes.

I have already indicated in the theoretical framework (*cf.* 2.2.7) that to decolonize minds, people need to become critically conscious that they lived in a racist and white supremacist society as well as use that particular knowledge to circumvent exploitation and oppression. For the marginalized, counter story-telling served as a powerful means of survival and liberation. Writing counter-stories also served as a tool for unmasking and challenging majoritarian stories that uphold racial privilege. I have also stated in the conceptual framework (*cf.* 2.3) guiding the study that teacher development should employ a school-based model in which all teachers participate.

Having studied the comments of co-researchers quoted above one may conclude that the lack of access to higher education is a problematic issue that needs to be addressed.

Similarities between the literature reviewed and the empirical data

I have already stated in the discussion on literature (*cf.* 2.7.1.1) that there was a huge gap at the time between the aims of OBE and C2005 (Curriculum 2005) and what the majority of teachers had been trained for. It is clear from the empirical data that the gap still exists even after the inception of the curriculum, and assessment policy statement (CAPS) that is currently followed as a guide for curriculum coverage in the teaching of agricultural sciences at school. This is widened by the existing lack of access to higher education agricultural programmes.

Differences between literature reviewed and the empirical data

The literature reviewed does not bear evidence of agricultural sciences teachers only being able to further their studies to the level of the advanced certificate in agriculture education, but it was captured during empirical data collection that they can "only study for a teaching qualification in the subject up to the advanced certificate in agriculture education*",* as posited by Mr Molinga. This again adds to the body of research.

Literature reviewed does not reveal that *Short courses*, as indicated by Mr Nzoko, the farm manager, are the only means towards teacher development. Only in the empirical data short courses were highlighted as an alternative means of teacher development for those who have no access to agricultural education programmes offered by universities. This new knowledge is another contribution that the study adds to the body of knowledge.

4.2.5 Inadequate supply of quality agricultural sciences teachers at school

Regarding the lack of sufficient numbers of quality teachers in agricultural sciences, co-researchers' responses created a bleak picture.

> Mr. Job (SES): *In our district I am the only subject advisor for agricultural sciences. I do not have enough time to give the best support I could provide to the teaching taking place at school, hence the decline in learner performance.*

I think what the subject advisor is implying is that he is overloaded with schools, which ensues in poor performance on his side, the teachers of agricultural sciences and the learners at school.

> Mr. Molinga (HOD): *The same applies to me; agricultural science is not the only subject that I head besides the fact that I am not good in teaching it. I mostly rely on the teacher in terms of what needs to be done. Due to manpower shortages the subject was added to the list of allocated subjects that require supervision from me.*

We can clearly see that Mr Molinga concurs with the subject advisor by citing empirical experiences in his own context.

> Mr Phahle (teacher): *At my school I am the only teacher for five classes of learners who take agricultural sciences as a subject. When attending subject conferences outside the municipal confines, learners will be left without a teacher for the whole period of the conferences. Under general circumstances learner numbers are more than I could afford to provide individual attention to those in need.*

According to Mr Phahle, the inadequate supply of quality agricultural sciences teachers is a problematic issue that is negatively affecting teachers at school. Learners also suffer due to a default that is clearly not produce by them at school.

> Mrs Sekharume (teacher): *"In my case we have all the resources for doing practicals, but I have no ability to perform other practical activities because I need appropriate subject practical skills. I learn at the same time with the learners I have to engage in quality practical activities.*

It is clear from Mrs Sekharume's remark that inadequate practical skills imply that she cannot cope even though in her case there are resources available.

> Mr Nzoko (farm manager): *Farm management involves a lot of work. During busy seasons I mainly pay more attention to farm production and productivity. I also need a teacher who will work as my assistant to organise practical sessions for teachers of agricultural sciences. Schools are allocated teachers according to learner numbers; as a result, I find it very hard to get an assistant farm manager with relevant teaching skills.*

We can notice from the comments made by the farm manager, Mr Nzoko that he needs to be assisted by a quality teacher who can manage the farm and teach the learners while he is out to market agricultural produce around the school environment.

It is clear from the views of the co-researchers that the inadequate supply of agricultural sciences teachers at school is a problem that calls for the attention of those responsible for the recruitment and appointment of teachers at schools.

The comments of the co-researchers quoted above do not in any way produce, maintain reproduce or have a bearing on social inequality. In each case I noticed that they were pressurized by contextual demands beyond their control. In this regard thus, and in view of the comments of the co-researchers, I can state that no reference was made to any form of social exclusion.

I have stated in the discussion on the literature reviewed (*cf.* 2.7.1.5) that few developing countries have implemented strong, effective policies, strategies or programmes that are aligned with the international evidence for attracting, recruiting, developing and retaining sufficient numbers of quality teachers. For a teacher to deliver effective and efficient agricultural science lessons, a sound agricultural and teaching background is necessary.

Teacher development policies such as IQMS and CPTD were designed to meet developmental needs of the agricultural sciences teachers, but these policies are very silent about the recruitment and employment challenges facing schools with staff shortages. In this regard these policies need the support of policies guiding the staff establishment at schools.

As I have indicated in the conceptual framework (*cf.* 2.3), a lack of commitment leads to poor implementation of education policy and the resultant weak performance in the education sector. Educational leaders need to clearly define the job descriptions of their teachers and provide room for professional development. Teachers need to be encouraged to contribute to quality

enhancement of the managerial and academic processes at school, and a properly developed and managed staff performance management system.

Similarities between the literature reviewed and the empirical data

In the literature (*cf.* 2.7.1.5), it is mentioned that human resources also is a serious concern, since enrolment in the schools increases annually, leading to inadequate curriculum supervision and implementation in schools. A similar concern was raised during the empirical data gathering when a co-researcher said, "learners will be left without a teacher for the whole period of the conferences."

Differences between literature reviewed and empirical data

In literature review (*cf.* 2.7.1.2) mention was made of the use of recruitment policies aimed at addressing staff shortages. The empirical data, however, do not show any references to the use of recruitment policies that might be used to address teacher frustrations about person power shortages. I therefore recommend that recruitment policies be used to address teacher frustrations with respect to person power shortages.

4.3 SOLUTIONS THAT WILL ADDRESS CHALLENGES EXPERIENCED DURING TEACHER DEVELOPMENT FOR THE TEACHING OF AGRICULTURAL SCIENCES

Approaches will now be discussed that enable teachers to meet the curriculum requirements and aims of teaching agricultural sciences at school. Among these are the effective implementation of CPTD programmes for agricultural sciences teachers at school, teacher development approaches geared to assist the DoE in retaining agricultural sciences teachers in the public sector, agricultural teacher participation in alternatives to higher education, and partnerships between agricultural sciences teachers and professionals with unique skills in teacher support.

4.3.1 Determining approaches that enable teachers to meet the curriculum requirements and aims of teaching agricultural sciences at school

During a participatory planning session co-researchers collectively shared the following contributions leading towards solutions that will address challenges experienced during teacher development in the teaching of agricultural sciences at school:

> Mrs Sekharume*: I am now aware of what is expected from us. It pains me to do work just for the sake of working even though I do not understand where to start.*

According to textual analysis, the words spoken above imply that she can decide on the appropriate approach because expectations in terms of curriculum implementation have been cleared. The situation causing "pains" as indicated by the co-researcher is no longer problematic in the teaching of agricultural sciences.

> Mr Molinga*: We have learned to master the planning, preparation and sound record keeping of agricultural sciences planning documents.*

When using textual analysis, the words of the co-researcher above imply that a better approach to planning, preparation and effective record keeping, applicable to agricultural sciences, has now been found through learning. These words again indicate that meeting the curriculum requirements and aims of offering the subject agricultural science at school is a new possibility.

> Mr Job*: Heads of departments have been trained to monitor and control progress made by teachers on regular basis.*

It is clear from the words spoken above that heads of departments will no longer find it problematic to monitor and control the progress made by teachers towards meeting the curriculum requirements of teaching agricultural sciences in as far as textual analysis is concerned.

> Mr Molinga*: Our team has mentored teachers in terms of examination guidelines, content curriculum coverage, annual teaching plans, and internal moderation guidelines, and according to their personal growth plans*

From this comment of Mr Molinga one may assume that teacher approaches in terms of the use of examination guidelines, covering curriculum content, pursuing the annual teaching plan, and internal moderation guidelines were enhanced through mentorship programmes during participatory action research meetings aimed at textual analysis. One may also infer that teacher development programmes have enabled teachers to complete their personal growth plans. The possibility of meeting the curriculum requirements and aims of teaching agricultural sciences now has been realised.

> Mr Nzoko: *Topic-experts have been involved during PLC sessions to clear concepts on which teachers were not confident in presenting.*

The words spoken by the co-researcher above imply that teacher confidence in approaching challenging agricultural topics has been raised. When undertaking textual analysis of empirical data generated, I can also deduce the value of PAR and PLC sessions in clearing subject-related concepts.

In terms of discursive analysis, the comments made by co-researchers quoted above do not produce, maintain or reproduce any form of inequalities during the processes of finding solutions that would enable teachers to meet curriculum requirements and the aims of teaching agricultural sciences at school.

In terms of socio-cultural analysis, the words spoken by co-researchers have not displayed the production, maintenance or reproduction of social exclusion; rather, solutions were generated that will foster approaches aimed at meeting the curriculum needs in the teaching of agricultural sciences at school.

In view of critical theory of teacher development (Stedman, Roberts, Harder, Myers, and Thoron, 2011: 419), teachers are public intellectuals who help students link what they learn in school with civic agency and empowerment outside of school. This repositions both teachers and

students as powerful producers of knowledge and it expands the curriculum to include what we call the pedagogy of the city. This community-centred pedagogy will lead to increased motivation and engagement, and student academic development, and it will also enhance relationships between students and teachers and between teachers and communities. We must create supportive networks of educators that help teachers create shared knowledge with students and communities. It is ultimately our responsibility, according to Stedman, Roberts, Harder, Myers, and Thoron (2011), to reclaim teaching as a democratic, intellectual, and professional activity and to offer a counter narrative of teaching to the discourse that proliferates through popular media and state and federal (in South Africa, provincial) governments.

In support of efforts made by the co-researchers, best practices have been sought in the study to determine enhanced approaches for teachers to be able to meet the curriculum requirements and aims of teaching agricultural sciences at school.

As stated in the curriculum and assessment policy statement (DBE, 2011:5), inclusivity should become a central part of the organisation, planning and teaching of agricultural sciences at each school. This can only happen if all agricultural sciences teachers have a sound understanding of how to recognise and address barriers to learning, and how to plan for diversity. The key to managing inclusivity is ensuring that barriers are identified and addressed by all the relevant support structures within the school community, including teachers, district-based support teams, institutional-level support teams, parents, and special schools as resource centres. To address barriers in the classroom, teachers should use various curriculum differentiation strategies.

The curriculum and assessment policy statement (DBE, 2011:5) referred to above is also supported by other literature which states that curriculum requirements and the aims of teaching agricultural sciences need to include the use of integrated place-based institutions (*cf.* 2.7.1). This will support the coordinated innovation and enterprise development needed to increase agricultural outputs from existing lands, while meeting high performance standards in economic, environmental and social terms (Okiror, Matsiko, and Oonyu, 2011:33). Active engagement with a wide range of interested parties occurs via various marketing, learning, and outreach efforts. A group of individuals who are willing to provide ongoing organisation and integration is key to this model. New approaches to agricultural science education will complement the deep knowledge of a scientific discipline that is the hallmark of skilled leaders in response to the challenges and opportunities of contemporary agriculture. However, the home gardening approach (Okiror et al, 2011:33) provided opportunities for pupils to practise what they learn at school and in their own homes. The home gardening approach demonstrated a number of additional benefits for both pupils and their parents, such as food for households, an income and the acquisition of other productive assets like chicken and rabbits. A participatory approach involving parents during the planning process may help to address the attitudinal problem through shared ownership of the gardening programme. Nevertheless, advances in ICT (Grunfeld, 2013:234), including software platforms for Open Distance Learning (ODL) and instructional ODL designs, have brought new learning strategies for teachers to expand their knowledge about agricultural techniques for improved practices. The relevance of ODL for teacher training could be as effective as face to face training for teacher adoption of new practices and starting new activities. Content should be updated on a regular basis to incorporate the latest agriculture research results.

Similarities between literature reviewed and empirical data

The research site has served as a place-based (*cf.* 2.3) institution for generating empirical data aimed at finding a working solution to a problematic challenge in the study. References to place-based institutions were also picked up during the literature review.

Differences between literature reviewed and empirical data

It was found from literature reviewed that school libraries could be used to create opportunities for teaching educators to master 21st century skills (*cf.* 2.7.1). Teachers could be assisted to identify critical resources that would empower them to make meaningful, sustainable changes in their career. Teachers could be assisted in creating lessons where agricultural sciences could be learned through the study of real-world issues that affect people's own health and well-being. This idea was not raised in empirical data hence I recommend that it be added as part of the solution for the lack of school libraries indicated above.

In conclusion, I can confidently state that in as far as meeting the requirements and aims of teaching agricultural sciences, collaborative efforts proved to be handy. Co-researchers have now adopted approaches mentioned above as part of their skills in the teaching of agricultural sciences at school. Below we now look at the next solution to challenges experienced during teacher development in the teaching of agricultural sciences.

4.3.2 Effective implementation of CPTD programmes for agricultural sciences teachers at school

Co-researchers met during the next cycle of PAR. In view of planning, implementation and careful observation of the CPTD programmes for agricultural sciences teachers, co-researchers reflected as indicated in subsequent paragraphs.

> Mr Molinga*: Teachers were trained to develop a professional development portfolio before engaging in generating professional development points.*

In the textual analysis of the empirical data, the words spoken by Mr Molinga above imply that effective implementation of CPTD programmes mainly are possible when teachers of agricultural sciences receive appropriate training, more especially in developing a professional development portfolio.

> Mrs Sekharume*: We have learned to file evidence of training electronically, with SACE to accumulate professional development points.*

The implication of the views of Mrs Sekharume, according to textual analysis, gives the impression that the CPTD programme can now be pursued with ease from the premise that teachers learned to file evidence of training received by using ICT resources. Now that teachers are able to file electronically, professional development (PD) points will be generated with ease.

According to discursive analysis, reflections generated from co-researchers do not in any form produce, maintain and reproduce inequalities between those involved in the teaching of agricultural sciences at school.

According to socio-cultural analysis, the comments of co-researchers do not indicate that social exclusion is produced, maintained and reproduced during the determination of a workable solution for challenges experienced while enhancing teacher development in the teaching of agricultural sciences at school.

On the other hand, critical theory (*cf.* 2.2.7) has indicated that in order to decolonise minds, teachers need to become critically conscious of the situation in which they work in order to use that particular knowledge to circumvent exploitation and oppression. Dialogue, as used during PAR, is the process of knowing and learning that allow teachers to share experiences in and with the world, in concert with pursuing CPTD programmes, to learn more about the self, others, the world, and teacher development as the object of study.

In order to add to the views of co-researchers cited above, we have to tap from the best practices from scholars in other parts of the world as seen in subsequent paragraphs below.

According to Habib (2014:3-4), both the IQMS and CPTD System have common features in terms of the developmental aspect. IQMS appraises individual educators with a view to determining areas of strength and weakness, and to draw up programmes for individual development. The CPTD System provides educators with a database of SACE approved providers and the menu of SACE-endorsed professional development activities or programmes to address the needs identified from the IQMS process. Teachers will largely use the SACE-endorsed Type 1 Professional Development Activities or Programmes, which are teacher initiated, to address the needs in their Professional Growth or Development Plan. School management teams will mostly use the SACE-Endorsed Type 2 Professional Development Activities or Programmes, which are school initiated, to address the needs in the school improvement plan. The districts and provinces generally will use the SACE-Endorsed Type 3 Professional Development Activities to address the needs in the District or Province Improvement Plan. In addition, educators earn PD points from the SACE-endorsed professional development activities in which they participate. SACE also manages educators' participation in the CPTD System and their professional development uptake through the professional development portfolios and the CPTD Information System (CPTD-IS).

It has been indicated that various approaches to the implementation of CPTD programmes may be considered as possible mechanisms, namely individual or peer portfolios; National Board Certification; computer-mediated content management; peer evaluation and coaching; computer-mediated coaching; conferences; and virtual learning communities (Kassner, 2014:17). These innovations represent a wide range of options from low- to high-tech, from face-to-face to computer-mediated, and from internal to external oversight and management. Kassner (2014:17) recommends beginning from a place of introspection while clarifying goals and purposes, assessing infrastructure, commitment, timeframe, and resources, and choosing the approach that best matches the goal, while striving to align actions with best practices and avoid pitfalls common to evaluation and professional development processes. Loveland (2012:29) indicates that the first part of a professional development plan for an educator is to set goals. These goals or performance objectives should be specific, measurable, and attainable. Well-defined performance objectives have the following three components: Content, which refers to subject matter or behaviour; conditions which refer to circumstances, situation or setting, and criterion level or extent of mastery expected.

Brown (2014:5) adds that leadership in agricultural sciences is a dynamic, ever-changing field of education that is continuing to challenge administrators, superintendents, schools districts,

and teachers, as agricultural technologies change and as the rules for how to interact with agricultural technologies continue to evolve. Departmental heads of agricultural sciences are required to develop competencies in a wide range of areas dealing with educational planning, decision-making about which kinds of data to use, how to evaluate teacher development programmes, and a myriad of other issues surrounding facilities, policies, and procedures. Cho and Rathbun (2013:155) maintains that online professional teacher development programmes (oTPD) using a problem-based learning approach allows agricultural sciences teachers to actively engage in programmes to improve their teaching and learning practices without the limitations of time and space. However, clear communication about the ways of operating oTPD, expectations of online programmes, as well as the facilitators' active role are significant factors in the successful use of oTPDPs.

In conclusion, Coggshall (2012:21) proclaims that the vast amounts of money, energy, and dedication currently being spent to reform teacher evaluation systems will only ensure the continuous improvement of teaching and learning if teacher learning is part of the evaluation. The full integration of high-quality work-based professional learning in teacher evaluation can be a powerful lever for creating and sustaining change. Using what is known about how teachers learn and creating evaluation systems with integrated opportunities for aligned work-based professional learning that is more learner-centred, knowledge-centred, community-centred, and assessment-centred will more likely capture the energy-generating potential of teacher evaluation reforms. Whether or not it does, depends on the conditions for learning that are present in schools.

Similarities between literature reviewed and the empirical data

Literature reviewed (*cf.* 2.7.2) indicates that online learning communities are now being used to support groups of learners to collaborate, critically reflect and develop shared meaning with peers. Teachers' continuous professional development (CPD) is one area where such communities are seen as offering valuable opportunities for authentic and personalised learning, informal exchange of good practice and peer learning. Teachers' online learning communities emerge as an attractive alternative to traditional face-to-face training courses. They allow teachers to apply what they are learning to their everyday teaching practice as they learn, and to discuss their experience with peers. The use of ICT for teacher development also was captured in the empirical data.

Differences between literature reviewed and empirical data

In the literature reviewed (cf. 2.7.2) it was stated that changes in teachers' practice depend on changes in their knowledge, beliefs, and attitudes. As a result, the effects of a CPTD programme may be different for teachers with different preconceived notions of responsibility, different beliefs and attitudes. I think this factor needs to be considered as it was not captured during the empirical data collection.

In view of the reflections from co-researchers and supporting perceptions based on the literature reviewed, I recommend the effective implementation of CPTD programmes which is bound to assist in enhancing teacher development in the teaching of agricultural sciences at school.

4.3.3 Determining teacher development approaches that will assist in retaining agricultural sciences teachers within the public sector

During the third cycle of PAR held at the research site, co-researchers converged to determine appropriate approaches towards retaining agricultural sciences teacher in the public sector. Based on the purpose of the meeting the co-researchers commented as follows of the solution of using teacher development approaches to foster retaining agricultural sciences teachers:

> Mr Molinga*: School-based agricultural sciences teachers were requested to provide mentoring, training and support to pre-service student teachers.*

In the textual analysis Mr Molinga's comments imply that when teachers are allocated leadership responsibilities, they will realise that they are valued and ultimately will stay working in the public sector for longer.

> Mr Nzoko*: It will also benefit agricultural sciences teachers to assist departmental heads in designing and implementing induction programmes for beginner teachers.*

According to the textual analysis, the views of Mr Nzoko hold the implication that the role of departmental heads can be made easier if the design and implementation of induction programmes become a collaborative effort carried out by experienced teachers and departmental heads of agricultural sciences.

> Mrs Sekharume*: Regular developmental meetings should be held by PLCs for in-service teachers.*

Based on the textual analysis, the sentiments of Mrs Sekharume imply that PLCs could be used to capacitate in-service teachers of agricultural sciences.

According to the discursive analysis, the words spoken by co-researchers nowhere produce, maintain or reproduce inequalities between the different groups within at school.

At socio-cultural analysis level the words spoken by co-researchers are not in any form indicative of the existence of social exclusion of certain groups of people within the school.

According to the theoretical framework grounding (*cf* 2.2.6), critical theory has the potential to at least address contemporary social problems and thus invites practical engagement and intervention. The ontology of becoming, on the other hand, views people as being in a constant process of becoming whatever it is that they want to become. Africa today requires education systems in which people are viewed and treated as subjects who are capable of working to change their social reality. We can clearly realise, the possibility of retaining teachers, through the theoretical lens driving the study.

Nevertheless, we can beef up the perceptions of co-researchers with the best practices in terms of retaining agricultural sciences teachers at school. Below are the best practices.

As Ableidinger (2010: 1-2) posits, to retain high performers in the teaching of agricultural sciences, schools may try a variety of strategies. Remuneration matters more to high performers

than other employees - it can keep them or send them fleeing. Jobs with differentiated pay, competitive pay packages, and timely raises make it more likely that the best teachers will stay. In addition, promotions and opportunities for advancement boost retention, especially of high performing teachers. High-performing teachers value opportunities to step into new roles and take on new challenges, even ones that do not involve linear advancement. Challenging work and jobs that are aligned with individual employees' interests make it more likely that a school will retain its teachers. Well-crafted hiring processes can improve both performance and retention of high performing agriculture teachers. A school's reputation in the community is more important to high performing teachers than other employees. Building prestige as a school can help encourage top employees to stay. A school's intentional efforts to foster transparency and clear communication throughout the system can improve teacher retention. In view of the above best practices (Bland, 2014: 2), working conditions appear to be even more important than wages, particularly for teachers in urban schools. Most teachers are attracted to high functioning schools with competent administrators, dedicated colleagues, and reasonably well-behaved children who are "teachable", even if they may come from poor families and have low skills. These are schools where teachers feel they can make a difference. Schools must become increasingly creative in developing practices and policies to attract and support teachers in every phase of their careers. Reflecting traditional school needs as well as the evolving expectations of members of the work-force, current best practices are focusing as much on the intangible aspects of job satisfaction as on the material conditions of employment. While money does talk, it is the entire quality of the work experience that ultimately tells a teacher whether to stay or to go.

Similarities between literature reviewed and empirical data

Literature reviewed (*cf.* 2.7.3) indicated that retention as a key component of talent management is likely to be important in the management and maintenance of existing talent pools and hence in the continuing commitment of talented individuals within schools as well as in efforts to develop and expand talent pools as a new source of candidates for vacant leadership roles. This is similar to the words spoken by Mr Nzoko when he said*:*

> *It will also benefit agricultural sciences teachers to assist departmental heads in designing and implementing induction programmes for beginner teachers.*

I think performing this kind of assistance raised in the empirical data requires a great deal of talent and skill as outlined by the reviewed literature.

Differences between literature review and empirical data

Literature reviewed (*cf.* 2.7.3) also stated that even districts that are extremely efficient in hiring will invariably hire some teachers who do not perform well in the classroom. Although it is politically and financially costly to dismiss existing teachers, it is easier to distinguish between effective and ineffective teachers once they start teaching than to predict which teachers will be effective. While money does talk, it is the entire quality of the work experience that ultimately tells a teacher whether to stay or to go. This caution was not captured in the empirical data, but I recommend that it needs to be considered when decisions towards retaining agricultural sciences teachers are made.

In conclusion co-researchers concur that if teachers of agricultural sciences are afforded some leadership responsibilities they could be attracted to serve for longer years at a school without even expecting additional economic incentives.

4.3.4 Maximizing teacher participation in alternatives to higher agriculture education

Co-researchers met on the research site to establish alternative ways in which to assist teachers who could not access higher agriculture education due to specific reasons. They then reflected on the available options as follows:

> Mr Job*: Teachers need to visit local farms in order to engage in farm site observations.*

Based on a textual analysis, Mr Job's words encourage teachers to contact local farms in order to gain permission to observe farming activities taking place there. According to him, it is what teachers of agricultural sciences *need* as an alternative to supplement knowledge which some of the teachers could not access through higher education institutions due to a number of reasons.

> Mrs Sekharume: *We have to ensure that we attend organised agricultural shows.*

Here the textual analysis indicated that Mrs Sekharume emphasises the importance of attending organised agricultural shows. The word *ensure* indicates that agricultural shows are an opportunity that should not be missed for teachers of agricultural sciences.

> Mr Nzoko: *Animal breeder societies could be requested to hold short informal courses on animal handling skills.*

Textual analysis of the words spoken by Mr Nzoko indicates that he promoted participation in short agricultural courses. According to him these short courses could be provided on request from well-established entities such as *animal breeder societies*.

> Mr Phahle: *It is important that teachers register with organisations of agriculture educators for regular updates on agricultural information.*

According to the textual analysis, Mr Phahle encourages teachers of agricultural sciences to apply for membership in institutions established mainly for teachers of agriculture. His contribution to finding a solution will benefit teachers through *regular updates on agricultural information*.

> Mr Molinga: *Teachers of agricultural sciences must organise and attend PLC programmes to share best teaching practices*.

The textual analysis of Mr Molinga's contribution implies that for agricultural sciences teachers organising and attending PLC programmes is a *must*-do activity. According to him these programmes bring with them the opportunity to *share best teaching practices*.

> Mr Nzoko: *We need to encourage schools and teachers of agricultural sciences to register with the AgriSETA to access free skills development programmes.*

On a textual analysis level Mr Nzoko suggests that schools and agricultural sciences teachers need to be members of the Agricultural Sector Education and Training Authority (AgriSETA). As an alternative to higher agriculture education programmes, the AgriSETA provides *free skills development programmes*, according to Mr Nzoko.

According to the discursive level of analysis the words spoken by the co-researchers are not indicative of the existence of inequalities that might have existed among different groups of people at the research site.

On a socio-cultural level of analysis the views of the co-researchers do not show a production, maintenance and reproduction of social exclusion among the various groups of people at the research site.

According to the lens guiding the study, politics cannot be treated like a commodity that can supply all of the answers or tell those of us who do political work precisely what to do. Words spoken by co-researchers indicate an effort is made without any form of prejudice to close agriculture educational gaps created by past colonial and apartheid circumstances in many African countries which denied many agricultural sciences teachers' entry into institutions of higher learning which offer a wide range of skills needed by agricultural sciences teachers.

According to literature reviewed (*cf.* 2.7.4), for best practices to be implemented successfully, each experiential-learning opportunity should be delivered in a way that helps teachers develop a broad range of knowledge and skills in research, problem solving, communication, empathy, and so forth, and it should be described accordingly. This enables teachers of agricultural sciences to maximize their learning, transfer that learning to other situations, and frame their experiences for postgraduate opportunities. Service learning activities should be designed, not just for modest, one-time contributions of assistance, but for more sustained and impactful change.

In connection with the above-mentioned best practices literature (*cf.* 2.7.4) states that individuals will need to be able to navigate a rapidly shifting landscape and critically reflect on the knowledge and skills they need to adapt to multiple situations. Experiential education, which is focused on learning through connection and collaboration through constant critical reflection, lends itself to developing these skills in individuals. Service learning and community service programmes in schools may promote teacher engagement and bolster attempts to reduce school dropout, particularly for at-risk or struggling learners.

Similarities between literature reviewed and empirical data

The literature reviewed (*cf.* 2.7.4) emphasized that experiential learning, service learning and community service could help to maximize teacher participation in alternatives to higher education. A similar idea was captured in the empirical data which encouraged teacher participation in agricultural shows which usually are organised outside the school context.

Differences between literature review and empirical data

The empirical data divulged that teachers of agricultural sciences should be encouraged to engage with breeders' societies, organisations of agriculture educators and the AgriSETA to maximise teacher participation in alternatives to institutions of higher learning. However, in the literature reviewed these alternatives for teacher development were not recommended. I therefore recommend that these options be added to the existing body of knowledge found in scholarly work.

In conclusion, I think there is mutual agreement among co-researchers that agricultural sciences teachers need to participate in various available alternatives to bridge skills barriers in the teaching of agricultural sciences at school.

4.3.5 Creating partnerships between agricultural sciences teachers and professionals with unique skills in teacher support

The co-researchers during the course of this study participated in a wool course organised through the Kruger Mohair and Wool Farmers at the research site as part of a practical teacher development programme. They made the following remarks when reflecting on the course they had attended:

> Mrs Sekharume*: Being an agricultural sciences teacher is not a bad idea. Career orientation programmes organised for school-based learners should include the teaching of agricultural sciences as one amongst the many available alternatives. We have to consult with institutions of higher learning for assistance.*

On a textual level of analysing, the words, "Being an agricultural sciences teacher is not a bad idea", make me think that Mrs Sekharume had negative thoughts about being a teacher for agricultural sciences at school. According to her, *"*career orientation programmes*"* did not include the teaching of agricultural sciences as part of the marketing. The word *consult* indicates that other stakeholders need to be consulted.

> Mr Nzoko*: Subject advisors and well experienced agricultural sciences teachers should provide assistance to schools when decisions on advertising; shortlisting and interviewing candidates for agricultural sciences-related posts are made.*

Based on a textual analysis Mr Nzoko is of the idea that the recruitment and appropriate appointment processes should enlist the assistance from skilled *well-experienced* stakeholders in agricultural sciences.

> Mr Phahle*: The presence of Kruger mohair & wool farmers in our PLCs has benefitted me a lot. I now know what is meant by wool quality.*

Figure 4.4: Lesson in wool course in progress (Picture by Baas NS 2017)

Figure 4.4 above presents a picture of members of the Kruger Wool and Mohair Company providing a theoretical lecture to the agricultural sciences PLC members on sheep shearing, wool classification and the marketing of wool prior to value adding.

Based on a textual analysis of his comments, Mr Phahle acquired knowledge concerning the quality of wool. We also got the impression that Mr Phahle had joined the PLC on his own accord.

> Mr Molinga*: I have learned practical skills to harvest, classify and market wool from the sheep course organised with the wool farmers, first time in my teaching career. Thanks to Kruger farmers.*

Figure 4.5: Dorne merino sheep ready for wool shearing process

Figure 4.5 shows sheep that are ready for the wool shearing process at school.

Figure 4.6: Classification of wool

Figure 4.7: Baling devise for wool

Figure 4.6 shows the different classes into which wool is separated immediately after the shearing process. These classes of wool are ready for the quality assessment processes.

Figure 4.7 shows blocks into which classified wool will be accumulated according to different quality bundles, which will be compressed and packaged for the wool market. The information and skills acquired by agricultural sciences teachers in this regard are aimed at enhancing the teaching of agricultural sciences at school.

On a textual analysis level, the implication behind the words of Mr Molinga is that he learned *practical skills* he never had before interacting with the Kruger wool farmers.

On a discursive analysis level the words spoken by co-researchers above do not produce, maintain or reproduce any evidence of inequality.

According to social-cultural analysis the words spoken by Mrs Sekharume promote, maintain and reproduce social inclusion of prospective teachers of agricultural sciences, more especially in career-orientation programmes at school. Another promotion of social inclusion is seen from what Mr Nzoko argued by indicating that agricultural sciences teachers from schools "should provide assistance to schools" when posts are advertised.

The literature reviewed (*cf.* 2.2.3) indicated that the diagnostic element of critical theory requires reference to our interpretive access to the world through mutual understanding. We have seen from empirical data (the words spoken by Mr Molinga) that there is mutual understanding among the co-researchers and the Kruger Mohair and Wool Company. The comment taken from the empirical data, "Career orientation programmes organised for school based learners should include the teaching of agricultural sciences*"* also indicates the need for mutual understanding between the school-based learning ecologies and presenters of career-orientation programmes.

In view of these premises, we can tap the best practices below to supplement our efforts in trying to find what works best in enhancing teacher development in the teaching of agricultural sciences at school.

Friend, Cook, Chamberlain, and Shamberger (2010:23) suggests that co-teaching stands as a metaphor for the profound transition currently occurring in education, that is, the blurring of traditional boundaries that separated students who experience significant difficulty in learning from their peers and the recognition that two systems, namely general education and special

education, may not work in the best interest of maximizing student achievement and other outcomes. Not only do the already apparent and likely continued changes, such as co-teaching, affect teachers, they also will have an impact on the contributions of other professionals. School psychologists will participate in the decision making regarding the appropriateness of this instructional approach for specific students with disabilities. Co-teaching is not a panacea for the effective education of students with disabilities, but it holds great promise. It demonstrates that through collaboration professionals can create innovative options within a single system of education that is more responsive to the diversity of today's learners.

However, Alpaydın (2015: 964-965) posits that the labour supply arising with its unique dynamics and the labour demand arising as a result of the demands of schools are not equal due to their nature. There may be unemployed people while there are open positions, and this imbalance may continue for a long time. The failures with the market mechanism model prevent supply and demand from balancing in less developed countries. Participatory data generation approaches should be preferred with a mixed approach combining the strengths of the manpower approach and social demand.

Farikullah (2015:16) expresses the opinion that the essential skills we want pre-service teachers to practise are preparation for clinical examinations. By teaching around practical examples, pre-service teachers are able to correlate what they have learned in textbooks with real learners, thereby aiding revision and enhancing the learning experience. By being involved in regular teaching, pre-service teachers of agricultural sciences will be able to build the skills, attitudes and practices of being competent teachers, thereby preparing them to become the educators and trainers of the future.

Similarities between literature reviewed and empirical data

Literature indicated (*cf.* 2.7.5) that staff development must model constructivist practices for teachers if those teachers are expected to be convinced of the validity of those practices and to understand them sufficiently well to make an integrative part of their classroom repertoires. It was captured in the empirical data that teachers constructed their own understanding and knowledge of handling sheep and wool through experiencing the real-life activities and reflecting on their own experiences.

Differences between literature reviewed and empirical data

Literature reviewed (*cf.* 2.7.5) indicated that the introduction of agricultural sciences and effective teacher development programmes in secondary schools is a worthwhile effort towards adequate food security. Empirical data, on the other hand, were very quiet about food security in relation to effective teacher development programmes. I recommend that we should enhance teacher development programmes with an emphasis on food security returns for the communities around the school context. This idea might assist to sustain partnerships between agricultural sciences teachers and professionals with unique skills for support teaching.

In conclusion of this sub-section, I think the teaching of sheep-handling skills by co-researchers was enhanced through their collaborative participation in the practical wool course which took place at the research site. Creating partnerships between agricultural sciences teachers and professionals with unique skills really supported the teaching of agricultural sciences at school.

4. 4 CONDITIONS REQUIRED FOR SUCCESSFUL IMPLEMENTATION OF SOLUTIONS

In view of the empirical data discussed above and supporting literature, it would be appropriate to determine the conditions that are required to make solutions generated above work towards achieving the aim of the study. Co-researchers looked at conditions such understanding the agricultural sciences subject curriculum, organising and assessment of data generated during developmental workshops and regular reflection sessions between agricultural sciences teachers and agri-business partners in education.

4.4.1 Understanding the agricultural sciences subject curriculum

According to Thoron (2011: 103), the transition from former teaching methods is a process that is different for each teacher. The transition must be created from knowledge and willingness to make a change from teaching by being or wanting to be the central focus of the classroom to making the students the central focus point. According to Thoron (2011: 103), more experienced teachers have a greater barrier to implementing inquiry into their classrooms as they hold the standpoint that the way in which they used to teach still works. Novice teachers are eager and quick to try out new methods of teaching; however, misconceptions and misunderstandings may lead to an inability to utilize an innovative method to its full potential and might leave the novice teacher unprepared through a lack of knowledge of the content under investigation. Therefore, teacher education programmes should instil a desire in pre-service teachers to collaborate with their agricultural sciences teacher peers in order to get a sure grip on content. Assoc (2014:809), however, indicated that education for sustainable development starts from curriculum goals. These goals must be elaborated at all levels of the curriculum as a distinctive part of the curriculum, namely society and the environment, as well as cross-curricular aspects of education. In view of the above-mentioned best practices, Liu and Kipchumba (2016:117) advises that agricultural universities may be beneficial, as they embark on the process of comprehensiveness.

In connection with the above-mentioned best practices co-researchers made the following remarks during collaborative discussions at school about understanding the agricultural sciences subject curriculum:

Mr Job*:*

> *Ho bohlokoa hore pele o ruta barutwana o tsebe hore o lokela ho ba ruta eng nako e kae le ka tsela efe. Re a tseba hore dintho di ngata tse ka o sitisang ho qeta mosebetsi ka nako, empa o lokela ho dumellana le bana hore le ka qetella mosebetsi o saletseng morao neng. (It is important to know what to teach, for how long and how before one begins to teach learners. We know that there are many contextual factors that can prevent one to complete their work, nevertheless one needs to agree with learners on due date for completing outstanding work).*

Mrs Sekharume*:*

> *Empa le ha ho le jwalo ntate le lona le lokela ho re hlomella kamehla le sa fele pelo moo re kgelohang ho sebedisa mekgwa ya jwale ya ho ruta barutwana. Ho boima, ka nako e nngwe tlwaelo ya mekgwa ya kgale e re sitisa ho amohela ha bonolo ditsela tsa jwale tsa ho ruta bana. (However, you have a right to train us*

without giving up on us where we deviate from applying modern teaching strategies to teach the learners. It becomes a challenge; there are times where old methods of teaching prevent us from easily adopting current approaches to teaching the learners).

Mr Molinga*:*

I do not have a problem with switching between various teaching methods, topics and duration of teaching and assessing content and practical when teaching agricultural sciences, but you need to assist me with the methods of identifying and addressing barriers to learning agricultural sciences, particularly those barriers experienced by the learners in the classroom. I am also willing to share my methods of teaching in the PLC meetings.

In terms of textual analysis, the words spoken by Mr Job imply that planning forms an integral part of teaching and learning. In the words of Mr Job we realise that contextual factors impeding the success of teaching and learning constantly call for collaborative approaches to contingency planning between the teacher and the learner. The same implication is emphasised by Mrs Sekharume in her words *le lokela ho re hlomella* which literally means *"*you need to train us*",* as a supplement to contingency planning. A similar supplement is found when in Mr Molinga's words: *"*You need to assist us with the methods of identifying and addressing barriers to learning*".* The textual analysis of the words spoken by the co-researchers implies that if planning and teacher development could be done, it would be easier to understand the agricultural sciences subject curriculum.

With specific reference to discursive analysis, the words spoken by Mrs Sekharume, *ntate le lona*, which literally mean *"*including you father*"* produce, maintain and reproduce the existence of inequalities between teachers of agricultural sciences and their supervisors. We get the feeling that supervisors impose certain expectations through their powers on the teachers, while they are not doing anything to support the work of the teachers.

When using socio-cultural analysis of empirical data, the words spoken by Mr Molinga, *"*I do not have a problem*",* produce, maintain and reproduce social exclusion between himself and the other co-researchers. He does not seem to be worried when others struggle in understanding the agricultural sciences subject curriculum. I think that he must be showing that he is willing to share his best practices with the fellow co-researchers to enable them to understand the agricultural sciences subject curriculum as well. Social exclusion is also evident in his words, "You need to assist me with the methods*".* The *me* in the words of Mr Molinga strictly refers to himself.

Critical theory as lens guiding this study is against the production, maintenance and reproduction of inequalities and social exclusion among co-researchers. Teacher development policies viewed in this study do not in any way promote inequalities and social exclusion. As a condition for finding solutions that enhance teacher development in the teaching of agricultural sciences, it would serve us best to produce, maintain and reproduce equality and inclusive approaches towards understanding the agricultural sciences subject curriculum.

In the light of the best practices and empirical data, we can generally state that co-researchers in this study agree that understanding the agricultural sciences subject curriculum remains a

condition for successful enhancement of teacher development in the teaching of agricultural sciences at school.

4.4.2 Organising and assessment of data generated during developmental workshops

As a best practice, Liakopoulou (2012:53) indicates that in order for field experience to contribute to the development of the reflection skills of agricultural sciences teachers, the feedback they receive is of decisive importance. Collaboration either in the form of teaching in pairs or collaboration between the student and the teacher in class may contribute to the feedback required in enhancing teacher development in the teaching of agricultural sciences at school. In support of this view, Bozdogan (2015:40) suggests that educators should use field trips as a path in the context of teaching agricultural sciences. Teachers need to receive training in selective courses, a specific course, a seminar, or other method of dedicated training related to planning and organising educational field trips as part of their teaching development. Arnab (2015:1187) recommends working with stakeholders from industry, student populations, academic research fields and service facilities that also may provide broad and sometime contradictory targets and trajectories. Focus group mediation sessions and cross-cutting interest areas are useful tools for assimilating the direction of analysis across an institution. It is critical to develop an analytics strategy to accompany these types of studies.

During a participatory action research meeting held at school co-researcher made the following comments about organising and assessing data generated during developmental workshops:

Mr Molinga:

> *Re lokela ho ba le mokgwa wa ho tseba hore jwaloka barutabana le na le kutlwisiso e tshwananang ya tlhomello eo le e fumanang dikopanong tsa tlhomello. Re tlameha ho fereha ditsha tsa thuto e phahameng ho lokisetsa barutabana dihlahlobo mabapi le seo ba ithutileng sona dikopanong tsa tlhomello. Ba sebeditseng hantle ba amohediswe dikgau tse lekaneng thuto eo ba e fumanang. (We need to determine if teachers have the same understanding of training received during developmental workshops. We must engage institutions of higher learning to prepare assessment tasks to test if teachers acquired information during developmental workshops).*

Mr Phahle:

> *Seo e kaba ntho ya bohlokwa bakeng sa pokello ya professional development portfolio. Empa re lokela ho dumellana hore mehlodi yohle ya tsebo jwalo ka di manuals tseo re di fumanang e bolokoa hantle, ho qoba tahlehelo e ka lebisang tshenyong e sa hlokahaleng ya nako le tjhelete ya ho fumana mehlodi e jwalo kgafetsa ho ena le ho etsa ho hong ho re ntshetsang pele. (That can best assist to build up the professional development portfolio. But we have to agree on ways to store resource materials like manuals safely to avoid unnecessary loss of time and money to find duplicates of such material at all times instead of doing other things that can develop us).*

Mr Nzoko:

Ke dumellana le wena, feela tsebo ke ntho e fetohang le dinako, ka baka leo le rona re lokela ho dumella ntjhafatso ya tsebo le mekgwa ya rona ya ho sebetsa

hore re ikamahanye le diphethoho mekgweng ya ho rupella barutabana. Ke ka hoo re lokelang ho ikamahanya le ditsha tsa thuto e phahameng ele tlatsetso hodima boiteko ba rona. (I agree with you, but knowledge changes with the times, it is in view of this change that we also allow improvement of our methods of teaching so that they align with the changed teaching methodologies).

The words spoken by Mr Molinga suggest that teachers write an assessment task based on the information they gained from the teacher development workshops. Molinga further suggests that institutions of higher learning be involved to assist in the provision of incentives to be awarded according to the amount of training received by teachers.

There is no inequality produced, maintained or reproduced in the words of co-researchers in terms of discursive analysis. This indicates that co-researchers agree that the above-mentioned condition apply to all who are affected by it.

On a social analysis level the words spoken by Mr Molinga, namely *Ba sebeditseng hantle*, are indicative of the existence of social exclusion when incentives are given to teachers.

Critical theory as lens guiding this study supports the production, maintenance and reproduction of equality and inclusivity among co-researchers. Teacher development policies viewed in this study promote equality and inclusivity. As a condition towards making solutions that enhance teacher development in the teaching of agricultural sciences work, it is imperative to promote equality and inclusive actions towards organising and assessing data generated during developmental workshops.

We thus can state that co-researchers agree on the condition of organising and assessing data generated during developmental workshops.

4.4.3 Regular reflection sessions between agricultural sciences teachers and agri-business partners in education

Hess (2011:159) suggests that to help learners align their thinking with desired goal conceptions, educators of agricultural sciences should focus curriculum development and teaching on the existing under-developed plans held by learners. Educational approaches can be developed to help learners build schemata that are more compatible with modern agricultural production systems applied by agri-business partners. Golban (2016:228) supports this view by adding that best practices from agri-business partners in education always advise that the increase in agricultural enterprises' competitiveness must be based on the elaboration of the normative acts regarding the foreign trade regulation with agricultural products. We can see that these inputs have the same aims as those pursued by the study. Adding to the same quest Serrano, Acero and Olmos (2016: 467) indicates that school-based agricultural sciences teachers' initial limitations in taking advantage of the economies of scale could be compensated for by their departmental heads and subject advisors who engage in establishing sustainable collaborative networks with agri-business partners in education.

During a round-table discussion in a PAR session held at school, the co-researchers aired the following views concerning conditions that should exist to ensure that the solutions to the problem under study can be implemented to achieve the aim of the study:

Mr Nzoko:

> *Ho hlakile hore maano a rona a boitjhoriso le dinako tsa teng mabapi le tlhahiso temong a lokela ho nyallana le mananeo a bo ratemo ba amohetseng ho sebedisana mmoho le rona. Sena se tla netefatsa hore boitjhoriso ba barutabana e ba bo atlehileng kamehla. (It is clear that our developmental plans and times thereof should be in line with production plans of the farmers who accepted to work together with us. This will ascertain the success of teacher development plans at all times).*

Mr Job:

> *Ebang re sa latele keletso eo re tla fumana re ba sitisa ho iketsetsa diphaeello tshebetsong ya bona kaha le bona ba lokela ho rekisa ba ikamahantse le melao ya kgwebisano le mafatshe a kantle ho naha ya rona. Ebang ba ka lahlehelwa menyetla ba tla qobelleha ho iphapanya ho re thusa jwalokaha ba hlalositse kopanang e fetileng. (If we do not follow that advice, the farmers will find it very challenging to generate profits from their work because they have to sell their produce according to the international legal prescripts. If they could lose profitable opportunities, they will avoid assisting us as they indicated in the past meeting).*

Mr Phahle*:*

> *Re lokela ho netefatsa hore bohle ba iponahatsa mananeong a boitjhoriso. Hodima seo ke boikarabelo ba dihlooho tsa mafapha le baeletsi ho tsa thuto ya temo ho etsa hore ba sitwang ho iponahatsa ba etsetswe monyetla wa ho ikopanya le ba bileng teng molemong wa ngwana thutong eo re e fang bana diphaposing tsa thuto le thupelo dikolong. (We have to ensure that everybody avails themselves during teacher development programmes. Over and above, it is the responsibility of departmental heads and subject advisors of agricultural sciences to share with those who were absent during follow-up meetings in the best interest of the learners that we teach in the school-based classrooms).*

At the textual analysis level the words spoken by Mr Nzoko imply that teacher development programmes should agree with production plans of farmers who serve as partners in education. This idea is supported by Mr Job who also is of the opinion that if plans do not concur, partners in education might be reluctant to assist. The words spoken by Mr Phahle, on the other hand, imply that the solutions to the challenges under study will work on condition that there is strict attendance and subsequent collaboration sessions in support to those who missed teacher development programmes.

On a discursive analysis level the word *bohle,* which literally refers to *all,* as spoken by Mr Phahle, indicates that co-researchers will be treated equally in terms of adhering to the condition to attend teacher development programmes.

At the socio-cultural analysis level the words spoken by Mr Nzoko, *bo ratemo ba amohetseng ho sebedisana mmoho le rona,* which literally mean, *those who accepted to work with us,* tend to produce, maintain and reproduce social exclusion between co-researchers and some farmers.

The theoretical underpinnings of the study do not promote or condone any form of social exclusion among co-researchers and some farmers. Ontologically, however, it remains almost unachievable to engage all farmers in regular reflection sessions due to the fact that each farmer is following a unique production programme that may not align with the teacher development programmes in terms of time. The epistemology of the lens guiding the study assumes that knowledge is acquired through questioning and critiquing which can be exercised during regular reflection sessions among co-researchers and their partners in education. Participatory action research, on the other hand, advocates for people to work together in a common quest for what is best in any given condition, but circumstances may not always allow for collaborative sessions as some role players sometimes may be occupied elsewhere.

We can conclude that the views articulated by the co-researchers as discussed above indicate that they all agree to the condition of holding regular reflection sessions between agricultural sciences teachers and agri-business partners in education as a means to achieve the prospects of the study.

4. 5 POSSIBLE THREATS TO TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AND WAYS TO CIRCUMVENT THESE THREATS

As in most studies, in this study risks occurred through which co-researchers had to work their way in their quest for enhancing teacher development in the teaching of agricultural sciences at school. Co-researchers found that they had to find ways to deal with a lack of motivation for teachers to attend sessions for agricultural sciences teachers, a lack of access to ICT facilities at school, and misappropriation of school funds allocated to enhancing the teaching of agricultural sciences at school.

4.5.1 Lack of teacher motivation to attend development sessions

The best practice to ensure teachers are motivated, according to Tulbure, Samfira, E. M., Samfira, I (2015:197), is to employ the psycho-social abilities of the departmental heads and subject advisors to convince teachers to become life-long learners. This can be achieved through the way these supervisors interact with teachers, the quality of professional communication and the socio-emotional relationship built between supervisors and the teachers being supervised. According to Tulbure et al (2015:197), teachers do not consider the manner in which supervisors organise and lead the group of teachers under their care, or their leading abilities or those relating to planning and design as being very relevant for the activation of enhancing pedagogy. In this regard Komarraju (2013:107) argues that supervisors who are accessible build rapport with teachers, and they provide constructive feedback which is perceived to be more likely to assist extrinsically motivated school-based teachers to acquire better skills and prepare successfully for their future careers in education. Teachers who know that they can put in the effort and obtain successful outcomes may be more independent than teachers who lack confidence and may need more assistance from supervisors who are caring, sensitive, encouraging, and flexible.

Meti (2013: 418) maintains that instructional competency is the major training need of agricultural sciences teachers, as they are working as teachers. Interactive lectures, small group techniques and self-learning exercises are the most preferred training methods for teachers; therefore, they should continually be motivated to foster and enhance their teaching skills. The training institutions should consider the most preferred training methods identified by teachers, and develop current training skills as well as motivate them to adopt more suitable strategies if required. Such training should be part of motivational sessions.

Co-researchers met at the school for collaborative discussions about the lack of sessions to motivate agricultural sciences teachers:

> Mr Phahle: *Ke amehile maikutlo ke ho fumana mangolo a memo ya dikopano ka morao ho nako dikopano tse jwalo di se di fetile. Bo ntate ake le lokiseng ditaba tseo hobane ke rona ba lahlehelwang ke dintlha le Seriti ka ho se tsamaye dikopano tse amanang le thuto ya temo eo ke lokelang ho e fetisetsa baneng. Le nna ke rata ho tshwana le barutabana ba bang. Ketsahalo eo e ntiya moya. (It feels very sad to receive invites after those meetings were held. Gentlemen, this needs to be addressed since we lose information and dignity due to not attending subject meetings on information we need to teach the learners. I also want to be like other teachers. That event demotivated me).*
>
> Mr Molinga:*Moreso wena o betere o fumana melaetsa kamora nako. Nna kaha hoa tsebahala hore jwaloka hlooho ya lefapha thuto ya temo ke e neilwe feela ho e okamela ke sa e tsebe, Mosuwehlooho o ntlodisa mangolo hodimo ebe o a fetisetsa ho morutabana wa thuto ya temo. Ke tla elellwa kamorao ha morutabana a kopa disebediswa tse batluwang kopanang hore ebile le nna ke lokela hoba teng kopanang eo ntle le hore le nna ke nehwe monyetla wa ho itokisetsa kopano eo. Ekare ho ka etswa ho hong ho fetola tsela eo mesuwehlooho e laolang melaetsa ka yona dikolong. Le nna jwalo ka wena ke se ke tlelwa ke ho nyahama jwale. (My brother, your situation is better since you do get belated messages. In my case everybody knows that agricultural sciences was just allocated to my department even though I do not know it, now the head of school avoids me and gives invitation letters to my subordinate. The only time I will know that I am also invited is when the teacher makes a request for resources indicated on the invitation letter. It would be better if something can be done to change the status quo. Just as you said, I also feel demotivated.)*
>
> Mr Job*: Ke tla fana ka dinomoro tsaka le email address hore bohle ba hlokang dintlha ba ntetsetse le hona ho romela di e-mail. Le ofisi yaka e tla dula e butswe le ha ke le siyo ho ba tla rata ho ikopanya le nna sefahleho le sefahleho. Le seke la emela hore nna ke le romelle mangolo, empa buang le nna kamehla ho sa tsotelle hore o morutabana kapa o hlooho ya lefapha molemong wa hore obe leseding kamehla. (I will provide my contact numbers and my e-mail address so that those who need information can correspond with me. My office will always be open even in my absence for those who would like direct contact. Do not wait for me to send you invites, talk to me irrespective of whether you are a teacher or departmental head, so that you remain informed at all times.)*

When analysed at textual analysis level, the words spoken by Mr Phahle implied that he often received belated circulars inviting him to meetings that had already expired. A similar implication is left by the words of Mr Molinga who stated that circulars in his department were withheld from him and instead given to his sub-ordinates. The words spoken by Mr Job, "buang le nna kamehla*"* which literally mean *"*Talk to me*",* imply that both teachers and departmental heads should talk to him directly on a regular basis to ensure that the threat concerning agricultural information is put to rest.

Analysis on a discursive level of the words of Mr. Molinga, "Ke e neilwe feela ho e okamela ke sa e tsebe", which literally mean, *"*It was allocated to me even if it was clear that I do not know it*"*, clearly indicates inequality existing between him and his subordinates.

In terms of the socio-cultural level of analysis Mr. Molinga's words, *"*Moreso wena o betere *…,"* which literally mean, *"*You stand a better position*"*, produce, maintain and reproduce the social exclusion that exists between himself and his subordinates. He feels excluded when circulars are given to his subordinates. The words spoken by Mr Job, "… ba hlokang dintlha ba ntetsetse *…"*, which literally mean *"*those who need information should call me*"* were an attempt to ensure inclusivity among teachers and departmental heads who report to him.

The lens guiding the study does not allow inequality and social exclusion. Policies guiding the study do not in any way produce, maintain or reproduce any form of inequality and subsequent social exclusion. PAR rather calls for social inclusivity where co-researchers share equal power during collaborative discussions of any matter, for example, circulars pertaining to agricultural sciences, at school.

In conclusion, the co-researchers in this study agreed that a lack of teacher motivation during sessions for agricultural sciences teachers poses a threat to enhancing teacher development in the teaching of agricultural sciences at school. In terms of empirical data generated the threat is made more by poor dissemination of information in the form of circulars. If communication is dealt with more effectively, more teacher motivation sessions could be organised.

4.5.2 Lack of access to ICT facilities at school

With regard to the lack of access to ICT, Branekova (2011:101) suggests that in terms of best practices the digital competence of teachers is a condition that only can be realised through thorough training in information and communications technology, which will ensue from real ICT support of the post-graduation qualification and the professional development of the pedagogical staff, particularly those involved in the teaching of agricultural sciences at school. In the same vein, Magallanes and Lavezores (2014: 662) warns that a primary barrier to teachers' readiness for and confidence in using ICT, despite general enthusiasm and belief in the benefits for learners, is their lack of training. The lack of training or training opportunities results in a lack of confidence to use and proficiency in using ICT, as well as knowledge of all of the potential uses and roles of ICT in teaching and learning of agricultural sciences.

To add to the dilemma of lack of training and training opportunities, Natia and Al-hassan (2015:123) indicates that due to many schools' lack of computers, internet access, electricity or power, among others, the use of ICT tools continues to be a distant dream. A quantum leap of success in the use of ICT for teaching, learning and research can be achieved if all stakeholders take hands to assist in achieving the goal of integrating the use of computers and internet in schools. According to Natia and Al-hassan (2015:123), a strong, vibrant and

sustainable public-private partnership among key educational stakeholders, including government, the private sector and civil society organisations is needed to map out plans and strategies to seriously tackle the problems hindering the smooth integration of ICT in the education system.

With a view to identifying best practices in integrating ICT in teaching agriculture, co-researchers expressed their opinions as follows concerning the lack of access to the use of ICT facilities at school during a PAR meeting held at the research site:

> Mr Job: *Ebe ke ba bakae ho lona ba ka kgonang ho iphumanela di video tse bontshang mosebetsi ya ditsebi lekaleng la temo? Ha o rata ho etsa PAT bakeng sa bana ba hao empa o hloka disebediswa, mokgwa o bobebe ke ho etsa hore ba bohe video clip ya topic eo o leng ho yona. Morao ho moo o ka ba botsa dipotso ka seo ba se boneng le ho ithuta sona. (How many of you are able to obtain videos to showcase the work of expert farmers? If you would like to organise PAT for your learners even though you lack resources, the easier way is to let them watch a video clip, after which you assess learners based on what they learned.)*
>
> Mrs Sekharume*: Nna tjhee ke tseba feela ho ngola le ho sheba di email ka computer. Haele di video tsona ke tla hloka training ya ho di fumana. Nka kgona ho nka video clip nakong ya field trip empa ke hloka ho tseba hore ke etsa jwang hore bana bohle ba e bohe ka nako ele nngwe phaposing ya borutelo. Ntle le moo boholo ba boeletsi boo re bo bokelleditseng kopanong tsena tsa rona ke lefeela. (All I know is to type and browse on e-mails with a computer. In as far as videos are concerned I will need training to get them. I can record a video clip during a field trip but I need skills to enable all learners to watch it in the classroom at the same time. Otherwise most of what I can gather from subject meetings will remain unusable.)*
>
> Mr Nzoko*: Ke na le tsona di video, empa ke hloka tsebo ya ho di hokela le ho di bapala ka bo nna. Ke kopa taba eo e be teng mananeong ohle a PLC. Ho hloka tsebo e batsi ya ICT ke ntho e ka batlang e nyopisa merero ya rona ya boitjhoriso thutong ya temo. (I have videos, but I want to know how to connect and play them on my own. I propose that this issue be addressed during PLC programmes. Lack of practical skills on usage of ICT fails our development plans in the teaching of agricultural sciences).*

At the textual analysis level the words of Mr Job indicate that he wants to know the number of teachers who are able to download *YouTube* subject-related videos for classroom display during the teaching of agricultural sciences at school. The words spoken by Mrs Sekharume and Mr Nzoko indicate that they need training and knowledge of working through the use of ICT systems at school.

In terms of discursive analysis the words as spoken by the co-researchers indicate intellectual inequalities existing among the co-researchers in their ability to use ICT in the teaching of agricultural sciences at school. This gap needs to be closed prior to teacher development in the teaching of agricultural sciences at school. Engaging in teacher development programmes without first honing teachers' skills in ICT remains a threat towards the aim of the study.

Words spoken by co-researchers in this regard produce, maintain and reproduce social exclusion that in some form is self-imposed by co-researchers who know that they have a challenge in the use of ICT, but have not done anything towards self-development to close the gap. This is particularly clear from Mr Nzoko's words, "Ke na le tsona di video, empa ke hloka tsebo ya ho di hokela*"*, which literally mean, *"*I have videos, but I am not able to connect these*"*.

Critical theory as a lens guiding this study promotes questioning and critique as the pillars for developing a desired epistemological stance. Words spoken by co-researchers, namely "Ke tla hloka training*",* which literally mean, *"*I will need training*",* open the field for participatory action research that may assist these teachers to deal with the lack of access to and the ability to use ICT facilities in the teaching of agricultural sciences at school.

To summarise, we can see that the co-researchers in this study agreed that the lack of access to and the ability to use ICT facilities threatens the enhancement of teacher development in the teaching of agricultural sciences at school.

4.5.3 Misappropriation of school funds allocated for the enhancement of the teaching of agricultural sciences at school

Modisaotsile (2012:4-5) clearly indicates that a number of factors or problems hinder teachers in South Africa in providing a good standard of education. Many school governing board (SGB) members lack the necessary financial knowledge and skills, and are placed under tremendous pressure because they are unable to develop practical financial solutions to practical financial problems. Most agricultural sciences teachers prefer not to teach at schools with little or old resources, as this hinders their performance and that of the learners. According to Thenga (2012:38-45), it is advisable for the principals to develop a whole school approach to the drafting of a budget, which means that everyone who is involved in implementing the budget should be involved in drawing it up. According to Thenga (2012:38-45), the principal, the finance committee and finance officer all have to play a role in the management of school funds. As a best practice, accounting for school funds may be done by chosen personnel in the school, but it remains the responsibility of the principal and the SGB, therefore it is essential that they have the competence to deal with financial matters. Mestry, Hendricks, and Bisschoff (2013:449) also argues that a need exists to initiate a collaborative relationship between the principal and SGB in the effective management of financial resources. Principals as collaborative leaders are in a good position to develop collaborative structures that promote trust, co-operation, delegation, teamwork, effective communication, and collaborative decision-making.

To finalise discussions on plausible risks that we needed to circumvent, the co-researchers met at the research site and aired the following views about the misappropriation of school funds allocated for enhancing the teaching of agricultural sciences at school:

> Mrs Sekharume*: Bana ba lefile tjhelete ya field trip ho ya iphumanela PAT , empa re hlokometse hore tjhelete yohle e wetse ka lebaka la mekitlane e mengata ho ya ka mosuwehlooho. Empa o ile a qetella a re adimile ya hae. O se a tla kenya claim ya tjhelete eo ho banka ya sekolo mohla motlakase o leng teng ka tsela ya ETF.(Learners have paid money for a field trip to acquire PAT, but we realised that all the money was consumed by debit orders according to the head of the*

school. But he finally lent us his personal money. The head of school will then claim it from the school funds as soon as electricity is available to do the ETF).

Mr Phahle*: Esale ke kenya kopo ya di textbook empa ese ebile ele dihlahlobo tsa June bana ba hloka dibuka tse balwang. Ha ho etswa budget hothwe re bue tseo re di hlokang. Ha tjhelete e fihla hoba le bothata ba ho rekela bana dibuka. Ka tsela ena mosebetsi wa rona o haellwa ke dithusa thuto. Re dula re ipotsa hore bothata bo kae hore re bolellwe feela se sitisang hore re tsebe ho leka mekgwa e meng ya ho fumanela agricultural sciences LTSM (learning and teaching support material). (I have requested that an order be made out for buying textbooks for learners, but we are now in June exams without learner textbooks. When drafting a budget we are requested to submit subject needs. When there is money available, what is the problem regarding the acquisition of textbooks? In this way our work lacks learner support material. We always ask ourselves why are we not being informed of things of what hinder the supply of textbooks so that we can improvise in agricultural sciences LTSM).*

Mr Job*: Mokgatlo wa barutabana ba temo o ntse o hlophisa di study guide tse ka fumanehang ka ditefello tse tlase ebile di ka hatiswa ke sekolo ka seng ho lekana palo ya bana ba grade 10-12. Mohlomong sena se tla bebofaletsa dikolo ditjeho tsa ho reka dibuka. Di study guide tsena di tla eketsa boiphihlelo ba barutabana ba sa tsebeng thuto ena ya temo ka botebo. (The organisation of agricultural sciences teachers has compiled cost-effective study guides for Grade 10-12 learners. This might reduce the costs of buying textbooks. These study guides will supplement the skills of teachers with limited knowledge of agricultural sciences.)*

At a textual analysis level the implication of the words spoken by the co-researchers is that some schools have more bills to settle and that this situation affects field trips as one of the methods of teaching agricultural sciences at school. Added to this, it came to the fore that some schools could not afford to buy textbooks for learners. We also heard that organisations of agricultural sciences teachers are preparing learning guides to reduce the risk of the misappropriation of school funds allocated for enhancing the teaching of agricultural sciences at school, as this misappropriation of school funds threatens the success of teacher development programmes in this study.

At a discursive analysis level the words spoken by Mrs Sekharume, "O ile a qetella a re adimile kareteng ya banka ya mekitlane ya hae*",* which literally mean, *"*He finally lent us money from his personal credit card*",* are indicative of inequalities that exist between some school leaders and sub-ordinates. Some teachers have to strictly follow legal imperatives in terms of school finance, while leadership, on the other hand, is at liberty to deviate without being subjected to disciplinary measures for misappropriation of school funds allocated for the teaching of agricultural sciences at school.

At socio-cultural level the words spoken by co-researchers produce, maintain and reproduce social exclusion between the school leadership and the teachers of agricultural sciences at school. The words of Mr Phahle, "Bothata bo kae hore re bolellwe feela se sitisang*",* which literally mean, "What is the problem in acknowledging us about the challenge" of not buying textbooks for each learner of agricultural sciences. Apparently the challenge is known by those

in charge of school finance, they just prefer not to involve the teachers in finding possible solutions to this threat.

Ontologically some schools are faced with a financial threat to teacher development in the teaching of agricultural sciences at school. Participatory action research (PAR) could assist to address the epistemological views on this threat. According to scholarly work dealing with the best practices in this regard, appropriate measures should be used to minimise the risk brought by the misappropriation of school funds allocated for enhancing the teaching of agricultural sciences at school.

We can conclude that co-researchers in this study agreed to the fact that misappropriation of school funds allocated to enhancing the teaching of agricultural sciences at school remains a plausible threat against achieving the aim of the study. Collaborative networks in the school structures could come in handy to minimise the risk perceived in this regard. We now should look into plausible indicators of success in enhancing teacher development in the teaching of agricultural sciences at school.

4.6 INDICATORS OF SUCCESS IN ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

As hallmarks of success, compilation and assessment of the CPTD, IQMS (Integrated Quality Management System) and subject-related files for each agricultural sciences teacher and/or organisation; regular updates and marketing of the agricultural sciences website and the establishment and management of effective programmable logic controller (PLCs), communities of practice and culture responsive educational programmes for agricultural sciences teachers are discussed in greater detail in the paragraphs to follow.

4.6.1 Successful compilation and assessment of the CPTD, IQMS and subject-related files for each agricultural sciences teacher

As best practice, according to Mosoge (2014:15-16), teachers act as the driving force behind the actualisation of transformation in education. The development of teachers, therefore, is crucial in an education system. It seems, however, that teacher development is a neglected aspect of the performance management system employed in South African schools. Performance management should enjoy centre-stage in all development workshops offered by the Department of Education. Expanded knowledge and expertise on processes such as mentoring, coaching and monitoring will enhance the zeal to implement performance management of agricultural sciences teachers at school. In this regard Goetz (2015:5) posits that the implementation of IQMS for enhancing teacher development in South Africa, which also evaluates job satisfaction and the working atmosphere of teachers at school, provides a good opportunity to develop enhancement strategies. Such enhancement strategies should be developed with the involvement of policy makers, departmental heads, and teachers themselves.

I support the best practices discussed and hope they will simplify the organisation of other subject-related portfolios applicable to agricultural education at school. I think the word *involvement* as stated in scholarly work referred to above means that teachers need to have a say in designing development approaches that affect their own growth. In my opinion

departmental heads, subject advisors and agri-business partners in teacher development fall in the category of professionals with *"*expanded knowledge and expertise*"*, identified by scholars in the best practices.

During a PAR meeting held at the research site, co-researchers expressed the following views regarding the successful compilation and assessment of the CPTD, IQMS and subject-related files for each agricultural sciences teacher:

> Mr Phahle: *PLC e nthutile hore ho bohlokoa ho nka karolo ho CPTD le IQMS. Ke nkile karolo ho IQMS dilemo tsohle ke nahana hore ke leano la ho qeka ho fumana 1% ya moputso waka.Ke hona ke lemohang hore e etseditswe boitjhoriso baka mosebetsing. Kamehla ke ne ke teneha ha ho fihla nako ya IQMS. (Through PLC I learned the importance of participating in CPTD and IQMS. I participated in IQMS thinking that it is only designed to help us earn an extra 1% income. Now I can see that it is important for my own development. I always became annoyed when the time for IQMS arrives).*
>
> Mr Job: *Re leboha karolo eo dihlooho tsa mafapha di e bapetseng ho di PLC meeting. Ebang ene ese ka lona ekabe eba le jwale barutabana ba etsetswa lerata la hore ha ba tsebe mosebetsi empa ka lehlakore le leng ba sa tjhoriswe ke baqosi ba bona. (We are grateful for the role played by departmental heads during PLC meetings. If it was not because of you, we could continue to see accusations that teachers are underperforming while on the other hand the very same teachers are not being developed by their accusers).*
>
> Mrs Sekharume: *Jwale motho o tla ke a hlahelle hantle. Ke se ke utlwisisa hore SBA file e etswa jwang le hore ke eng. Ha motho o qala ho ruta ntho tsena di a ferekanya, empa jwale ke se ke bone hore mosebetsi o etswa jwang. (Now one will get good exposure. I now understand how to organise an SBA file and what it actually is. At early stages of teaching these things seem to be confusing, but I can now see how the work is done).*

At textual analysis level the words spoken by Mr Phahle imply that he learned the importance of taking part in CPTD and IQMS. He said he always thought that the reason to participate in IQMS was mainly to get 1% of his salary. He also implies that he now is aware that IQMS also is designed for his own development. Lastly he implies that he always got annoyed when the time for IQMS arrived. The words spoken by Mr Job imply that he is grateful for the role played by departmental heads in PLC meetings, but he still is concerned about teachers who are always blamed for poor performance, but they are not capacitated to improve in this regard. The implication behind the words spoken by Mrs Sekharume is that she now understands how an SBA file is organised. She further implied that when she started teaching for the first time things seemed challenging, but as time elapsed she became aware of the how work should be done.

On a discursive level of analysis the words spoken by co-researchers do not produce, maintain and reproduce inequalities among various groups involved in the study. I see this as a sign for improvement in the way PLCs are conducted.

At socio-cultural level the words of the co-researchers do not produce, maintain or reproduce social exclusion among various people involved in the participatory action meetings.

The empirical data generated concur with the principles of critical theory, subject policies and participatory action research applied in this study. Contributions made by co-researchers correspond with the best practices stated under the indicators of success reviewed. As stated in the conceptual framework under study, the goal of teacher development (*cf.* 2.3) is to have teachers who are reflective practitioners; who can make informed professional choices; and who are prepared to become empowered professionals.

We can finally conclude that co-researchers in this study concurred that the compilation and assessment of the CPTD, IQMS and subject-related files for each agricultural sciences teacher indicated success in enhancing teacher development in the teaching of agricultural sciences at school.

4.6.2 Successful organisation, and regular updating and marketing of the agricultural sciences website for the agricultural sciences teacher

A number of best practices are proffered by Ndem (2016:14-15), who suggests that if the teachers are provided with the basic incentives, given regular training and re-training such as in conferences and workshops, being properly supervised, provided with the adequate instructional materials, as well as employment of qualified and experienced teachers, coupled with the application of the appropriate teaching methods such as discussion, problem solving, demonstration, project methods, as well as field trips, the implementation of secondary school agricultural sciences programme by the teachers will be enhanced. Ndem (2016:14-15) further indicates that modern teaching requires the use of modern tools and equipment, as well as the use of information and communication technology tools and gadgets such as the computer, power points, overhead projectors, video tapes, microphones, mega-phones and audio-visual equipment. The equipment can only be operated effectively by the teachers if they are re-trained on the use and manipulation of the equipment. However, Douthwaite (2010:255) indicates that teachers could be successful largely because they are able to work with evolving networks of partners and that they do need to be embedded in networks through which they become aware of the need and opportunity, of how the technology is being promoted and used, and of what the market is likely to demand in future. It is a way of putting the dictate to act locally, and think globally, into practice. Crista (2014:56) supports these approaches by emphasising that the teaching methodology used by teachers while teaching agricultural sciences is based on oral communication methods, and direct reality exploration methods in equal shares with the direct action and oral-visual communication methods. Crista (2014:56) further maintains that from the point of view of the teaching methodology used in basic agricultural education, an adaptation to student learning needs is required in the sense of using new active and interactive teaching strategies, based on effective student involvement in the learning process.

In my view, the above-mentioned solutions can be realised through the presence of an accessible agricultural sciences website where teachers from different walks of life can form a network to exchange shared knowledge and skills required in the teaching of agricultural sciences at school.

Co-researchers aired these views concerning the successful organisation, regular updating and marketing of the agricultural sciences website for the agricultural sciences teacher during a PAR meeting held at school:

> Mr Molinga*: Hona le di magazine tse tswetseng pele tsa temo mona naheng ya rona. Ebile di a fumanahala ho marangrang a internet ka mokgwa wa ho etela website tsa bona. Ke rata ho le kgothalletsa ho etela di website tseo hobane di na le thuto tseo le ka di nehang bana ka tsela ya CASE study. (There are well established agricultural magazines in our country. These are also available on the internet through their web-addresses. I would like to encourage you to surf through these websites because they contain lessons appropriate for designing case studies for learners).*

> Mr Phahle*: Ke lemohile hore ho thakgotswe website bakeng sa thuto ya Natural sciences. Tsohle tseo barutabana ba di hlokang ba kgona ho di fumana moo. Ho kaba molemo le rona ha re ka ba le website ya mofuta oo moo le rona re ka kotulang tsohle tse ahang bokgoni ba rona. (I have realised that a website for the natural sciences subject has been launched. Everything that teachers need is made available there. It would benefit us if a website of this kind could be established for agricultural sciences teachers where we could, as well, find what could grow our skills).*

> Mrs Sekharume*: Ke ditaba tse monate tseo le tlang ka tsona. Ebile di bontsha katleho le tswelopele ho PLC ena ya rona. Ke dintho tse jwalo tse qholotsang motho hore o ithute ho sebedisa komporo ha o ruta bana thuto ya temo. (You have brought us interesting news. This kind of information indicates the success of our PLC. It is things such as these that provoke one to make use of a computer when teaching agricultural sciences.)*

At textual analysis level the words spoken by Mr Molinga imply that teachers should surf through the websites of agricultural magazines to get information that could be used for case studies. The implication we get from the words of Mr Phahle is that he became aware that in some subjects like natural sciences a website has been created for teachers. He further said that we should establish a website for agricultural sciences teachers. The words spoken by Mrs Sekharume indicate that she realises that she has to improve her computer skills.

At discursive level of analysis the words spoken by Mr Phahle produce, maintain and reproduce inequalities between the teachers of agricultural sciences and teachers of the natural sciences. The existence of a website for natural sciences indicates that we need to enhance teacher development by creating a website for agricultural sciences teachers. I think this is an outstanding contribution which we would not have realised if there were no PLC meetings for agricultural sciences teachers.

At sociocultural level of analysis the words spoken by Mr Phahle produce, maintain and reproduce self-imposed social exclusion between teachers of natural sciences and teachers of agricultural sciences. I think a website created for the natural sciences teachers was not necessarily created by any personnel in agricultural sciences field. Again the creation of such a website may not be created to dehumanise the role of teachers in the teaching of agricultural sciences.

In terms of critical theory, it is correct to question the absence of a website for agricultural sciences teachers. According to the CAPS policy (*cf.* 2.6), all the information needed to assist teacher development endeavours could be made available on the website proposed to inculcate epistemological perspectives needed for teacher development. Ontologically, the website proposed could assist to improve collaborative sessions among PLC members in the subject agricultural sciences.

In view of the above comments and the best practices mentioned, I posit that co-researchers agree that organisation, regular updating, and marketing of the agricultural sciences website for the agricultural sciences teacher will indicate success in enhancing teacher development in the teaching of agricultural sciences at school.

4.6.3 Successful establishment and management of effective PLCs, communities of practice and culture-responsive educational programmes for agricultural sciences teachers

Watson (2014: 26-27) warns that PLCs may function as a means to silence dissatisfaction through the hegemonic appeal to community and its normalising function as arbiter of ideological control. Assumptions that underpin the notion of community are not self-evident truths which lead inexorably to enhance professional learning and school improvement. Zhang, Yuan and Yu (2017:233) advises that teachers need to break down the cultural barriers to enhance authentic sharing and collaboration. Leaders and policy makers should provide more supportive conditions for schools to enact PLCs. All the concerned parties should constantly communicate with one another to enhance their mutual understanding. Sa'ad, Sabo and Abdullahi (2015:114) posits that micro-teaching assists undergraduate agricultural education students in developing teaching skills, confidence, reduction in their level of anxiety and fear, ability of managing classes, selecting proper teaching goals, preparing good lesson plans, ability of speaking in front of a group as well as the selection of appropriate instructional materials and proper time management, which ultimately lead to enhanced teaching practice performance. I think micro-teaching needs to be exercised so that PLCs become effective in enhancing the teaching of agricultural sciences at school.

During collaborative discussions among co-researchers held at school, the following views concerning the successful establishment and management of effective PLCs, communities of practice and culture-responsive educational programmes for agricultural sciences teachers were expressed by co-researchers:

> Mr Nzoko*: Re tla be re atlehile dikopanong tsena tsa rona ebang re ka etsa sebaka hore e mong le e mong a re bontshe hore yena o ruta thuto ya temo ka mekgwa e jwang. Empa seo se ka atleha ebang re ka dumellana hore re hlongwe dipotso tse batlang tlhakisetso. Ke dipotso tse tla bontsha kgaello boitokisetsong ba rona ba ho ruta thuto ya temo. (We shall have succeeded in our meetings if we could create space for everyone to show us how they teach agricultural sciences. But this can only be possible if we could be allowed to ask clarity seeking questions. Questions will indicate limitations of our teacher development programmes.)*
>
> Mr Phahle*: Rona ba bang re ikela feela baneng re ilo ruta re sa tshwara le ha ele pampiri e bontshang boitokisetso. Jwale tlwaelo eo e tlo feela ebang re ka qala ho rutana re le bang. Le ha hole jwalo ke ananela tlhahiso eo kaha le ho di PLC tsa dipalo ba latela yona tsela eo. (Some of us go to class without any lesson*

preparation. That habit will have to stop if we conduct micro-teaching amongst ourselves. Nevertheless, I accept that procedure which is already applied by teachers of mathematics.)

Mrs Sekharume*: Ebang ho ka kgonahala, re lokela ho iketsetsa monyetla wa ho bua kamehla le bo ratemo hobane le moo re ka fumana tsebo eo re ka e arolelanang dikopanong tsena tsa rona. Ka tsela eo re fetoha bafuputse ba ditaba tsa temo ba ka dinako tsohle. (If it was possible, we ourselves could create an opportunity to talk to farmers on a continuous basis to add to the knowledge that is shared in our meetings. In that way we act as investigative journalists of all times for agricultural news.)*

At textual analysis level Mr Nzoko gives the indication that he wants teachers to reflect on their own teaching methodologies. He also indicated agricultural sciences teachers should allow learners to ask questions as they indicated that these questions would assist teachers to close learning gaps. The impression we gain from Mr Phahle is that he occasionally goes to class unprepared. On the other hand, Mrs Sekharume implies that we need to have regular interaction with farmers in order to get information that can be shared during PLC meetings.

At discursive level of analysis the words spoken by co-researchers do not produce, maintain or reproduce inequalities among various groups of people involved in participatory action research. I think this indicates progress towards achieving the aim of the study.

At socio-cultural level the words spoken by co-researchers do not produce, maintain or reproduce any form of social exclusion. Instead, we see Mr Nzoko promoting inclusivity that is hoped to exist when learners are proffered with an opportunity to ask questions in order to enhance teacher development in the teaching of agricultural sciences.

In terms of critical theory, it is imperative for teachers to question their own methodologies if they want to meet the needs of learners in their agricultural sciences classrooms. On the other hand, teachers like Mr Phahle need to strictly observe the subject policy as it suggests (*cf.* 2.7.1.1) that planning forms an integral part of teacher development in the teaching of agricultural sciences.

It is clear, according to the empirical data which are aligned with the best practices, and the lens guiding this study and teacher development policies, that co-researchers agree that the establishment and management of effective PLCs, communities of practice among farmers and teachers, as well as culture-responsive educational programmes for agricultural sciences teachers all display success in achieving the aim of the study.

4. 7 SUMMARY

In this chapter we elucidated a number of approaches which can be followed in order to enhance the teaching of agricultural sciences at school. Co-researchers had an opportunity to question, comment and critique all the challenges, solutions, conditions, threats and the indicators of success in our PAR-based collaborative quest to find what works best in enhancing teacher development in the teaching of agricultural sciences at school. According to Hanuscin (2012:440), collaboration between general and special educators is one way to increase responsiveness to the need of their diverse learners in the classroom. However, that

collaboration should not stop at the classroom level, but continue beyond into all discussion forums.

The empirical data generated were analysed with the aid of critical discourse analysis (CDA). Empirical data generated through PAR sessions were viewed through Critical Theory (CT) as the theoretical framework guiding the study. We had the opportunity to compare the opinions of co-researchers in different situations in our quest to find ways to enhance teacher development in the teaching of agricultural sciences at school (*cf*. Rubtcova, 2016:69). Similarities and differences between empirical data and the literature review were also investigated in this chapter. It is in view of the differences one can claim that this study adds to the body of knowledge in enhancing teacher development in the teaching of agricultural sciences at school. This is supported by Aladag (2014:884) who posits that it would be beneficial to integrate several teaching approaches and instructional technologies to enhance the effectiveness of teacher development programmes in the teaching of agricultural sciences at school.

CHAPTER 5

FINDINGS AND RECOMMENDATIONS ON ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL

5.1 INTRODUCTION

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. Chapter five proffers a synopsis of the general findings and recommendations established and those revealed while comparing similarities and differences between literature reviewed and empirical data generated during collaborations among co-researchers. We also found it appropriate to remind the reader about the background to the study, theoretical framework, problem statement, research question, objectives of the study, research design and methodology and data analysis used in an effort towards reaching the aim of the study. Chapter five also reflects on the limitations of the study and recommendations for future quests. At the end of Chapter five is a brief summary. Below I begin with the background to the study.

5.2 BACKGROUND TO THE STUDY

The aim of the study was to enhance teacher development in the teaching of agricultural sciences at school. The need to address the aim of the study exists because (*cf.* 1.1) some teachers have not specialised in teaching agricultural sciences, while in some schools agriculture still is used as a form of punishment. It thus became a challenge for some teachers to meet curriculum requirements and aims outlined in the CAPS document. Integration of the subject agricultural sciences with other subjects in the school curriculum remains a challenge for some teachers because they have not specialised in mathematics, physical sciences, life sciences, technology, economics, geography and other subjects which are needed as additional approaches to teaching and learning the subject agricultural sciences, and this caused frustrations in teachers. It was evident that methods of teaching the subject have not been broadcast on television by some countries, hence the need to enhance teacher development in the teaching of agricultural sciences. The study used PAR to assist in generating data which when were analysed to be used to make recommendations to contribute to enhancing teacher development in the teaching of agricultural sciences at school.

In view of this background I recommend (*cf.* 4.6.2) that teachers be provided with the basic incentives, are given regular training and re-training through PLC networks, conferences and workshops, and are properly supervised. Provision of adequate instructional materials is vital, as well as the employment of qualified and experienced teachers who, upon employment, must be continuously developed in terms of usage of appropriate teaching methods such as discussions, participatory action-based problem solving, demonstrations, project methods and well as field trips. The study found that these recommendations are anticipated to be effective, on condition that modern tools and equipment as well as information and communication

technology tools and gadgets such as the computer, power points, overhead projectors, video tapes, microphone, mega-phone and audio-visual equipment are also used in the teaching of agricultural sciences at school. The risk of mitigation of the above recommendations and supporting conditions is the discord between the learners' learning needs and the teaching methods in the sense of using new, active and interactive teaching strategies, based on effective learner involvement in the learning process.

The study found that Agricultural Sciences is viewed, by some scholars, as the study of the relationship among (*cf.* 2.6) soils, plants and animals, with reference to the production and value adding on food, fibre, fuel and other agricultural commodities that have an economic, aesthetic and cultural importance. As a field of study, Agricultural Sciences is focused on Soil Science; Plant Studies; Animal Studies; Agricultural Economics; Basic Agricultural Chemistry; Basic Genetics and Biological Concepts; Sustainable Natural Resource Utilization and Agro-ecology. The aims of teaching agricultural sciences learners from Grades 10 to 12, in the context of public schooling in South Africa, are inclusive of developing an awareness of the management and care of the environment, natural resources and the humane treatment of animals through application of science and related technology; developing problem-solving mechanisms within the contexts of agricultural production, processing and marketing practices; developing awareness on the social and economic development of the society at large through personal development in the commercial and subsistence farming enterprises; to ensure that teachers and learners are kept abreast of information aligned with responsible citizenship in the production of agricultural commodities, inculcating maximum care for the environment and addressing social justice issues; and to enhance awareness of agricultural indigenous knowledge and practices through understanding agricultural sciences in historical and social contexts.

If agricultural sciences are a field of study in terms of the above findings, I recommend that those responsible for CPTD consider grounding their efforts in currently researched approaches. I personally view agricultural sciences teachers as community members. In the light of this view, as well as the aims of teaching agricultural sciences, I recommend that teachers be developed under the conditions where COP are established among teachers, local farmers, extension officials and other relevant stakeholders in enhancing teacher development in the teaching of agricultural sciences at school. A risk that needs to be addressed in supporting the recommendation and its condition stated above refers to the act of undermining indigenous epistemologies and ontological perspectives associated with past agricultural science reforms.

Teacher development is a process (*cf.* 1.1), and, therefore, different training activities and support systems are required at various stages of this continuum. I therefore recommend that the IQMS be augmented in such a way that teachers of agricultural sciences could possibly be assisted, through IQMS, in meeting the curriculum requirements and aims of teaching agricultural sciences in the context of South African private and public schools. The education that teachers receive has the potential to make a difference to children's learning and therefore warrants careful attention.

Based on the study, it is recommended that the following be effectuated:

- A developed teaching force;
- continuous teacher support;
- constructive teacher critique;

- effective time-management and efficiency;
- effective management of the teaching and learning environment;
- setting higher teacher development targets;
- improved teacher-developer networks;
- simplified agricultural sciences curriculum;
- clear and focused lesson presentations;
- continuous monitoring and control of the work of teachers and learners;
- inclusive teaching and assessment strategies; and
- rewards for enhanced teacher and developer performance.

Specific conditions should reign in order to ensure that the recommendations stated above be realised to effect the desired enhancement of teacher development in the teaching of agricultural sciences at school. While only some conditions might be valid in the initial activities of some teacher development programmes, achievable initial steps are important starting points in the process of enhancing teacher development in the teaching of agricultural sciences at school.

In the study it was found that teacher developers need to reconsider the occasions when (*cf.* 1.1) agricultural sciences teacher frustrations and challenges with the process of development might create counter-educative experiences. This issue has particular reference to lack of access to higher education (*cf.* 4.2.4). In the light of this finding I recommend that alternative approaches to the use of higher education institutions, be applied towards enhancing teacher development in the teaching of agricultural sciences. In the context of the South African education system, teachers of agricultural sciences need mathematics and physical sciences from basic education as prescribed requirements to register for admission into some higher agricultural sciences education degree qualifications. The threat this condition holds should be considered by education authorities and the education systems, to determine whether alternatives to higher education could not be considered to improve teacher salaries and promotions in the career of agricultural sciences teaching.

The findings of the study also indicate that (*cf.* 1.1) there are better methods of learning than through the conventional ways of instruction. Some post-secondary institutions and universities in particular, are beginning to realise the relevance of the use of appropriate methods through which agricultural sciences teachers can be developed. Some methods of teacher development have been proved to be non-transformative and as a result do not assist teacher developers to enable teachers to master the skills needed to unlock the potential of the learners at school. This is supported by Mr Molinga in the quote below.

Mr Molinga argued that:

> *Nna ha ke kgone ho mamella ho ballwa ditaba nako e telele ke sa etse letho. Ho a tshwana ha re sa fuwe sebaka sa ho etsa ho hong, re ntse re tlo lebala ntho tseo ba re jwetsang tsona. (This literally means that one cannot endure listening to prolonged speeches without being actively involved in doing something. It's all the same, if we are given nothing to do we are still going to forget everything they are telling us.)*

In view of the above I recommend that a school governing body, with its financial committee, should raise funds towards obtaining resources needed for the implementation of school

improvements and the subject improvement plan. The threat to this recommendation is theft and vandalism by some members of the school community. This directly calls for an effective school safety policy. Nevertheless, it remains particularly important to attract active participation of teachers in programmes aimed at enhancing teacher development in the teaching of agricultural sciences at school. Mr Phahle suggested another functional mechanism that could assist schools to circumventing possible damage to school property so as to ensure maximum utilisation of school-based agricultural resources.

Mr. Phahle:

> *Ho ka re tswela kgomo ho sebetsa mmoho le setjhaba tlhokomelong ya dirapana tsa meroho le tlhokomelong ya diphoofolo tsa temo tse fumanwang sekolong, haholo dibakeng tseo mesuwe ya temo e lebang malapeng ha sekolo se tswile, mafelong a beke, matsatsing a phomolo le ka dinako tsa kotulo ebang sekolo se lemme masimo a maholo. (*Meaning: *It would serve us best to work in cooperation with the members of the school community in maintaining vegetable gardens and in maintaining the livestock that is found at school, particularly in areas where agricultural sciences teachers need to return to their homes after school, during weekends, during school holidays and during the times of harvest in cases where schools have large areas of field crops.)*

The study found the contribution of Mr Phahle to be an indicator of success in enhancing teacher development in the teaching of agricultural sciences, particularly at school. I therefore recommend that schools that offer agricultural sciences be used as centres of excellence for teacher development. This recommendation will benefit the society more, on condition that the agricultural produce and by-products found during the process of teaching and teacher development could be traded within local markets. The success of such a venture could in turn supplement school grants while generating jobs and adding to the food security basket of immediate school communities.

In conclusion: It is obvious from the background to the study that enhancing teacher development in the teaching of agricultural sciences carries with it more advantages than usually anticipated. As stated in the background, enhancing teacher development is a continuous process which cannot be achieved in a few years of teaching agricultural sciences at school. In view of the above sentiments I recommend that teacher development be taken seriously by all stakeholders. The threat that could ensue in failure of this recommendation would be teacher developers focusing their programmes only on monitoring, threatening and charging teachers for poor performance in the execution of their duties, while missing another route that is bound to result in success, namely enhancing teacher development, particularly in the teaching of a complicated subject such as agricultural sciences, through a continuum of mentorship programmes at places where teachers are employed to perform their functions.

5.2.1 Theoretical framework

The theoretical framework that is used in the study is critical theory. We found that critical theory was helpful in providing excellent tools that not only indicated our world and ourselves

through new and valuable lenses, but also could strengthen our ability to think logically, creatively, and with a good deal of insight (*cf.* 2.2).

I recommend that stakeholders engaged in enhancing teacher development in the teaching of agricultural sciences at school undertake a more profound assessment of the CPTD, IQMS and other teacher development policies to unlock and pay attention to that which prevents them from taking a comprehensive approach to teacher development. My understanding of critical theory made me believe that there is more to it than that which we managed to find in this study. The threat against this recommendation may be fear from the side of stakeholders and teachers to question the status quo of teacher development in the teaching of agricultural sciences with particular reference to what is taking place at school. This fear was evident in the comment made by Mrs Sekharume, quoted in the excerpt below.

Mrs Sekharume said:

> *Ha ho bonolo ho nyatsa maano a ntshetsopele ya mesuwe le ha re ntse re bona hore ha e re thuse ho atlehisa mosebetsi wa ho ruta thuto ya temo mona sekolong. Ho botsa feela ese eba mokgwa wa hore o fahlile mmuso ka lehlabathe kapa hona ho iketsa tsebanyane ditabeng tsa tsamaiso sekolong.* (Literally this means that it is not easy to question teacher development policies even though we are aware that they fail to improve our teaching of agricultural sciences at this school. By merely asking questions you shall have undermined the authorities by behaving as though you are highly knowledgeable in matters of school management.)

In view of my understanding of critical theory I recommend that leaders of teacher development activities use everything in their power to create an atmosphere that is conducive to free participation by all involved in collaborative dialogues aimed at enhancing teacher development in the teaching of agricultural sciences at school.

In the next sub-section we look at the problem statement.

5.2.2 Problem statement

The interest in the object of study was raised by the lack of teachers who specialised in teaching agricultural sciences at school; a challenge for some teachers was to meet the curriculum requirements and aims of teaching the specified subject. Some school-based departmental heads had no interest in providing school-based continuous teacher development and support since they were not employed to manage the allocated subject at school. The problem under study is enlarged by an inadequate number of subject advisors who are expected to provide continuous teacher development and support to a large number of schools that offer agricultural sciences.

5.2.3 Research question

The question this study set out to answer was: How can we enhance teacher development in the teaching of agricultural sciences at a school?

5.2.4 The aim of the study

In concurrence with and based on the research question the aim of the study was to enhance teacher development in the teaching of agricultural sciences at school.

5.2.5 The objectives of the study

In order to find answers to the research question and to be able to attain the aim of the study, the objectives determined were to identify the challenges to teacher development and to make recommendations in terms of solutions, conditions, threats and indicators of success in enhancing teacher development in the teaching of agricultural sciences at school.

5.2.5.1 The challenges facing teacher development programmes in the teaching of agricultural sciences

The study found that an integrated focus (*cf.* 4.2.1) on the practice of agricultural sciences in which the ethical and societal implications of the science are taken into consideration, allows teachers to see the connections between their research, the concepts they learn in lectured courses, and the broader impact of the science on society. Agricultural sciences, as Toomey (2014:496) indicated, deserve a holistic process that responds to a continuum of sciences and the applications they will generate. Such a holistic approach also needs to consider multiple standpoints on ethical issues. Diagnostic reports on examinations may evoke various issues aligned with the enhancement of teacher development in the teaching of agricultural sciences at school.

I thus recommend that teacher development programmes implement an integrated focus in their endeavours to enhance the teaching of agricultural sciences at school. Based on the findings of the study it also is recommended that the implementation of an integrated approach take place under collaborative PLC conditions and during IQMS and CPTD sessions and also when planning for daily classroom presentations.

However, poor teacher participation and involvement in teacher development programmes remain a problematic issue that may jeopardise the success of the recommendations indicated above.

5.2.5.2 Solutions that will address challenges experienced during teacher development for the teaching of agricultural sciences

Ultimately it is our responsibility (*cf.* 4.3.1) to reclaim teaching as a democratic, intellectual, and professional activity, and to offer a counter narrative to the discourse that proliferates through popular media and state and provincial governments. When considering the preparation of teachers for urban schools, according to Petchauer (2011:1428-1429), it is vital to devise new ways for teachers to engage with and think about the broad endeavour of teaching. This includes aspects such as curricular models and pedagogical approaches. This is supported by Tsotetsi and Mahlomaholo (2013:89) who posits that professional development

of teachers is a cornerstone for the provision of quality teaching and learning in the education system of a country.

I therefore recommend that workshops be held for collaborative capacitation of teachers in terms of the above identified continuum of practical teacher development activity. I fully concur with Mrs Sekharume who said: *"*Leano puso ya setjhaba ka setjhaba e batla batho ba rutehileng*"*, which literally means "Democracy requires educated people". If this holds true, teaching will become a professional activity where talent and science are applied comprehensively.

The recommendation above requires as a condition that all teachers engage in IQMS, PLC and CPTD projects at school. A threat to the above recommendation lies with teachers who seldom study current information which can be shared among co-researchers in the study.

5.2.5.3 Conditions required to render the proposed solutions successful in efforts to realise the aim of the study

The study found that the transition from former teaching methods (*cf.* 4.4.1) is a process that is experienced differently by different teachers. The transition should be built on knowledge and a willingness to make the change from teaching by being the 'sage on the stage', that is, being, or wanting to be, the central focus of the classroom. According to literature (*cf.* 4.4.1), more experienced teachers have a greater barrier to implementing inquiry into their classroom based on the standpoint that the way lessons were taught in the past, still will work in current times. Novice teachers are quicker to try out new methods of teaching; however, misconceptions and misunderstandings might lead to the inability to utilize innovative methods to their full potential and might leave the novice teacher unprepared through lack of knowledge of the content under investigation. A mixed-methods approach to enhancing teacher development, according to McCaughey (2016:6), will allow a wider range of studies to be included to present a comprehensive understanding of the use of peer mentoring as an intervention for beginner teachers under induction processes at school.

I also recommend that teachers encourage learners to use peer mentoring to improve learner performance in the subject, and that teacher developers also use peer mentoring to intervene when teachers struggle in their performance and during developmental workshops to make the change to new teaching methods and strategies. It also recommended that the skills of departmental heads be supplemented with strategies to initiate and manage change in the teaching of agricultural sciences. The condition where this recommendation will effectively benefit departmental heads is where supervisors are developed on their own in the absence of their sub-ordinates. Mr Job elucidated this issue by stating:

> *O tsebe hore ba bang ba tla swaba ho ntsha mathata a bona moo ba mametsweng ke mesuwe e tlasa taolo ya bona. (*This simply means that one should know that others will shy away from confessing their challenges when subordinates are around.

Participatory action research makes room for one-on-one discussions. It is acceptable to accommodate a condition where the view of Mr Job is allowed when determining the best

practices in terms of empirical data generated towards enhancing teacher development in the teaching of agricultural sciences at school.

5.2.5.4 Possible threats and ways to circumvent these threats to teacher development in the teaching of agricultural sciences

Some teachers do not consider the manner in which supervisors organise and lead the group of teachers under their care (*cf.* 4.5.1), their leading abilities, or their abilities related to planning and design as relevant for the activation of enhancing pedagogy. Teachers who know that they can put in the effort and obtain successful outcomes may be more independent, whereas teachers who lack confidence may need assistance from supervisors who are caring, sensitive, encouraging, and flexible. By analysing the challenges investigated and revealed during collaborative meetings, devising detailed solutions, discussing special ways of handling them, and proposing conditions for success as Wang (2016:463) indicated, we may prevent some ontological perspectives ensuing from thinking of the comparative examinations as a sort of challenge to be surmounted. However, researchers and co-researchers never should think that everything will be satisfactory once a specific challenge is beaten back. Empiricism must not be allowed to fizzle out as a cornerstone for enhancing teacher development in the teaching of agricultural sciences at school, nor must personal theories be allowed to supplant evaluations by the masses.

I recommend that supervisors be supported in terms of their organisation and leadership skills before they are exposed to groups of teachers. This recommendation will only be successful on condition that institutions of higher learning are engaged in this regard.

On the other hand Mr. Molinga added the importance of research by saying:

> *Ke mang ya tsebang, mohlomong diphuputso tseo re di etsang mmoho ekaba tsona motheo wa tsela e tla sebediswa ho ruta thuto ya temo nako e tlang* (which literally means that the research we are engaged in might be the foundation for teaching agricultural sciences in future).

The only threat against the above recommendation is when teacher development programmes do not supply proof of attendance in the form of informal certificates. It is recommended that, in addition to certificates, schools consider participation in these programmes as an addition to school-based price giving occasions and also when recommending teachers for national teacher awards. This could motivate supervisors with no interest in agricultural sciences to participate in higher numbers.

5.2.5.5 Indicators of success towards enhancing teacher development in the teaching of agricultural sciences at school

Teachers act as the driving force behind the actualisation of transformation in education (*cf.* 4.6.1). The development of teachers therefore is crucial in an education system. It seems, however, that teacher development is a neglected aspect of the performance management system employed in South Africa. Performance management should enjoy centre-stage in all development workshops offered by the Department of Education. Expanded knowledge and

expertise on processes such as mentoring, coaching and monitoring will enhance the zeal to implement performance management of agricultural sciences teachers at school. According to Wade, Rasmussen and Fox-Turnbull (2013:168-169), the use of technology in enhancing teacher development in the teaching of agricultural sciences at school, by itself can do nothing; but, technology in conjunction with engaged, excited, and motivated teachers, and innovative supervisors and subject advisors can change the status quo. Using best practices in the classroom, school, and district, a culture shift in which departmental heads and teachers are engaged in rich and exciting supervision and teaching environments can be facilitated.

I recommend that teachers be involved in the planning, organising, leadership and control of development projects designed for them. This will assist to circumvent issues around the claim by Mr Molinga when he said: *Ha ho letho le lokelang ho hlophisetswa rona kantle ho rona* (Nothing is for us, without us).

In order to ensure that the driving force behind transformative education is engaged, I recommend that departmental heads of agricultural sciences hold regular subject meetings whereby teachers become involved during mentoring, coaching and monitoring as equal partners in their own development. Subject advisors need to allow teachers an opportunity to present certain aspects of content, particularly those that seem to be problematic in the teaching of agricultural sciences.

The threat to recommendations made above revolves around inadequate preparation on the side of participants involved in teacher development projects. I therefore recommend that stakeholders always be up to date with current issues affecting teacher development in the teaching of agricultural sciences at school.

5.2.6 Research design and methodology

In order to achieve the aim of the study participatory action research (PAR) was used as research design and methodology. PAR provided a replicable model and practical insights for many other organizations interested in engaging those involved as evaluators and researchers in this study. The study found that PAR served as a funds-of-knowledge bridge between the classroom and the teacher realities. Although transformation at the school level always was uncertain for students, personal changes did occur from their involvement in PAR. (*cf.* 3.2.1).

In view of the above, the approach below was adopted from Coats (2005:4) who posits that it is quite possible to continue with participatory action without research or to do research without embarking on participatory action, but the unique combination of the two is what distinguishes participatory action research from other forms of enquiry. Coats (2005:4) further adds that PAR is not restricted to an educational context, even though in this study we used it to enhance teacher development in the teaching of agricultural sciences at school.

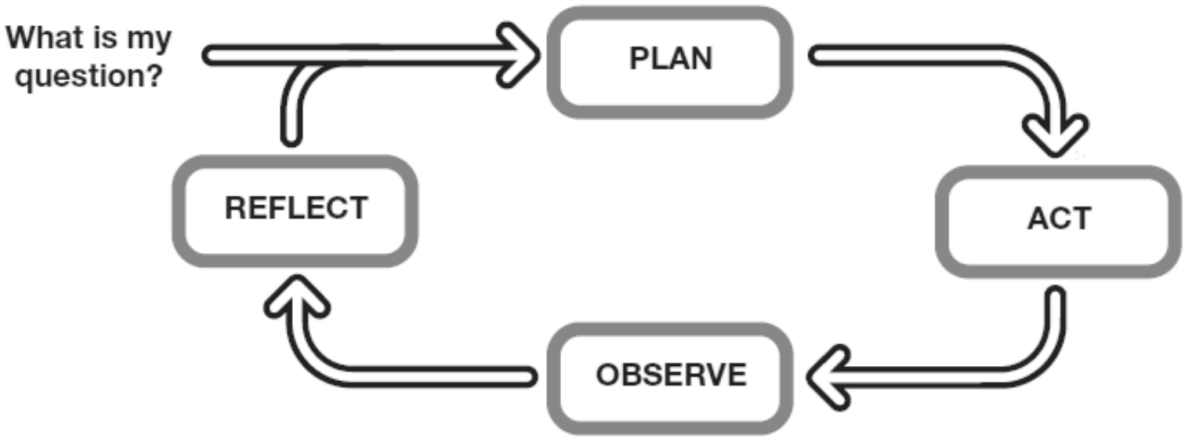


Figure 5.1: The process of participatory action research

For this study the process of PAR, as depicted in Figure 5.1 above, was found to be most useful. We recommend that this process be used even during agricultural sciences meetings. Each agenda item may be placed as a question to be addressed, and then colleagues can collaborate in planning approaches that can be followed to address the agenda item. When planning is done, colleagues can put all planned approaches into action. They then have the opportunity to observe their actions thoroughly and reflect on what they have observed during the actual implementation of strategies and action plans or approaches. PAR also may serve as an alternative approach to teaching and learning in the teaching of agricultural sciences at school.

5.2.7 DATA ANALYSIS

In order to achieve the aim of the study critical discourse analysis (CDA) was used to analyse and interpret empirical data generated during the PAR process in the study. For the study critical discourse analysis (CDA) was found to be useful in the sense that it allowed for the expression of knowledge as the basis of action and formative action that shaped home and school reality experienced by co-researchers in the study, not only for the analysis of discursive practices but also for the basis of subsequent analysis of non-discursive practices (*cf.* 3.8). This approach is supported by Osborne (2010:466) who states that policymakers and educators believe that individuals' ability to undertake critical, collaborative argumentation is an essential skill required by future societies. Developing teachers to reason, argue, and think critically will enhance their conceptual learning of agricultural science teaching methodologies. Collaborative discourse during which agricultural sciences teachers engage constructively with each other's ideas offers a means for improving the quality of their teaching experience, the depth of learners' thinking, and their learning of agricultural sciences itself.

I found critical discourse analysis useful, particularly when dealing with inequalities and issues with respect to social exclusion associated with teacher development in the teaching of agricultural sciences at school. I therefore recommend that teachers should shy away from accepting the status quo around teacher development if such contexts produce, maintain and reproduce inequalities and any evidence of social exclusion. The outstanding threat in not being

complacent with problematic educational issues lies in acting without having generated and analysed adequate data on any appropriate discourse.

The recommendation above is underscored by Elyas (2016:79) who argues that as the teachers of agricultural sciences and their developers are exposed to the materials used for teacher development, their learning and teaching identities are likely to change. Elyas (2016:79) further posits that the rapidly changing teacher development policies and socio-political environment, and mixed messages presented both in the media and policy documents also are likely to cause ideological conflicts within specific groups engaged in the teaching of agricultural sciences at school.

5.3 FINDINGS AND RECOMMENDATIONS

When comparing similarities between the findings of the literature review and the empirical data, conclusions were drawn which are presented in the paragraphs below. Appropriate recommendations also are made in this regard.

5.3.1 Assisting teachers in creating lessons aimed at learning agricultural sciences through the study of real world issues affecting people's health and well-being

When comparing literature and empirical data, the study found that teachers were not assisted in creating lessons where agricultural sciences could be presented through the use of actual real-world issues that are interrelated with agriculture in such a way that the subject could be learned from issues that affect people's own health and well-being. The study found that some teachers simply follow the text book and learners were expected to learn by memorising factual information provided in the teaching of agricultural sciences at school.

The impact of this lack of assistance to create a real-world context for their learning prevented learners from attempting to answer questions that were designed on unfamiliar practical scenarios. This lack of context ensued in an inability on the side of the learners to make meaning of the facts they had to master and resulted in meaningless memorising, thus they resorted to surface learning, which could deprive them of the marks required to complete their grades. Even those learners who are fortunate enough to complete their grades run the risk to become drop-outs from institutions of higher learning, because of not being able to make sense of what they learned at school and the reality they experience in the their immediate live situations. The current lesson template, as indicated in Figure 5.1 below, does not cater for adequate space to refer to theoretical and practical school-based teaching and learning activities.

Period Planner						
Text books used: 1		2			WEEK	
Educator Name	Grade	Class size:		Date	to	
Lesson Topic (Content): Aim/Objectives Procedure/Method Assessment Task:		Date Textbook pages: Instructional Materials: CW/HW:			Comment/Challenges: Other Resources:	

Figure 5.2: A template for period planning in Agricultural Sciences

A period planner which would cater for adequate space should probably look like the one designed below (Table 5.1):

Table 5.1: Period Planner Template for Teaching Agricultural Sciences at School

PERIOD PLANNER TEMPLATE FOR TEACHING AGRICULTURAL SCIENCES AT SCHOOL					
TEACHER				**WORK NUMBER**	
SCHOOL				**No:**	
NUMBER OF LEARNERS			**GRADE**		
DATE		**TIME**		**LANGUAGE:**	
SUBJECT TOPIC:					
LESSON TOPIC:					
LESSON OBJECTIVES:					
At the end of this lesson, learners should be able to:					
Tools for teaching and learning					
Sources of information			**New knowledge and skills to be learned**		

Learning material		**Attitudes and values**	
Identification of prior learning			

Teaching methods	**Learning methods**
○ **Narrative** ○ **Scaffolding** ○ **Demonstration** ○ **Question and answer** **Other methods(specify below):** ○	○ **Cooperative** ○ **Discussion** ○ **Project** ○ **Role-play** ○ **Experimentation** ○

LESSON INTRODUCTION	
Teacher activities	**Assessment strategies**
Learners' activities	

LESSON PRESENTATION	
Teacher activities	**Assessment strategies**
Learners' activities	

LESSON CONCLUSION	
Teacher activities	**Assessment strategies**
Learners' activities	

Homework	
Expanded opportunities	

In view of the finding elucidated above we can see why it becomes particularly imperative to infuse our teacher development programmes with real-life examples of what needs to be done to enhance teacher development in the teaching of agricultural sciences at school. Below, the researchers' recommendation is given to circumvent the above stated finding in future teacher development programmes.

5.3.1.1 Recommended assistance for teachers to create lessons where agricultural sciences could be learned through the study of real-world issues that affect people's health and well-being.

During a PLC meeting I recommended that the contents of the lesson planning, preparation and presentation be made to accommodate both theoretical and practical activities.

In congruence with Govender and Zulu's (2017:326) argument, this study reveals that some teachers hold a blend of naive, adequate, transitional, but more inadequate understanding about the aspects of nature of agricultural sciences. They are mostly dependent on the textbooks and departmental curriculum documents to teach the content in agricultural sciences. Critical discourse analysis (CDA) revealed that the teachers were unable to make connections with content knowledge in the planning, preparation and presentation of their lessons. Most of the teachers did not plan to teach agricultural sciences explicitly and some of their teaching approaches can be described as implicit. However, teachers should integrate calculations, as stipulated in the diagnostic report (DBE, 2016: 27), into the informal and formal assessment tasks. The report further prescribes that they should emphasise the use of correct formulae that will help learners to develop their ability to make accurate calculations. Teachers further should inculcate in learners an understanding that Agricultural Sciences is a science subject and that all formulae should therefore be scientifically presented. Teachers should therefore integrate calculations into the informal and formal assessment tasks. They should emphasise the use of correct formulae that will help learners to develop their ability to make accurate calculations.

When reacting to the recommendation above, the co-researchers agreed that we should make use of common practical assessment tasks to assess learners doing agricultural sciences from Grade 10 to Grade 12 in the Thabo-Mofutsanyana education district with effect from 01 September 2017.

The subject advisor, as one of the co-researchers, assumed the responsibility to ensure that co-researchers and other teachers of agricultural sciences are proffered with content training and support through developmental workshops. The study further recommends that both private and public schools offering agricultural sciences in the basic education sector adopt the responsibility to attend to teacher developmental needs for them to create lessons where agricultural sciences could be learned through the study of real-world issues that affect people's health and well-being.

Mr Nzoko added:

> *Ho bohlokoa hore re etele di website tsa masedinyana a temo. Ha ngata masedinyana a phatlalatsa ditlaleho tsa diphuputso tsa bona moo ho di website tsa bona tsa temo. Ka tsela ena re ka kgona ho ruta ditaba tse amang bana le maphelo a bana le barutabana thutong ya temo.* (This literally means that teachers can visit the website of agricultural magazines. In this way we should be able to teach learners about interrelated issues that affect people's lives in agriculture as they practically happen.)

It is also recommended that the school library obtain agricultural magazines and that teachers motivate students to read them regularly. Teachers then can use articles and reports as case studies and examples to strengthen their teaching with real-world occurrences.

It is hoped that the above recommendation will assist in enhancing teacher development in the teaching of agricultural sciences at school. Below we then look at the condition under which the above recommendation will be effective.

5.3.1.2 Recommended condition for assisting teachers to create lessons where agricultural sciences could be learned through the study of real world issues that affect people's own health and well-being.

The condition under which teachers could be effectively assisted in creating lessons through which agricultural sciences would be learned through the study of real-world issues that affect people's health and well-being, refers to a situation where all teachers attend and contribute in communities of practice, professional learning communities, conferences and field trips on a continuous basis. They also should read agricultural reports and magazines, and the school should ensure that the teachers and learners are always provided with reading material on agriculture. This will increase their interest in agriculture as a reality and not merely a subject they have to teach, or in the case of learners to pass.

The condition stated above is supported by Wilson (2016:57), who argues that an essential component of a school culture is the existence of social capital, which discusses the power of social connections between individuals and groups. Social capital is a major catalyst in empowering teachers to lead within their schools. Such capital must not only exist in peer teacher relationships, but must also be evident in how departmental heads form connections with their teachers. In addition to trust and relationships, school principals are responsible for ensuring that the school's goals are met in an adequate manner. School leaders should inspire the school mission and vision. Gauthier (2016: 10) supports the vision that cultivating communities of practice among teachers will inspire departmental heads and subject advisors to consider how they frame teacher development activities within teacher development

programmes. Teachers need opportunities to participate in determining the internal direction of the programmes and to engage in learning both individually and as a group.

Mrs Sekharume added:

> *Ke ne ke ile thekong matsatsing a phomolo ya mariha ya dikolo, kopanang e neng e hlophisitswe hore ke ilo tsamaisa dikgetho tsa komiti ya mokgatlo wa mesuwe ya temo. Batho bao ba entse kopo ya hore mokgatlo wa mesuwe ya temo o be le kemedi nakong eo ho botswang pampiri ya hlahlobo ya temo bakeng sa mophato wa sehlopha sa leshome. Pehelo e mabapi le seo e tla ba thusa mesuwe ho ikamahanya le diphetoho.* (Literally this means: I visited Durban during winter school holidays for a meeting arranged for me to assist as an electoral officer for a committee that will run the Association for Agriculture Educators. These people want the association of agriculture teachers to be represented when setting national agricultural sciences examination papers for Grade 12 learners. Feedback from such representation will assist teachers to align with changes.)

This is an excellent example of the kind of engagement that foster the generation of data needed when creating lessons in which agricultural sciences could be learned through the study of real-world issues that affect people's health and well-being. The importance of compiling and referring to annual diagnostic reports cannot be over-emphasised as one of the conditions for creating lessons as indicated above. I therefore recommend cluster marking for work done by learners in Grades 10 to 11 to be used as an additional condition that will assist teachers in these grades to compile a diagnostic report as a frame of reference towards creating lessons satisfying the recommendation stated above.

5.3.1.3 Threats with regard to assisting teachers to create lessons where agricultural sciences could be learned through the study of real world issues that affect people's own health and well-being

The study revealed a continuum of threats that may jeopardise the identified finding of the need for real-life examples and context in lessons. A clear threat to the success of teachers in creating lessons in which agricultural sciences could be learned through the study of real-world issues that affect people's health and well-being is teachers preferring not to attend teacher development activities designed for their own development, therefore the importance of attending these activities must be brought home to teachers, and their interest and motivation in the improvement of teaching agricultural sciences must be boosted. If this is not done, it will be a challenge for teachers to apply lessons created in their absence. I believe that teachers need to own the lessons; therefore, they should be created in their presence.

Aggravating the lack of development activities and the lack of interest to attend such activities is the current lack of manpower. The study revealed that in some schools there are no departmental heads for agricultural sciences. In some schools, personnel tasked with the duty to head agricultural sciences as a subject have very limited access to experiential training and support in the duties entrusted upon them. With regard to such a situation, Osakwe (2015: 50) purports that departmental heads should equip themselves adequately with various administrative strategies such as effective planning, organisation skills, directing, motivation, controlling, proper delegation of duty, effective leadership, supervision, monitoring, communication, and effective disciplinary ability since these strategies have a lot of influence

on the effective management of human resources at school. Osakwe (2015: 50) further states that the school leadership should support and intensify efforts at training and retraining departmental heads on strategies that would boost effective management of agricultural sciences teachers. In support of this, DeLander (2017:3) posits that the most challenging part of being a departmental head of a blended subject like agricultural sciences is individuals who look to you to help facilitate their success. DeLander (2017:3) further adds that if one takes their lead, listen well, tell the truth, intervene selectively, and remain unfailingly supportive of their development, one will discover that those individuals are also the most rewarding part of the job of a school-based head of department.

Above all, teacher workloads gave rise to common concern among co-researchers in this study. In some schools offering agricultural sciences the study found a lack of access to ICT facilities, resulting from inadequate library material resources and discontinuous electrical power supply, as a threat towards enhancing teacher development in terms of creating the above recommended type of lessons. Some of the issues raised above are supported by collaborative dialogues among co-researchers quoted in excerpts below:

Mr Buhle and Mr Xhoxo, engaged in a dialogue as indicated below:

> Mr. Buhle: *Are you going to the agricultural sciences workshop?*
>
> Mr Xhoxo: *I am not sure, it will depend.*
>
> Mr Buhle: *Can you tell me why?*
>
> Mr Xhoxo: *I requested the principal to assist with transport but he has not as yet replied.*
>
> Mr Buhle: *Enlist the support of your departmental head to persuade him.*
>
> Mr Xhoxo: *We currently don't have a departmental head - he was promoted to a senior management post at another school. He just went out to pay the school's electricity bill; we just experienced a power failure because of non-payment in the past few months.*
>
> Mr Buhle: *Did you get the invitation to the workshop, in view of the power-cut you have just identified?*
>
> Mr Xhoxo: *No. I got information from a colleague in another school. She promised to find a copy of the circular for* me.
>
> *Mr Buhle: How do you currently cope without a departmental head?*
>
> Mr Xhoxo: *The principal has instructed me to submit all my work to him for monitoring and control. He said he will try to assist even though he is not sure about agricultural sciences.*

In order to prevent the risks identified above, I recommend that teacher attitudes be developed through continuous motivation sessions and pastoral care to enable them to attend developmental activities in higher numbers. I also recommend that principals of schools engage the Thabo-Mofutsanyana Education District Human Resources Department in advance if they

anticipate possible shortages of manpower in the teaching of agricultural sciences at their school. For schools with limited access to ICT facilities I recommend that they form a network with the ICT team at the existing education resources centres (ERCs) closer to their schools where they can access internet broadcasting programmes (IBPs) and other related information and communication equipment. I also recommend the practice of sound financial management by school governing bodies to alleviate discontinuous electrical power supply which subsequently prevent teachers to make use of available ICT facilities in the teaching of agricultural sciences at school.

5.3.2 Lack of implementation of teacher development initiatives for agricultural sciences teachers

The findings of the study revealed that some schools lack effective implementation of the continuous professional teacher development policy. Some teachers and their departmental heads were not even registered for CPTD purposes.

In view of this finding, I concur with Mundschenk and Fuchs (2016:60) that in order to build capacity for the effective implementation of CPTD policy, leadership teams need ongoing collaborative and critical analysis of practices that support knowledge sharing and innovation. We need to provide sufficient professional development activities through which teachers can examine their own instructional data until they are comfortable engaging in evidence-based decision making. The analysis of CPTD practices, according to Hastings (2013:170), promotes renewal in the profession in that it provides opportunities to respond to the individual circumstances of the classroom, and create new knowledge in the educational field. As a result, feedback, as an essential component of reflective practice, is critical to the ongoing refinement of an agricultural sciences teacher's pedagogy, and the development of shared corporate or community knowledge, based on a continuous cycle of informed professional learning. The capacity to provide and receive critical and constructive feedback is fundamental towards enhancing teacher development in the teaching of agricultural sciences at school.

The above finding was revealed when comparing the differences between the findings of the literature review and empirical data. Some teachers attend agricultural sciences developmental programmes, but they do not provide feedback that could earn them PD points. Some of the teachers did not even know about the CPTD policy.

Mrs Tseleng added:

> *Ke qala ho utlwa ka CPTD, empa ke na le thahasello ya ho tseba hore e hloka hore matitjhere a etse eng. (*This literally means: It is the first time I hear about CPTD, but I have an interest in knowing what it expects the teachers to do.)

In conclusion, teacher development in the teaching of agricultural sciences can be enhanced if schools of the Department of Basic Education ensure that their staff regularly attends the existing teacher development programmes. A recommendation regarding this finding is discussed in the following sub-section.

5.3.2.1 Recommendation for effective implementation of the CPTD programmes

The study recommended during participatory action research meetings held by co-researchers at school, that effective implementation of the CPTD policy should be done at school.

Co-researchers heeded this call. Departmental heads started with processes to register teachers under their supervision with the SACE for the CPTD programme. Nevertheless, the South African Council for Education (SACE 2013: 7) indicated that principals, deputy principals and heads of department are required, as part of their duties and responsibilities, to help teachers develop professionally. Principals, deputy principals and heads of department are also required to undergo professional develop themselves. Thus, according to SACE, professional development is an all-teacher and all-school affair. In line with this view, Evans (2014:193) warned that educational leaders at all levels must take care to avoid narrow conceptions of professional development and of how and where it occurs. According to Evans (2014:193), they need to recognise that professional development is not confined to designated or planned opportunities, such as workshops, courses, appraisal meetings or formal mentoring; it may occur in any context and, indeed, most frequently does so accidentally or incidentally, as part and parcel of daily working life and interaction with a myriad of stimuli that can spark off an idea or thought that leads immediately or eventually to enhanced teacher development, particularly in the teaching of agricultural sciences at school.

A further recommendation is that teachers and school-based supervisors need to ensure that beginner agricultural sciences teachers become engaged with the existing teacher professional development policies to pave the way for sustainable teacher development programmes.

This recommendation is important in that it will benefit teachers of agricultural sciences while assisting to build on the skills that teachers have already acquired through training with higher education institutions, and they will be kept up to date with new developments and knowledge in the fields of education as well as their subjects. When teachers are enrolled for CPTD, the work of departmental heads will be enhanced in such a way that time and educational resources are saved for future developmental programmes.

These sentiments are supported by Ferreira, Junior and Rodrigues (2016:522) who argues that even in the 21st century there still are many teachers who are not prepared to handle digital educational technologies in their teaching and learning process. Having said that, Ferreira (2016:522) further alludes to teachers' difficulties in handling technology, which clearly indicates the need for specific training regarding educational technologies. This gap also is evident in comments of some co-researchers engaged in this study as referred to by one of them in the excerpt below. In order to offer simplified assistance to teachers in this regard, (Gunnarsdóttir, 2014:169) advises that creating opportunities for agricultural sciences teachers to attend accessible courses at universities is an important step to take in order to enable teachers to attend professional classes of longer duration and to secure more depth and progression in their studies. Gunnarsdóttir (2014:169), however, is of the opinion that this is not likely to meet fully with their needs to collaborate with other practising teachers and create PLCs. It is therefore also important that the universities design courses that meet the needs of agricultural sciences teachers to collaborate with other teachers and to study together.

> Mr Phahle added: *Re ananela boitjhoriso ba kamehla thutong ya temo, empa ha re a lokela ho iphapanya hore rona ba bang re tla hloka ho thuswa hore*

> *re tsebe ho romela bopaki ba boitjhoriso ba rona ka tsela ya maranrang a di komporo ka tsela e tla thusa ho ipokella dintlha bakeng sa kgatelopele ya rona.* (This literally means we accept CPD in the teaching of agricultural sciences, but we may not ignore the need to be assisted with ICT for us to report our progress while accumulating development points.)

In view of the recommendation made above that we identify a condition that will assist schools in the effective implementation of the CPTD policy at schools offering agricultural sciences.

5.3.2.2 Recommended condition for effective implementation of the CPTD programmes

It is recommended that all teachers first enrol for the CPTD programmes with SACE. Upon enrolment of teachers, departmental heads need to ensure that teachers under their care are trained on how to build a professional development portfolio. Training on how the CPTD programme works needs to be done for teachers and their departmental heads by the senior management. Teachers need to be reminded on a regular basis that they need to provide SACE with the necessary proof of training and development so as to accumulate PD points.

Mukeredzi, Mthiyane, and Bertram (2015:7-8) articulates that the need for comprehensive mentor training for school-based departmental heads cannot be over-emphasised. Meetings held directly with departmental heads would establish and strengthen school-university partnerships, expose the university to the realities in schools while uncovering university expectations of mentoring. Such training would engage with notions of agricultural sciences teaching as a specialised practice, and mentoring as requiring both specialised and generic pedagogic feedback. In congruence with this recommendation regarding the training of departmental heads, Chou, Promes, Souza, Topp and O'Sullivan (2012: 448-449) maintains that to conduct their work, departmental heads increasingly rely on communication across geographical sites. While they recognise that there are many formats for that communication, the ultimate goal of most of those opportunities is to result in products of many different kinds, including curricula, committee projects, and publications. Approaching communication from the perspective of the PLC process provides a method of organising guidelines in order to tangibly benefit agricultural sciences teachers in accomplishing their work. By collaboratively practising and implementing these guidelines, educators can build relationships with remote colleagues, produce work more efficiently, and potentially save time and money.

5.3.2.3 Threats with regard to effective implementation of the CPTD programmes

A threat that might prevent the effective implementation of the CPTD programmes is when there are no service providers who could offer free or affordable training when teachers engage in self-initiated teacher development programmes outside of school. Similarly, schools that experience a shortage of funds could find it difficult to organise independent professional development organisations to provide school-based teacher development programmes. Lack of access to the school’s Wi-Fi system could cause delays when teachers of agricultural sciences need to submit data needed for the accumulation of PD points.

According to Mrs Sekharume:

> *Re na le bana ba bao re ba lefellang ditsheng tsa thuto e hodimo, ho kaba molemo ho rona ha re ka fumanelwa ba fani ba ditshebeletso dithupellong tsa ho ruta thutho ya temo ka ditjeho tseo re ka di fihlellang. (*This literally means: We have children for whom we pay fees at tertiary institutions, it would benefit us if affordable service providers in the teaching of agricultural sciences could be organised.)

In the light of this concern, Macleod (2013:398) warns that parents who are also teachers sometimes are seen as being to blame, or being too limited, in terms of personal, social and economic resources for them to be able to effect change in their own development and that of their offspring. As Macleod (2013:398) stated, there is a restricted set of positions that are available to these parents, none of which are empowering and all of which seem to hinge on the degree to which they have agreed with service providers, as well as on their social class in terms of access to capital in all senses of the word.

However, the study recommends that teachers and schools be assisted with a list of affordable service providers for teacher development, particularly in the teaching of agricultural sciences at school. Teachers need to be able to access the school Wi-Fi system in order to be able to make submissions for the accumulation of PD points. In addition, regular and updated training must be provided for those teachers of agricultural sciences who have limited experience in the use of ICT facilities.

This recommendation will alleviate the threat by ensuring that the implementation of the CPTD programme will have minimum financial implications for teachers and departmental heads.

5.3.3 Involvement of external partners in enhancing teacher development

When addressing the developmental needs of agricultural science teachers during workshops in the course of the study, the absence of breeder societies, organisations of agricultural educators and AgriSETA came under discussion as alternatives to institutions of higher learning.

According to the skills plan of AgriSETA (2016: 45-46), the ecological challenges associated with climate change in current times present the agricultural skills development sector with a problem. There is a need to adjust to the contextual demands of developing knowledge, technologies and skills that will allow for sustainable farming, which begins at secondary school agricultural sciences education, with a view to long term. This is why AgriSETA adopted an approach of insisting on a cross-cutting focus on the promotion of green knowledge across all subsectors, including the higher education sector, and enterprise sizes. AgriSETA thus formalised a mentorship programme for the top ten scarce skills, including farm managers and agricultural science teachers. Alongside this, career pathways should be mapped to create a pipeline for youth to move from unskilled to skilled occupations.

Mr Nzoko during a study meeting, referred to this notice of the AgriSeta in this contribution:

> *Re eleditswe ke ba ikarabellang ntshetsopeleng ya thuto tsa temo ho etsa bonnete ba hore dikolo tsa temo di ngodiswe ho AgriSETA molemong wa ho thusa barutwana ho iphumanela mahlale a ikgethileng molemong wa thuto eo re ba*

> *fang yona.* (Literaly meaning: We found advice from subject education specialists to register agricultural schools with AgriSETA to assist learners in acquiring scarce agricultural skills above what we provide at school.)

In connection with this remark of Mr Nzoko, Nchabeleng's (2016:73) words are applicable and valid, namely that co-operatives are not able to attract the youth who could bring in special agricultural skills. Nchabeleng (2016:73) further posits that it is important that an effort be made to reach out to other community members, including the youth, and help them identify projects in which they can collaborate and work on. Unemployment among the youth continues to increase but co-operatives are unable to attract them due to lack of skills which could be accumulated at schools on condition that agricultural science teachers are supported and provided with the teaching tools to provide quality teaching to these youth.

The impact of not engaging professional bodies such as mentioned above results in a shortage in the supply of information and skills required by the agricultural sciences teachers. Ultimately learners may only end up with limited expertise which may not suffice when learners attempt to respond to questions where application of skills is needed during end of year exams, and they also thus suffer from lack of skills when they start employment.

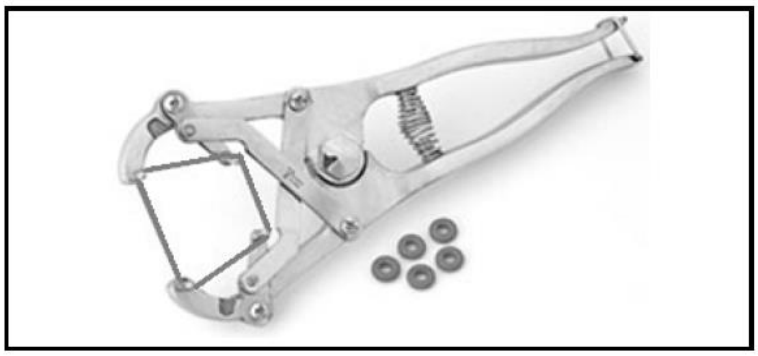
In view of the above finding, the study makes the following recommendation:

5.3.3.1 Recommended engagement of breeder societies, organisations of agriculture educators and AgriSETA in enhancing teacher development

Based on the findings of the study it is recommended that when teacher development practices are implemented at school, breeder societies; organisations of agriculture and AgriSETA have to be involved to supplement the skills required during agricultural sciences related workshops. Educational authorities and school principals should work together to ensure that this recommendation be put into action.

Stakeholders in the teaching of agricultural sciences found that the above recommendation would be beneficial to agricultural sciences teachers, departmental heads and subject advisors, and most important, the learners for whom they are responsible.

> Mr Job: *It is at times important to invite plant and animal breeder societies in our teaching at school. This will expose learners to* ***modern technology*** *applied by these people in ensuring sustainable production and productivity on farms. This technology is also part of assessment in teaching of agricultural sciences at your schools.*



Identify the apparatus above.

Name TWO management practices for this apparatus in sheep.

Give ONE reason why EACH management practice in QUESTION 3.2.2 is important.

Figure 5.3: A sample Grade 12, paper 1 question item requiring practical support from sheep breeder societies.
Source: DBE in RSA 2016 November agricultural sciences exam paper.

In view of the questions indicated in Figure 5.3 above, I recommend that organisers of teacher development programmes must invite the identified professional bodies (and/or other experts who can make a contribution) to be part of teacher training workshops. Teachers should attend such training sessions in acceptable numbers for them to participate as recommended (sometimes attendance should be compulsory, depending on teachers' lack of competencies, willingness to attend of their own accord, and the topic(s) covered in the activities). Teachers should be motivated to network with breeder societies in efforts to improve their teaching activities, as the teaching of agricultural sciences then would benefit the learners most as they will no longer struggle to perform during end of year examinations, or to find employment.

This recommendation also will assist the professional bodies concerned to market their own organisations among the learning ecologies. These organisations also may become involved in sponsoring teacher development workshops with motivational incentives and teaching and learning resources which some schools cannot afford to purchase due to inadequate funding.

To elucidate these recommendations the conditions for such inputs from external organisations are discussed now.

5.3.3.2 Recommended conditions for engaging breeder societies, organisations of agriculture educators and AgriSETA to enhance teacher development

The reason why breeder societies, organisations of agriculture educators and AgriSETA should be involved rests upon the creation of a teacher development condition that is enriched with all **practical resources** that are much needed for enhanced skilling of agricultural sciences teachers.

Figure 5.4: Sheep breeds picture taken during a teacher development event organised by an agricultural sciences teacher organisation.

In Figure 5.4 above, the sheep breeds depicted display a ewe with two newly born lambs. According to the information presented by the breeder during a field trip, the genetic structure of the ewe was developed over a series of trials to enable it to produce twins during every lambing season. This, according to the breeder made the ewe to be more valuable, especially to farm managers who intend to generate high returns in their yield from the sales of quality sheep breeds. This type of practical information for learners is rarely found except under conditions where breeder societies are engaged during teacher development programmes.

The sheep breeder proclaimed that, *"It is very important to respect the personal space of the breeds if you intend to achieve more profit from them"*

When reflecting on the opinion of the sheep breeder Mrs Sekharume remarked, *"I did not know that animals too, like human beings, have personal space."*

By "personal space", the breeder refers to the observable condition where one keeps a certain distance away from the breed to avoid any retaliation from it, which could in turn harm or injure the breeder when the animal attacks for its own safety. One can alternatively name this a safety space. This illustrates that for human beings (as for animals) to thrive specific conditions or circumstances are required. For teachers and learners to thrive on interaction with outside agencies suitable conditions and circumstances are required too.

The information that breeder societies are able to proffer include valuable and updated ontologies, aligned with the practical and theoretical teaching of agricultural sciences. The condition required for such engagement during organising teacher development programmes in the teaching of agricultural sciences, should be enthusiasm from the side of the teachers as well as the organisation, society or other agency entering the educational domain. Teacher interest, support from their superiors and the provision of suitable and accessible physical surroundings and other aids must be part of these activities to render the efforts successful. Interest is a major ingredient of motivation for learning – therefore, teachers must be interested in development activities like these to be able to confer the same advantage to their learners.

5.3.3.3 Threats that may hamper engagement with outside agencies in enhancing teacher development

More often than not, teacher development programmes are run in places far from the schools where teachers work. Some schools, due to lack of funding, are not able to provide financial support in the form of transportation, accommodation and meals to teachers who wish to attend teacher development workshops.

In this regard, Ahmed (2013: 535) demonstrates that agricultural sciences teachers will benefit from and be satisfied with the training when it is tailored to respect their privacy, their needs and their time. Ahmed (2013: 535) further indicates that teachers resist learning when they are taken out of their comfort zone. Giving agricultural sciences teachers a safe learning environment and an opportunity to study at their own convenience and at a time and place that suit their needs is more acceptable than being coerced into a mandatory teacher development programme. However, Kalsi (2016:106) advises that learning the principles of self-management impacts positively on employment, self-efficacy and readiness for teacher development programmes; therefore, teachers also should take responsibility for their own development and realise that they must be willing and eager to sacrifice leisure time or holidays to attend self-development activities as these cannot always be offered at times and places teachers would prefer.

I recommend that funds are raised in advance by schools to supplement the economical shortages to meet the training needs of teachers.

This recommendation is supported by Kibuka (2015:121), who argues that an enhanced teacher development programme in the teaching of agricultural sciences defines the triangle of environmental, economic and social dimensions. Kibuka (2015:121) also adds that there cannot be just one solution for the challenges of pollution, global warming and loss of biodiversity, unless a concerted joint effort is made. Local and international collaboration is essential in educating societies about managing the present and preserving the earth for future generations. Curry (2012: 251), however, posits that macroeconomic conditions, the number of development staff, and the size of a development budget do not necessarily predict performance. According to Curry (2012: 251), performance is related to a transformational approach to development work built on a compelling vision that is communicated clearly. The core challenge for agricultural sciences teachers is the development of visions and programmes that speak to the realities of the 21st century, and the development of broad-based leadership to take us there.

Mr. Phahle remarked:

> *Ha re ka tsitlalla tabeng ya tshebedisano mmoho le balemi, re ka qoba ditjeho tse amanang le teko ya ho intshetsa pele ka bo rona ntle le ho fumana dithuso ho tswa baleming ba sebetsang ka seo re se hlokang ha re ruta dikolong*. (This literally means that when we focus on building collaborative networks with farmers involved in that with which we struggle to get when teaching at schools, we might attract assistance in terms of scarce resources that we need when teaching at schools.)

When teachers have access to funding when they attend teacher development workshops, they might be motivated to improve in performing duties allocated to them.

5.3.4 Teacher development programmes: Linking home and school ontologies in the teaching of agricultural sciences

Another finding of the study was that staff development programmes do not always establish the link between home and school ontologies.

In most cases teachers attend developmental workshops in the teaching of agricultural sciences at school, but very few schools manage to establish production units such as broiler production, layer production, vegetable gardens, dried fruit outlets, to name but a few. Local community members might work at these agricultural units at schools to support the schools, teachers and learners in the production of agricultural products with the purpose of generating an income and food, and the school thus can create sustainable job opportunities for parents and relatives of learners attending the school. This is anticipated to add value to the teaching and learning of agricultural sciences at school, in that the community will benefit too, and teachers and learners have the opportunity to share their knowledge and skills without having to spend too much school time on carrying out all the manual labour themselves.

Savescu and Crista (2014:332) maintains that the prospect of a modern educational system, liable to innovation and curriculum reforms, is guaranteed by the quality of the agricultural sciences teaching staff, whose competencies are formed and profiled alongside teaching and continuous formation experiences of a good teacher who is able to advance innovative solutions for the teaching process and efficiently manages the factors involved in the teaching process. Kovalčikienė (2015:4) agrees with this by stating that motivation is the best predictor of teachers' satisfaction with their professional choice of teaching agricultural sciences compared to other aspects of academic motivation. It can be assumed that teacher motivation is a mechanism which is based on expectations regarding teacher development programmes. Teachers, who enter the formal and informal development contexts because of their interest in or enjoyment of agricultural sciences, tend to demonstrate self-determined behaviour, have internal locus of causality, and are motivated teachers.

When teachers attend a teacher development workshop outside of the boundaries of the school where they work, the situation around their schools remains unchanged.

Learners of agricultural sciences and local cities may not find a reason why they have to protect the school infrastructure, land and buildings if these are not used by agricultural sciences teachers to circumvent the increasing challenge of food security within their immediate surroundings. Through the study we devised a recommendation towards addressing the food security problem as it affects teacher development efforts.

5.3.4.1 Emphasis in teacher development programmes on food security for the communities surrounding the school

It is a given that schools are founded within communities that they serve. What agricultural science teachers do at schools must respond to the needs of the people living in close proximity

around the school. Due to an escalating rate of unemployment in the Thabo-Mofutsanyana education district, it is recommended that the school governing body come up with developmental projects that will assist both teacher development programmes and the households that send their children to school.

During the study discussions Mrs Tseleng made the following remark in this regard:

> *We have enough space around the school campus which can be developed by the agricultural sciences teacher while engaging learners in practical agricultural assessment activities. The produce from these spaces can assist in curbing the escalating hunger in families where there are breadwinners who can provide for the multitudes of learners who come to school with nothing in their stomachs. As we speak, the soil in this unused space is deteriorating day by day.*

The response to this recommendation was supported by co-researchers who unanimously stated that schools in return could have access to the homes of the learners as they were considered to be the learner's funders of knowledge.

Integrating students' out-of-school sources (funds) of knowledge into classroom practices (Johnson, 2016:117) is a powerful tool for supporting all students, but even more so for those from traditionally marginalized populations. Personalized learning techniques are enhanced when agricultural sciences teachers draw on their students' scholastic funds of knowledge as part of the process. As successful applications of this approach proliferate within the agricultural sciences teacher preparation programmes and professional development contexts, teachers will become more aware of the accessibility of personalized learning techniques and the value of integrating their learners into lesson development and implementation to promote meaningful instruction. In support of Johnson (2016:117), Hedges (2016:61) maintains that positive relationships between teachers of agricultural sciences and parents may be particularly vital in supporting children to become successful learners. Funds of knowledge, the relations between every day life and scientific concept formation, and the zone of proximal or potential development provide a framework for conceptualising these shifts, leading to more reciprocal and responsive teacher and parent partnerships that would benefit learners and future life achievements in the Thabo-Mofutsanyana district.

Schools should facilitate dialogues between the community members and teachers that address food security. Parents of learners should participate in higher numbers in basic practical activities in agriculture. Various government departments and local business people could support teacher development programmes by donating required agricultural resources needed for teacher development programmes. This will generate a good base for establishing effective and blended teacher development programmes between home and school contexts.

In this regard Eaton (2015: 52) asserts that quality blended dialogues in teacher development programmes hold the potential to provide equity and access to rural and remote agricultural sciences teachers. Pre-service teachers trained through blended agriculturally based dialogues may be better positioned to prepare their future learners to effectively and simultaneously use agriculture technologies for learning, regardless of whether that learning happens in a traditional classroom or during practical excursions. The debate around whether equity and

access for rural pre-service teachers can be addressed through meaningful and effective blended environmental dialogues hinges on how such programmes can best be designed to address the needs of pre-service agricultural sciences teachers and educational stakeholders, such as administrators who hire teachers for rural and remote areas. However, Hauser (2013:45) argues that the blended learning approach provides a mechanism through which knowledge and skills gained by cohort members are shared throughout the community, and each teacher of agricultural sciences becomes a leader and facilitator of and learner and contributor to producing both deep understanding and new knowledge. It is an approach that transforms a traditional face-to-face course into a blended learning environment centred in dialogue, inquiry, critical thinking, valuing diversity, collaboration, reflection, and deep and life-long learning.

This recommendation is meaningful and important in that it will ensue in building social cohesion while contributing to community and teacher development at the same time. Below we describe a condition under which this stated recommendation will effectively give rise to the realisation of the aim of the study.

5.3.4.2 Recommended condition with regard to emphasis of teacher development programmes on food security for the communities around the school context

We need to establish a network among teachers, parents, local business organisations, and teacher organisations with an interest in agricultural sciences in order to address the issue of food security through teacher development programmes.

In support of the recommendation made above, Reddy (2016:649) declares that although food supply in some countries is more than sufficient, there still exists a need to increase the production of agricultural produce in most agricultural schools to improve on agriculture and food production through technologies such as drought-resistant varieties, and agronomic and management practices such as watershed development. An agricultural school should compile all its teacher development guides, such as, for example, for literacy and other subjects, to raise food awareness and become more food secure in order to proffer context-based access to agricultural laboratories that respond to the needs of teachers in most Afro-montane learning environments. In view of agronomic management, Negalur, Guruprasad, Gowdar and Narappa (2017:272) adds that pesticides play an important role in agricultural production by means of increasing crop yield and farmers' income. The indiscriminate use of chemicals has resulted in a reduction of biodiversity of natural enemies, outbreak of secondary pests, development of resistance to pesticides and contamination of food and ecosystems. Agronomic measures of pest management, as would be applied by most school-based farm managers, involve variations in usual school-based farm operations and households which usually are preventive and indirect - they are the cheapest of all the control measures. Insect pest and disease management in its broadest sense includes everything that makes the life difficult for insects, kills them or prevents their increase and makes it laborious for them to spread about the world.

Mrs Tseleng remarked: *"In other words, the teaching provided by agricultural sciences teachers has a bearing on some agricultural practices that learners experience at home."*

In view of what was said by Mrs Tseleng, teacher development programmes need to be tailor-made in ways that contribute to the learners funds of knowledge. In this way, the integration suggested by some curriculum policies could be forged, particularly on behalf of those departmental heads and teachers of agricultural sciences who are hindered by limited epistemological stance in their own teaching. I provide this condition as an attempt to respond to the food security challenge faced by some schools in the 21st century.

5.3.4.3 Threats with regard to emphasis of teacher development programmes on food security for the communities around the school context

Stock theft, predation, the outbreak of diseases and parasites could hamper the success of teacher development programmes to an extent where food security is threatened in the community that we serve around the school.

Mr Nzoko said in this regard:

> *We lost 57 sheep during school holidays due to stock theft. The animals were ready for us to engage the learners in a sheep shearing practical assessment task. We reported the matter to the police but nothing was found. This makes our work difficult.*

Livestock owned by an agricultural school can assist to supplement meat demands in local communities. Stock theft can shutter this and other practical projects such as tail-docking, vaccination, and others, which are aimed at valuable skills inculcated in the learners of agricultural sciences of focused schools, if something is done to minimise the scourging. Even pre-service teachers could be badly affected by these occurrences during agricultural teaching practice seasons.

Figure 5.5: Picture of a livestock disease called foot rot.

The above picture (Figure 5.5) displays the effects of a disease called foot rot. This disease mostly affects cattle and sheep. Due to limited experience, departmental heads of agricultural sciences with limited knowledge of the disease may not be able to identify and hence take precautionary measures to advise parents and learners about the danger of this disease, which

may affect food security in households around the school. At times some parents have livestock which can be used by the school to provide learners with animal handling skills.

According to Meissner, Scholtz, and Engelbrecht (2013:314), the creation of enabling environments for the livestock industries to operate in the global village is the responsibility of governments. The Department of Basic Education, as well as agricultural industries as a collective of commodity organisations, should engage in enhancing agricultural sciences teacher development, sharing the responsibility to enable the services required to effect a viable enabling agricultural schools environment. Only then will the education industry fulfil its potential in job creation, poverty alleviation, food security, and rural stability, and become a healthy and sustainable industry in South Africa. Carrasco (2017:70) states that the establishment of integrated parasite control programmes could reduce the impact of endo- and ecto-parasites on the health and productivity of some cattle breeds owned by agricultural schools. The major risk may occur if teachers of agricultural sciences have limited practical experience of these parasites, let alone strategies to mitigate them. This will in turn hamper the knowledge we offer to the learners of agricultural sciences.

Mr Molinga added:

> *There is nothing more painful than seeing learners fail to attempt question items based on practical, school based, agricultural projects which one could not effectively teach due to limited live experiences from our side. It is embarrassing to encourage the learners to avoid answering what I could also have not seen done in my own experience.*

In view of the above, the study recommends the involvement of a continuum of stakeholders with appropriate expertise needed to forestall food security challenges while enhancing teacher development in the teaching of agricultural sciences at school.

Next we look at teacher development policies.

5.3.5 Teacher development policies which seldom enhance the epistemological needs of Agricultural sciences teachers

The study revealed that some educational policies only state what needs to be done and are not specific in terms of detailed procedures to be followed and tools to be used when planning for lesson presentation, internal moderation, monitoring and the control of the work of teachers and learners. The absence of specific procedures and tools breeds frustrations in teachers and their departmental heads. Ultimately, lack of specific procedures and tools only leads to poor performance at school. Teachers and departmental heads are often left stranded in the middle of the curriculum continuum to either swim or sink on their own.

In light of the above, Dimas (2011:101-102) suggests that teacher development requires explicit activities generated through collaborative dialogues by the supervisors and agricultural sciences teachers in order to help them contextualize subject content and articulate it. Teacher development still is a complex task that requires careful planning and serious commitment on the side of both supervisors and agricultural sciences teachers in order to see its long-term benefits. It is the stakeholders' duty in the teaching of agricultural sciences to find the most plausible activities to enhance teacher development beyond training acquired from institutions

of higher learning. However, Lee and Takahashi (2011:223-225) adds that stakeholders need an analytical approach to turn classroom interaction and the accompanying procedural details into researchable phenomena. This analytic undertaking encourages agricultural sciences teachers to use lesson plans to address the contingency of classroom interaction head-on instead of determining who or what is responsible for any educational gaps. Lesson plans are reflexive resources for teachers to make sense of what happens in the course of their interaction with the learners.

Mr Tshabane in this regard remarked:

> *Despite the fact that IQMS and CPTD develop teachers differently, we often find these are not assisting us to equip teachers with the necessary behaviour, approaches and skills needed to meet current agricultural sciences requirements.*

It is in view of the above that we proffer a detailed approach to ensure that teacher development policies enhance the epistemological aspirations of agricultural sciences teachers.

5.3.5.1 Recommended changes to some educational policies such as PAM, CAPS, IQMS and CPTD

It is recommended that educational policies should clearly articulate procedures to be followed and tools to be used when planning for lesson presentation, internal moderation, monitoring and control of the work done by teachers and learners.

Co-researchers agreed with the recommendation made with regard to educational policies.

While we await changes to be effected to some educational policies, regular collaborative dialogues will be held to outline clear ways through which educational policies could be converted into practical and user-friendly materials which may be implemented with ease. School-based departmental heads should hold reflection sessions at school level at regular intervals to determine if decisions arrived at are easy to implement.

In terms of holding reflection sessions among teachers of agricultural sciences (Gonzalez, 2015:9), it is important for teacher development programme directors to be aware of teachers' emotions and to realize that the movie clip approach can turn those emotions into a useful developmental resource. When the programme director begins to work with the teachers' affective domain, they discover that this can be an effective, pleasant and direct path for education. When the audience comprises teachers, they shift to the core and focus on their roles as educators. By the end of these reflection sessions, stakeholders may have the opportunity to discuss in a profound sense how they are educating learners in agricultural sciences. Saliga, Daviso, Stuart and Pachnowski (2015:53) supports the opinion of Gonzalez (2015:9) by suggesting that enhancing teacher development in the teaching of agricultural sciences may increase content knowledge and knowledge of teaching strategies, but the greatest achievement may be the increase in teacher confidence in teaching agricultural sciences. As the teachers' confidence grows, their openness to ask questions and willingness to participate in collaborative dialogues about agricultural sciences also grow. Saliga et al (2015:53) and Gonzalez (2015:9) agree that addressing the teachers' anxiety and confidence in subjects

related to the teaching of agricultural sciences necessarily forms part of any professional development endeavour for these teachers.

The recommendation given above will assist stakeholders in the teaching of agricultural sciences at school to prepare for daily classroom activities with ease. Departmental heads should find ways to support teachers on a daily basis and in times of need, even if they are qualified to teach and perform administrative functions pertaining to the subject under study. Teacher appraisals must be done with the clear understanding that the developmental support groups in agricultural sciences specifically know what to do in terms of policy implementation.

5.3.5.2 Recommended condition to ensure that some educational policies such as PAM, CAPS, IQMS and CPTD are less generic in form

It is recommended that collaborative dialogues take place between teachers involved in the teaching of agricultural sciences and policy makers.

If a comprehensive educational opportunity is a right, according to Michael, Rebell and Jessica (2012:64), the department of education must firmly commit to provide that opportunity and must develop a policy that will assure broad access, uniform quality, regularized funding, and firm accountability structures to ensure that all teachers of agricultural sciences have an equal opportunity to obtain the necessary comprehensive services. Past efforts to ensure comprehensive opportunities for teachers of agricultural sciences had been proven to be ephemeral mainly because the educational authorities did not create the policy infrastructure that would permanently ground reforms.

However, such opportunities must be provided under supportive circumstances and on the condition that all stakeholders be offered an opportunity to contribute towards breaking generic teacher development policies into achievable school-based activities. Placing developmental skills like self-motivation, self-determination, and perceived and actual teaching competence at the core of teacher development policies will provide beginner teachers of agricultural sciences with the capacity and competencies to choose appropriate practical teaching strategies, if they have the necessary capabilities and motivation, to strive for an enhanced teaching performance (MacNamara, Collinsa, Bailey, Toms, Forde, and Pearcef, 2011:274).

All stakeholders at first should engage in a brainstorming activity to establish appropriate components of mentoring, monitoring and control as prerequisites in designing user-friendly teacher development policies.

5.3.5.3 Threat to changing educational policies such as PAM, CAPS, IQMS and CPTD which are very generic in form

Designing teacher development policies on the basis of limited experience of the ontological perspectives affecting the teaching of agricultural sciences at school remains a problematic exercise.

Mrs Sekharume in this regard remarked:

> *Ka makgetlo a mangata re qoswa ka hore ha re tsebe ho ruta empa haho le kamohla re kopuwang hore re ntshe maikutlo ka di phepetso tse re sitisang ho ruta agricultural sciences ka tsela e nepahetseng.* (This literally means that we often get criticised that we do not know how to teach although our views in terms of challenges impeding our correct teaching strategies are not taken into consideration.)

I recommend that more ground work needs to be done to generate adequate information in terms of the needs, views and aspirations of teachers of agricultural sciences of whom it is expected to implement teacher development policies at school level. The primary reasons for the qualification and skills mismatches in the public schools with respect to higher education are the lack of information on what graduates will need in future and to what extent, determining the contents of higher education programmes without considering the demands of agricultural sciences teachers at school, and a failure to ensure the matching of skills provided in teacher development programmes with the requirements of teaching agricultural sciences, since the relation and communication between the higher education system and the basic education system is insufficient (Alpaydın, 2015:964). Shekarpour, Höffner, Lehmann and Auer (2013:294) maintains that by tightly intertwining the keyword interpretation and query generation with the available background knowledge from the agricultural sciences teachers, results of relatively good quality can be obtained.

This recommendation might enhance teacher development for agricultural sciences. The views of the marginalised teachers of agricultural sciences will be heard. Teachers of agricultural sciences finally will have a say in issues affecting their daily planning, preparation and presentation of a number of concepts which they cannot do without having their voices heard.

5.4 CONTRIBUTION OF THE STUDY TO THE EXISTING BODY OF KNOWLEDGE

It is now time to evaluate the contribution the findings of this study will make to the existing body of knowledge in the field of the development of teachers in agricultural sciences at school.

1. The study has indicated the need for training of departmental heads of agricultural sciences due to the other subjects making the subject agricultural sciences to build content and school-based subject management approaches.

2. The study also indicated that there is a need for short agricultural sciences learning programmes from universities and other institutions of higher learning for teachers of agricultural sciences with specific focus on developing subject content knowledge and teaching methods in the subject.

3. The study discovered a tendency to skip certain sections of the subject content due to limited abilities on the side of some teachers.

4. The study has also indicated the value of using the services of a farm manager by schools offering agricultural sciences.

5. The study found a heavy reliance on textbooks and past exam papers by some teachers.

6. The study has highlighted the value of associations of agricultural sciences teachers as well as both public and private organisations in professional learning communities in the teaching of agricultural sciences at school.

7. The study indicated that educational policies need to be specific in terms of what really has to be done when developing agricultural sciences teachers.

8. The study indicated that agricultural sciences, like physical sciences and mathematics, need to be given serious attention and better career pathing opportunities that will assist in retaining quality teachers in the best interest of the learners at school.

9. The study indicated the need for networking between teachers of agricultural sciences and teachers of related subjects like accounting, economics, life sciences, physical sciences, mathematics, engineering and technology.

10. The study indicated the need for parental involvement in the teaching of agricultural sciences which can be done through:
    - 10.1 Sectional meetings between parents, teachers and agricultural sciences learners to identify challenges observed while sharing strategies to improve performance in the teaching and learning of agricultural sciences at school. The study considers the home environment of the child as the funds of knowledge.
    - 10.2 Prize-giving functions.
    - 10.3 Parents' meetings.
    - 10.4 Annual celebration of the overall school performance improvement.
    - 10.5 Agricultural tours.

10.6 Enhancing food security at school with the aid of school gardens and other school-based agriculture-related projects.

10.7 Sound management of financial grants allocated for the improvement of agricultural sciences at school.

5.5 LIMITATIONS OF THE STUDY

Although we tried everything we could to ensure that this study becomes the voice of the voiceless agricultural sciences teachers on the ground, there still remains a number of problematic issues regarding teacher development in the teaching of agricultural sciences that need to be addressed through further research. The study only focused on a few schools in TMED - the inclusion of more schools might give a different picture. The study used PAR as a research methodological approach, which worked well but other approaches may render different results.

Below we provide recommendations for further research.

5.6 RECOMMENDATIONS FOR FURTHER RESEARCH

In view of the limitations provided we recommend the following to be attended to in further research:

- Promoting the teaching and learning of mathematical concepts in agricultural sciences in the afro-montane region.
- Designing the strategy to teach agricultural economics to Grade 12 learners at school.
- Enhancing the teaching of plant studies in the subject agricultural sciences in secondary schools.
- Developing a strategy to simplify the teaching and learning of basic agricultural chemistry in secondary schools.
- Enhancing the teaching and learning of agricultural soil sciences in secondary schools.
- Designing a strategy for teaching and learning of animal studies in agricultural sciences in secondary schools.
- Involvement of other stakeholders, for example learners.

5.7 SUMMARY

All efforts in the study focused on enhancing teacher development in the teaching of agricultural sciences at school. In our quest we found it imperative to deal with an ongoing inability to meet the curriculum requirements and aims of teaching agricultural sciences at

school, reluctance in implementing Continuous Professional Teacher Development (CPTD) programmes for agricultural sciences teachers at school, the influence of salary options between the private and public sector, lack of access to higher agriculture education programmes, inadequate supply of quality agricultural sciences teachers at school, and the inadequate supply of quality agricultural sciences teachers in times of need at school.

Critical theory was used as a theoretical framework for the study. It made us realise that it was necessary to unlearn what we already knew in terms of teacher development as an object of study in this research. This unlearning proffered an opportunity to critically view the past teacher development efforts while designing an action plan. PAR was then applied to generate empirical data which I later analysed using CDA.

In view of the above, the study found that teachers could not be assisted in creating lessons where agricultural sciences could be learned through the study of real-world issues that affected people's health and well-being. The study also found that there was a lack of effective implementation of the CPTD programmes. Breeder societies, organisations of agriculture educators and the South African AgriSETA were not enjoying maximum attention and consideration in enhancing teacher development as alternatives to institutions of higher education. The main reasons why people participated in sustainable agricultural practices were, among others, to make profit while ensuring food security. However, the study found that teacher development programmes did not emphasise food security returns for the communities around the school context. The study found that due to the generic format of educational policies such as personnel administration measures (PAM), CAPS, IQMS and CPTD renders these policies difficult to be analysed and interpreted by stakeholders in teacher development. I therefore recommended that the above gaps be attended to as a matter of urgency to enhance teacher development in the teaching of agricultural sciences at school.

LIST OF REFERENCES

Abbasi. E. 2013. *The role of transformational leadership, organizational culture and organizational learning in improving the performance of Iranian agricultural faculties*. 66(4), 505-519.

Abdulhamid. A. 2013. *Effects of teaching method on retention of Agricultural Science knowledge in senior secondary schools of Bauchi Local Government Area, Nigeria*. International Journal of science and technology. 4(4), 63-69.

Ableidinger. J. 2010. *Shooting for Stars. Cross-Sector Lessons for Retaining High-Performing Educators.* The Turkish online journal of educational technology. *www.opportunityculture.org.*

Adendorff. S. 2016. *Technology Integration: Exploring Interactive Whiteboards as Dialogic Spaces in the Foundation Phase Classroom. Cape Peninsula University of Technology*. 15(3), 141-150.

Adnan. M. 2017. *Assessment of a multinational online faculty development program on online teaching: reflections of candidate e-tutors.* 18(1) (2), 22-38.

Africa-America Institute (AAI). 2015. *State of Education in Africa Report. A report card on the progress, opportunities and challenges confronting the African education sector*. Nigeria.

AgriSETA. 2016. *Agricultural sector skills plan 2017-2018*. RSA

Ahmed. S. 2013. *Tailoring online faculty development programmes: overcoming faculty resistance.* Ain Shams University Medical School. 47(5), 513-535.

ÄIJÄLÄ, K. 2001. *Public sector – an employer of choice? Report on the competitive public employer project*. OECD. Paris.

Alabi. D. L. 2017. *Gender analysis of problems and prospects of rural household-based enterprises in Osun state, Nigeria*. 17(1), 31-38.

Aladag. M. 2014. *Opinions of Counsellor Candidates Regarding Counselling Skills Training*. Ege University. 14(2), 879-886.

Alemu. B. M. 2015. *Integrating ICT into Teaching-learning Practices: Promise, Challenges and Future Directions of Higher Educational Institutes.* Adama Science and Technology University. 3 (3), 170-189.

Aliber, M. 2003. *Chronic poverty in South Africa: incidence, causes and policies.* World Development. Human Sciences Research Council. Pergamon. 31(3): 473–490.

Alpaydın. Y. 2015. *Identifying Higher-Education Level Skill Needs in Labor Markets: The Main Tools Usable for Turkey*. Marmara University. 15(4), 945-967.

Amena. R. 2013. *Parameters assessed for quality and management of modular system by the students of first and second year MBBS*. Pakistan. Khybermed University. 5(2), 86-90.

Amin. A. 2008. *Knowing in action: Beyond communities of practice*. Durham University UK. Research Policy 37 (2008), 353–369.

Antonio YVA. 2008. *Universal history disavowed: on critical theory and post colonialism*. 11(4), pp 451-473.

Anwaruddin, S. M. 2015. Teachers' engagement with educational research: Toward a Conceptual framework for locally-based interpretive communities. *Education Policy Analysis Archives, 23*(40): 1-25. http://dx.doi.org/10.14507/epaa.v23.1776

Arnab S. 2015. *Foundations of dynamic learning analytics: Using university student data to increase retention.* 46 (6), 1175-1188

Assoc. 2014. *Mapping of education for sustainable development in the new curriculum of Kosovo and challenges of implementation. University of Prishtina.* Kosovo.
DOI: 10.5593/sgemsocial2014/B11/S3.103.

Atieno. A. J 2014. *Influence of teaching and learning resources on students' performance in kenya certificate of secondary education in free day secondary education in embakasi district, kenya*. University of Nairobi.

Babalola I. 2007. *Effectiveness of video as an instructional medium in teaching rural children agricultural and environmental sciences*. Lagos State. 3(3), pp. 105-114

Balakrishnan, V and Claiborne, L. 2016. *Participatory action research in culturally complex societies: opportunities and challenges.* Educational Action Research. Routledge. 25:2, 185-202, DOI: 10.1080/09650792.2016.1206480.

Balschweid M. 2008. *Teaching advanced life sciences in an animal context: agricultural science teacher voices*. Purdue University. 49(1), pp 17-27

Barbera. J. R. 2010. A dictionary of cultural and critical theory. https://seminar580.files.wordpress.com

Bartle. E. 2015. Experiential learning: an overview. http://www.itali.aq.edu.au

Bateman N. 2016. *Photosynthesising in the classroom*. Australia. 62(3), pp 12-15.

Beighton C. 2014. *Payback time? Discourses of lack, debt and the moral regulation of teacher education.* 37(1), pp 30-42.

Benard B. 1997. *Turning It Around for All Youth: From Risk to Resilience*. New York. ED412309 1997-08-00. http://www.eric.ed.gov

Bennett MJ. 2016. *The value of cultural diversity: rhetoric and reality*. DOI 10.1186/s40064-016-2456-2

Biggs AG. 2014. *Overpaid or underpaid? A State-by-state ranking of public-employee compensation*. America.

Birbirso, D. T. 2014. *Crises in EFL Proficiency and Teacher Development in the Context of International Donation and Transformation Discourses*. *Australian Journal of Teacher Education.* Haramaya University, Ethiopia. 39(2): 1-20. http://dx.doi.org/10.14221/ajte.2014v39n2.6

Bisschoff T. 2009. *Perceptions of teachers on the benefits of teacher development programmes in one province of South Africa*. South Africa. 29, pp 475-490

Bland P. 2014. *Strategies for Attracting and Retaining Teachers*. Emporia State University. DOI: 10.5929/2014.4.1.2

Bognar B. 2009. *Creativity in teaching plant production*. Slavonski. Educational Journal of living theories: 2(2), pp 232-256

Bognar B. 2015. *Constructivist E-learning in Higher Education.* Josip Juraj Strossmayer University of Osijek. Vol.8 (1), pp 31- 46

Bozdogan AE. 2015. *Determination of biology department students' past field trip experiences and examination of their self-efficacy beliefs in planning and organising educational field trips. Giresun University*. Turkey. 22(7), pp 31-44

Bozkurt G. 2016. *Mathematics Teachers and ICT: Factors Affecting Pre-service use in School Placements.* Eskisehir Osmangazi University. Turkey. 2(2), pp 453-468.

Branekova D. 2011. *ICT and e-learning in teacher training*. Trakia University. Bulgaria. 9(4), pp 97-101.

Brigham Young University. Reading Psychology 33: 367-398. Taylor & Francis Group, LLC: DOI: 10.1080/02702711.2010.515858

Bronner SE. 2002. *Sketching the Lineage: The Critical Method and the Idealist Tradition*.

Brown, E. C., Hawkins, J. D., Rhew, I. C., Shapiro, V. B., Abbott, R. D., Oesterle, S., Arthur, M. W., Briney, J. S., Catalano, J. F. 2014. *Prevention System Mediation of Communities That Care Effects on Youth Outcomes.* 15(5): 623–632

Buettner E. 1996. *Lessons from Reading Recovery Lessons*. North America. 9(1), pp 2-5.

Bukhari NHS. 2013. *Critical Discourse Analysis and Educational Research*. Tsinghua University. China. 3(1): 9-17

Burns L. 2005. *Why Critical Discourse Analysis in Literacy Research*. Michigan State University.

Bybee, R. W. 2011. *The Teaching of Science: 21st Century Perspectives. The science teacher.* National Science Teachers Association 78(4): 75-78

Caballero. M. A. 2015. *Critical discourse analysis in the study of representation, identity politics and power relations: a multi-method approach*. USA. 28(2): 39-54.

Caena, F. 2011. *Literature review quality in teachers' continuing professional development*. Europe.

Camilus. 2014. *Friends without Benefits: how states systematically short-change teachers' retirement and threaten their retirement security.*

Cammarota, J. and Romero, A. 2016. *Participatory Action Research for High School Students: Transforming Policy, Practice, and the Personal with Social Justice Education*. University of Arizona, Tucson. 25(3): 488–506

Cano. J. 2005. *Resources for teaching*. Ohio state university. https://www.questia.com/library/journal

Cape Coast Metropolis. Agricultural Science. Published by Science and Education Centre of North America. Cape Coast Metropolis. 3(1): 13-20

Carl A. 2005. *The "voice of the teacher" in curriculum development: a voice crying in the wilderness?* 25(4), pp223–228

Howarth, C. 2006. *Future directions for a critical social psychology of racism/antiracism*.

Carolyn. 2015. *Academic symposium: "How to make research succeed in your emergency department: How to develop and train career researchers in emergency medicine"*

Carr, W. 2006. *Philosophy, Methodology and Action Research.* Journal of Philosophy of Education 40(4): 421-435.

Carragher, J and McGaughey J. 2016. *The effectiveness of peer mentoring in promoting a positive transition to higher education for first-year undergraduate students: a mixed methods systematic review protocol.* Dundalk Institute of Technology. Systematic reviews. Ireland. 5: 1-9. DOI 10.1186/s13643-016-0245-1

Carrasco. D. G. 2017. *Potential economic impact assessment for cattle parasites in Mexico*. Review. Mexico. 8(1): 61-74

Carrie. 2015. *Making Space for Critical Pedagogy in the Neoliberal University: Struggles and Possibilities.* The University of Kentucky

Carrie. 2015. *Sequencing learning experiences to engage different level learners in the workplace: An interview study with excellent clinical teachers*. University of California, USA

CDE. 2015. *Teacher Evaluation in South African Schools*. South Africa.

Chen, P., Weiss, F. L., and Nicholson, H. J. 2010. *Girls study girl's Inc.: engaging girls in evaluation through participatory action research. Girls Incorporated. Indianapolis*. Journal of Community Psychology. USA. 46(1-2): 228-237. Doi: 10.1007/s10464-010-9328-7

Chen. 2016. *A study on research hot-spots and frontiers of agricultural science and technology innovation – visualization analysis based on the Citespace III*. Huazhong Agricultural University. China.

Cheryl. 2014. *Teacher Rewards: Going beyond the Stickers: Moving beyond Extrinsic Motivation*. Red Deer, Alberta.

Chezare. 2014. *Exploring the Role of Empathy in Student-Teacher Interactions*. Michigan State University

Cho, M. H and Rathbun, G. 2013. *Implementing teacher-centred online teacher professional development (oTPD) programme in higher education: a case study*. Innovations in Education and Teaching International. Routledge. USA. 50(2): 144–156. http://dx.doi.org/10.1080/14703297.2012.760868.

Chou, C. L., Promes, S. B., Souza, K. H., Topp, K. S and O'Sullivan, P. S. 2012. *Twelve tips for facilitating successful teleconferences.* Medical Teacher. University of California, San Francisco, USA. 34(6): 445-449, DOI: 10.3109/0142159X.2012.668241.

Christine, A. T; Francoise, M. B and Karen, L. A. 2000. *Framework of Teacher Knowledge and Skills Necessary in a Standards-Based System*. New Orleans, LA. http://www.ous.edu/pass

Christopher. 2010. *Inclusive education policy implementation: implications for teacher workforce development in Trinidad and Tobago*. University of Minnesota.

Chupp. 2010. *Getting the most out of service learning: maximizing student, university and community impact.* Case Western Reserve University, Cleveland, Ohio, USA.

Claudiu .2014. *Rewards and punishments role in teacher-student relationship from the mentor's perspective*. University of Pitesti. Romania.

Cleland J. 2012. *Focus on underperformance, and how to address this.* Doi: 10.1111/j.1743-498X.2011.00522.x

Coats. 2005. *Nonverbal Behaviour and the Vertical Dimension of Social Relations: A Meta-Analysis*.

Coggshall. 2012. *Generating Teaching Effectiveness: The Role of Job-Embedded Professional Learning in Teacher Evaluation*.

Coker, J. S and Porter, D. J. 2015. *Maximizing Experiential Learning for Student Success, Change: The Magazine of Higher Learning*, 47:1, 66-72, DOI:10.1080/00091383.2015.996101

Cooper, R. 2000. *Urban School Reform from a Student-of-Colour Perspective*. 34 (5): 597-622.

Courtney. 2013. *Examining the silence of academic disappointment: A typology of students' reasons for not discussing disappointing grades with instructors*. Indiana.

Craig. 2007. *Participatory action research: Involving all players in evaluation and change*. New York.

Crane. 2011. *Participatory Action Research Workbook. A workbook designed to support the recording key elements of a Participatory Action Research process*.

Crista. 2014. *Valences of investigation method application in the study of biology and agricultural sciences.* Banat University of agricultural sciences and veterinary medicine. Romania.

Curry. 2012. *Relational Economies, Social Embeddedness and Valuing Labour in Agrarian Change: An Example from the Developing World*

Dagenais. 2017. *Research dissemination workshops: observations and implications based on an experience in Burkina Faso.* Burkina Faso

Daniel. 2012. *Teacher Incentive Fund: First Implementation Report*. U.S. Department of Education.

Danilo. 2014. *Knowledge and transformative social action: The encounter of selected traditions of participatory action research.*

Darko, R. O., Offei-Ansah, C., Shouqi, Y., and LIU, Jun-ping. 2015. *Challenges in the Teaching and Learning of Agricultural Science in Selected Public Senior High Schools in the Cape Coast Metropolis*. Agricultural Science. Published by Science and Education Centre of North America. Cape Coast Metropolis. 3(1): 13-20

Darko. R. O. 2016. *Constraints encountered in teaching practical agriculture in selected senior high schools in the sekondi-takoradi metropolis*. Jiangsu University. China. 3(7): 2604-2611

Dauer. 2017. *Indicators of Informal and Formal Decision-making about a Socioscientific Issue*.

Davids, B. 2009. *The new negotiator: The Teacher Development Summit*. RSA. 3(1), pp 1-15.

DBE. 2006. *The national policy framework for teacher education and development in South Africa*. RSA. http://www.education.gov.za

DBE. 2011. *Curriculum and Assessment Policy Statement Further.* https://www.education.gov.za/Curriculum

DBE. 2016. *National senior certificate diagnostic report*. RSA. https://www.ecexams.co.za/NSC Diagnostic report

Dehmlow. 2017. *Editorial Board Thoughts: Developing Relentless Collaborations and Powerful Partnerships.* University of Notre Dame

DeLander. 2017. *Lessons from a Recovering Department Chair.* Oregon State University College of Pharmacy.

Dennis. 2013. *Twelve-month follow-up of cognitive behavioural therapy for children with functional abdominal pain.*

Department of Agriculture (DOA). 2007. *Agricultural education and training access barriers report.*

Department of Education (DOE). 2001. *Draft national plan for higher education in South Africa*. RSA

Department of Education (DOE). 2007. *Guidelines for Teacher Training and Professional Development in ict*.

Dethier, J. J and Effenberger, A. 2012. *Agriculture and development: A brief review of the literature*. The World Bank, Washington, DC, United States. DOI: 10.1016/j.ecosys.2011.09.003

DHET. 2012. *Report of the working group on fee free university education for the poor in South Africa*. RSA

Dilara. 2016. *Active life centre: a Turkish model for teaching students with disabilities.*

Dimas. 2011. *Explicit Vocabulary Instruction in an English Content-Area Course with University Student Teachers: When Comprehensible Input Needs to be comprehended.* Universidad del Rosario, Colombia

Division for Adult Education (DAE). 1987. *Principles and techniques for effective adult basic education staff development*. Vocational and Adult Education, Washington, DC. U.S. Department of education. http://jite.org/documents/Vol8/JITEv8IIP079-090Armstrong333.pdf

Djordjevic. 2017. *The role and scope of information communication technologies in the research of university teachers in Serbia*. University of Nis. Serbia.

Dolin. 2016. *The new negotiator: The role of unions in education*. RSA.
Don, T., Paul, F. 2010. *At a Tiny College, an Epic Battle over Academic Authority*. 56(25): 16-18.

Donnie, W. W., McCuller, J. W., Bisesi, L., Tanamly, S., Sim, T and Kavich, J. A. 2004. *Preparing Adolescents for Success in School: A School-Based Indicated Prevention Model for Adolescents in the Alternative High School Setting.* Journal of HIV/AIDS Prevention in Children & Youth, Vol. 6(2): 7-31. Doi: 10. 1300/J499v06n02_02.

Donohue. D. 2014. *The challenges of realising inclusive education in South Africa*. University of Pretoria, South Africa. 34(2): 1-14

Lopez, D. M. and Schroeder, L. 2008. *Designing strategies that meet the variety of learning styles of students*. Saint Xavier University. Chicago.

Dormody. 1993. *Science Credentialing and Science Credit in Secondary School Agricultural Education*. New Mexico State University.

Douthwaite. 2010. *Learning selection revisited: How can agricultural researchers make a difference?* Philippines.

Dumm, T and Lenson, D. 2009. *A conversation with cornel west*. The Massachusetts Review. 50(1): 55-67

Eaton. 2015. A *Review of the Literature on Rural and Remote Pre-Service Teacher Preparation with a Focus on Blended and E-Learning Models.* University of Calgary

Egun, A. C. 2009. *Educational Futurism: A Case for the Teaching of Agricultural Education to Youths in Nigeria*. Delta State University Abraka. Nigeria. International Journal of Educational Sciences, 1:1, 53-60, DOI: 10.1080/09751122.2009.11889976

Eleonora. 2003. *Sustainability-focused Organizational Learning: Recent Experiences and New Challenges*. doi:10.5539/jel.v2n1p262

Elizabeth. 2015. *Planning to Have It All: Emerging Adults' Expectations of Future Work-Family Conflict.* University of Pennsylvania, Philadelphia, PA, USA.

Elyas. 2016. *English language educational policy in Saudi Arabia post-21stst century: enacted curriculum, identity, and modernisation: a critical discourse analysis approach.* King Abdulaziz University, Saudi Arabia.

Emine, O., and Dikkartin, O. F. T. 2016. *An investigation into logical thinking skills and proof writing levels of prospective mathematics teachers*. Journal of Education and Training Studies. Eric. Balikesir University. Turkey. 5(2): 10-20

Engelbrecht. 2016. *Criteria for continuing professional development of technology teachers' professional knowledge: a theoretical perspective.* University of Johannesburg. RSA

Erol. 2015. *Rural Turkish students' reactions to learning science in a mobile laboratory*. Turkey.

Ersozlu. A. 2016. *The Changes in Experienced Teachers' Understanding towards Classroom Management*. Gazi University. Turkey. 4(1), 144-150.

European Commission (EC). 2014. *Report to the European Commission on New modes of learning and teaching in higher education.* European Union

Evagorou. 2017. *Engaging elementary school pre-service teachers in modeling a Socioscientific issue as a way to help them appreciate the social aspects of science*.

Evans. 2014. *Leadership for professional development and learning: enhancing our understanding of how teachers develop.* University of Leeds. UK.

Evelyn. 2010. *A case study of participatory action research in a public New England middle school: empowerment, constraints and challenges.*

Ewnetu. 2016. *Research and conservation of the larger parrots of Africa and Madagascar: a review of knowledge gaps and opportunities.*

Eze. 2015. *Colleges of education librarians in Nigeria*. Enugu State University of Science and Technology.

Foutz, T., Navarro, M., B. Hill, R. B., Miller, K and A. Thompson, S. A. 2011. *Using the discipline of agricultural engineering to integrate math and science*. Journal of STEM Education. University of Georgia. 12(1 & 2): 24-32

Frantz, J. M., Filies, G., Jooste, K., Keim, M., Mlenzana, N., Laattoe, N., Roman, N., Schenck, C., Waggie, F., Rhoda, A. 2016. *Reflection on an inter-professional community-based participatory research project.* University of the Western Cape. South Africa. 8(2): 234-237.

Friedrich, T. 2017. *Carnival utterance, carnival body, carnival pedagogy: using bakhtin to work*. Knowledge Cultures. Addleton Academic Publishers. 5(3): 47-48.

Fritsch, J. 2012. *Social Networking as Educational Tool: A Community of Practice*. Techniques. https://w w w. a c t e o n l i n e. o r g

Galié. A. 2013. *Empowering women farmers. The Case of Participatory Plant Breeding*. 34(1), 58-92.

Galletta A. 2010. *"Why are you doing this?" Questions on purpose, structure, and outcomes in Participatory engaging youth and teacher candidates.* 46(3), 337-357 DOI: 10.1080/00131941003782452

Gardiner M. 2008. *Education in rural areas. Centre for Education Policy Development*. RSA. 4, pp 1-34

Gauthier L. 2016. *Redesigning for Student Success: Cultivating Communities of Practice in a Higher Education Classroom.* Queen's University. 16(2), pp. 1-13

George C. 2006. *Doctors as teachers*. British Media Association. No volume number, pp 1-34.

Georghiou L. 2015. *Value of research policy paper by the Research, Innovation, and Science Policy Experts (RISE).* Europe. Doi: 10.2777/732192.

Geraldine O. 2012. *Giving student groups a stronger voice: using participatory research and action (PRA) to initiate change to a curriculum*. University College Dublin Ireland. http://dx.doi.org/10.1080/14703297.2012.677656.

Gewertz, C. 2017. *Rural Educator sows passion, preparation*.

Gloeckner, G. W. 1992. *Integrating Basic Skills into Vocational Teacher Education Curricula*. Colorado State University.

Goering, S., Shudak, N. J and Thomas E. 2014. Philosophy in Schools: An Introduction for Philosophers and Teachers. Routledge. 38(3): 339 – 343. DOI: 10.5840/teachphil201538347

Goetz. K. 2015. *Working Atmosphere and Job Satisfaction of Health Care Staff in Kenya: An Exploratory Study*. http://dx.doi.org/10.1155/2015/256205

Golban A. 2016. *The analysis of the economic reforms in the Agri-food sector and their impact on competitiveness increasing of the Moldovan agricultural enterprises.* 59(1), pp 225-228

Goldstein B. 2016. *Food Justice: Combating Racism in the Agricultural System*. No Volume number, pp 56-57

Gonzales R. 2017. *Towards a Critical Race Theory of Evidence*. Journal for Learning through the Arts.

Gonzalez BP. 2015. *Education through Movies: Improving teaching skills and fostering reflection among students and teachers*. University of California. http://escholarship.org/uc/item/2dt7s0zk

Gordon SM. 2012. *Enhancing student research through a virtual participatory action research project: Student benefits and administrative challenges*. USA. 10(2), pp 205-220.

Govender, N and Zulu, D. 2017. *Natural sciences junior high school teachers' understanding of the nature of science and its impact on their planning of lessons.* Journal of Baltic Science Education. University of KwaZulu-Natal, South Africa

Gregoratto, F. 2015. *Political Power and its Pathologies: An Attempt to Reconsider Habermas' Critical Theory of Democracy*. *Constellations. 22(4): 533-542.* Doi: 10.1111/1467-8675.12189

Greysen, S. R., Kind, T. and Katherine C. 2010. *Online Professionalism and the Mirror of Social Media.* 25(11):1227–9. DOI: 10.1007/s11606-010-1447-1

Grove KJ. 2008. *Student Teacher ICT Use: Field Experience Placements and Mentor Teacher Influences.* University of Nevada. Las Vegas. No Volume number, pp 1-5.

Grove-White A. 2010. *All in the same direction, all at the same time an approach to enhancing creativity*. UK. (4), pp 7-13.

Grunfeld. 2013. *Using ICT for Climate Change Adaptation and Mitigation through Agro-ecology in the Developing World.* Victoria University. Australia. DOI: http://dx.doi.org/10.3929/ethz-a-007337628.

Gunnarsdóttir GH. 2014. *Professional development: Possibilities and restrictions for mathematics teachers in lower secondary school in Iceland.* University of Iceland. 11(1) (10), pp 155-171.

Guo, K. L. and Yong, Y. 2013. *Policies and Practices of Professional Development in China: What do Early Childhood Teachers Think? Australian Journal of Teacher Education*. University of Waikato, New Zealand. 38(6):88-102. http://dx.doi.org/10.14221/ajte.2013v38n6.4

Gutman C. 2014. *Involving Older Adults as Co-researchers in Social Work Education*. DOI: 10.1080/03601277.2013.802185

Habib AR. 2014. *Study on postgraduate student preferred or dislike teaching or learning techniques: a case study of a private university in Malaysia*. No Volume number, pp 273-279.

Hajer, M., Nilsson, M., Raworth, K., Bakker, P., Berkhout, F., De-Boer, Y., Rockström, J., Ludwig, K. and Kok, M. 2015. *Beyond cockpit-ism: four insights to enhance the transformative potential of the sustainable development goals.Sustainability.7:1651-1660.* Doi: 10.3390/su7021651

Hal A., James, L. C., Pyles, C. L., Jurkowski, J. M, and Bozlak, C.T. 2015. *Participatory action research*. Doi: 10.1093/sw/swv049.

Hamer L. 2013. *Kwanzaa Park: Discerning principles of Kwanzaa through Participatory Action Research as a basis for culturally relevant teaching*. University of Toledo. Journal of Ethnographic and Qualitative Research. 7, pp 188-203.

Hamre B. 2011. *Implementation fidelity and teachers' engagement in a course on effective teacher-child interactions: effects on teacher beliefs, knowledge and practice*. United States of America.

Hanafin J. 2014. *Multiple Intelligences Theory, Action Research, and Teacher Professional Development: The Irish MI Project*. Australian Journal of Teacher Education. 39(4), pp 126-142.

Hanuscin D. 2012. *The Use of Blogging as a Practice to Support Ninth-Grade Science Teachers' Identity Development as Leaders.* University of Missouri. No Volume number, pp 1-20

Hardy I. 2009. *The Production of Australian Professional Development Policy Texts as a Site of Contest: The Case of the Federal Quality Teacher Programme*. Charles Sturt University. 36(1), pp 73-88

Hardy, T. 1973. *Encyclopaedia Britannica*. Edinburgh, Scotland. https://www.britannica.com

Harvey, M. 2013. *Setting the Standards for Sessional Staff: Quality Learning and Teaching.* Journal of University Teaching and Learning Practice. Macquarie University. 10(3): 1-33. http://ro.uow.edu.au/jutlp/vol10/iss3/4

Hashmi, K. 2014. *Human resources management strategies and efficiency within school. A Co-relational Study*. The IAFOR Journal of Education. Pakistan. 2(1): 65-87.

Haskins, N. H and Singh, A. 2015. *Critical Race Theory and Counsellor Education Pedagogy: Creating Equitable Training. Counselor Education & Supervision*. 54: 288-301. DOI: 10.1002/ceas.12027

Hastings W. 2013. *Collaborative feedback and reflection for professional growth: preparing first-year pre-service teachers for participation in the community of practice.* Charles Sturt University, Bathurst, Australia. 41(2), pp 159-172.

Hauser L. 2013. *Cultivating a Doctoral Community of Inquiry and Practice: Designing and Facilitating Discussion Board Online Learning Communities.* California State University. 14(3), pp 29-46.

Hayes. D. 2010. *Crossing School and University Boundaries to Reshape Professional Learning and Research Practices*. Wales, Australia. 36(3), pp 491-509.

Hedges H. 2016. *Aspiring to quality teacher–parent partnerships in Vietnam: Building localised funds of knowledge.* Monash University. 7(3), pp 49-68

Helen J. C, Richard J. K and du Plessis J. 1998. *Teacher Development Making an Impact*. University of Colorado.

Henry AG. 2003. *Public Pedagogy and the Politics of Resistance: Notes on a critical theory of educational struggle.* Penn State University, U.S.A. educational philosophy and Theory. 35(1), pp 5-16.

Hess. A. J. 2011. *A Qualitative Study of Agricultural Literacy in Urban Youth: Understanding for Democratic Participation in Renewing the Agri–food System*. 52(2), 151-162.

Holmes B. *2013. School Teachers' Continuous Professional Development in an Online Learning Community: lessons from a case study of an eTwinning Learning Event.* European Journal of Education. 48(1), pp 97-112.

Hoover, D. and Flexer, R. W. 2007. *Enhancing and Evaluating Content on Teambuilding in a Graduate Transition Course*. Cleveland State University. 29(3), pp 4-12

Hunter L. 2017. *Promote Mutual Understanding, Improve Client Compliance.* http://www.veterinaryteambrief.com

Hwang K. 2014. *Culture-Inclusive Theories of Self and Social Interaction: The Approach of Multiple Philosophical Paradigms*. Journal for the Theory of Social Behaviour. 45(1), pp 40-63

Imran. 2012. *Exploring action research as an approach to interactive (participatory) evaluation*. Lahore College for Women University. *Interventions and Supports with Culturally Responsive Practices.*

International Monetary Fund. 2016. *Managing government compensation and employment institutions, policies.* http://www.imf.org/external/pp/ppindex.aspx

Iwan S. 2015. *Study of Role of Agribusiness Young Actors on Optimalization of Private Agricultural Extension in West Java Province*. Indonesia. International Journal of Humanities and Social Sciences. 5(9), pp 11-169

JA'Afar-Furo, R. M., Abdullahi, Y., and Badgal, E. B. 2014. *Effects of demonstration and lecture methods of teaching apiculture on performance of agric student*. ADAMAWA STATE UNIVERSITY, NIGERIA. 14(2):173-178

Jacobs P. 2012. *Skills development in rural areas- a brief review of evidence*. RSA.

Jerlando FLJ. 2014. *The use of regional data collection to inform university led initiatives: the case of a stem education swot analysis*. University of Wisconsin. Journal of stem Education. 15(1), pp 11-19

Johansen A. 2011. *An examination of New Zealand teachers' attributions and perceptions of behaviour, classroom management, and the level of formal teacher training received in behaviour management*. New Zealand. 12(2), pp 3-12.

Johnson EJ. 2016. *Enhancing Academic Investment through Home—School Connections and Building on ELL Students' Scholastic Funds of Knowledge*. US. Journal of Language and Literacy Education 12(1), pp 104-121

Jones, R. 2005. *NCSALL and Goodling institute study circle guide: rethinking instruction and participation for adult basic education. https://* www.ncsall.net

Jordan, N. 2013. *Landlabs: An Integrated Approach to Creating Agricultural Enterprises That Meet the Triple Bottom Line.* University of Georgia. *Journal of Higher Education Outreach and Engagement 17*(4):175-200.

Joseph, H. 2003. *Marketing Critical Theory*. *New Political Science* 25(3): 436-449

Kabirizi, T. 2007. *Main-streaming participatory and cross-disciplinary approaches in animal science research in developing countries*. Uganda. *African Journal of Agricultural Research* 2(4): 119-130. http://www.academicjournals.org/AJAR

Kabugi, K.S. 2013. *Challenges to teaching and learning of agriculture in secondary schools in kakuyuni division, kangundo district, Machakos County*. Kenya.

Kalsi, P. *2016. "Work is a beautiful thing...." Exploring attitudes towards employment in chronic pain (CP) patients attending a pain management programme (PMP).* City University London. Journal of Vocational Rehabilitation. 44(1):97-107. DOI: 10.3233/JVR-150783

Keeling. K 2014. *Critical theory and popular education. Cultural Studies* 28(4): 676-689.

Karadeniz, M. H. 2017. *Reflections from the Application of Different Type of Activities: Special Training Methods Course*. European Journal of Educational Research. Giresun University. Turkey. 6(2): 157-174

Kariuki. C. 2009. *Professional development for 21st century teachers: effective classroom management*. Jackson State University.

Kassner, L. 2014. *Opportunities to Personalize Teacher Learning: Innovative Approaches to Bridge Evaluation and Professional Development for Continuous Improvement*. Virginia Commonwealth University.

Keiler, K. C., Jackson, K. L., Jaworski, L., Lopatto, D. and Ades, S. E. 2017. *Teaching broader impacts of science with undergraduate research. Pennsylvania State University*. USA. Biology. PLoS Biol 15(3): e2001318. https://doi.org/10.1371/journal.pbio.2001318

Kemmis, S and McTaggart, R. 2007. *Participatory action research. Communicative action and the public sphere*.

Ketch, A. 2005. Conversation: The comprehension connection. International Reading Association. The reading teacher. 59(1): 8-13.

Khan, A., Khan, S., Zia-Ul-Islam, S. and Khan, M. 2017. *Communication Skills of a Teacher and Its Role in the Development of the Students' Academic Success*. Journal of Education and Practice. Pakistan. IISTE. 8(1): 18-21.

Khan, K. S. 2013. *Bridging the gap of knowledge and action: A case for participatory action research (PAR)*. Action Research. Aga Khan University, Pakistan. SAGE. 11(2): 157–175. DOI: 10.1177/1476750313477158

Kibuka. 2015. *Towards a model for international collaboration and partnerships in teacher education in Africa: education for sustainable development in South Africa.* University of South Africa.

Kim, J.H. 2013. *Teacher action research as Bildung: An application of Gadamer's philosophical hermeneutics to teacher professional development*. Curriculum Studies. 45(3): 379-393.

King, A. 2015. *Scholarship Yesterday, Today and Tomorrow, Quarterly Journal of Speech*, 101:1, 127-131, DOI: 10.1080/00335630.2015.999984

Kiran, J.P 2016. *Livelihood system assessment and planning for poverty alleviation: a case of rainfed agriculture in Jharkhand*. India. Special Section: Soil and Water Management 110(9): 1773-1783. Doi: 10.18520/cs/v110/i9/1773-1783

Koen, P.R. B. 2012. *Cultivating a Process-Oriented Methodology for Studying Administrative Practice*. University of Glasgow. The actionable Researcher 34(3): 433-455. DOI: 10.2753/ATP1084-1806340306

Komarraju, M. 2013. *Ideal Teacher Behaviours: Student Motivation and Self-Efficacy Predict Preferences.* Teaching of Psychology. SAGE. Southern Illinois University Carbondale. USA. 40(2): 104-110. DOI: 10.1177/0098628312475029

Komba, S. C. and Chiwamba, S. V. 2016. *An Examination of the Congruency between the University Teacher Training Contents and Secondary School Contents in Tanzania: The Case of Sokoine University of Agriculture*. Journal of Education and Learning .Canadian Center of Science and Education. Tanzania. 5(2): 100-108. Doi:10.5539/jel.v5n2p100.

Komba, S.C. 2015. *Reflections on the Implementation of Competence Based Curriculum in Tanzanian Secondary Schools*. Sokoine University of Agriculture, Morogoro, Tanzania. Journal of Education and Learning 4(2): 73-80.

Konyango, J. J. J. O. 2015. *Secondary School Agriculture: Participatory Approaches to the Implementation of Secondary School Agriculture Curriculum in Kenya between 1959 and 2012*. Egerton University. Kenya. International Journal of Scientific Research and innovative Technology 2(1): 1-11.

Kovalčikienė, K. 2015. *Extrinsic regulation vs. intrinsic motivation as predictors of professional choice satisfaction in agriculture study programs.* Aleksandras Stulginskis University. Lithuania. DOI: http://doi.org/10.15544/RD.2015.094

Krishnaveni, R. 2008. *Capacity building as a tool for assessing training and development activity: an Indian case study*. USA. International of Training and Development 12(2): 121-134.

Kyaruzi, A. A. 2014. *Reconsidering the philosophy of Education for Self-Reliance (ESR) from an experiential learning perspective in contemporary education in Tanzania*. Sokoine University of Agriculture, Tanzania. Educational Research for Social Change. 3(1): 3-19

LaCapra, D. 2004. *Tropisms of Intellectual History*. Rethinking History 8(4): 499-529

Lawrence, A. O. 2015. *Comparative analysis of agricultural science instructional resource utilization in public and private secondary schools in ankpa education zone of kogi state*. University of Nigeria Nsukka

Leitner, H. and Sheppard, E. 2015. *Provincializing critical urban theory: extending the ecosystem of possibilities.* INTERNATIONAL JOURNAL OF URBAN AND REGIONAL RESEARCH. Urban research publications limited. DOI:10.1111/1468-2427.12277.

Lewis, J., Oliver, R. and Oliver, M. 2017. *An evaluation of the impact of an agricultural science outreach programme on the attitudes of rural students*. Teaching science. Australia. 63(2): 35-41.

Liakopoulou, M. 2012. *The role of field experience in preparation of reflective teachers. Australian Journal of Teacher Education*. University of Thrace. Greece. 37(6): 41-54

Lindsay, B., Merrill, S; Sharon, L; Ibtissem, K. 2010. *Mediating between scientific and spontaneous concepts through languaging.* 19(2): 89-110

Liu, Z., Kipchumba, K. S., Liu, L. 2016. *Paths for world-class universities in agricultural science*. 71:97–118. DOI 10.1007/s10734-015-9891-9

Livingstone, A. M. 2014. *Youth Participatory Action Research and School Improvement: The Missing Voices of Black Youth in Montreal*. Johns Hopkins University. Canadian Journal of Education 37(1): 283-307. www.cje-rce.ca

Long, J. S., Robblee, M, S, Schaefer, L., Steeves, P., Wnuk, S., Eliza Pinnegar, E., and Clandinin, D. J. 2012. *Literature review on induction and mentoring related to early career teacher attrition and retention.* 20(1): 7-26, DOI: 10.1080/13611267.2012.645598

Loveland, T. 2012. *Professional Development Plans for Technology Education: Accountability-Based Applications at the Secondary and Post-Secondary Level.* St. Petersburg College. Florida.

Macleod, G, Pirrie, A, McCluskey, G., and Cullen, A. M. 2013. *Parents of excluded pupils: customers, partners, problems?* Educational Review. Routledge. University of Edinburgh, Edinburgh, UK. 65(4): 387–401.

MacNamara, A., Collinsa, D, Bailey, R, Toms, M, Forde, P and Pearcef, G. 2011. *Promoting lifelong physical activity and high level performance: realising an achievable aim for physical education*. Physical Education and Sport Pedagogy. Routledge. University of Central Lancashire, Preston, UK. 16(3): 265–278

Madlela, B. 2015. *ICT Opportunities and Threats in Implementing Teaching Practice Programmes*. Universal Journal of Educational Research. University of South Africa (UNISA), South Africa 3(6): 351-358

Magallanes, Lavezores, A. 2014. *A Framework for an ICT-based Development Program for Science Teachers in State Universities and Colleges in Region VI*. Universal Journal of Educational Research. Horizon Research Publishing Philippines. 2(9): 659-668

Mahon, M., Farrell, M and McDonagh, J. 2010. *Power, positionality and the view from within: agricultural advisers' role in implementing participatory extension programmes in the republic of Ireland*. Europe. 50(2): 104-120

Maitlis PM. 1986. *Journal of the Chemical Society, Chemical Communications.* 12. pp 893-984

Manik, S. 2015. *Calibrating the Barometer1: Student Access and Success in South African Public Higher Education Institutions*. RSA. 17: 226-244

Maposa, M. T. 2015. *Reflections on applying critical discourse analysis methodologies in analysing South African history textbooks*. University of KwaZulu-Natal. RSA. Yesterday and Today 14: 58-75

Somerville, M and Green, M. 2012. *Place and sustainability literacy in schools and teacher education*. University of Western Sydney. No volume or Doi.

Maria. 2010. *Partnering with Children Diagnosed with Mental Health Issues: Contributions of a Sociology of Childhood Perspective to Participatory Action Research*. Canada. Journal of Community Psychology 46: 84-99. DOI 10.1007/s10464-010-9323-z

Mark, G. 2014. *Promoting Teachers' Social and Emotional Competence: a Replication Study of the Cultivating Awareness and Resilience in Education (CARE) Program*. Pennsylvania State University.

Mark, R. 2005. *Integrating Methods for Developing Sustainability Indicators to Facilitate* Learning and Action. Retrieved online on 09 September 2016. Journal of ecology and society 10(1): No page numbers. http://www.ecologyandsociety.org/vol10/iss1/resp3/

Mayida, Z., John, T. 2013. *Knowing what I can do and who I can be: youth identify transformational benefits of participatory action research. Journal of ethnographic and Qualitative Research.* 8(1):42-55

Mbajiorgu, C. A. 2014. *Factors that impact on the teaching and learning of agriculture science in FET schools in Mpumalanga, South Africa: A case of Mandlethu FET School. 45(2): 137-145*

McCormick JB. 2014. *Challenges in Translational Research: The Views of Addiction Scientists.* 9(4), pp 1-7

McCrickerd, J. 2012. *Understanding and Reducing Faculty Reluctance to Improve Teaching*. Drake University. 60(2): 56-64

McDonell, L. M and Weatherford, M. S. 2000. *Practical Deliberation in Local School Districts: A South Carolina Experiment. CSE Technical Report.*

Meissner, H. H., Scholtz, M. M. and Engelbrecht, F. A. 2013. *Sustainability of the South African Livestock Sector towards 2050 Part 2: Challenges, changes and required implementations*. South African Journal of Animal Science. RSA. 43(3): 298-319. http://dx.doi.org/10.4314/sajas.v43i3.6

Melissa, P. 2010. *Framing the Assessment of Educational Technology Professional Development in a Culture of Learning*. University of Houston. International Society for Technology in Education. Www.iste.org. Journal of Digital Learning in Teacher Education 26(4): 126-131.

Melters, P. D, Bradnam, R.K, Young A. H, Telis, N, May, R. M, Ruby, G. J, Sebra, R, Peluso, P, Eid, J, Rank, D, Garcia, F. J, DeRisi, L. J, Smith, T, Tobias, C, Ibarra, R. J, Korf, I., and Chan, W. L. S. 2013. *Comparative analysis of tandem repeats from hundreds of species reveals unique insights into centromere evolution*. http://genomebiology.com/content/14/1/R10

Mestry, R., Hendricks, I. and Bisschoff T. 2013. *Collaboration for the effective and efficient management of school financial resources*. *South African Journal of Education*. University of Johannesburg. Johannesburg. South Africa. 29: 475-490.

Meti, C. B. 2013. *Assessment of training needs of agriculture university teachers. Indian Journal of Agricultural Research.* India. 47(5): 411-418.

Mhangani, M. E. 2012. *The implementation of integrated quality management system in primary schools of Mopani district of Limpopo province*. RSA

Michael, E. 2014. *Integration of climate change into the senior secondary school Agricultural Science curriculum*. Nigeria. Atmospheric and Climate Sciences 4: 614-621.

Mistry, J., Li, J., Yoshikawa, H., Tseng, V., Tirrell, J., Kiang, L., Mistry, R. and Wang, Y . 2016. *An Integrated Conceptual Framework for the Development of Asian American Children and Youth. 87(4): 1014-1032.*

Modebelu, M.N. and Nwakpadolu, G. M.. 2013. *Effective Teaching and Learning of Agricultural Science for Food Security and National Sustainability. Journal of Educational*

and Social Research. Michael Okpara University of Agriculture Umudike, Abia State of Nigeria. *3(4): 161-170.* Doi:10.5901/jesr.2013.v3n4p161

Modisaotsile, B. M. 2012. *The Failing Standard of Basic Education in South Africa*. Policy brief. South Africa. 72: 1-8. https://www.ai.org.za

Mora. A. 2013. *English Language Teachers' Professional Development and Identities*. 16(1), 49-62.

Mosoge, M. J. 2014. *Performance management: the neglected imperative of accountability systems in education. South African Journal of Education.* North-West University. South Africa. 34(1): 1-18

Msila, V. 2013. *Democratic Education through the Eyes of the Poor: Appraising the Post-Apartheid Experience.* Universal Journal of Educational Research. Horizon Research Publishing. University of South Africa. RSA. 1(3): 191-199.

Mukeredzi, T. G. 2014. *Creating Space for Pre-service Teacher Professional Development.* Australian Journal of Teacher Education. 42(2): 125-145

Mukeredzi, T. G., Mthiyane, N., and Bertram, C. 2015. *Becoming professionally qualified: The school-based mentoring experiences of part-time PGCE students.* South African Journal of Education. 35(2): 1-10

Mundschenk, N. A and Fuchs, W. W. 2016. *Professional Learning Communities: An Effective Mechanism for the Successful Implementation and Sustainability of Response to Intervention.* SRATE Journal. Southern Illinois University. 25(2): 55-64

Mwebaza. 2010. *Continuous assessment and students" performance in „a" level secondary schools in masaka district*. Makerere University Kampala.

Myers, B. E., Thompson, G. W. 2009. *Perceptions of the national agriscience teacher ambassador academy toward integrating science into school-based agricultural education curriculum*. Journal of Agricultural Education. University of Florida. 50(4): 120-133

Mirra, N., and Morrell, E. 2011. *Teachers as Civic Agents: Toward a Critical democratic Theory of Urban Teacher Development.* Journal of Teacher Education. SAGE Publications. 62(4): 408–420

Natia, J. A and Al-hassan, S. 2015. *Promoting teaching and learning in Ghanaian Basic Schools through ICT. International Journal of Education and Development using Information and Communication Technology.* Ghana. 11(2):113-125.

Nchabeleng, M. J. 2016. *Assessing the Impact of the Department of Agriculture Farm Together Programme on Development and Growth of Selected Agricultural Co-operatives in Capricorn District Municipality in Limpopo Province.* University of Limpopo. RSA.

Ndem, J. U. 2016. *Mechanisms for Enhancing Teachers' Effectiveness in the Implementation of Agricultural Science Programme in Secondary Schools in Afikpo Education Zone of Ebonyi State.* Ebonyi State University. Abakaliki. Journal of Education and Practice 7(4): 6-16.

Nedanov, A., and Žutinić D. 2015. *Cooperative organization as a factor of competitiveness and sustainability in Croatian agriculture*. University of Zagreb. Croatia. 61(1): 113-120

Negalur, R. B., Guruprasad, G. S., Gowdar S. B., and Narappa G. 2017. *Appropriate Agronomic Practices for Pest and Disease Management*. *International Journal of Bio-resource and Stress Management.* India. 8(2):272-279

NSC. 2016. *Exam Diagnostic Report*

Nyirenda, J. E. 1996. *Collaboration for adult literacy in Botswana*. Michigan State University Library. http://digital.lib.msu.edu/projects/africanjournals/

O'Siochru, C., and Norton, L. 2014. *Epistemic match: a pedagogical concept for understanding how students fit into the chosen subject*. Innovations in Education and Teaching International. Routledge. Liverpool Hope University. UK. 51:2, 195-206.

Oakleaf, M. 2010. *Value of Academic Libraries: A Comprehensive Research Review and Report. : 1-82*

Okechukwu, F. 2015. *Problems of teaching agricultural practical in secondary schools in delta state, Nigeria*. Delta State University, Abraka. International Journal of innovative Education research 3(2): 7-12.

Okiror, J. J., Matsiko, B. F., and Oonyu, J. 2011. *Just How Much Can School Pupils Learn from School Gardening? A Study of Two Supervised Agricultural Experience Approaches in Uganda*. *Journal of Agricultural Education.* Makerere University, Uganda. 52(2):24–35

Okoli. A. C. 2017. *Relating communication competence to teaching effectiveness: implication for teacher education*. Michael Okpara University of agriculture. Umudike Abia state. 8(3), 150-154.

Okseon, L and Choi, E. 2015. *The Influence of Professional Development on Teachers' Implementation of the Teaching Personal and Social Responsibility Model. Journal of Teaching in physical Education* Seoul National University. 34(4): 603-625

Ono, Y and Ferreira, J. 2010. *A case study of continuing teacher professional development through lesson study in South Africa*. South African Journal of Education. EASA. 30:59-74.

Osakwe, R. N. 2015. *Administrative Strategies of Departmental Heads as Determinants for the Effective Management of Human Resources in Tertiary Institutions in Delta State, Nigeria.* Higher Education Studies. Published by Canadian Center of Science and Education. Delta State University. 5(1): 43-50

Osborne, J. 2010. *Arguing to Learn in Science: The Role of Collaborative, Critical Discourse*. 328(5977): 463-466

Oxford English Dictionary. 2012. *Oxford English Dictionary Third Edition*.

Programmes as Perceived by Business Education Lecturers in Universities in South Nigeria. Nigeria. Published by Canadian Center of Science and Education. International Education Studies 6(10): 78-89. http://dx.doi.org/10.5539/ies.v6n10p78. doi:10.5539/ies.v6n10p78

Pahl, K. and Allan, C. 2011. *'I don't know what literacy is': Uncovering hidden literacies in a community library using ecological and participatory research methodologies with children*. *Journal of Early Childhood Literacy*. University of Sheffield, UK. SAGE. 11(2) 190–213. DOI: 10.1177/1468798411401864

Palmon, S., Cathcart, A., Lembeck, P. T., and Peterson, R. L. 2015. Service learning and community service. University of Nebraska-Lincoln. http://k12engagement.unl.edu/service-learning

Parker, R., Kolle, S., Harris, J., Murdock, A. B., Harris, K., Artist, G. 2011. *Science of agricultural plants*. Mississippi.

Parsons and Felisha. 2017. *An Intervention for the Intervention: Integrating Positive Behavioural Interventions and Supports with Culturally Responsive Practices.* 83(3): 52-57

Patricia, A. J., Joshua, L. B., Jennifer, F., Regin, T., Sebrina, D., Damira, R., Anna, D., and Paul, A. 2015. *Representations of a high-quality system of undergraduate education in English higher education policy documents*. UK. Studies in higher education 40(4): 610-623.

Paula, C. G. 2015. *Telling Tales: Towards a new Model of Literacy Development Using e-Readers in Teacher Education in Chile*. Universidad Andres Bello, Santiago, Chile. The Electronic Journal of e-learning 13(2): 84-96. www.ejel.org

PAM. 2016. Personnel Administrative Measures (PAM).

Petchauer, E. 2011. *I Feel What He Was Doin': Responding to Justice-Oriented Teaching Through Hip-Hop Aesthetics*. Urban Education. SAGE. Lincoln University. 46(6): 1411-1432

Pickett, K. E and Wilkinson, R. G. 2015. *Income inequality and health: A causal review*. 128: 316-326. https://doi.org/10.1016/j.socsimed.2014.12.031

Piercy, F. P., Franz, N., Donaldson, J. L., Richard, R. F. 2011. *Consistency and Change in Participatory Action Research: Reflections on a Focus Group Study about How Farmers Learn*. *The Qualitative Report.* USA. 16(3): 818-829

Pool J. 2013. *An evaluation of Technology teacher training in South Africa: shortcomings and recommendations*. North West University. DOI 10.1007/s10798-011-9198-9

Pulakka, A., Ashorn, P., Gondwe, A., Phiri, N. 2015. *Malawian parents' perceptions of physical activity and child development: a qualitative study*. University of Tampere School of Medicine. Finland. 41(6): 911-919. https://doi.org/10.1111/cch.12218

Qi, J. 2014. *A networked-hutong siwei of critiques for critical teacher education*. University of Western Sydney. Australia. Asia-Pacific Journal of teacher Education 42(4): 379-391

Qing G and Christopher D. 2013. *Challenges to teacher resilience: conditions count*. University of Nottingham. UK. British Educational Research Journal. 39(1): 22-24.

Rabbini R. 2016. *Realising potential and empowerment through universal laws*. International Journal of Arts & Sciences. Rikkyo University. Japan. 07(05):357–364

Rachel Q, Martha T, Ross M, Sandra T and Amanda B. M. 2004. *Progress monitoring in an inclusive standards-based assessment and accountability system*. Synthesis Report 53. National Center on Educational Outcomes. University of Minnesota. http://education.umn.edu/NCEO/OnlinePubs/Synthesis53.html

Reddy A. A. 2017. *Food security indicators in India compared to similar countries.* India. CURRENT SCIENCE. Research Gate. 111(4): 631-640.

Reedy K and Lacireno-Paquet N. 2015. *Implementation and Outcomes of Kansas Multi-Tier System of Supports*. San Francisco. https://WestEd. Org

Rhodes C and Brundrett M. 2012. *Retaining Leadership Talent in Schools*. 40(1): 19-34

Rodriguez. D. 2006. *Un/masking Identity: Healing Our Wounded Souls.* 12(6): 1067-1090

Rogers, J. G., Cooper, S. J. G., Cooper, S., Tingley, D. D., Braithwaite, N., Moreno, M., Rodrigues, A, and Salvia, G. 2015. *Product longevity and shared ownership: Sustainable routes to satisfying the world's growing demand for goods*. University of Bath. UK. 3(4): 547-561.

Roni, J. D. 2012. *(Re) imagining literacy and teacher preparation through collaboration*. Brigham Young University. Reading Psychology 33: 367-398. Taylor & Francis Group, LLC: DOI: 10.1080/02702711.2010.515858

Ross, R. R. 2010. *The Value of Research. 34: 1-8. http://jesna.org.j/pdfs/re_netres34.*

Roux AV. 2009. *Race /ethnicity and telomere length in the Multi-Ethnic Study of Atherosclerosis.* University of Vermont, Colchester USA. 8(2009), pp251–257.

Rubtcova, M. 2016. *How to Identify Negative Attitudes towards Inclusive Education: Critical Discourse Analysis of Russian Transcripts Using Role and Reference Grammar*. www.journals. Aiac.org.au

Sa'ad, T. U., Sabo, S., Abdullahi, A. D. 2015. *The Impact of Micro-Teaching on the Teaching Practice Performance of Undergraduate Agricultural Education Students in College of Education, Azare*. Journal of Education and Practice. Iiste. School of Education College of Education. Nigeria. 6(26): 109-116.

SACE. 2008. *The design of the continuing professional teacher development (CPTD) system*. RSA.

SACE. 2010. *Teacher Migration in South Africa, Advice to the Ministries of Basic and Higher Training.*

SACE. 2013. *The CPTD management system handbook*. RSA

SACE. 2014. *Guidelines for developing the professional development portfolio (PDP)*. RSA

SACE. 2016. *National legislation and policy*. RSA.

Saleem. 2010. *The challenges of transformation in higher education and training institutions in South Africa*. RSA.

Saliga, l. M., Daviso, A., Stuart, D and Pachnowski, L. 2015. *Steps Forward and Back in Adult Numeracy Teacher Professional Development: A Reflection on a Teacher Workshop Experience. Journal of Research and Practice for Adult Literacy, Secondary, and Basic Education.* Practitioner Perspective. University of Akron. 4(1): 40-54

Saunders, K., Brumm, T., Brooke, C., Mickelson, S., Freeman, S. 2013. Assessing Student Work to Support Curriculum Development: An Engineering Case Study. *Learning Communities Research and Practice*, 1(1), Article 6. Available at: https://washingtoncenter.evergreen.edu/lcrpjournal/vol1/iss1/6

Savescu, I. C and Crista, N. G. 2014. *The opinions of agriculture undergraduate students regarding the skills profile of the teacher.* Research Journal of Agricultural Science. Banat's University Of Agricultural Sciences And Veterinary Medicine. Romania. 42(2): 332-337

Scales, J., Terry, R and Torres, R. M. 2006. *Are Teachers Ready to Integrate Science Concepts into Secondary Agriculture Programs? Journal of Agricultural Education.* University of Central Missouri. 47(4): 102-113

Schenck, J and Cruickshank, J. 2015. *Evolving Kolb: Experiential Education in the Age of Neuroscience*. Journal of Experiential Education. SAGE publication. University of Wyoming. USA. 38(1): 73–95

Schleicher A. 2012. *Preparing Teachers and Developing School Leaders for the 21st Century: Lessons from around the World.* OECD Publishing. *http://dx.doi.org/10.1787/9789264xxxxxx-en.*

Serrano, R., Acero, I., Olmos, M. F. 2016. *Networks and export performance of Agri-food firms: New evidence linking micro and macro determinants*. Spain. 62(10): 459–470

Shaw, A. 2016. *When worlds collide – Examining the Challenges Faced by Teacher Education Programmes Combining Professional Vocational Competence with Academic Study, Lessons from Further Education to Higher Education*. Universal Journal of Educational Research. University of Hull. 4(5): 1111-1116

Shekarpour, S., Höffner, K., Lehmann, J and Auer, S. 2013. *Keyword Query Expansion on Linked Data Using Linguistic and Semantic Features*. University of Leipzig. http://www.wolframalpha.com

Shewchuk, S. 2014. *Children in need of protection: reporting policies in Ontario school boards*. Canadian Journal of Educational Administration and Policy. Queen's University. Canada. 64(162): 1-37

Shudak, N. J. 2014. *The Re-Emergence of Critical Pedagogy: A Three-Dimensional Framework for Teacher Education in the Age of Teacher Effectiveness*. *Creative Education,* 5: 989-999. http://dx.doi.org/10.4236/ce.2014.511113

Sleeter, C. E. 2017. *Critical Race Theory and the Whiteness of Teacher Education*. Urban Education. SAGE publication. 52(2) 155–169

Sobolev, A. B. 2016. The Teacher Education Development Program: New Challenges. Russia

Soltaninejad, N., Keshtiaray, N and Vaezi, S. H. 2017. *Explanation of Educational and Cultural Dimensions of Globalization in the Views of Ayatollah Javadi-Amoli*. International Education Studies. Canadian Center of Science and Education. Azad University. Iran. 10(1): 172-178

Sonia, M. P. M. 2012. *Tackling perinatal loss, a participatory action research approach: research protocol*. Spain. Blackwell Publishing Ltd. Journal of advanced nursing 68(11): 2578-2585. Doi: 10.1111/j.1365-2648.2012.06015.x

Stain HJ. 2008. *Improving mental health capacity in rural communities: Mental health first aid delivery in drought-affected rural New South Wales.* The University of Newcastle. Australia. 16, pp 313-318.

Stedman, N. L. P., Roberts, T. G., Harder, A., Myers, B. E., and Thoron, A. C. 2011. *The Relationship between experience and self–perceptions of knowledge and relevance of teaching competencies of faculty in a college of Agricultural and Life Sciences*. *Journal of Agricultural Education.* 52(1):50–60

Strong, S. I. 2017. *Clash of cultures: epistemic communities, negotiation theory, and international law making. Akron Law Review.* Published by IdeaExchange. 50(3) (4): 495-535.

Sullivan. 1997. *Case Study: North, Laurel High School*. London, Kentucky. http://www.sreb.org/programs/hstw/publications/case_studies/North _Laurel.asp.

Susan, T. 2014. *A qualitative review of literature on peer review of teaching in higher education: an application of the swot framework*. Malaysia. Review of Educational Research 84(1): 112-159. *DOI: 10.3102/0034654313499617*

Szeto, E and Cheng, A. Y. N. 2017. *Pedagogies across subjects: what are preservice teachers' TPACK patterns of integrating technology in practice?* Journal of Educational Computing Research. SAGE. China. 55(3): 346–373.

Teilanyo, D. I. 2016. Rhetoric and rivalry a*rrow of God* and present-day Nigerian politics. 48: 239-252. Doi: 10.1163/18757421-04802001

Tengo, M., Brondizio, E. S., Elqvist, T., Malmer, P., Spierenburg, M. 2014. *Connecting diverse knowledge systems for enhanced ecosystem governance: the multiple evidence base approach.* 43: 579-591

Tesch, J. 2006. *Expanding and Enhancing Rural Education Through Agricultural.* Rural Minnesota Journal. https://www.ruralmn.org.

Thamarasseri, I. 2016. *Forms of Knowledge and its Organisation in Schools*. Indian Journal of Educational Studies. Central University of Kashmir. India. 3(1): 1-11.

The Public Service Commission. 2007. *Toolkit for the management of poor performance in the public service*. RSA. www.psc.gov.za

Thenga, C. M. 2012. *Managing school funds in selected secondary schools in Gauteng province.* South Africa.

Thomson G W. 2007. *Integrating science into the agricultural education curriculum: do science and agriculture teachers agree?* Oregon State University. 48(3), pp 1-12

Thoron, A. C., Myers, B. E and Abrams, K. 2011. *Inquiry-based instruction: how is it utilized, accepted, and assessed in schools with national agriscience teacher ambassadors? Journal of Agricultural Education.* University of Illinois. 52(1): 96-106. *DOI: 10.5032/jae.2011.01096*

Timmis K. N. 2015. *Pseudomonas putida: a cosmopolitan opportunist PAR excellence.* 4 (12), pp 779–781

Timperley H. 2008. *Reframing Teacher Professional Learning: An Alternative Policy Approach to Strengthening Valued Outcomes for Diverse Learners*. University of Auckland. DOI: 10.3102/0091732X07308968

Toomey, C. 2014. *An Asilomar for nanotech*. University of South Carolina. https://www.nature.com/naturenanotechnology

Torrise, M. L. 2010. *Role of the Library Media Specialist in Greening the Curriculum: A Community-Based Approach to Teaching 21st Century Skills Outside of the School Library through the Practice of Urban Agriculture. T*oward a theory for creating liberatory, institutional spaces for male student writers. Library Media Connection. 28(4): 18-20. https://eric.ed.gov

Tran, V. D. 2016. *Coping Styles with Student Misbehavior as Mediators of Teachers' Classroom Management Strategies*. International Journal of Higher Education. Sciedu Press. A Giang University, Vietnam. 5(1): 1-10

Troy, W. 2013. *Agriculture and climate change education in K–12 classrooms*. USA. 3: 78-79

Tsotetsi, C. T and Mahlomaholo, S. M. G. 2013. *Teacher Professional Development Programmes: What is missing?* Journal of Educational Studies. University of the Free State. South Africa. 12(1): 89-102

Tugba, Y. Y. 2012. *The strategic planning (swot) analysis outcomes and suggestions according to the students and the lecturers within the distance education system*. TURKEY. Turkish online Journal of Distance Education 13(2): 267-276.

Tulbure, C., Samfira, E. M., Samfira, I. 2015. *Perception of Pre-Service Teachers Regarding the Relationship between Didactic Competencies and Learning Motivation.* Revista Romaneasca pentru Educatie Multidimensionala. 7(1): 193-202.

Tulinius. C. 2012. *Increasing the general level of academic capacity in general practice: introducing mandatory research training for general practitioner trainees through a participatory research process*. UK. 20(57): 57-67

Tynan B. 2008. *Participatory action research for professional development: Changing our approach to distance learning*. University of New England. http://www.ascilite.org.au/conferences/melbourne08/procs/tynan.pdf
Rutgers University. New Political Science. 24(2), pp 265-292.

Tyson, L. 2006. *Critical theory today, A User-Friendly Guide*. Routledge. USA

Ullrich, C., Mahler, C., Forstner, J., Szecsenyi, J and Wensing, M. 2017. *Teaching implementation science in a new Master of Science Program in Germany: a survey of stakeholder expectations*. Implementation Science. DOI 10.1186/s13012-017-0583-y.
Van, T. T. M. 2009. *The Relevance of Literary Analysis to Teaching Literature in the EFL Classroom.* English teaching forum. Vietnam. 3: 2-17

Verovšek, P. J. 2012. *Meeting Principles and Lifeworlds Halfway: Jürgen Habermas on the Future of Europe.* Yale University. Political Studies 60: 363-380

Vesterinen, Tolppanen and Aksela. 2016. *Toward citizenship science education: what students do to make the world a better place?* International. Journal of Science Education. Routledge. 38(1): 30-50. DOI: 10.1080/09500693.2015.1125035.

Virginia Department of Education. 2013. *A Strategic Review of Agricultural Education*. Richmond, Virginia.

Wade, W. Y., Rasmussen, K. L and Fox-Turnbull, W. 2013. *Can Technology Be a Transformative Force in Education?* Preventing School Failure. Routledge. University of West Florida, Pensacola, FL, USA. 57(3): 162-170. DOI: 10.1080/1045988X.2013.795790.

Wang, T. 2016. *While Guiding a Special Democratic-Life Meeting of the Standing Committee of the Hebei Provincial Party Committee, Xi Jinping Emphasizes the Proper Use of Criticism and Self-Criticism as a Weapon to Improve the Ability of Leading Groups to Solve Their Own Problems*. Chinese law and government. Routledge. 48(6): 462–464.

Watson, C. 2014. *Effective professional learning communities? The possibilities for teachers as agents of change in schools.* British Educational Research Journal. BERA. University of Stirling. UK. 40(1): 18–29.

Whitehead, J and Huxtable, M. 2016. *Creating a profession of educators with the living-theories of master and doctor educators.* Sage Publication. University of Cumbria, UK. 32(1): 6–25.

Wielewska, I., Gliniak, M and Sobczyk, W. 2017. *Ecological education for sustainable development of rural areas*. 45: 250-257.

Wilmshurst. , Linda, A. 2002. *Treatment Programs for Youth with Emotional and Behavioural Disorders: An Outcome Study of Two Alternate Approaches*. 4(2): 85-96.

Wilson, A. 2016. *From Professional Practice to Practical Leader: Teacher Leadership in Professional Learning Communities*. International Journal of Teacher Leadership. The University of Tampa, USA. 7(2): 45-62.

World Economic Forum. 2015. *Managing the Risk and Impact of Future Epidemics: Options for Public-Private Cooperation*. https:// www.weforum.org

Yang, K. 2015. *Participatory Reflexivity in Community-Based Participatory Research: Insights from reflexive interview, dialogical narrative analysis, and video ethnography.* Journal of Community & Applied Social Psychology. John Wiley & Sons, Ltd. University of British Columbia. Canada. 25: 447–458. DOI: 10.1002/casp.2227

Yigit, C and Bagceci, B. 2017. *Teachers' Opinions Regarding the Usage of Action Research in Professional Development*. Journal of Education and Training Studies. Redfame Publishing. University of Gaziantep. Turkey. 5(2): 243-252.

Zachariah, M. and Moreno, R. 2006. *Finding My Place: The Use of Sociometric Choice and Sociodrama for Building Community in the School Classroom. Journal of group psychotherapy psychodrama and Sociometry. 58(4): 157-167*

Zehetmeier, S. 2014. *The others' voice availing other disciplines' knowledge about sustainable impact of professional development programmes. The Mathematics Enthusiast*. University of Klagenfurt, Austria. 11 (1): 172-196.

Zhang, J., Yuan, R and Yu, S. 2017. *What impedes the development of professional learning communities in China? Perceptions from leaders and frontline teachers in three schools in Shanghai*. Educational Management Administration and Leadership. Sage. China. 45(2): 219-237.

APPENDIX A ETHICAL CLEARANCE LETTER

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS·UV
EDUCATION
OPVOEDKUNDE

Faculty of Education

14-Dec-2016

Dear **Mr Nkwenyana Baas**

Ethics Clearance: **ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL**

Principal Investigator: **Mr Nkwenyana Baas**

Department: **School of Education Studies (Bloemfontein Campus)**

APPLICATION APPROVED

With reference to you application for ethical clearance with the Faculty of Education, I am pleased to inform you on behalf of the Ethics Board of the faculty that you have been granted ethical clearance for your research.

Your ethical clearance number, to be used in all correspondence is: **UFS-HSD2016/0424**

This ethical clearance number is valid for research conducted for one year from issuance. Should you require more time to complete this research, please apply for an extension.

We request that any changes that may take place during the course of your research project be submitted to the ethics office to ensure we are kept up to date with your progress and any ethical implications that may arise.

Thank you for submitting this proposal for ethical clearance and we wish you every success with your research.

Yours faithfully

Dr. Juliet Ramohai

Chairperson: Ethics Committee

Education Ethics Committee
Office of the Dean: Education
T: +27 (0)51 401 9683| F: +27 (0)86 546 1113 | E: RamohaiJ@ufs.ac.za
Winkie Direko Building | P.O. Box/Posbus 339 | Bloemfontein 9300 | South Africa
www.ufs.ac.za

APPENDIX B APPLICATION TO CONDUCT RESEARCH FROM EDUCATION FDOE

Ref: Research Application

APPLICATION TO REGISTER AND CONDUCT RESEARCH IN THE FREE STATE DEPRARTMENT OF EDUCATION

- Please complete all the sections of this form that are applicable to you. If any section is not applicable please indicate this by writing N/A.
- If there are too few lines in any of the sections please attach the additional information as an addendum.
- Attach all the required documentation so that your application can be processed.
- Send the completed application to:

DIRECTOR: STRATEGIC PLANNING, POLICY AND RESEARCH

Room 319, 3rd Floor
Old CNA Building
Bloem Plaza
Charlotte Maxeke Street
BLOEMFONTEIN, 9300

OR

Free State Department of Education
Private Bag X20565
BLOEMFONTEIN, 9300

Email: berthakitching@gmail.com and B.Kitching@fseducation.gov.za

Tel: 051 404 9283 /9211 / 082 454 1519

1. **TITLE** (eg Ms, Mrs, Mr, Dr, Prof, etc):

M	R		

2. **INITIALS**

N	S			

3. **SURNAME**

B	A	A	S												

4. **TELEPHONE HOME:**

0	7	3	8	4	1	8	7	3	2						

5. **TELEPHONE WORK:**

0	5	8	7	1	4	0	1	2	7

6. **TELEPHONE CELL:**

0	7	3	8	4	1	8	7	3	2

7. **FAX:**

0	8	6	4	2	5	5	3	5	5

8. **E-MAIL : baasagric@webmail.co.za**

b	a	a	s	a	g	r	i	c	@	w	e	b	m	a	i

9. **ADDRESS HOME:**

0	5	4	7	P	H	A	M	O	N	G				
W	I	T	S	I	E	S	H	O	E	K				
Postal Code											9	8	7	0

10. **ADDRESS WORK:**

P	R	I	V	A	T	B	A	G	X	8	6	6		
W	I	T	S	I	E	S	H	O	E	K				
Q	W	A	Q	W	A									
Postal Code											9	8	7	0

11. POSTAL ADDRESS

P	O	B	O	X	1	4	9	6	1					
W	I	T	S	I	E	S	H	O	E	K				
Postal Code											9	8	7	0

12 **NAME OF TERTIARY INSTITUTION / RESEARCH INSTITUTE AND STUDENT NUMBER**

U	N	I	V	E	R	S	I	T	Y	O	F	T	H	E	
F	R	E	E	S	T	A	T	E							

13. OCCUPATION

E	D	U	C	A	T	O	R								

14. PLACE OF EMPLOYMENT

S	E	O	T	L	O	N	G	A	G	R	I	C			
A	N	D	H	O	T	E	L	S	C	H	O	O	L		

15. NAME OF COURSE

M	A	S	T	E	R	S	I	N	P	O	L	I	C	Y	S
T	U	D	I	E	S	I	N	E	D	C	A	T	I	O	N

16. NAME OF SUPERVISOR / PROMOTER

D	R														
C	I	A	S		T	S	O	T	E	T	S	I			

17. TITLE OF RESEARCH PROJECT

ENHANCING TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL.

18. CONCISE EXPLANATION OF THE RESEARCH TOPIC

The aim of the study is to enhance teacher development in the teaching of agricultural sciences at school. The need to address the aim of the study exists because the integration of the subject agricultural sciences with other subjects in the school curriculum remains a challenge for some teachers because they have not specialized in Mathematics, Physical sciences, life sciences, technology, economics, geography and other subjects which are needed as additional approaches to teaching and learning the subject agricultural sciences, and this brings frustrations in teachers.

19. APPLICATION VALUE THAT THE RESEARCH MAY HAVE FOR THE FREE STATE EDUCATION DEPARTMENT

The outcome of the study, enhancing teacher development in the teaching of agricultural sciences at school, will benefit the school based agricultural sciences teachers; office based educators; learners and their parents; non-governmental organizations with interest in education; the department of education; commerce and industry; educational researchers (local and abroad) and finally the communities within which agricultural schools are based around the world.

20. LIST OF SCHOOLS AND DISTRICTS INVOLVED IN THE RESEARCH
(If not enough space, please include rows)

S	E	O	T	L	O	N	G	S	C	H	O	O	L
T	H	A	M	E	S	O	S	C	H	O	O	L	
M	A	M	P	O	I	S	C	H	O	O	L		
T	H	A	B	O	M	O	F	T	S	A	N	Y	A
D	I	S	T	R	I	C	T						

21. LIST OF DIRECTORATES / OFFICIALS IN THE DEPARTMENT INVOVLED IN THE RESEARCH

S	U	B	J	E	C	T	A	D	V	I	S	O	R
F	O	R	A	G	R	I	C	U	L	T	U	R	A
L	S	C	I	E	N	C	E	S					

22. DETAILS OF TARGET GROUP WITH WHOM THE RESEARCH IS TO BE UNDERTAKEN

Target group	Number	Grade	Subject	Age	Gender	Language
TEACHERS	3	10-12	Agricultural Sciences	≥ 25yrs	M or F	ENGLISH
HOD'S	3	10-12	Agricultural Sciences	≥ 25yrs	M or F	ENGLISH
SES	1	10-12	Agricultural Sciences	≥ 25yrs	M or F	ENGLISH
Agribusiness	1	N/A	AGRICULTURE	≥ 25yrs	M or F	ENGLISH

23. FULL PARTICULARS OF HOW INFORMATION WILL BE OBTAINED, EG QUESTIONAIRES, INTERVIEWS, STANDARDIZED TESTS, ETC.

Please attach copies of questionnaires, questions that will be asked during interviews, tests that will be completed or any other relevant documents regarding the acquisition of information. **Please note that should learners be part of the research as a target group then it should be clearly explained how their safety and identify will be protected and guaranteed.**

In order to achieve the aim of the study participatory action research (PAR) is used as research design and methodology. Attached please find three action plans to be used during collaborative sessions where data will be generated during collaborative dialogues.

24. STARTING AND COMPLETION DATES OF THE RESEARCH PROJECT

Please bear in mind that research is usually not allowed to be conducted in schools during the fourth academic term (October to December).

23 January 2017 until 31 March 2017

25. WILL THE RESEARCH BE CONDUCTED DURING OR AFTER SCHOOL HOURS?

Please bear in mind that research is usually not allowed to be conducted in schools during normal teaching time.

The research will be conducted after school hours.

26. HOW MUCH TIME IS NEEDED WITH THE TARGET GROUP/S TO CONDUCT THE RESEARCH?

Target Group	Activity (ie interview, questionnaire, etc)	Time Needed
TEACHERS	PARTICIPATORY ACTION RESEARCH	9 HOURS
DEPARTMENTAL HEADS	PARTICIPATORY ACTION RESEARCH	9 HOURS
SUBJECT ADVISORS	PARTICIPATORY ACTION RESEARCH	9 HOURS
AGRIBUSINESS OWNERS	PARTICIPATORY ACTION RESEARCH	9 HOURS

27. HAVE YOU INCLUDED / ATTACHED?NE

27.1 A letter from your supervisor confirming your registration for the course you are following?

Yes	No

X	

27.1 A draft letter / specimen that will be sent to principals requesting permission to conduct research in their schools?

Yes	No
X	

27.2 A draft letter / specimen that will be sent to parents requesting permission for their children to participate in the research project?

Yes	No
	N/A

27.3 A copy of the questionnaires that you wish to distribute to the target group/s?

Yes	No
	N/A

27.4 A list of questions that will be asked during interviews with the target group/s?

Yes	No
	N/A

27.5 Ethical clearance certificate

Yes	No
X	

28 I **BAAS NKWENYANA SOLOMON** ..... herewith confirm that all the information in this application form is correct and that I will abide by the ethical code and the conditions under which the research may be undertaken, ie:

28.1 I will abide by the ethical research conditions in the discourse of my study in the FSDoE.

28.2 I will abide by the period in which the research has to be done

28.3 I will apply for extention if I cannot complete the research within the specified period

28.4 If I fall behind with my schedule by three months to complete my research project in the approved period, I will apply for an extension.

28.5 I will not conduct research during the fourth quarter of the academic year

28.6 I will not disrupt normal learning and teaching times at schools to undertake my research

28.7 I will submit a bound copy or CD of the research document to the Free State Department of Education, Room 319, 3rd Floor, Old CNA Building, Charlotte Maxeke Street, Bloemfontein, upon completion of the research.

28.8 I will upon completion of my research study make a presentation to the relevant stakeholders in the Department as per the arrangements of the Department.

28.9 The ethics documents will be adhered to in the discourse of my study in your department.

28.10 The costs relating to all the conditions mentioned above are for my own responsibility.

SIGNATURE: _____ DATE: 19/01/2017

APPENDIX C APPROVAL TO CONDUCT RESEARCH

Enquiries: KK Motshumi
Ref: Research Permission: NS BAAS
Tel. 051 404 9283 / 9221 / 079 503 4943
Email: K.Motshumi@fseducation.gov.ZA

education
Department of Education
FREE STATE PROVINCE

NS Bass
0547 Phamong
Witsieshoek
9870

078 612 8731

Dear Mr. NS Baas

APPROVAL TO CONDUCT RESEARCH IN THE FREE STATE DEPARTMENT OF EDUCATION

1. This letter serves as an acknowledgement of receipt of your request to conduct research in the Free State Department of Education.

   Topic: Enhancing teacher development in the teaching of Agricultural Science.

   Schools involved: Seotlong, Thameso and Mampoi Secondary Schools.

   Target Population: 3 Grade 10-12 Agricultural Science teachers. 3 Agricultural Science HODs and 1 Agricultural Science SES.

   Period of research: From the date of signature of this letter until September 2017. Please note the department does not allow any research to be conducted during the fourth term (quarter) of the academic year.

2. Should you fall behind your schedule by three months to complete your research project in the approved period, you will need to apply for an extension.

3. The approval is subject to the following conditions:

   3.1 The collection of data should not interfere with the normal tuition time or teaching process.

   3.2 A bound copy of the research document or a CD, should be submitted to the Free State Department of Education, Room 319, 3rd Floor, Old CNA Building, Charlotte Maxeke Street, Bloemfontein.

   3.3 You will be expected, on completion of your research study to make a presentation to the relevant stakeholders in the Department.

   3.4 The attached ethics documents must be adhered to in the discourse of your study in our department.

4. Please note that costs relating to all the conditions mentioned above are your own responsibility.

Yours sincerely

DR JEM SEKOLANYANE
CHIEF FINANCIAL OFFICER

DATE: 30/05/2017

RESEARCH APPLICATION NS BAAS PERMISSION EDITED MAY 2017

Strategic Planning, Policy & Research Directorate
Private Bag X20565, Bloemfontein, 9300 - Room 318, Old CNA Building, 3rd Floor, Charlotte Maxeke Street, Bloemfontein
Tel: (051) 404 9283 / 9221 **Fax:** (086) 6678 678

APPENDIX D CONSENT FORM FOR THE FARM MANAGER

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

DATE

FROM 01 MAY 2017 TO 30 JUNE 2017

TITLE OF THE RESEARCH PROJECT

Enhancing teacher development in the teaching of agricultural sciences at school

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT NUMBER(S):

BAAS NS	2001093778	0738418732
Name of student/researcher	*Student number*	*Contact number*
Name of student/researcher	*Student number*	*Contact number*
Name of student/researcher	*Student number*	*Contact number*

FACULTY AND DEPARTMENT:

EDUCATION
Department OF EDUCATION

STUDYLEADER(S) NAME AND CONTACT NUMBER:

DOCTOR TSOTETSI CIAS
058 718 5344

WHAT IS RESEARCH?

Research is something we do to find new knowledge about the way things and people work. We use research projects or studies to help us find out more about children and teenagers and the things that affect their lives, their schools, their families and their health. Research also helps us to find better ways of helping, or treating children who are sick. We do this to try and make the world a better place!

WHAT IS THE AIM / PURPOSE OF THE STUDY?

THE AIM OF THE STUDY IS TO ENHANCE TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL.

WHO IS DOING THE RESEARCH?

I am Mr Baas NS and a teacher by profession. I am currently an employee of the Free State Department of education. I do the study to enhance teacher development in the teaching of agricultural sciences at.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2016/0424

WHY ARE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

You are cordially invited to take part in this research project by virtue of your position, expertise and interest in teacher development in the teaching of agricultural sciences at school.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

Your role in the study is to help generate data on the study through your contribution during participatory action research dialogues. The study involves audio taping . We will collectively determine how we can enhance teacher development in the teaching of agricultural sciences at a school. The study will allow a minimum of two hours per dialogue session from 01 MAY 2017 until 30 JUNE 2017. There is no risk in participating in the study.

CAN THE PARTICIPANT WITHDRAW FROM THE STUDY?

Participation in the study is voluntary and there is no penalty or loss of benefit for non-participation. Your are under no obligation to consent to participation. If you decide to participate you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

Your participation in the study will be kept confidential until the results of the study have been offically published.

WHAT IS THE ANTICIPATED INCONVENIENCE OF TAKING PART IN THIS STUDY?

There is no inconvenience or discomfort to you as participant in the study as there are no possible or foreseeable risks of harm or side-effects.

WILL WHAT I SAY BE KEPT CONFIDENTIAL?

Confidentiality of information will be maintained under maximum care. Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a fictitious pseudonym and you will be referred to in this way in the data, any publications, or other reporting mehtods such as conference proceedings.

HOW WILL THE INFORMATION BE STORED AND ULTIMATELY DESTROYED?

Hard copies of your contributions will be stored in maximum security devices in and undisclosed area until all data has been analysed. Electronic information will be stored on a password protected computer. Hard copies will be destroyed by means of fire. Electronic information will be destroyed by formating the storage properties of the harddrive.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICPATING IN THIS STUDY?

Participation in this study is voluntary as there is no payment or reward offered, financial or otherwise.

HOW WILL THE PARTICIPANT BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

If you would like to be informed of the final research findings, please contact Mr. Baas NS on 073 841 8732 or by e-mail to baasagric@webmail.co.za

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

CONSENT TO PARTICIPATE IN THIS STUDY

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

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable). I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

I agree to the recording of the *insert specific data collection method*.

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

Full Name of Participant: _____

Signature of Participant: _____ Date: _____

Full Name(s) of Researcher(s): _____

Signature of Researcher: _____ Date: _____

APPENDIX E CONSENT FORM TO EACH OF THREE HOD'S OF AGRICULTURAL SCIENCES

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

DATE

FROM 01 MAY 2017 TO 30 JUNE 2017

TITLE OF THE RESEARCH PROJECT

Enhancing teacher development in the teaching of agricultural sciences at school

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT NUMBER(S):

BAAS NS	2001093778	0738418732
Name of student/researcher	*Student number*	*Contact number*
Name of student/researcher	*Student number*	*Contact number*
Name of student/researcher	*Student number*	*Contact number*

FACULTY AND DEPARTMENT:

EDUCATION
Department OF EDUCATION

STUDYLEADER(S) NAME AND CONTACT NUMBER:

DOCTOR TSOTETSI CIAS
058 718 5344

WHAT IS RESEARCH?

Research is something we do to find new knowledge about the way things and people work. We use research projects or studies to help us find out more about children and teenagers and the things that affect their lives, their schools, their families and their health. Research also helps us to find better ways of helping, or treating children who are sick. We do this to try and make the world a better place!

WHAT IS THE AIM / PURPOSE OF THE STUDY?

THE AIM OF THE STUDY IS TO ENHANCE TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL.

WHO IS DOING THE RESEARCH?

I am Mr Baas NS and a teacher by profession. I am currently an employee of the Free State Department of education. I do the study to enhance teacher development in the teaching of agricultural sciences at.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2016/0424

WHY ARE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

You are cordially invited to take part in this research project by virtue of your position, expertise and interest in teacher development in the teaching of agricultural sciences at school.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

Your role in the study is to help generate data on the study through your contribution during participatory action research dialogues. The study involves audio taping . We will collectively determine how we can enhance teacher development in the teaching of agricultural sciences at a school. The study will allow a minimum of two hours per dialogue session from 01 MAY 2017 until 30 JUNE 2017. There is no risk in participating in the study.

CAN THE PARTICIPANT WITHDRAW FROM THE STUDY?

Participation in the study is voluntary and there is no penalty or loss of benefit for non-participation. Your are under no obligation to consent to participation. If you decide to participate you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

Your participation in the study will be kept confidential until the results of the study have been offically published.

WHAT IS THE ANTICIPATED INCONVENIENCE OF TAKING PART IN THIS STUDY?

There is no inconvenience or discomfort to you as participant in the study as there are no possible or foreseeable risks of harm or side-effects.

WILL WHAT I SAY BE KEPT CONFIDENTIAL?

Confidentiality of information will be maintained under maximum care. Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a fictitious pseudonym and you will be referred to in this way in the data, any publications, or other reporting mehtods such as conference proceedings.

HOW WILL THE INFORMATION BE STORED AND ULTIMATELY DESTROYED?

Hard copies of your contributions will be stored in maximum security devices in and undisclosed area until all data has been analysed. Electronic information will be stored on a password protected computer. Hard copies will be destroyed by means of fire. Electronic information will be destroyed by formating the storage properties of the harddrive.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICPATING IN THIS STUDY?

Participation in this study is voluntary as there is no payment or reward offered, financial or otherwise.

HOW WILL THE PARTICIPANT BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

If you would like to be informed of the final research findings, please contact Mr. Baas NS on 073 841 8732 or by e-mail to baasagric@webmail.co.za

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

CONSENT TO PARTICIPATE IN THIS STUDY

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

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable). I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

I agree to the recording of the *insert specific data collection method*.

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

Full Name of Participant: _____

Signature of Participant: _____ Date: _____

Full Name(s) of Researcher(s): _____

Signature of Researcher: _____ Date: _____

APPENDIX F CONSENT FORM TO SUBJECT ADVISOR

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

DATE

FROM 01 MAY 2017 TO 30 JUNE 2017

TITLE OF THE RESEARCH PROJECT

Enhancing teacher development in the teaching of agricultural sciences at school

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT NUMBER(S):

BAAS NS	2001093778	0738418732
Name of student/researcher	*Student number*	*Contact number*
Name of student/researcher	*Student number*	*Contact number*
Name of student/researcher	*Student number*	*Contact number*

FACULTY AND DEPARTMENT:

EDUCATION
Department OF EDUCATION

STUDYLEADER(S) NAME AND CONTACT NUMBER:

DOCTOR TSOTETSI CIAS
058 718 5344

WHAT IS RESEARCH?

Research is something we do to find new knowledge about the way things and people work. We use research projects or studies to help us find out more about children and teenagers and the things that affect their lives, their schools, their families and their health. Research also helps us to find better ways of helping, or treating children who are sick. We do this to try and make the world a better place!

WHAT IS THE AIM / PURPOSE OF THE STUDY?

THE AIM OF THE STUDY IS TO ENHANCE TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL.

WHO IS DOING THE RESEARCH?

I am Mr Baas NS and a teacher by profession. I am currently an employee of the Free State Department of education. I do the study to enhance teacher development in the teaching of agricultural sciences at.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2016/0424

WHY ARE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

You are cordially invited to take part in this research project by virtue of your position, expertise and interest in teacher development in the teaching of agricultural sciences at school.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

Your role in the study is to help generate data on the study through your contribution during participatory action research dialogues. The study involves audio taping . We will collectively determine how we can enhance teacher development in the teaching of agricultural sciences at a school. The study will allow a minimum of two hours per dialogue session from 01 MAY 2017 until 30 JUNE 2017. There is no risk in participating in the study.

CAN THE PARTICIPANT WITHDRAW FROM THE STUDY?

Participation in the study is voluntary and there is no penalty or loss of benefit for non-participation. Your are under no obligation to consent to participation. If you decide to participate you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

Your participation in the study will be kept confidential until the results of the study have been offically published.

WHAT IS THE ANTICIPATED INCONVENIENCE OF TAKING PART IN THIS STUDY?

There is no inconvenience or discomfort to you as participant in the study as there are no possible or foreseeable risks of harm or side-effects.

WILL WHAT I SAY BE KEPT CONFIDENTIAL?

Confidentiality of information will be maintained under maximum care. Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a fictitious pseudonym and you will be referred to in this way in the data, any publications, or other reporting mehtods such as conference proceedings.

HOW WILL THE INFORMATION BE STORED AND ULTIMATELY DESTROYED?

Hard copies of your contributions will be stored in maximum security devices in and undisclosed area until all data has been analysed. Electronic information will be stored on a password protected computer. Hard copies will be destroyed by means of fire. Electronic information will be destroyed by formating the storage properties of the harddrive.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICPATING IN THIS STUDY?

Participation in this study is voluntary as there is no payment or reward offered, financial or otherwise.

HOW WILL THE PARTICIPANT BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

If you would like to be informed of the final research findings, please contact Mr. Baas NS on 073 841 8732 or by e-mail to baasagric@webmail.co.za

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

CONSENT TO PARTICIPATE IN THIS STUDY

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

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable). I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

I agree to the recording of the *insert specific data collection method*.

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

Full Name of Participant: _____

Signature of Participant: _____ Date: _____

Full Name(s) of Researcher(s): _____

Signature of Researcher: _____ Date: _____

APPENDIX G CONSENT FORM FOR EACH OF THREE TEACHER'S OF AGRICULTURAL SCIENCES

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS UV

RESEARCH STUDY INFORMATION LEAFLET AND CONSENT FORM

DATE

FROM 01 MAY 2017 TO 30 JUNE 2017

TITLE OF THE RESEARCH PROJECT

Enhancing teacher development in the teaching of agricultural sciences at school

PRINCIPLE INVESTIGATOR / RESEARCHER(S) NAME(S) AND CONTACT NUMBER(S):

BAAS NS	2001093778	0738418732
Name of student/researcher	*Student number*	*Contact number*
Name of student/researcher	*Student number*	*Contact number*
Name of student/researcher	*Student number*	*Contact number*

FACULTY AND DEPARTMENT:

EDUCATION
Department OF EDUCATION

STUDYLEADER(S) NAME AND CONTACT NUMBER:

DOCTOR TSOTETSI CIAS
058 718 5344

WHAT IS RESEARCH?

Research is something we do to find new knowledge about the way things and people work. We use research projects or studies to help us find out more about children and teenagers and the things that affect their lives, their schools, their families and their health. Research also helps us to find better ways of helping, or treating children who are sick. We do this to try and make the world a better place!

WHAT IS THE AIM / PURPOSE OF THE STUDY?

THE AIM OF THE STUDY IS TO ENHANCE TEACHER DEVELOPMENT IN THE TEACHING OF AGRICULTURAL SCIENCES AT SCHOOL.

WHO IS DOING THE RESEARCH?

I am Mr Baas NS and a teacher by profession. I am currently an employee of the Free State Department of education. I do the study to enhance teacher development in the teaching of agricultural sciences at.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This study has received approval from the Research Ethics Committee of UFS. A copy of the approval letter can be obtained from the researcher.

Approval number: UFS-HSD2016/0424

WHY ARE YOU INVITED TO TAKE PART IN THIS RESEARCH PROJECT?

You are cordially invited to take part in this research project by virtue of your position, expertise and interest in teacher development in the teaching of agricultural sciences at school.

WHAT IS THE NATURE OF PARTICIPATION IN THIS STUDY?

Your role in the study is to help generate data on the study through your contribution during participatory action research dialogues. The study involves audio taping . We will collectively determine how we can enhance teacher development in the teaching of agricultural sciences at a school. The study will allow a minimum of two hours per dialogue session from 01 MAY 2017 until 30 JUNE 2017. There is no risk in participating in the study.

CAN THE PARTICIPANT WITHDRAW FROM THE STUDY?

Participation in the study is voluntary and there is no penalty or loss of benefit for non-participation. Your are under no obligation to consent to participation. If you decide to participate you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

Your participation in the study will be kept confidential until the results of the study have been offically published.

WHAT IS THE ANTICIPATED INCONVENIENCE OF TAKING PART IN THIS STUDY?

There is no inconvenience or discomfort to you as participant in the study as there are no possible or foreseeable risks of harm or side-effects.

WILL WHAT I SAY BE KEPT CONFIDENTIAL?

Confidentiality of information will be maintained under maximum care. Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a fictitious pseudonym and you will be referred to in this way in the data, any publications, or other reporting mehtods such as conference proceedings.

HOW WILL THE INFORMATION BE STORED AND ULTIMATELY DESTROYED?

Hard copies of your contributions will be stored in maximum security devices in and undisclosed area until all data has been analysed. Electronic information will be stored on a password protected computer. Hard copies will be destroyed by means of fire. Electronic information will be destroyed by formating the storage properties of the harddrive.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICPATING IN THIS STUDY?

Participation in this study is voluntary as there is no payment or reward offered, financial or otherwise.

HOW WILL THE PARTICIPANT BE INFORMED OF THE FINDINGS / RESULTS OF THE STUDY?

If you would like to be informed of the final research findings, please contact Mr. Baas NS on 073 841 8732 or by e-mail to baasagric@webmail.co.za

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

CONSENT TO PARTICIPATE IN THIS STUDY

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

I have read (or had explained to me) and understood the study as explained in the information sheet. I have had sufficient opportunity to ask questions and am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable). I am aware that the findings of this study will be anonymously processed into a research report, journal publications and/or conference proceedings.

I agree to the recording of the *insert specific data collection method*.

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

Full Name of Participant: _____

Signature of Participant: _____ Date: _____

Full Name(s) of Researcher(s): _____

Signature of Researcher: _____ Date: _____

APPENDIX H CONSENT FORM FOR PRINCIPAL

Researcher:
NS Baas
0547 Phamong Village
Phuthaditjhaba
9866
baasagric@webmail.co.za

Supervisors:
Dr. CT Tsotetsi
Prof. L Hlalele
Faculty of Education
University of the Free State
QwaQwa Campus:
+27(0)58 718 5344
TsotetsiCT@ufs.ac.za

Date: 14 June 2017

The Principal

PERMISSION TO UNDERTAKE RESEARCH IN YOUR SCHOOL

I am a Master's Degree student at the University of the Free State presently working on my dissertation. I am involved in a research project which is aimed at enhancing teacher development in the teaching of Agricultural Sciences at school. Teacher development is a process and, therefore, different training and support is needed at different stages of this continuum. The education that teachers receive has the potential to make a difference to children's learning and therefore warrants careful attention.

The outcome of the study is anticipated to benefit the school based Agricultural Sciences teachers; Office Based Educators; learners and their parents; non-governmental organisations with interest in Education; the Department of Education; Commerce and Industry; Educational researchers(local and abroad) and finally the communities within which Agricultural schools are based around the world.

Approval to conduct research in the Free State department of education has been granted. This project will be done outside working hours. The name of your school and teachers involved will remain completely anonymous. Your assistance in this regard will be highly appreciated.

Yours sincerely

_____ _____

NS Baas Dr. CT Tsotetsi (Supervisor)