ASSESSMENT OF THE IMPLEMENTATION OF THE NATIONAL CERTIFICATE (VOCATIONAL) PLANT PRODUCTION MODULES

A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE

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ABSTRACT

From 2010, the South African vocational skills education is offered by the Department of Higher Education and Training (DHET) through the Technical Vocational Education and Training (TVET) colleges. TVET colleges need to be transformed in order to empower young learners with the skills required by the various sectors of the economy. The purpose of this study was to assess the implementation of the National Certificate (Vocational) Plant Production module in Training and Vocational Education and Training (TVET) Colleges. The sample for this study is concurrent triangulation whereby complementary methods of data sources were brought together to offset each other's weaknesses. The sample for this study consisted of participants from three TVET colleges: one deep rural, one semi-rural/semi-urban and one urban in terms of geographical location. A total of 18 participants were interviewed: 2 subject advisors engaged by the colleges, 1 lecturer from college A, 3 lecturers from college B, 2 lecturers from college C, 4 graduates from college B, 3 graduates from college C and 3 employers .Research design for this study has features of both a survey and a case study. The mixed-method approach was applied using document analysis, questionnaires and interviews for data collection. The researcher found out that there is a disparity between the Plant Production guidelines and their implementation and assessment. Among the main reasons for failure to implement the guidelines properly are poor or inadequate infrastructure for doing practical work, high rate of student absenteeism within the investigated categories, and the high drop-out rate at Levels 2–4. To minimize the challenges in offering the Plant Production module, the study recommends that since some colleges cannot afford purchasing large sizes of land to properly implement the Plant Production guidelines, the government and the DHET should link the Primary Agriculture training to the land reform program where students can be trained under the land reform program.

Key Words: Assessment, Implementation,National certificate, Vocational, Plant production modules

DECLARATION

I, Phakama Perry MacMillan Langa (student no.: 8316795), of the University of Fort Hare, hereby declare that this thesis is a presentation of my original research work. Whatever contributions of others involved, every effort is made to indicate this clearly, with due reference to the literature and collaborative research and discussions.

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DEDICATION

I dedicate this study to government employees who do not betray the people they serve.

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LIST OF ACRONYMS

AET: Agricultural Education and Training

AGRIBUSINES: A business that earns most of its revenues from agriculture

AGRISCIENCE: The application of scientific principles to agriculture.

ASGISA: Accelerated and Shared Growth Initiative for South Africa

BATAT: Broadening Access to Agriculture Thrust

CBOs: Community Based Organizations

COSATU: Congress of South African Trade Unions

DoA: Department of Agriculture

FAO: Food and Agriculture Organization

FET: Further Education and Training

HSRC: Human Sciences Research Council

ITBs: Industrial Training Boards

JIPSA: Joint Initiative for Priority Skills Acquisition

NATED: National Technical Education

NDP: National Development Plan

NGOs: Non Governmental Organizations

NSA: National Skills Authority

NSDS: National Skills Development Strategy

NTB: National Training Board

POEs: Portfolios of Evidence

PSAET: Post School Agricultural Education and Training

SABETA: South African Board of Education and Training in Agriculture

SAQA: South African Qualifications Authority

SDA: Skills Development Act

SETAs: Sector Education and Training Authorities

TAFE: Technical and Further Education

TVET: Technical and Vocational Education and Training

WBEs: Work-Based Experience

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CHAPTER ONE

INTRODUCTION AND BACKGROUND

1.1 Introduction

Since the birth of the post-apartheid South Africa in 1994, the country has experienced several educational and curriculum changes in the post-school education that were aimed at to bringing about social and economic changes through skills development.

Curriculum changes happen all over the world, and the South African technical and vocational education and training (TVET) has not been an exception. The Further Education and Training (FET) Act of 1998 and its subsequent amendments placed FET colleges that offer TVET under the National Department of Higher Education and Training (DHET).

A combination of a variety of factors effect curriculum changes, but curriculum changes alone do not bring about empowerment or build capacity. Principals and teachers this century have little influence on the curriculum content because it is determined at the national government level in most countries, including South Africa. Noteworthy is the fact that if a curriculum is not optimum in its content and implementation, the desired results will not be achieved (Kleve, 2004; Ono & Chikamori, 2010).

Harden (2000) asserts that not only teachers but also the heads of institutions have an important role in implementing curricula. Capacitating teachers to effectively implement curricula has also been attracting researchers' attention, as the studies by Peneul, Fishman, Yamaguchi and Gallagher (2007), and Edwards and Bates (2011) indicate. Furthermore, the curriculum content and its implementation may not achieve the intended objectives, especially preparing the learners for the workplace, as opined by Sincoff and Owen (2004) and Ardichvili (2012).

Numerous studies have been conducted on mismatches and discrepancies between intended and implemented policies and guidelines (Aichison, 2003; Willard, 2006; Karlsson, (2007); Ijaduola, (2011); Ncube, Mammen & Molepo, (2012). Kleve (2004)

and Ono and Chikamori (2010) specifically investigated discrepancies between intended and implemented curricula. Effective curriculum implementation is an empowering process for learners (Kennedy, 2012). This research focuses on the assessment of the National Certificate (Vocational) plant production modules.

1.2 Background

1.2.1 The South African TVET College System

From 2010, South African vocational skills education is offered by the Department of Higher Education and Training through TVET colleges. Various international and national bodies, including the United Nations Educational, Scientific and Cultural Organization (UNESCO), have emphasized the importance of countries' investment in Vocational Education and Training (VET). The UNESCO Report (2012) noted that many disadvantaged young people around the world leave school without skills that might have otherwise assisted them while striving for decent jobs in society. This lack of skills thwarts the youth's aspirations to advance towards contributing to the economic growth of their countries. The youth should be offered training lest they become trapped in working poverty for life.

To assist in the fight against the perpetuation of the growing numbers of the unskilled youth, the Minister of the Department of Higher Education and Training (DHET) in South Africa has highlighted the contents of the New Growth Path framework. According to the minister, the framework sets the creation of decent work opportunities as government's central economic goal. He and the DHET have identified sectors in which jobs can be created on a large scale (Nzimande, 2010). The sectors include infrastructure development, mining and beneficiation, agriculture and the processing of farm products, manufacturing, the green economy, tourism and high-level services, and knowledge-based sectors of the economy.

Many writers and publications in various countries note that skills shortage has motivated the expedited establishment of technical education all over the world. The following are examples of publications that outline how various countries addressed skills shortages: Denmark, (EDEFOP, 2012); Serbia, (Bachman, 2013); Italy, (Battista, Palomba and Bergani, 2009); Australia, (Figgis, 2009); and Nigeria, (Kennedy, 2012). The BRICS countries (Brazil, Russia, India, China and South

Africa) have also focused on technical and vocational education as a means of reducing skills shortage (Bessinger & Mammen, 2010).

Cosser (2012) expresses a concern about the skills shortage among the South African youth and suggested that the Further Education and Training (FET) college sector must be transformed in order to empower young learners with skills required by various sectors of the economy.

There is a concern about the student throughput rates in these colleges. According to the Human Sciences Research Council (HSRC) Audit Report on FET Colleges (2012), the NC (V) achieved a national average throughput rate of 30% per annum over a three-year period from 2007 to 2009. The National Technical Education (NATED) programs achieved a 47% while other programs achieved 66%. In further highlighting some of the challenges recently faced by FET colleges in South Africa, Freemen (2010) describes the low pass rates as pertinent and emphasized the need to increase pass rates in order to assist in speed up the growth of the skills base, which will in turn stimulate short- to medium-term economic growth. Systemic inefficiency manifests itself in the low pass rate. Gever (2013) records that there are 3 million people sitting at home and the number grows by more than 500 000 each year. The DHET observed that the throughput rate has to be to 80% for the system to make an impact in the skills needed by the youth aged 18–24 years.

The concerns about challenges facing skills-based training in South Africa seem to be on the increase. Du Plessies (2012) expresses a concern that there is a rising number of young people around the world who have not been able to break into the job market. Similar concerns are also expressed by Miriam (2012). Furthermore, Miriam (2012) states that South Africa's unemployment rate has unexpectedly risen to 25.2% in the first quarter of 2012.

South Africa's unemployment rate, which includes people who have stopped looking for work, rose from 35.4% to 36.6% in the first quarter of 2012. This gloomy picture is worrying. The Department of Higher Education and Training is heavily subsidising an agricultural training course of which plant production is a part. It is not only the government but also the larger community and industry that are interested in ensuring that young people qualify from TVET colleges.

Gasskov (2000) asserts that the mandate of vocational education is to deliver both foundation and specialist skills to individuals in order to improve technologies, the quality of tasks and people's socio-economic conditions. First, the ultimate economic objective of education and training is improved personal and social productivity. According to Stats SA (2013), the South African government has a challenge of dealing with the country's unemployment rate that stands at 25.2%. All the unskilled and unemployed people need to be trained so that they become productive citizens of the country.

Second, skills-training assists in structural change when employees, for example, are retrenched and retrained to use their skills to adapt to new or different technologies. This point is especially relevant in the South African agricultural sector. For example, in February 2013, 2000 farm workers were retrenched in South Africa (SA News, 2013). If there was a ready training plan by TVET colleges, those retrenched workers could have received immediate training so that they could join the productive workforce again. It is not only retrenched people from the agricultural sector who need training, but also many other people who have been retrenched from different sectors of the economy.

Third, it is common knowledge that more skilled people stand a better chance of being employed and earning better wages or salaries. Fourth, education and training can be viewed as a tool for achieving national economic and social objectives. Fifth, education and training can generate massive social benefits like crime reduction, health improvement and better social cohesion. The South African society is terribly affected by crime, and there is a general belief that if the unemployed individuals can be trained and be either employed or self-employed, crime can be reduced in the country (Gasskov, 2000). The TVET college training can hopefully assist in this regard.

In 2004, there were 2 666 395 crimes committed in South Africa. Although there was a decrease of this number to 2 178 700 in 2013 (Crime Stats SA, 2012), the figure is still high and includes all sorts of crime ranging from more serious crimes like murder to theft. There is also a general view that skills development will generate positive individual and social benefits, as many people believe that educated and skilled workers are more productive and earn more than the others.

1.2.2 Apartheid Thinking and TVET Education

There was the thinking that manual workers could not be trained in intellectual tasks, yet the philosophy of constructivism (which shall be discussed later in this chapter) shows that TVET needs students are able to think critically in order to be able to receive and construct knowledge. D.F Malan, former president of South Africa (during the apartheid era), once declared,

> "We should not give the natives an academic education as some people are too prone to do. If we do this, we shall later be burdened with a number of academically trained Europeans and non-Europeans, and who is going to do manual labour in the country. We have to be careful in this respect. I am in thorough agreement with the view that we should conduct our schools in such a way that Natives who attend these schools will know that, to a great extent, he must be a labourer in the country and not the man who sits with a pen behind his ear." (SA House of Assembly Debates, 1945).

It is such negative sentiments that led to the very weak foundations of the then vocational education, which was mainly associated with manual labour and specifically designed for the native Africans.

Public TVET colleges evolved under colonialism and apartheid and reflected the racial politics of access of both eras. It was not until the Manpower Training Act of 1981 (RSA, 1981) that Africans were able to become apprentices and, hence, have access to the principal programmes of the then technical college sector. However, the public college sector has seen a radical transformation of its racial composition of students since the early 1990s. By 2002, 73% of learners were African, 17% White, 8% Coloured, and 2% Indian (Powell & Hall, 2004:77).

Growth in FET Colleges between years 2007 to 2010

Cosser (2012) notes an increase in FET college enrolments from 300 000 in1998 and 330 000 in 2010. The increase between 2007 and 2009 was 20%, which was even more promising. There was, however, disappointment when a 14% decline occurred between the years 2009 and 2010.

Table 1.1 DHET in 2011: NC (V) and other enrolment numbers.

Year	Total N Courses enrolled	Total NCV enrolled	Other enrolments	Total enrolled
2007	245 230	31 414	45 449	322 093
2008	178 086	81 742	41 250	301 078
2009	175 999	166 469	42 638	385 106
2010	169 803	122 257	40 520	332 580

HSRC (2011)

Jaff (2004) outlined the evolution of the TVET colleges from the previous to the current outlook. Private provision had a very different evolutionary path but a clear majority of African learners were enrolled at TVET colleges (73% of the total in 2002). Akoojee (2003) outlined the racial mix in 2002 and found that only 10% of the students were white, 11% coloured, 6% Indian, with black Africans making the remainder. As expected, there were widespread variations in the gender mix across the various vocational areas. In engineering, males predominated.

Whereas public provision remained largely organised around nationally administered examinations and certificated qualifications, private provision was far more diverse in terms of assessment, moderation and certification. Private providers tended to argue that their provision was driven by a greater concern for quality as compared to the public provider. However, they seemed to be operating with a materially different conception of quality as compared to that of the public provider. Private providers largely based their conception of quality on individual learner support and the relevance of programmes based on labour market responsiveness, rather than internal (or, for that matter, external) moderation procedures. Of providers surveyed in 2002, 38% reported that they had ‘external moderation’ mechanisms in place. In public colleges, quality was largely seen in terms of what proportion of those sitting for national examinations passed them (pass rates) and what proportion of those who originally enrol passed (throughput rates).

Apart from historically imposed inefficiencies, there are substantial inefficiencies and poor quality delivery at TVET colleges. Gever (2010) substantiates this view by

basing his argument on the 2009 results of TVET colleges. He further observes that there is fundamentally a persistent absence of an enabling framework for colleges and industry to work together. Colleges lack capacity and credibility to engage with industry on equal terms. Employers are reluctant to work with colleges and do not have faith in the colleges' ability to produce quality graduates.

1.2.3 Knowledge production in TVET colleges as a tool for transformation

The main characteristic of TVET colleges is development emanating from the transformed vocational and technical colleges. Up to the late 1990s, there were state and state-aided technical colleges. The state colleges were inadequately resourced and mainly for the Blacks and the state-aided colleges were mainly White, well-resourced and autonomous.

According to Badroodien and Kallaway (2003) and Gamble (2003), some remarkable work on the transformation of the South African TVET system has been done. In the past, technical colleges, due to their smaller enrolments, received reduced national publicity, exposure and government attention; consequently, in trying to implement policies, there was evident lack of balance between expectations and actual outcomes.

In the latter part of the 20th century and the first part of the 21st century, South Africa, like the rest of the world, was faced with a variety of challenges ranging from HIV/AIDS; illiteracy; poverty; discrimination in terms of gender, race, creed and disability; and, recently, the economic recession. In order to deal with these challenges, the government has since formulated a legislative framework and a number of policies. These policies include the South African Qualifications Authority Act (Act No. 58 of 1995), Skills Development Act (Act No. 57 of 1998), Skills Development Levies Act (Act No. 9 of 1999), Further Education and Training Act (Act No. 98 of 1998), and the White Paper 4, which is a companion strategy of the Skills Development Strategy of the Ministry of Labour. The White Paper 4 fosters collaboration between the ministries of Education and Labour.

To facilitate the implementation of policies, various bodies and structures were established. These bodies included the Sector Education and Training Authorities (SETAs). These were structures established according to the Skills Development Act with the aim of replacing the old Industrial Training Boards (ITBs). The SETAs

provided a combination of education and training, unlike the boards, which were only there for industrial training. Subsequently, there was Joint Initiative for Priority Skills Acquisition (JIPSA), and then Accelerated and Shared Growth Initiative for South Africa (ASGISA). The National Skills Authority (NSA) was responsible for the implementation of capacity-building projects for the stakeholders. Such projects were aimed at enabling workers to have access to education and training that leads to further economic and social opportunities for the workers.

In 2011, the National Skills Development Strategy III (NSDS III) 2011 to 2016 was introduced with the aims of:

- Ensuring increased access to training and skills development opportunities.
- Addressing the challenges of skills shortage and mismatch in skills qualifications.
- Improving productivity in the economy
- Achieving the fundamental transformation of inequities linked to class, gender, race, age, and disability in the society.
- Supporting the governments' goals for rural development

This strategy had to support the New Growth Path, Industrial Policy Action Plan, Human Resource Development Plan and any other sector development plans.

Prior to the NSDS III, there had been the National Skills Development Strategy I (NSDS I) and the National Skills Development Strategy II (NSDS II). In essence, the two are synoptic to the NSDS III; the difference, in the main, is that the latter is the product of the Department of Higher Education, whereas the former two were initiated by the Department of Labour.

Most literature on the subject of TVET colleges seems to be delving on the expectations of industry, the government and the society at large, and on some other issues ranging from financing TVET college education to infrastructure to personnel/labour issues to student support systems. Most of these policies had to address the issues of equity, redress, democracy, equality, empowerment and development. The Constitution of the country itself addresses most of these. Social factors became central in the South African transformation agenda and they include an improvement in the standards of living of those most disadvantaged by apartheid; the reinforcement of an acceptance of cultural diversity and the re-establishment of

family values and social norms, and the eradication of unemployment. (Angelis, Lolwana, Marock, Matlhaela, Mercorio, Tsolo and Xulu 2001).

Nonetheless, a lot still needs to be done in agricultural education. The majority of people who are supposed to benefit from the envisaged training arrangements are mainly the Blacks who were, at a particular time of their lives, citizens of economically deprived homelands. Even long before the homeland era, the majority of Blacks, in general, were subjected to a host of unfavourable economic conditions. The educational allocation in the per capita expenditure ratios is an example of this fact.

By 1994, the country was still experiencing some form of negative discrimination where the Black children in the former Department of Education and Training (DET) (White areas) received better treatment than other Black children. Whites in all the areas continued to receive better funding.

Obviously, rural colleges are going to have less numbers as compared to the urban colleges because of a high failure rate at Grade 12 in rural areas. Grade 12 schools are the main feeders to their local or nearby TVET College. Generally, South African rural areas are economically backward and poor, and, therefore, rural feeder schools to rural colleges are likely to feed low numbers to colleges which might ultimately result in low college enrolments. The rural colleges should, therefore, be funded differently to make up for their disadvantaged position. A turnaround strategy is needed to fund rural education so that an impact is made so as not to replicate the oppressive methods of the colonial and apartheid masters in a different fashion.

1.2.4 Challenges Facing the South African TVET College System

To assist in the supply of relevant skills, the Minister of the DHET issued a gazette with a plan to meet the demands of Human Resource Development Strategy of South Africa from 2010 to 2030. The gazette lists top 100 skills which are on demand. To meet the demand, the minister envisages that the DHET should develop the relevant qualifications in the areas of scarce skills (Nzimande, 2014).

To further address the skills shortage, the minister reminds South Africans about the views of Nelson Mandela on the education of the youth, which were part of Mandela's main concerns about the future of the youth. Mandela passionately

believed that education could enable young people to fulfil their potential. In addition, there is no country that can develop if its citizens are uneducated (Nzimande, 2015).

1.2.5 The Culture in the South African TVET Colleges

The institutional culture of TVET colleges was supposed to be shaped by the contents of the founding principles of the FET Act (Act No. 98 of 1998). With the change of government in 1994, the majority of Black people of South Africa developed some expectations, which included, among other things, that they would be skilled for the betterment of their livelihoods. The FET Act of 1998, because of its founding principles, was seen as a positive response to the training challenges in South Africa. FET colleges were in a better position to carry out the training function because of their legal training status and their even distribution throughout the country.

The founding principles were supposed to serve as a foundation upon which a sound college culture would be built. Contrary to the expectations, the HSRC Audit Report on FET colleges (2012) revealed that the colleges in general were performing below expectations. The TVET college sector is struggling at all levels of management. The following are some of the reasons for the challenges faced by the college management: In the main, the college governance does not engage the King Report III on Governance. The report basically contains principles of corporate governance which include that: there are no proper employment contracts for staff at the colleges; there is uneven approval of college strategic plans; there is discrepancy in funding by provinces; there are rapid policy interventions from the National Department of Education, which lead to instability in the FET college sector; there are usually different interpretations of policies, and no plans accompany such policies; the dual accountability in colleges has led to tensions among council members and management staff and that the throughput rate in the NC (V) between 2007 and 2009 was 30%. Over the same period, the NATED (191) was at 47%, while other programs had a 66% throughput rate.

Because of the above reasons, one can say that the culture in FET colleges is generally bad.

In order for South Africa to handle the crisis better, there is, therefore, a need to carry out a study that should add to the understanding of the TVET educational process.

1.3 Importance of the Study of General Agriculture

1.3.1 Meeting the Nutritional Needs of the World

UNESCO (2010) noted that close to one billion people in the world do not have sufficient food for a healthy and active life. While much progress has been made towards food security in recent decades, without further urgent and coordinated action, factors such as poverty, hunger and malnutrition will continue to undermine the lives of hundreds of millions of people now and in years to come. The world's population reached 6 billion in 1999 and is expected to reach 8.5 billion by 2025.

This situation requires certainty as to how the world is going to feed its growing population; however, the long-term ability to meet the growing demand for food often seems uncertain. Thus, one of the greatest challenges is increasing food production in a sustainable manner so that everyone can be adequately and nutritiously fed without over-exploiting the Earth's ecosystem. Obviously, to achieve these objectives, the nations of the world (including South Africa) need to take seriously the agricultural training needs of the ever-increasing population. The seemingly much more practical and feasible way to conduct this training is through education, particularly through TVET colleges. Because of the TVET colleges being evenly distributed throughout the country, they are in a better position to handle the training function. Furthermore, UNESCO (2010) advises that in order for TVET colleges to be able to teach plant production effectively, they have to take the following fact into account:

Teaching plant production has to generate ideas about ways in which the theme of sustainable agriculture can be integrated into the curriculum as part of the process of reorienting education towards a sustainable future.

In teaching plant production, some of the teaching objectives should be as follows:

- To understand the nature and importance of sustainable agriculture;
- To understand ways in which different agricultural practices can alter the environment either positively or negatively;

- To analyze examples of farming practices that are economically viable, environmentally sound and socially responsible; and
- To appreciate how enquiry learning can be used to promote an appreciation of sustainable agriculture in the school curriculum.

To further shed more light on the subject, Tilman, Cassman, Matson, Naylor and Polasky (2002) have predicted that by 2050, global population is projected to be 50% larger than it is at present. With the growth, the global grain demand is projected to double. Total worldwide energy demand is expected to increase by 25 % from 2006 to 2030.

The doubling of grain demand will result from a projected increase in per capita real income and from dietary shifts towards a higher proportion of meat (most of the animals are grain fed) associated with higher income. Furthermore, Tilman et al. caution that increases in agricultural output are essential for global political and social stability and equity. Doubling food production again and sustaining it at this level are major challenges.

Agricultural practices determine the level of food production and, to a great extent, the state of the global environment. Agriculturalists are the chief managers of terrestrial 'usable' land, which is broadly defined as all land that is not desert, tundra, rock or boreal. So without proper training, no nation can effectively manage its agricultural resources; hence, the need for South African TVET colleges to properly train students in agriculture to become future managers in the agricultural sector.

About half of global usable land is already in pastoral or intensive agriculture. In addition to causing the loss of natural ecosystems, agriculture globally adds significant and environmentally detrimental amounts of nitrogen and phosphorus to terrestrial ecosystems. This makes it essential to train younger generations to be knowledgeable with good practices of proper land usage. Furthermore, Tilman et al. (2002) argue that there is a general consensus that agriculture has the capability to meet the food needs of 8–10 billion people but there is little consensus on how this can be achieved by sustainable means.

1.3.2 The Realisation of Cross-Cutting Themes Relevant to Crop Production

Alam (2009) noted that a task assigned to attendees of the conference held at the National Institute for Plant Genome Research, in Delhi, was to explore some cross-

cutting themes relevant to crop production. The conference highlighted that agriculture is central to three of the Millennium Development Goals: (1) eradicate poverty and hunger, (2) ensure environmental sustainability, and (3) develop a global partnership for development.

The following goals were identified by key research areas: Drought tolerance; Nutrient use efficiency; Soil management; Pest and disease control; Nutrient content (of harvested crops); Systems approaches to biotic and abiotic stress; Holistic farming; Minor crops which are not traded internationally, and informatics (Alam, 2009).

1.3.3 Possible Consequences of Neglecting Agricultural Education

Neglecting Vocational Education and Training (VET) and Agricultural Education and Training (AET) does not assist to contain disasters like the situation in Bangladesh. Alam (2009) noted that immediately after gaining their independence, the people of Bangladesh had agriculture as the main economic sector employing 95% of the total population in 1971. At the time, the agricultural sector contributed 78% of the total Gross Domestic Product (GDP).

Because of the poor attention paid towards the development of agriculture, by 2009, the agricultural contribution to the GDP had reached a low of 22%. Upon examining the probable underpinning reasons for the decline, it was revealed that education was not supporting agriculture. In the South African context, it is encouraging to note, however, that the Department of Higher Education and Training is, on a comparative basis, heavily subsidising the training of students in the agricultural NC (V) skills (See Table 2). The government contributes 80% towards the training of students in TVET colleges, and other sources contribute 20%.

1.4 Historical Perspective of Agricultural Education and Training (AET) in South Africa

The neglect of plant science has historical relevance. Hershey (1996) traces this neglect clearly from 1902. In South Africa, for a long time prior to 1994, including that of the Bantu Education Act (Act No. 47 of 1953), agriculture was taught as a non-scientific subject that was grouped with subjects like history, geography, and biblical

studies (DoA, 2005). The Department of Agriculture commissioned a study to determine the challenges facing the AET in South Africa.

The AET is, in many cases, characterized by lack of coordination, and the following findings support this viewpoint:

- Differences in quality standards and curricula among agricultural training institutions.
- Poor linkage between AET and the agriculture industry.
- No quality control in informal AET

Given the challenges above, the DHET ought to consider the above shortcomings as it progresses with AET.

1.4.1 The Development of the AET Strategy

Wallace and Tailor (1996) argue that improving human capital in agriculture is of special importance, especially where the shortage of trained human resources is a major limiting factor to development. The Department of Agriculture (DoA, 2007) expressed the view that one of the constraints to AET in South Africa, especially by the marginalized, is access. Wallace and Tailor (1996) found that many curricula for both formal and informal AET do not involve any form of systematic training-needs analysis and often adopt delivery modes and mechanisms that do not meet the needs of the people in their communities. Access to both formal and informal education in agriculture is essential for improving agricultural and rural development.

Before the South African democratic dispensation, agricultural education and training lacked coherence and co-ordination. There was very poor articulation between formal and informal agricultural programs. White agricultural education was better funded and resourced compared to Black education. Therefore, he Department of Agriculture developed the AET Strategy, which was launched in 2005 by the then Minister of Agriculture, Hon. Thoko Didiza, to address such inequalities**.** In trying to reform agricultural education, the Broadening Access to Agriculture Thrust (BATAT) was formed with the aim of improving agricultural training, and one of its major tasks was to develop a master plan for technology development.

1.5 Evaluation of AET Curricula in the DHET

1.5.1 The General Vocational Pathway

The Vocational Pathway that leads to a National Certificate (Vocational) is primarily offered by TVET Colleges. This pathway is relevant for 16- to 18-year-olds who have yet to make a career choice, wish to progress to Higher Education in a career-focused pathway, or have not been able to secure access to a workplace for trade, occupational and professional skills training. Unemployed adults may have similar reasons for taking this route.

The National Certificate (Vocational) (NC (V)) is also comprises fundamental, core and elective learning components with a focus on vocational fields. The NC (V) is offered through TVET colleges and specialised technical senior secondary schools at NQF levels 2–4. Programmes in this pathway do not prepare learners for a specific occupational competence but offers them a broad orientation to employment skills within a sector, as well as sufficient academic education to prepare them for admission to Higher Education.

The NC (V) is also a band exit-level outcomes-based qualification at Level 4 of the NQF. Portability of learning credits will be possible to permit co-ordination with other learning pathways. The vocational subjects offered within the agricultural field include soil science, plant production, animal production, farm planning, and mechanisation and agribusiness.

1.5.2 Factors Contributing to the Achievement of Agribusiness Learning Outcomes (As Identified by the DHET)

- An enabling environment: The subject should be presented in the context of small, medium and micro enterprises (SMMEs), emerging small-scale farmers and personal needs.
- Resources: Students should have access to all the necessary resources needed for chosen practical activities.
- Experiential exposure: Students should be exposed to real and simulated work environments.
- Suitably qualified lecturers: Lecturers should have a solid command of subject knowledge and skills and be well informed about legislation,

community issues and access to support systems (for example, systems provided by the Department of Agriculture).

1.5.3 Teaching Subjects in the Fields Related to Plant Production—Teaching Botany

Surprisingly, the functions to be performed by the educator of this era still relate so closely to the functions performed by the teacher of the 20th century. Clements (1923) summarised the functions of the teacher in botany as that of guiding the student from the first day to do his own planning, observing, experimenting and thinking. In doing his work, the teacher should be a sympathetic and enthusiastic companion in learning. He recognizes that the student must be allowed to make and correct his own blunders. Clement realizes that the growing ability to plan, observe, experiment, reason, and apply results is the only real test of progress, and he refuses to regard the usual classification of students on the basis of set examinations as either fundamental or final.

Most of the facts put forward by Clement are also relevant for plant production. The teachers constantly guide students as they prepare their portfolios of evidence. The teachers do not have to insist on perfection too soon, because some of the students are taking agriculture for the first time in their academic careers; hence, they should be allowed to make mistakes and correct them at their own pace.

In teaching ecology in botany, Clements (1923) further gives guidance that at the end of teaching, the teacher may first wish to merely determine the extent to which the student retains the knowledge of the course, and this is readily done by unexpected questions, written or oral, during the term. One finds it difficult to embrace this kind of assessment. Why should students not be told on what they will be evaluated? Students should be told exactly when they will be tested and in some cases be told exactly what questions will be asked in order for them to prepare properly.

Thinking about ‘what knowledge a student will have after he/she has long left the school’ is highly important. What makes this kind of thinking important is that it can affect the student's attitude or habits as he/she learns. During a student’s botany classes, there are tests that are primarily to do with the student's complete progress rather than with memory. These are termed practical, applied and correlation tests,

and are directed especially to the skill and accuracy with which the student can organise his results and apply them to other problems of the same and different categories. With these tests are associated progress tests of the various learning processes, namely observing, experimenting, reasoning, remembering, etc., which enable both the student and the teacher to determine the actual advance in each, and to direct a particular effort to a process that lags. All the information here is compatible and applicable to the teaching of Primary Agriculture and Plant Production.

1.6 Primary Agriculture in the DHET: The NC (V)

The NC (V) in Primary Agriculture is a three-year qualification. Each of the levels 2, 3 and 4 will take one year full-time and every level carries a total of 130 credits. This course is designed to provide both the theory and practice of primary agriculture. The practical component of study may be offered in a real workplace (Work Integrated Learning (WIL)) or in a simulated workplace environment, and it provides students with an opportunity to experience work situations during their period of study. Primary Agriculture is categorized into two: Animal Production and Plant Production. The curriculum in Primary Agriculture comprises three groups of subjects: (1) Fundamentals of English, Mathematics and Mathematical Literacy, and Life Orientation (LO); (2) The Core Vocational Subjects: Soil Science, Plant Production, Animal Production and Agribusiness; and (3) The Electives: Farm Planning, Mechanics, Advanced Plant Production, Agribusiness and Animal Production. Some TVET colleges such as Lovedale TVET College have an additional subject, Computer Training, under the Fundamentals.

Table 1.2 Training cost for a single student in the Plant Production program within 3 years (Modified from DHET funding norms)

Year	Total TR Cost	80% (By the state)	20% (Other sources of funding)
2013	R78 004	R62 403	R15 601
2014	R84 482	R67 585	R16 896
2015	R90 312	R72 250	R18 062

1.6.1 General Admission Requirements at NQF Level 2

In some TVET colleges, there is no selection and placement tests (for example, Mthashana TVET college), whereas there are such tests in others (for example, Lovedale TVET College). Those who conduct admission tests do so to assist students to make a correct career choice and to ensure the correct selection and placement of students. The admission requirements outlined below are applicable.

- Grade 11 and 12 learners who are at least 17 years of age are given first preference.
- A year-end school report for grade 9 or a higher grade
- An NQF Level 1 qualification; or
- An approved bridging program designed for the specific purpose to access NQF level 2; or
- A Recognition of Prior Learning (RPL) assessment to meet the basic requirements for access to NQF Level 2.

These requirements are set with the understanding that the above categories of learners have the ability to complete the training and assist in realizing the government's objecting of improving the skills training among the prospective labour force.

1.6.2 Possible Career Opportunities and Activities for NC (V) in Primary Agriculture Graduates

- Advising farmers on farming techniques/methods
- Working at a nursery, botanical garden, etc.
- Working for a company: advising farmers on management of finances
- Advising farmers on marketing, advertising and selling agricultural products
- Working as a production planner for crops and animal enterprises
- Planning plant and animal production
- Working in and outside a farm

One of the main aims of teaching Plant Production should be to develop entrepreneurs in the field of agriculture. Colleges should not overemphasise the idea

of ‘being employed’ by an industry of some kind but students should be motivated towards self employment as well.

1.6.3 Plant Production Subject Guidelines for NQF Level 4 (As Compiled by the DHET and Approved by Umalusi)

Plant Production is a vocational subject in the National Certificate (Vocational) in Primary Agriculture programme that deals with the physiology and anatomy of plants and the establishment of the vegetable and agronomic crops and fruits.

1.6.3.1 Areas covered by the subject

- Establishment of agricultural practices,
- Cultivation and crop management principles,
- Harvesting and post-harvesting storage

The subject is important in that having gained skills and techniques in the establishment and management of crops and fruits, better employment or self-employment opportunities are created for students who have completed the Primary Agriculture programme. The learning outcomes of Plant Production assist students achieve critical career development. The establishment of agricultural practices should not just be inculcated to manifest themselves within the college training years but should be taken by students to practices beyond college life.

According to the Department of Higher Education (2007), all the outcomes of the Primary Agriculture programme relate to and promote the following knowledge or skills: Teamwork, Self-organization, Communication, Self-development, Problem solving, Science, Technology, and Information gathering and evaluation. All the outcomes are important in producing graduates who are able to work to the satisfaction of the labour market in general and agricultural sector in particular. Teamwork is important as an outcome because in agriculture people work with people in the main it is therefore important for graduates to be trained in teamwork. This study also emphasises social constructivism and the social learning theory as theoretical frameworks encouraging teamwork. Communication and self development are of equal importance because students have to communicate continuously in the ever changing world hence the need to develop oneself and lean

new ways of doing things in technology and science through problem solving information gathering and evaluation.

There are a number of factors that contribute to achieving learning the outcomes of Advanced Plant Production, and they include:

- An enabling environment,
- Resources, and
- Experiential exposure and suitably qualified lecturers

1.6.4 Assessment Guidelines in Advanced Plant Production NQF Level 4 (As Produced by the DHET and Approved by Umalusi)

Assessment in the National Certificate (Vocational) programmes is underpinned by the objectives of the National Qualifications Framework (NQF) (Department of Higher Education, 2007), which are to:

- Create an integrated national framework for learning achievements
- Facilitate access to and progression within education, training and career paths
- Enhance the quality of teaching and training
- Redress unfair discrimination and past imbalances and thereby accelerate employment opportunities
- Contribute to the holistic development of the student by
    - social adjustment and responsibility,
    - moral accountability and ethical work orientation,
    - economic participation and
    - nation building

1.7 Assessment Framework for Vocational Qualifications

Internal Continuous Assessment (ICASS) is all about assessing skills, knowledge, values and attitudes (SKVAs) throughout the year. The ICASS practical component is undertaken in a real workplace or a ‘structured environment’. This component is moderated internally and evaluated for quality assurance by Umalusi.

1.7.1 External Summative Assessment (ESASS)

External summative assessment (ESASS) is either a single or a set of question papers set to the requirements of a subject's learning outcomes. A compulsory component of the external summative assessment is the Integrated Summative Assessment Task (ISAT).

1.7.2 Types of Assessment

The following are the types of assessment recognised by the Department of Education (2007):

- Baseline assessment,
- Diagnostic assessment,
- Formative assessment, and
- Summative assessment

1.7.3 Moderation of Assessment

Internal moderation: This is the moderation of assessment according to the internal policy of a TVET college.

External moderation: It is conducted by the Department of Education, Umalusi and, where relevant, an Education and Training Quality Assurance (ETQA) body according to South African Qualifications Authority (SAQA) and Umalusi standards and requirements.

1.8 Some General Guidelines in Structuring Agriculture Curriculum

Cunderdin (2012–2014), from the Western Australian College of Agriculture, provided some guidelines in structuring units of an agriculture curriculum that can assist in preparing for post-school and further training in plant production systems. The guidelines may be of help in teaching the National Certificate (Vocational) plant production modules. In the module units students will learn how to: investigate how healthy plants function; learn about different types of plant production

In addition to the above, students investigate available markets and the effects of plant production systems on natural systems and its influence (both positive and negative) in general plant production. Students have access to production systems

to research plant production systems and enterprises, and to discover how the function of essential plant structure affects production.

Like the South African NC (V) Plant Production subject levels 2, 3 and 4, the West Australian levels are 1c and 1d, 2a and 2b, and 3a and 3b. In the Plant Production systems, 1c and 1d students partake in the following: learning about plant production basic processes through harvesting of plant produce; discovering how healthy plants function and the different types of plant production and how they have contributed to the shaping of agriculture today; finding out about economic tools and their influence on plant production; Identifying and using a variety of equipment and structures safely; routinely working with plants, recognizing hazardous situations and suggesting solutions; Investigating plant function, available markets, and the effect plant production systems have on the environment and communities; examining how plant production systems are part of natural systems and have an influence, in both positive and negative ways, on the elements within; and having access to production systems to research plant production systems and enterprises and discover how the function of essential plant structures affects production. Students also use a variety of equipment found within plant production systems to determine their effectiveness.

In the intermediate level, which is Plant Production Systems 2a and 2b, students focus on meeting the needs of plant production systems and on the selection of crops and varieties to meet market demands while minimizing the impact on the environment; monitoring the growth and life cycles of plants to ensure market requirements are met; looking for ways to provide and maintain optimal production conditions and comply with industry codes of practice; collecting production data while implementing a number of operations involving the selection of crops and production of plant products; look for ways various processes work together to sustain growth and for methods available to treat and control diseases; experiencing the process of finding solutions to problems and demonstrating reasoning by making recommendations for the best course of action; and exploring the concept of sustainability.

In the advanced Plant Production Systems 3a and 3b level, students discover the importance of sustainable management practices and the balance of short-term financial needs with long-term maintenance and improvement of resources; Identify major markets and advantages of one’s country’s produce, identify issues for one’s

country in maintaining global competitiveness, and examine market protection strategies; use results of plant tissue and soil tests and their knowledge of plant environment to design effective plant nutrition programs and predict changes in the requirements through the growing season; evaluate experimental data and scientific methods, and propose adaptations to plant production systems based on their own and external research; investigate the implications of climate change on plant production systems and the breeding of new cultivars; learn about manipulating plant processes and managing pests to optimize production in a sustainable manner, and consider and propose solutions to address sub-optimal production; critically analyse the advantages and disadvantages of new technologies, and consider the moral, ethical and economic issues associated with their adoption; and asses and manage risks involved in plant production and use financial analysis to guide decision-making, and consider the importance of conservation and restoration of natural and agricultural ecosystems.

1.9 Teaching Commercial Vegetable Production

Kahn (1982) evaluated the teaching of commercial vegetable production as taught at Oklahoma State University, found the teaching to be having some challenges. The following are some of the challenges:

- The university offered the course as an elective, and only in few cases the course was offered as part of the plan of study;
- There was no laboratory for the course's experiments;
- There was no suitable local site for outdoor exercises;
- The simulation of the outdoor commercial vegetable production was only for one semester, which made it difficult for students to master; and
- Students had to watch seedling development only in a greenhouses and were given jars of vegetable seeds to study, but they were eventually quizzed on both seedling and seed identification.

Because of the foregoing challenges, the Oklahoma University had to undertake major curriculum changes. One driver for the change was to bring teaching assignments more into balance with actual full -time equivalents (FTEs).

1.10 Reflective Activity in Science Teaching

Akerson, Khalick and Lederman (2000) noted that it is not only students of science who need their concepts of the nature of science assessed, but the teachers also need to have theirs assessed. Fifty undergraduate and graduate students enrolled in a science-teaching methods course engaged in six hours of activities designed to target key nature-of-science concepts. After the initial activities had been concluded, the student teachers were encouraged to reflect on those concepts as opportunities arose within the designated pedagogical content, and were assigned two writing tasks focusing on the nature of science. Their responses were analysed for key concepts to determine whether the students held adequate conceptions in the areas where they had to formulate science concepts. The major findings were as follows:

- There were few differences between graduates and undergraduates: Most students began the course with largely inadequate conceptions.
- Students began the course understanding least about the empirical nature of science, the tentative nature of scientific knowledge, the difference between theories and laws, and the role of creativity in science.
- Significant gains were achieved as a result of instruction. Student conceptions improved most in the areas of the tentative nature of scientific knowledge, the difference between theories and laws, and the difference between observation and inference.

The implications are that the TVET college plant production curriculum units should not take for granted ensuring that students who are enrolled for the course have adequate background knowledge with respect to the subject concepts. Students hold tenacious misconceptions about the nature and process of science. Instructors should additionally focus on helping students see the inadequacy of their current conceptions.

Scharmann, Smith, James, and Jensen (2005) conducted research among science-education teachers to determine their views of the nature of science and perhaps even help them recognize that intelligent design is less scientific than evolutionary biology. Through multiple iterations of a pre-service science teacher-education

course, the researchers designed a 10-hour instructional unit. In the unit, students are instructed to:

- attempt to arrange a set of statements along a continuum from more to less scientific;
- develop a set of criteria for making such judgments;
- participate in a set of inquiry activities designed to teach the nature of science (for example, the black box activity);
- read and reflect on articles about the nature of science; and
- analyse intelligent design, evolutionary biology, and *umbrellaology* (a satirical description of the field of umbrella studies) in terms of the criteria they developed.

The final iteration of this set of activities was judged by the researchers to be highly effective at changing students' views of the nature of science and perhaps even helping them recognize that intelligent design is less scientific than evolutionary biology. Furthermore, the researchers suggest that using a continuum approach regarding the classification of endeavours as more or less scientific may be helpful for students who have strong religious commitments, and that explicit, respectful discussion of religion in relation to science early in instruction is equally important for these students.

1.11 The Meaning of Teaching and Learning Science

Does science teaching imply the simple transfer of scientific knowledge from the mind of the teacher to the mind of the student? Does it have ‘transferring’ the knowledge initially in the teacher’s mind into the minds of the students as its aim? This is not the case. The young child is often thought of as a little scientist exploring the world and discovering the principles of its operation. We often forget that while the scientist is working on the border of human knowledge and is finding out things that nobody yet knows, the child is finding out precisely what everybody already knows. Learning science at the school level is not the discovery or construction of ideas that are new and unknown. Rather it is making what others already know your own.

Baker, Slingsby and Tilling (2002) emphasise the importance of fieldwork in the study of biology. After a long time of attending school, a student will remember more of what they saw and did as compared to what they read from books. Indeed, for all science, including plant production, the important thing is 'to do it', not just to read about it. Today, there are signs that the fieldwork component of biology may be declining. Most scholars are in agreement that the decline in practical work should not be allowed to take place.

Hofstein and Lunnetta (2003) noted that during the past 20 years, people had expanded their knowledge of circumstances that inhibit or promote conceptual learning in science classrooms and in the science laboratory. Factors that continue to inhibit learning in the school science laboratory include the that many of the activities outlined for students in laboratory guides continue to offer "cook-book" lists of tasks for students to follow ritualistically. These factors do not engage students in thinking about the larger purpose of their investigation and of the sequence of tasks they need to perform to achieve that end. Assessment of students' practical knowledge and abilities and of the purposes of laboratory inquiry tends to be seriously neglected even by high-stakes tests that purport to assess science standards. Thus many students do not perceive laboratory experiences to be particularly important in their learning; Teachers and school administrators are often not well informed about what is suggested as best professional practice and they do not understand the rationale behind such suggestions. Thus, there is a high potential for a mismatch between a teacher's rhetoric and practice that is likely to influence students' perceptions and behaviours during laboratory work. Incorporating inquiry-type activities in school science is inhibited by limitations in resources (including access to appropriate technology tools) and by lack of sufficient time for teachers to become informed and to develop and implement appropriate science curricula. Other inhibiting factors include large classes, inflexible scheduling of laboratory facilities, and the perceived focus of external examinations. The nature and sources of these problems need to be examined carefully and recommendations for policy and practice need to be based upon the findings of that research). The problem of large classes has been seen in all the three colleges studied in this research, especially at Primary Agriculture Level 2.

There are great opportunities to pursue research and development building on our knowledge and on literature in order to enhance the effectiveness of science

education. Special opportunities identified in this literature review include; developing and evaluating teaching strategies, assessment tools, and resources that are effective in helping teachers and students to attain important learning outcomes that equip students with different abilities, learning styles, motivational patterns, and cultural contexts; encouraging students to use empowering inquiry tools and strategies; and familiarising students with justifying assertions on the basis of scientific evidence.

Notably, this review of scholarly literature in science education suggests the following implications:

- Goals for students' learning outcomes must drive what is done by curriculum developers and by teachers in the classroom and the laboratory;
- Effective teaching engages, builds upon, and enhances students' knowledge (conceptual and procedural), attitudes, perceptions and culture;
- Internal and external assessment of students' learning and attitudes must be consistent with the goals for learning outcomes;
- Classroom-based research and development associated with curriculum and teaching is important in helping science teachers and students achieve important science learning outcomes;
- Appropriate teacher professional development, informed by relevant scholarship, is important in helping teachers become more effective in science teaching;
- In a time of increasingly rapid change in science and technology, competent teachers must continue to be informed about contemporary professional issues across a professional lifetime.

Finally, it is disappointing to note the continuing limitations in systematic scholarship associated with such a central medium as the laboratory in science education. There is new information about limitations in the effectiveness of school science education; however, there are still valid reasons to believe that school laboratory activities have a special potential as media for learning that can promote important science-learning outcomes for students, and teachers need knowledge, skills, and resources that enable them to teach effectively in practical learning environments.

Temu, Rudebjer and Chakeredza (2010) suggest that in order for universities and other institutions of learning to implement proper curricula, they should consider setting goals that acknowledge complex, dynamic systems and support curriculum development that meets such goals: teaching innovation systems approaches; using problem-solving as a learning approach—how to state, structure and analyse a problem, in collaboration with stakeholders; dealing with both the depth and breadth of a problem, such as drivers that influence change; putting more emphasis on understanding trade-offs and feedback mechanisms of interventions; and creating more publishing opportunities for integrated science.

Policy-makers have, among others, the following tasks: making decisions to recognize integrated knowledge and skills in educational policies and in job markets; reviewing institutional structures and processes to facilitate multi- and inter-disciplinary problem-solving; recognizing and measuring/monitoring the benefits of integrated approaches to farming, especially the promotion of environmental services; helping to improve the capacity for integrated approaches to farming and to establish ways and means to reward farmers for the public benefits accrued from integrated farming systems. Experience shows that a networking approach can play an important role in expediting the mainstreaming of integrated subjects into education, research and development initiatives.

1.12 Theoretical Framework of the Study

This study was guided by the following theories: Constructivism, the Cognitive Learning Theory, Expectancy Theory and the Social Learning Theory.

1.12.1 Constructivism

According to Jenkins (1996), constructivism is an epistemology which holds that human beings construct knowledge by giving meaning to current experience in light of prior knowledge, mental structures, experiences and beliefs. Kerka (1997) believes that constructivism rests on a notion that there in an inner desire within individuals to make sense of the world. Learners construct knowledge instead of absorbing knowledge passively. Learners construct knowledge by interpreting new information and experiences into what they had previously come to understand. TVET colleges and teachers therefore have to expose their students to new information and new experiences.

The following are some basic principles of constructivism applied to education:

- Knowledge is generated by both the external world and the subjective internal world of the learner.
- A learner's general and domain-specific knowledge determines the meaning that he or she derives from any experience.
- Each learner is an active participant in constructing meaning from external reality.
- Multiple interpretations of reality exist in any given instructional setting.
- Learning involves understanding concepts and procedures at ever-increasing levels of complexity.

As learners advance in learning, they form more accurate pictures of content and skills.

1.12.1.1 Some Principles of Constructivism in Education

In addition to the preceding principles, Epstein (2002) has nine general principles that can be derived from constructivist learning. These principles hold the view that learning is an active process in which the learner uses sensory input and constructs meaning from it, and that learning requires *a priori* knowledge. Piaget (1952:23) states that "there is no structure apart from construction" It is not possible to create new learning without having some structure developed from previous knowledge to build on. This then calls for synergy and continuity in subject content from a lower level to the higher; for example, from NC (V) Level 2 to Level 3, and then from 3 to 4. Learning constructs systems of meaning by linking new information to previous knowledge, and it involves reflective activity. According to Dewey (1910), these are activities that require both the motor and logical skills. Reflective thinking is obviously the necessary ingredient of good learning, thus making constructivism a necessary theoretical framework to productive didactical interaction. Learning involves language, and language and learning are inextricably intertwined as the language we use affects our learning, which makes it necessary that students are well versed with the language of their tuition. Learning is a social activity.

Learning is intimately associated with connection to other human beings: teachers, classmates, family, etc.; hence, the need for students to be engaged in community agricultural projects as suggested later in this report; Learning is contextual: We

learn in relationship to what else we know, what we believe, our prejudices and our fears. Learning is a process. For learning to happen, students need time to digest new information, ponder on it and try it out. This calls for teachers not to insist on perfection too soon, and for the inclusion of practical work in plant production lessons. Motivation, especially self-motivation, is a key component of learning.

Worth considering are other theories mentioned earlier in this section. One cannot agree more with the statement by Byrnes (1996) that accurate perception is important in effective learning. This thinking is in line with the Gestalt theory. In addition to finding meaning and accurate perception during learning, there is a conviction by the Gestalt psychologists that human consciousness cannot be broken down into its elements. This is true when one looks at the nature of the projects in plant production. Most of the projects look into the totality of the plant production cycle, especially those that stretch over the entire year. In the main, this view was held by the leading the Gestalt psychologists, such as Max Wertheimer (1880–1943), Wolkgag Kohler (1887–1967) and Kurt Koffka (1886–1941) (Byrnes, 1996).

In answering the question about where and when constructivism takes place in learning, Brookes (1999) said the following: “As long as there are people asking each other questions, we have constructivist classrooms.” Constructivism, the study of learning, is about how we all make sense of our world, and that reality has not changed (Brookes, 1999). Kerka (1997) observed that constructivism rests on a notion that there is an inner desire within individuals to make sense of the world. Learners construct knowledge instead of absorbing knowledge passively. The plant production guidelines for both the practical and theoretical components require students to be engaged in lectures, demonstrations, group discussions, observations, and role-playing independent activity synthesis and evaluation. All these activities require students to have the ability to construct knowledge. Normally, educators give information to learners and they construct knowledge by actively receiving information and interpreting the new information. Piaget defines this process as ‘assimilation’ and ‘accommodation.’

Taking into consideration all of the above principles, one comes to the understanding that the subject guidelines provided by the Department of Education should be such that they allow the learners to construct knowledge. In assessing whether or not this takes place, the following question is asked: Do subject guidelines cater for a

constructive approach on the part of learners? If there is a general agreement about the fact that teaching should be learner centred, then it is common understanding that the teaching in learner centeredness has to be characterised by the construction of knowledge by learners.

In order for students to better understand the Plant Production course, they should be afforded an opportunity to construct knowledge. In order to have a constructivist classroom, educators need to gauge prior knowledge, progress from the simple to the complex and lead learners from the known to the unknown and these are pertinent in science and agriculture education.

1.12.1.2 Teaching and Learning Science in the Constructivist View

Hofstein and Lunnetta (2003) assert that when science is taught in terms of abstract ideas, transmission simply does not work. The learner must play an active role in 'taking on' the new knowledge, while 'making sense' of the experiences and discourse of the science class, and use it to 'construct meaning'. In this essentially constructivist view of learning, however, the knowledge that we want the students to construct is already known to the teacher throughout.

1.12.1.3 Constructivism and Practical Learning at TVET College Level

Doolittle and Cam (1999) are of the view that cognitive constructivism is most compatible with career and technical education. The established theoretical framework that still guides career and technical education is based primarily on the work of Snedden and Prosser (1939), Camp and Hillison (1983), and Doty and Weissman (1984). The current researcher shares the same view and is of the conviction that plant production learning and teaching can be understood better using cognitive constructivism.

Behaviourism has been for most of the time the guiding theoretical framework of technical education training. The implicit learning theory underpinning career and technical education, which was adopted before the Smith Hughes Act (1917) has been behaviourism. The so-called social *efficiency doctrine* assisted the USA in shaping technical education.

Social efficiency advocates went on to contend that public schools were an arm of the social system; and, as such, they had an inherent mission to further the good of

society by contributing to its efficiency. Clearly, career and technical education, as envisioned by Snedden and Prosser (1939), made up one of the bulwarks of social efficiency, in that the preparation of a well-trained, compliant workforce was a *sine qua non* of an efficient society (Wirth, 1972). This view is acceptable because, anyway, the training of students at any institution of formal training subscribes to and is sanctioned by societal norms. A more detailed and elaborate discussion will be dealt with under 'social learning theory'.

When applying the view to an educational setting though, it should be noted that the learning does not come as a doctrine. In plant production, farming methods change over time, so nothing doctrinal can be taught. The students should subscribe to the rules of society because it is good to do so, but they should do so with an open mind. Behaviourism was seen as a possible theoretical education framework to produce an efficient society. Through behaviourism, education, it was believed, would contribute to social efficiency.

Fosnot (1996) noted that constructivism acknowledges the learner's active role in the personal creation of knowledge and the importance of experience (both individual and social) in creating this knowledge. During this knowledge creation process, it is important that a person (a student in this regard) experiences whatever ingredients and processes that are necessary when knowledge is created. It is, therefore, improper to teach plant production if students are not going to experience what goes into creating knowledge because of the lack of adequate resources for practical work. Should students fail to create their own knowledge, yet they have to be assessed on the subject content, the possibility is that they are likely to be given someone else's created knowledge. When students have not created their knowledge, they will regurgitate what they have been told about the subject without understanding. The TVET colleges must, therefore, provide proper and adequate sites for doing practical work in plant production. Obviously, knowledge created by students will vary in its degree of validity in as far as presenting accurate reality.

1.12.1.4 Categories of Constructivism

Constructivism has its own categories, namely cognitive constructivism, radical constructivism, social constructivism and constructivist pedagogy.

1.12.1.4.1 Cognitive constructivism

Cognitive constructivism represents one end, or extreme, of the constructivist continuum and is typically associated with information processing. Knowledge construction is considered primarily a technical process of creating mental structures, but has little bearing on the nature of the subjective knowledge within the mind. According to Kitsikis (1990), Cognitive structuralism was founded by Piaget 1896–1980, Lev Vygotsky 1896–1934 and many other constructivists such as Bruner, Ausubel and Bruner (1986), claim that constructivism began with Immanuel Kant in 1795 who, in his Critique of Pure Reason, argued that the human mind is an originator of experience rather than a passive recipient of perception. Kant believed that the external physical world is known only through individual sensations. The representation makes the object possible. Humans are interpreters who construct their own reality by engaging in mental activities.

John Dewey's laboratory school at the University of Chicago is arguably that first formal attempt to institute some form of constructivism in an educational setting (Dewey, 1896). Dewey believed in the centrality of the individual student and organized the laboratory school accordingly. For Dewey, all learning experiences were integrated from the vantage point of the individual student. The laboratory-school program began and ended with the individual student. The concept that learners construct their own knowledge from experience is termed constructivism (Fosnot, 1996).

The implication for this statement is that for students to be able to construct their knowledge, they should 'experience' whatever they have to construct knowledge upon. The question arises: Are students in the researched TVET colleges 'experiencing' whatever they have to experience in order to construct knowledge? Are colleges exposing them to appropriate environments so that they can construct knowledge? The answer does not seem positive for, especially, colleges A and B.

Fosnot (1996) further states that Ausubel in 1968 proposed the rote meaningful learning. He contended that in order to learn meaningfully, students must relate new knowledge (concepts and propositions) to what they already know. Bruner came up with insightful learning which was based on the argument that people's understanding of objects or facts was developed through stages. Piaget's focus was

cognitive psychology, which focuses on studying how people think, understand and know.

Teachers can apply many principles suggested by constructivists such as insightful learning, meaningful learning, scaffolding, expository approach, and techniques of memorizing devices such as mind-mapping and mnemonics. Byrnes (1996) of The Asia University asserts that accurate perception is important in good learning. It is highly important to note this fact of accurate perception for proper learning to take place. If students in plant production are not exposed to adequate practical realities of the agricultural world, the possibility is that they may end up imagining things inaccurately and ultimately end up with wrong perceptions and thus wrong conclusions. It is therefore necessary for TVET colleges offering plant production to have farms for practical work.

The features of cognitive learning relate well to constructivism and meaningful learning. From the cognitive learning perspective, learning involves the transformation of information in the environment into knowledge that is stored in the mind. When can it be said that learning has taken place? It can be said that learning has taken place when new knowledge is acquired or existing knowledge is modified by experience. Cognitive theories, especially of Piaget and Vygotsky, emphasise an individuals' active construction of understanding. How are the learning environments of the TVET colleges in question? Are students in a position to modify the existing knowledge from the environment presented to them? The answer is no, especially for colleges A and B.

In answering the question where and when constructivism takes place in learning, Brookes (1999) answered the question by saying, "As long as there were people asking each other questions we have constructivist classrooms." This understanding should serve as a guide to plant Production Curriculum designers so that in their designs, they do not produce 'half-baked' projects. It is noteworthy that the lessons taught to children must be meaningful when the totality of whatever is being taught can be perceived. Features of the cognitive theory can be related to constructivism and meaningful learning. The two most prominent figures of cognitive psychology are Jean Piaget, 1896–1980 and Lev Vygotsky 1896–1934. There are basically three important cognitive theories, namely Piagets' Cognitive Developmental Theory, Vygotskys' Social Cognitive Theory and Information Processing Theory.

1.12.1.4.2 Radical constructivism

Radical constructivism is concerned with the construction of mental structures, the position of cognitive constructivists, and the construction of personal meaning. In this sense, radical constructivism involves a greater degree of construction than does cognitive constructivism, involving two planes of construction, structure and meaning, rather than structure alone.

1.12.1.4.3 Social constructivism

Social constructivism maintains that the social nature of knowledge, and the belief that knowledge is the result of social interaction and language usage, and, thus, is a shared, rather than an individual, experience (Prawatt & Floden, 1994). In addition, the social interaction always occurs within a socio-cultural context, resulting in knowledge that is bound to a specific time and place (Gergen, 1995; Vygotsky, 1978). The focus of social constructivism is on shared social experience and social negotiation of meaning. The view of social constructivism suggests that some students can work better in groups while learning and, therefore, suggests the utilisation of group work during the teaching and learning of plant production. Who are the consumers of the product from the TVET colleges?. The answer is, they are the society. This therefore means that students should understand, and learn for and from a particular social environment. There should be clear and formal linkages between colleges and the agriculture industry. In short, students construct knowledge from a particular social environment.

1.12.1.4.4 Constructivist pedagogy

Constructivist pedagogy is among the central and important drivers of this study because it establishes a link between theory and practice. The constructivist pedagogy has its own essential requirements, which are that:

- Learning should take place in authentic and real-world environments. Simulations created by TVET colleges without a college farm are not adequate to create authentic and real farming environments. Over and above the simulation rooms or workshops, students still need to be exposed to the real farming environments.

- Experience provides the activity upon which the mind operates. In addition, knowledge construction is enhanced when the experience is authentic. As indicated earlier, teachers of plant production should not create artificial situations because, in the first place, there is no need to do so since there are many opportunities for real experiences rather than the creation of artificial situations. For the cognitive constructivist, authentic experiences are essential so that the individual can construct an accurate representation of the "real" world, not a contrived world.
- Learning should involve social negotiation and mediation.

While only social constructivism emphasizes social interaction as a basis for knowledge construction, both cognitive and radical constructivism assign social interaction a role. Social interaction provides for the development of socially relevant skills and knowledge. This fact is relevant in that TVET colleges are training mainly to solve the skills shortage in the country. It is evident that the skills for which the students in plant production are trained are naturally the prescripts and requisites of particular societies, and it is therefore relevant for plant production students to take into account the societal requirements while undertaking their training.

1.12.1.4.5 Cognitive constructivism and social learning

From a constructivist perspective, when a student answers a test question incorrectly, it is the teacher's responsibility to discover what question he or she answered correctly. How does the student see the world in order to answer the question the way he or she did? If the teacher successfully reconstructs the student's mental state, then he or she is in a position to intervene and help the student improve.

Newman, Griffin and Cole (1989) suggest, "Instead of giving the children a task and measuring how well they do or how badly they fail, one can give the children the task and observe how much and what kind of help they need in order to complete the task successfully."

Jonassen (1994) concluded the following about constructivist learning environments: Constructivist learning environments provide multiple representations of reality, which avoid oversimplification and represent the complexity of the real world; these environments emphasize knowledge construction instead of knowledge

reproduction, and authentic tasks in a meaningful context rather than abstract instruction out of context; constructivist learning environments provide learning environments such as real-world settings or case-based learning instead of predetermined sequences of instruction; constructivist learning environments encourage thoughtful reflection on experience; constructivist learning environments "enable context-and content-dependent knowledge construction"; and constructivist learning environments support collaborative construction of knowledge through social negotiation, not competition among learners for recognition.

The above conclusions and requirements are comprehensive to outline what environments the TVET colleges should have created for students to learn effectively. From the audit of infrastructure the colleges have, it is evident that the colleges are far behind in creating an enabling learning environment. All the above are essentials of conducive constructivist learning environment.

Jenkins (1996) argues that some constructivists believe that there is no objective world independent of human mental activity. This view holds for most situations if one thinks about it. In learning plant production, definitely student will draw from their previous experiences in order to understand the new concepts. Other constructivists believe that the mind is instrumental in interpreting events, objects, and perspectives in the real world, and those interpretations produce a knowledge base that is peculiar to that particular individual (Jonnassen, 1991). Applied to education, constructivist theory acknowledges the contribution of unobservable events to human behaviour. During the learning process the learner’s mind is viewed as an active participant in helping people make sense of reality.

Constructivist teaching practices are designed to help students internalize new information in order to create new understanding. To a constructivist, challenging students is more than memorizing material to pass a standardized test. It involves developing new cognitive structures leading to more sophisticated meanings. The ability to solve difficult problems depends on the knowledge, skills, and strategies an individual possesses generally and on a specific domain. To a constructivist, instruction is a developmental process that begins with a student’s current level of functioning and moves him/her along a continuum towards expert performance.

Having evaluated the stock registers at the three colleges, one had to evaluate the views as put forward by respondents relating to the open-ended section of the

questionnaire. There was a strong feeling from all the categories of respondents that the colleges were not doing well as far as practical work was concerned.

1.12.2 Cognitive Learning Theory

Cognitive psychology focuses on how people think, understand and know. From a cognitive learning perspective, learning involves the transformation of information in the environment into knowledge that is stored in the mind. With this fact in mind, it becomes important to ensure that the teaching and learning environment is conducive for its purpose, with very little or no destruction that may divert the attention of students away from learning. In the case of Plant Production at all levels, college lectures should therefore provide all the tools and teaching aids that are necessary to ensure that students are provided with the maximum opportunity of exposure to a total learning environment.

Furthermore, the theory holds the view that learning occurs when new knowledge is acquired or existing knowledge is modified by experience. Cognitive theories emphasise on individuals' active construction of understanding. This obviously calls for teaching methods that encourage student participation. It means that students should define the meaning of what is being taught to them. The educators' role here becomes that of verifying whether the knowledge constructed is accurate and correct. The educator also ensures that the student correctly understands the subject being taught.

1.12.3 The Expectancy Theory

The theory proponent, Vroom (1964), asserted that an individual will decide to behave or act in a particular way because he/she is motivated to select a particular way over other choices that might be available at the time. What actually motivates a person to select a particular behaviour is the desirability of a particular outcome. This calls for motivating and interesting behaviour-stimulating rewards if teachers in Plant Production or any other subject are to motivate their students. Various writers and researchers have done some remarkable work on the subject of 'expectancy theory.' (Holford and Lovelace, 2001; Droar, 2006).

In organizational behaviour, expectancy theory is a motivation theory proposed by Victor Vroom in 1964 of The Yale School of Management. Vroom concluded that

expectancy theory is about mental processes regarding the choices. An individual makes a choice based on the hope that such a choice will produce the desired outcome. Motivation therefore can be viewed as a product of individuals' expectancy that certain effort will lead to intended performance; hence, the intended outcome.

In Plant Production, like in any subject taught at college, students should be motivated to strive for desired outcomes. Vroom was of the view that there are three variables in motivating behaviour, namely expectancy (E), instrumentality (I) and valence (V).

1.12.4 The Social Learning Theory

Some writers of the 20th century tried to address the topic of social learning (Mischel, 1968; Marmor, 1962; Dulay & O'Connel, 1963; Spielberger & De Nike, 1966; Postman & Sassenrath, 1961). In the social learning view, man is neither driven by inner forces nor baffled helpless by environmental influences. Rather, psychological functioning is best understood in terms of consensus reciprocal interactions between behaviour and its controlling conditions.

Billett (1996) felt that although learning is a matter of personal and unique interpretation that takes place within the social context. In addition, learning must be useful to the learner. Intrinsic motivation emerges from the desire to understand or construct meaning (Billet, 1996). Hickman (2009) is of the view that human beings are observers, participants and agents who actively generate and transform the patterns through which they construct the realities that fit them.

Learning constructed within a social environment brings us to the Social Learning Theory, which is basically founded on the conviction by psychologists in behaviourism that 'causes of behaviour are found not in the organism but in the environmental forces'. The social theory views as important the roles played by various symbolic and self-regulatory processes. If this view is to hold in the teaching and learning environment, it is not only the environment that should be made conducive to teaching and learning but also the states of the minds of children. Their minds like the teaching environment should be well prepared, meaning that the learners in class should be psychologically ready to learn. This requirement does not only hold for the Plant Production students but is applicable to all students in educational institutions.

The theory also notes that learning can sometimes be by observation and not necessarily through experiencing something. When analysing learning by the notion of experience, one comes to conclude that reinforcing consequences partly serves as an unarticulated way of influencing performance. Dulaney (1962) and Spielberger and De Nike (1966) found that reinforcing consequences were ineffective in modifying subjects' behaviour as long as they were unaware of what they had to do to produce rewarding outcomes. The authors then came to the conclusion that learning cannot take place without awareness of what is being reinforced. According to the theory, learning can also take place through modelling, and people also learn through observing the behaviour of others. In order for teachers to use motivational reinforcement techniques, they should make the students aware of the objectives and the behaviour or responses that qualify for the rewards.

Behaviourism has been a major determinant of what and how students are taught. To a behaviourist, all events are clearly observable. Since activities of the mind are not observable, the mind as such is not useful concept. Behaviourists reason that, while the mind may exist, it is an unnecessary construct in understanding the learning process. If there is a view that needs to be accepted with extreme caution in teaching, it is this one (should someone decide to accept it at all). This era is the era of critical thinking. All students, be it in plant production course or any other course, have to use their minds to think and construct knowledge. The reason behind the thinking of a behaviourist could be that they were in favour of conformities as opposed to critical thinking and, therefore, were comfortable with education that was doctrinal. An example of this could be the South African apartheid education, which has been referred to earlier in this report. The fact that the mental processes are not observable does not mean they do not exist. Their existence can be scientifically proven.

All learners construct meaning from the external world by comparing and contrasting the new information with information held in long-term memory (LTM). This notion calls for TVET colleges to provide the environment with baseline information so that students can build on it. There is also a notion of 'new' information. This means that when colleges, like College C in this regard, have provided the avenue for baseline information, they should not rest but continue to provide new avenues with new equipment so that the students, in their programs, are on par with the scientific agricultural developments.

A fact was raised by one employer and one lecturer at College C that students admitted to the Plant Production TVET college training should be students who had done Agriculture at high school level. Maybe to a certain extent this could be necessary for students to be able to draw from their previous experiences as he theory suggests. When this view is adopted, it should be done so with caution so that the students who love agriculture but did not do it at school are not discriminated against. A short bridging course can be a solution because from it, all can have 'previous' knowledge to base their new knowledge on.

In social constructivism, there are arguments relating to how the knowledge is constructed and how information is stored in LTM (long-term memory). The arguments hold the view that:

- Individual learners construct knowledge by giving meaning to current experiences in light of their prior knowledge.
- Each person makes sense of his/her world by accommodating new experiences into what he/she has previously come to understand.

Fosnot (1993) observes, "Learning is not discovering more, but interpreting through a different scheme or structure."

The implications outlined here are for schools and also apply to the South African TVET college system. Social constructivism, buttressed by research in cognitive science, is changing the way instruction is designed and delivered to students in contemporary schools. It has generated ideas which are frequenting educational theory and practice.

Teachers grounded in cognitive research develop learning environments supportive of where students are in the learning continuum and fashion interventions to strengthen students' abilities to make sense of what they perceive. A plant production learning environment should be structured such that if fulfils this role. The DHET has increased expenditure in education, particularly for the NC (V) in Primary Agriculture, which makes it possible for colleges to spend adequately in creating an appropriate learning environment. The learning environments should accommodate individual differences.

How students are taught is equally important to what they are taught. Presenting information and skills to students in relevant contexts increases the likelihood that

they will be able to transfer knowledge and skills to real-world situations. For this reason, the need of agricultural field trips cannot be overemphasised. Resnick (1987) posits that learning occurs most effectively in context and that context becomes an important part of knowledge associated with learning.

Collaborative learning arrangements are fundamental to achieving multiple representations of school content. This notion makes group learning a valuable input.

Assessment of student learning is integrated into daily instructional routines**.**

1.13 Purpose of the Study

As alluded to in the introduction section, this study focuses on the discrepancies between the South African National Certificate (Vocational) (NC (V)) Subject and Assessment Guidelines and their implementation in the plant production courses in terms of the content, teaching and assessment.

1.14 Research Problem and Questions

1.14.1 Problem Statement

Since the early 1990s, research on technical and vocational education and training has been dominated by the Human Sciences Research Council (HSRC) and a few other non-governmental organizations (NGOs) and individuals. There are very few researchers based at universities who devoted time to researching about technical education. There is limited historical analysis and significant contemporary policy analysis available, but only a handful of studies have examined the complex issue of knowledge in the technical and vocational field and how this is translated into curriculum. The issue of vocational pedagogy is hardly addressed at all. Wedekind (2008) concurs that there has been limited research conducted in the South African TVET college system. It for this reason, in the main, that this research is conducted to contribute to the domain of subject teaching, with a specific focus on the teaching of Plant Production subject of the NC (V) in Primary Agriculture.

This study focuses on the discrepancies between the South African NC (V) subject and assessment guidelines and their implementation in the Plant Production subject

in terms of the content, teaching and assessment. The DHET has issued subject and assessment guidelines for all NC (V) courses and modules, and Plant Production is included in the broad band of Primary Agriculture. A structure called Umalusi (Nguni languages' word that means 'herder' or shepherd) is responsible for the quality assurance of various assessments and assessment processes.

Wedekind (2008) noted that there had been limited research conducted in the South African TVET college system in the past. However, recently, there has been some remarkable general research work which has been done in the TVET college sector; for example: du Plessies – Robertson (2015) conducted research on Leadership Development for Technical and Vocational Education and Training College Levels in South Africa; Balwanz and Hlatshwayo (2015) researched on Re-imagining Post-Schooling in Sedibeng Community-Based Research and Critical Dialogue; Wedekind (2015) worked on 'Employability and Curriculum Responsiveness in Post School Education and Training'; Mashoangane (2016) has researched 'The impact of National Certificate (Vocational) on the Continued Learning; and Spaull (2011) studied 'How Low-Quality Education Becomes a Poverty Trap'. There are numerous other studies that can now be found on a variety of issues in the TVET college sector.

First, with a host of recent studies in TVET education, there doesn't seem to be adequate research with respect to Plant Production taught at these colleges. Second, Umalusi and the DHET publish pass and failure rates in the country and compare these among provinces, and these publications indicate low pass rates in Primary Agriculture, which includes Plant Production. However, no study could be found on why the pass rates are low for primary agriculture or plant production. Third, there is a lot of literature regarding failure rates and under-qualification of the lecturing staff in TVET colleges, but one is unable to find adequate literature dealing with the implementation of the Plant Production curriculum. This research seeks to shed some light on these pertinent issues. More attention should be paid to the teaching of the program, because it is costly to train students under the program.

1.14.2 Research Question

Are there disparities between NC (V) Plant Production subject guidelines and their implementation and assessment?

1.14.3 Research Sub–Questions

- What opinions in terms of strengths and weaknesses do the plant production *graduates* from the TVET colleges have on the course that prepared them for employment or entrepreneurship opportunities?
- What opinions in terms of strengths and weaknesses do the *employers* of plant production graduates from the TVET colleges have on the course that prepared their employees for employment?
- What is the nature of strengths and weaknesses of the *subject guidelines* for plant production modules for levels 2–4 in terms of level content suitability and optimal content sequence from one level to the next higher level?
- What are the strengths and weaknesses of the *curriculum implementation* in terms of subject and assessment guidelines for plant production modules for level 2–4 equipping learners with expected outcomes?
- Are there any notable strengths and weaknesses of the implementation of *assessment guidelines* and how they affect expected outcomes?

1.15 Objectives of the Study

- Gather graduates' opinions in terms of strengths and weaknesses relating to the suitability of the plant production course for employment or entrepreneurship opportunities.
- Get the opinions in terms of strengths and weaknesses by the employers of plant production graduates from the TVET colleges to see if the course has prepared them for employment.
- Ascertain the strengths and weaknesses of the subject guidelines for plant production modules for levels 2–4 in terms of level content suitability and optimal content sequence from one level to the next higher level from one level to the next higher level to equip learners with expected outcomes.
- Establish the strengths and weaknesses of the curriculum implementation in terms of subject and assessment guidelines for plant production modules for levels 2–4 equipping learners with expected outcomes.
- Collect information on the strengths and weaknesses of the implementation of assessment guidelines and how they affect the achievement of expected outcomes.

1.16 Significance of the Study

1.16.1 Theoretical Significance

- The study is going to determine if there are any gaps in the subject policies that need to be attended to.
- Should gaps exist, recommendations shall be made as to what should be done to better the situation.
- The study is going to determine if the current policies are relevant for producing programs that are relevant for the betterment of the society.
- Well-researched college subject policies could assist towards structuring correct and relevant college curricula and training programs.
- The research shall add to the academic body of knowledge for reference of other researchers or any other users of educational knowledge.

1.16.2 Practical Significance

When recommendations are made and implemented at the end of the study, this may lead to:

- Improved teaching methods
- Improved perceptions of the subject by communities and the business world
- Improved image of the subject in the eyes of the international community

1.16.3 Social and Economic Significance

A sizable number of the South African population lives in rural areas, and their main income should be from agricultural production, but they lack expertise in plant production. Students who graduate from the program can be self-employed and practise as entrepreneurs in the field of agriculture and related fields. If capable and well-skilled plant production graduates are produced by TVET colleges, they can capacitate, empower and assist the rural communities to earn a livelihood from farming and agricultural production. Furthermore, there are many commercial farmers who seek well-trained people. Agricultural produce is an important contributor to not only the local food market but also for export to bring in the much needed foreign exchange to South Africa.

1.17 Operational Definitions of Terms

TVET College: A college offering technical and vocational education and training

Curriculum: A course of study offered at a school or college. “The aggregate of courses of study given in a TVET College” (Longman Dictionary, Standard (1st) Edition)

Vocational training: Vocational training deals with imparting knowledge and skills to prepare learners for a job in specific field or entrepreneurship in that field.

Assessment: Assessment refers to measurement of learning achievements and learning outcomes from a planned curriculum.

Agricultural science: Agricultural science deals the scientific animal and plant sciences including the study of horticulture, agronomy, forestry, plant ecology and flower production.

The next chapter discusses literature review and the implementation of curricula of the courses and subjects related to plant production. Because of the scarcity of research conducted in the field of plant production, the research and literature from related fields were cited. The related fields include science, botany, biology, agronomy, agriculture and agriscience curricula. The general curriculum implementation is also addressed.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The preceding chapter gave an overview of the South African TVET system: its past and present outlook, which includes knowledge production at TVET colleges as a tool for transformation. The chapter also outlined the challenges facing the TVET college system, and the historical perspective of the system was outlined. Some important aspects of agricultural education have been discussed. The sections specifically discussed the policies relating to the implementation of Plant Production curriculum. The policies relating to NC (V) plant production curriculum have also been outlined and reflected upon. Of importance in the sections was the theoretical framework that guided the study. The framework included: constructivism, the cognitive learning theory, the expectancy theory and the social learning theory. The chapter ended by outlining the purpose of the study, the research problem and questions, and the problem statement. Also important and addressed are the objectives of the study and its significance. This chapter will discuss the matters below.

2.2 Curriculum Implementation

Issues surrounding the implementation of curriculum have been with the education sector for some time now. A number of scholars such as Fullan and Park (1981), Ornstein and Hunkins (1998), Glatthorn, Boschee and Whitehead (2009), Olga (2011) and Giampo (2013) have expressed their views on curriculum development and implementation. All these researchers are of the view that when the curriculum is developed, the learner should be at the centre of the curriculum. Educators should not be left out in the curriculum development processes since they themselves are the developers and implementers of the curriculum. Parents also should be consulted to make their contribution concerning the content of the school curriculum. Ornstein and Hunkins (1998) emphasise some factors of importance during the implementation of curriculum, and the factors emphasise that implementation:

- requires educators to shift from the familiar to the modified programs.

- requires change in knowledge, action and attitudes of the people.
- is a process of professional development.
- involves a change in attitude and behaviour.
- needs to be organized into manageable events and a set of achievable goals effectively.

2.2.1 Problems in Effective Implementation of TVET Curricula

Bidal (2010) noted that in the main, a properly implemented curriculum, as prescribed by the curriculum designers, is likely to yield the quality desired results. There is also a possibility of a well-designed curriculum to fail in implementation if the right attitude is not present at the implementation stage. Some of the problems facing the effective implementation of TVET curricula include the fact that many government, non-government and private institutions have been conducting various TVET programs. They have their own curricula, and there is no single system in place for a standardized format of their curricula.

This fact should, however, be taken with caution. It is not a bad thing when TVET colleges differ in their curriculum offerings. The needs of various regions and communities differ, so each area should offer training according to its 'current' needs. For example, in this research, the common curriculum is problematic for some agricultural programs. In frost-free areas, there is no problem in planting tomatoes throughout the year, yet in frost-affected areas students don't get an opportunity to plant and observe the growth of tomatoes from planting to harvesting. By the time tomatoes mature for harvesting, students have already closed for the summer vacation.

In noting that the labour market needs are not well studied while developing curricula, Bidal is correct. Bidal's research (2010) found that the students find it difficult to find employment because most employers are of the view that the NC (V) Plant Production students are not adequately trained for the needs of the agricultural labour market. Bidal (2010) further noted the poor linkage of the course with industry and industrial associations for effective curriculum implementation and placement of students. He further notes that there is lack of meaningful linkage with the world of work; that is, producing professionals and technicians without having any kind of professional experience during the course of their studies.

This is one of the series weaknesses of the system of technical education in most countries. This has been a challenge for a long time in the South African TVET system. Not until recently has the government tried to correct this through the SETAs, which are entrusted by the Department of Higher Education and Training to form the links between TVET colleges and industry. On the lack of orientation of faculties and staff for highlighting important features of new/revised curricula for their effective implementation and the lack of training of faculties in new and emerging areas as stipulated in the curricula, the situation at TVET colleges is better. There is evidence that staff members undergo regular in-service training.

Bidal (2010) also correctly notes that Industrial/field visits are organized in a limited way and are generally not planned well in advance, and ultimately take the shape of excursions. In most cases, the objective of industrial visits is unclear to neither the students nor the instructors. This fact became clear at College B when the lecturer stated that some farmers felt that students were wasting their time and that of their employees.

The fact that the TVET system has a single entry and exit point and there is no provision for students to pursue the course of studies according to their interest and emerging areas of technology is a point that has been improved in the South African general TVET sector. On the lack of sufficient budget for developing quality curriculum and for its effective implementation, the DHET has improved in the area by initiating the Recapitalization of TVET colleges with a huge cash injection.

The researcher of the current study also agrees with Bidal (2010) on the following issues:

- There is weak linkage for collecting feedback from students and teachers for improving the teaching and learning process and revising the curricula.
- There are many modular curricula available, but they have not been applied and integrated.
- There is weak preparation of horizontal and vertical organization of curricula.
- The training program deserves recognition of training certificates from national and international agencies.

On curriculum implementation, Zhu (2011) has pointed out that when evaluating a curriculum, the following questions should be asked: Were the aims of educational programs and activities adaptable to the children's status in classroom? Were the educational content, methods, strategies and environment able to promote children's motivation to learn? Can the educational processes provide meaningful learning experiences for children and meet their developmental needs?

These are all relevant and necessary in teaching. This research, however, found that the learning environment in most cases was not adaptable to the learning programs and that the learning environment was not motivating for students to learn. The example of this fact was the students at College C, who attended fully when it was time to ride the bus for practical work but showed serious absenteeism during lectures.

2.3 General College Curriculum Competencies and Skills

Zekeri (2004) analysed the general college curriculum competencies and skills former students found essential to their careers. Descriptive statistics and factor analysis were used for the analyses. Concerning general educational competencies, or basic academic skills, there is a high degree of agreement on the types of skills needed by these former students to improve their career experiences. The crucial skills needed to improve their careers are oral communication, written communication, problem-solving techniques, motivating and managing others, and setting personal and organizational goals. On the contrary, the graduates who were interviewed during this research strongly emphasised the need to be trained in practical work. One does, however, agree that the competencies listed by Zekeri are necessary and important. These competencies should be considered essential or basic skills for TVET college graduates at the end of their general education requirements.

Zekeri's findings are supportive of previous studies (Litzenberg & Schneider, 1987; Pestillo & Yokich, 1988; Nelson & Gilbert, 1988; Hoerner, 1991; Zekeri & Wheelock, 1995). Communication and interpersonal skills, problem solving, and critical thinking are essential in the workforce as we begin the 21st century.

Regarding professional agricultural competencies, many of the graduates rated most of the agricultural competencies as not needed in their current careers, or on their

jobs. Zekeri (2004) explains that one of the explanations of this low rating accorded agricultural competencies for current occupation or careers may lie in the academic majors themselves. College graduates in a specific field would be expected to have developed more skills in subject areas directly associated with their majors. This low rating may also indicate that many of the agricultural competencies to which agricultural graduates are exposed have few general applications to other career areas. One reason technical agricultural skills tend to receive primary emphasis in practice is that they represent the obvious focus and mission of land-grant programs. Students should pursue excellence in communication competencies that are essential to the transfer of knowledge from classroom practice to real-life problems.

2.4 Intended and Implemented Curriculum

To determine the nature of intended and implemented curriculum, Ntoi (2007) conducted a study in Lesotho Junior Secondary Science–Technology Curriculum. The curriculum implementers strive towards the attainment of a scientifically and technologically literate society. That study, however, found that attaining the above stated goal was not possible. The technocratic perspective to curriculum development and, consequently, the curriculum design model adapted by the curriculum developers might have contributed to lack of success in the attainment of the goals of the curriculum.

Furthermore, lack of teacher training, which resulted in teachers in the study formulating their own perception of science integrated with technology, could have made it difficult for the science–technology curriculum to be implemented as envisaged by the curriculum developers. In addition, learners' background knowledge was also found to be a hindrance as teachers tried to implement the curriculum the way they had perceived it. Different perceptions by curriculum designers, the teachers and students made it impossible for all to find the common ground, thus leading to different interpretations. Like in the implementation of any curriculum, as it is the case with Plant Production, it was necessary for all role players to find a common ground in order to establish synergy in the entire undertaking.

The findings of the study indicate that three out of the four schools in the study also separated science subjects on the timetable and in teaching them. The scope and sequence of the science syllabus was found to be following the spiral approach and based mostly on science content; consequently, in dealing with technological applications, teachers had to rearrange the sequence.

Due to lack of teacher training, the teachers formulated their own perception of technology integrated with science. The results of the study indicated that they perceived technology as the application of science, so in their teaching, they often used a technology-as-an-illustration approach. In addition, it was found that teachers relied heavily on learning outcomes, but the learning outcomes did not indicate the scope of treatment of different technological applications and artefacts well. Hence, teachers treated the technological applications at a different conceptual level. Poor teacher training obviously results in improper curriculum implementation; hence, it is necessary to ensure that sufficient training is received by all involved.

In the case of the Lesotho research, learners, consequently, did not experience a similar curriculum as far as technological applications are concerned. The learners in the study had different experiences and different science backgrounds, which made it difficult for teachers to treat some technological applications. As a result, the teachers were forced to transfer content from the grades they were teaching to the upper grades, or to move content from the upper to the lower grades. This worked against the principles of sequencing content.

In brief, the aim of the science–technology curriculum, which is to attain scientific and technological literacy, has remained a statement of intent. What has been implemented, instead, is a science curriculum that is rich in technological examples. The factors which have contributed to this state of affairs are the technocratic perspectives to curriculum held by curriculum developers, the teachers' perception of technology integrated with science, and the lack of learners' prerequisite knowledge.

The study recommended, first, that the curriculum design and development models should be tailor-made to suit every context; hence, it is necessary to contextualise the curriculum models. This fact is relevant for most curriculum implementation settings. For example, in the Plant Production curriculum, implementation of deep rural development models cannot be similar to that of urban models. In a deep rural

setting, where there are vast amounts of land, extensive land farming can be practised, as opposed to an urban setting, where more of intensive farming, including hydroponics and greenhouses, is necessary.

This suggests that the National Curriculum Development Centre (NCDC) in Lesotho cannot depend on one curriculum model for all the different subject areas. There is a need to evaluate the curriculum design and development models that are used against the theoretical foundations of a Science, Technology and Society (STS) approach. The NCDC would therefore need to deliberate and determine which approach to science–technology syllabus they find most suitable for the Lesotho context.

Second, curriculum innovations usually follow global trends. Consequently, there is a substantial body of research on the innovations related to technology education. It is, therefore, recommended that the curriculum developers in Lesotho should familiarise themselves with this literature so that they become acquainted with trends, debates and pertinent issues in technology education. This is a good and relevant fact to draw from global experiences without, of course, implementing the idea as it is without considering and evaluating the context in which the idea is to be implemented.

Third, the study has indicated that without teacher training, teachers find it difficult to interpret the intentions of the curriculum planners. Further teacher training is required in Lesotho to support the curriculum initiative that the study has investigated, and others that may follow. Fortunately, in Plant Production there was evidence that teachers were adequately trained, and this did not seem to be the problem. Fourth, the attempt to incorporate technology in the Lesotho Junior Science Curriculum is a worthwhile experience for all stakeholders of science education in Lesotho.

The knowledge and skills that curriculum developers, teachers, subject examination officers and learners have gained through this curriculum initiative is valuable. It has contributed significantly towards the improvement of science education in Lesotho. Nonetheless, curriculum studies are about the relationship between intentions and practice. Focusing on one aspect of curriculum widens the gap between the intended curriculum and the experienced curriculum. As a result, isolating curriculum development from the context in which it is intended to operate brings about a

mismatch between the plan and practice. As part of needs assessment for developing curriculum, the developers ought to conduct surveys of teachers' and learners' capabilities as well as schools' support abilities.

2.5 Teaching as Inquiry

Hipkins, Cowie, Boyd, Keown and McGee (2011) investigated the teaching process as inquiry. A number of different teacher-as-inquirer models were used across the case study. Each school could be using one or a combination of the following approaches:

- An accountability approach in which the focus is on "improving the numbers" in relation to specific aspects of student achievement
- A structured group reflection approach in which the focus is on exploring professional parameters
- An action research approach with a focus on a particular aspect of practice: a question or issue that leaders or teachers are exploring individually but with team input
- A lesson study approach

A continuum of Possibilities

Concerns were expressed by the case study's secondary and primary school leaders and teachers about the potential of the standards to narrow the taught curriculum and undermine the intent of using the New Zealand curriculum to design a local curriculum aimed at addressing students' differing learning strengths and needs. Other concerns revolved around the integration of evidence from multiple sources. On accessing and using resources to help lift achievement in the secondary schools, when the question of resources was raised, the common first response was, "What resources?" It appears teachers are often unaware of the source of materials they use. Comparing this situation to Plant Production teaching, teachers/lecturers seem to be aware of what teaching resources they ought to have received. This was seen in all the three colleges that were part of the research.

2.6 How the School Curriculum Responds to the Needs of the Students and Community

Hipkins et al. (2011) conducted research in 60 schools to determine benefits of the school curriculum. The schools were working actively to address the challenge of building a responsive curriculum, and some of them posed as 'early adopters.' The schools that had taken the initiative understood the necessity of making changes in schooling, and they were aware that effecting changes would require a collaborative learning effort.

The research was guided by the fact that schools have a challenge of transforming the curriculum to meet the needs of the 21st century without falling back into the old ways, while focusing on not losing the momentum of transformation. Schools have to initiate the curriculum change; otherwise, they will reach a decline phase. The study concluded that indications are that ongoing adaptive curriculum change will need to be underpinned and informed by the development of greater transparency about:

- the goals of education/schooling
- what institutions envisage as student learning and achievement
- learning challenges implicated in new ways of working
- learning processes that inform new conversations, such as learning to learn
- knowledge and knowledge-building processes that underpin the various disciplines
- means and purposes for valuing of community and student funds of knowledge
- strategic use of different leadership models

One cannot agree more with the points outlined above. When education goals are transparent, all role players know what is expected of them, and every role player's input can be evaluated in terms of the set goals. Student achievement has to be measured so as to determine whether or not the institutional objectives are met. As the curriculum transforms, there will be challenges as seen in the transformation of the plant production curriculum contained in the N courses to NC (V) format.

2.7 Evaluating Knowledge of the Nature of Science

Plant production is part of primary agriculture, which is a science; therefore, plant production is as such a science. This, therefore, makes it relevant to look into science and the nature thereof when we study plant production.

Achilli (2011) argues that the instruments used in evaluating knowledge of the nature of science are inadequate in several ways. They focus too much on declarative knowledge instead of conceptual understanding and these instruments are designed for research but not classroom assessment, and they are inauthentic in the sense that they do not examine student knowledge in contexts similar to those in which students are expected to use the knowledge learnt at school or college. Furthermore, lists of the tenets of the nature of science (which such assessments are based upon) are oversimplified and incomplete.

Achilli (2011) further argues that instead of assessing whether students can list the characteristics of scientific knowledge, assessment should focus on whether students can effectively analyse information about scientific and socio-scientific controversies and assess the reliability of scientific claims that affect their decision-making. In order to do this, students need to understand how the process of science lends credibility to scientific ideas. Inasmuch as the argument is valid, it is important that when such assessment and evaluation is to be applied to Plant Production, it is important to note that assessment still has to cater for all orders of questions. These include low order, mid order and high order questions. The listing of characteristics should, therefore, not be seen as an idea without merit.

The appropriate type of assessment is one that requires a well-informed analysis on the part of the student, involving authentic contexts, and can be adapted for many different assessment purposes and situations. It should be remembered that in the job context of Plant Production, students can be employed in a variety of agricultural sub-sectors, which include pasture management for dairies, game parks, beef farming, agronomics and a range of horticultural activities. In this kind of assessment, students are asked to analyse historic and modern case studies of scientific and socio-scientific controversies. Prototypes for this type of assessment are provided, and students can build from them.

2.8 Teachers' Concepts of the Nature of Science

Abell, Martini and George (2001) emphasise that there are important aspects of student learning in science. The researchers wanted to determine how students learn regarding observation in science, the role of creativity and inference, and social aspects of science. Two sections of an undergraduate course in elementary science education were observed during an extended investigation in which students made observations of the moon and tried to develop explanations for what they saw. Students worked in groups, were engaged in many aspects of the process of science, and were asked to reflect on their own learning regarding the moon.

At the end of the session, eleven student journals of the experience, along with interview transcripts from these activities, were analysed. The following are major findings:

- Students recognized that observations are important in science but did not recognize the role that observation plays in science.
- Students recognized that their own work involved observing, predicting, and coming up with explanations, but they did not generally connect this to the process of science.
- Students recognized that collaboration facilitated their own learning but did not generally connect this to the process of science.

The results of the study are equally important for students in Level 2 Plant Production. In Level 2, subject guidelines require that 40% of the internal assessment mark comes from the theoretical component. Internal assessment of the theoretical component takes the form of observation. This requirement makes it necessary for all involved to note that observations are important in science. The implication, therefore, is that since Plant Production is a science, it is necessary and important that TVET college lecturers highlight the pedagogical importance of making the nature and process of science explicit: Even though students were actively engaged in scientific processes, they did not get many of the key messages that the instructors implicitly conveyed.

Among the recommendations made by the researchers was that students should be asked to reflect on how their own understanding of the nature and process of

science is changing over time. This recommendation is in line with Leve2 Plant Production guidelines, in which students are required to do practical work in a way of lectures, demonstrations, group discussions and activities, practical work, observation, role-play, independent activity, synthesis and evaluation.

Lederman and Zeidler (1987) assessed eighteen high-school biology classrooms led by experienced teachers over the course of one semester. Teachers' understanding of the nature and process of science was assessed at the beginning and end of the semester. In addition, the researchers made extensive observations of each classroom at three different points in the semester and categorized the teachers' and students' behaviours along many variables relating to teaching the nature and process of science. The researchers found no relationship between a teacher's knowledge of the nature and process of science and the teacher's general instructional approach, the nature-of-science content addressed in the classroom, the teacher's attitude, the classroom atmosphere, or the students' interactions with the teacher.

This finding challenges the widely held assumption that students' understanding of the nature and process of science can be improved simply by improving a teachers' understanding. Instead, the teachers' level of understanding of this topic was unrelated to his/her classroom performance. However, this conclusion should be taken with serious caution, as it does not mean that a teachers' understanding of science has totally no bearing on students' understanding. It was highlighted during this research at College B that students felt that if they had teachers who were adequately exposed to primary agricultural practices, maybe they themselves would have better understanding. It should therefore be emphasized that this doesn't indicate that a teacher's ideas don't matter at all; teachers need at least a basic understanding of the topics they will teach, but this alone isn't enough. The researchers suggest that to improve their teaching in this area, instructors also need to be prepared with strategies designed specifically for teaching the nature and process of science. Science is not limited only to the memorization of isolated facts and concepts.

Deep scientific understanding includes a coherent system of facts, concepts, scientific inquiry and strong problem-solving ability. Students should, in science classes, be confronted with tasks that aim to develop problem-solving skills. In order

to develop such skills, the Department of Higher Education has prescribed that for Level 3, the practical component must contribute 60% of the internal assessment mark. The learning outcomes that are addressed in each assessment must be clearly indicated. Practical activities may include case studies, assignments, integrated activities, knowledge tests, group work and exercises, discussions, research projects, presentations (lectures, demonstrations, group discussions and activities, practical work, observation, role-play and self-initiated activities), use of aids, visits, guest speaker presentations, practical experiential training and workplace practical excursions.

When students are used to solving problems, problem solving, then, becomes what they do when they have little or no idea what to do. Presently, most school science contains too many exercises and too few problems. This involves translating the problem as presented into a form that is meaningful to the problem-solver. This initial step is largely conceptual, reflective, and qualitative, even when the problem and the problem-solving process depend largely on mathematics. Effective and ineffective problem-solvers make similar numbers of errors, but effective problem solvers have better checking strategies to identify and correct errors. Students can become more effective problem-solvers through science teaching that emphasizes scientific problem solving and de-emphasizes exercises.

2.9 Teachers' Understanding on the Nature of Science

Lederman (1999) examined whether teachers' conceptions of the nature of science were reflected in their teaching. Five high-school biology teachers were observed weekly for one year and the researcher also collected data from questionnaires, student and teacher interviews, and classroom materials. All five teachers had accurate understanding of the nature of science. The most experienced teachers used pedagogical techniques consistent with the nature of science, though they weren't explicitly trying to do so and did not claim to be trying to improve students' understanding of the nature of science.

Less experienced teachers did not teach in a manner consistent with their views of the nature of science. This suggests that an adequate understanding of the nature and process of science and curricular flexibility alone are not sufficient to ensure that teachers will use pedagogical techniques that reflect that understanding. In addition, the researcher found that students in these classrooms gained little understanding of

the nature of science, regardless of their teacher's experienced. This supports the idea that teachers need to be explicit about how lessons and activities relate to the nature and process of science in order for students to improve their understanding in this area.

The researcher concluded that teacher education programs need to make a concerted effort to help teachers improve their ability to explicitly translate their understanding of the nature of science into their teaching practices. Furthermore, teachers should be encouraged to view an understanding of the nature of science as an important pedagogical objective in its own right.

Teachers usually teach science as a sequence of lectures and reading assignments on its body of knowledge. If laboratory activities are included, the main focus is only on the development of laboratory skills and techniques, not on constructing new scientific ideas through inquiry. Such teaching falls short of preparing students for advanced study, careers, and a future as scientifically literate citizens.

Today's students live in a world full of the products of scientific inquiry and engineering development. When students complete their formal schooling, they will enter a world filled with products that do not exist today—products that will be the result of scientific inquiry and engineering development. This situation calls for a creative and inquiring mind. Today's students must learn how to do scientific inquiry and use scientific information to make decisions that will affect their personal lives, careers and societies. The world of work is ever-changing, and it, therefore, requires students to be equipped with skills of scientific enquiry. For a long time, for example, plant production would mainly take place on arable land. Now vegetable farming is also done inside nets and using hydroponics. All these changes require an inquisitive flexible mind.

In order to prepare students to live and work in tomorrow's world, science teachers must make room for scientific inquiry by decreasing their emphasis on teaching science as a sequence of lectures and reading assignments on the body of scientific knowledge. To implement this requirement in TVET colleges, prescriptive and constricting curriculum activities that are centrally constructed should be done away with to allow for more flexibility. In addition, teachers must greatly decrease their coverage of non-core scientific knowledge. While doing that, they must retain the

core knowledge in the scientific disciplines and increase their emphasis on scientific inquiry as a core part of science content and as a method of instruction. It should be noted, however, that explicit, reflective teaching does not mean didactic teaching, but rather instruction that specifically targets the nature of science concepts and that provides students with opportunities to relate their own activities to those of scientists and the broader scientific community.

Schwartz, Lederman, and Crawford (2004) assessed developing views of nature of science in an authentic context. A group of pre-service science teachers participated in a program that included 10 weeks of work with a scientific research group, discussions of the group's research (in which they took part) and the nature of science, and writing prompts that asked the pre-service teachers to make connections between their research and the process of science. Participants were interviewed and observed, and they also responded to a questionnaire about the nature of science.

Eighty-five percent of the participants improved their understanding of the nature of science over the course of the program. The two participants who did not improve their understanding are those that focused on the content of their research and did not reflect on how it related to the nature of science. Participants also seemed to gain a better understanding of how to teach the nature and process of science explicitly. The researchers concluded that the research experience alone did little to improve students understanding, but the experience was important for providing the context in which active reflection about the nature and process of science could occur. They recommended that scientific inquiry in the classroom incorporates reflective activities and explicit discussions relating the inquiry activity to the nature and process of science.

What, then, are the implications for this finding in Levels 3 and 4 Plant Production teaching? On reflective activities in the classroom for the practical component, among other activities, students are expected to do research. Taking into account the advice above, it means that research alone will not assist students, but the research should be coupled with reflective activities and explicit discussions relating the inquiry activity to the nature and process of science.

2.10 Techniques in Teaching Science: Their Practical Application

Lederman and Zeidler (1987) suggested effective techniques to be used by teachers to promote deep scientific understanding. In order for teachers to determine if tasks are problems or exercises for students, teachers should ask all students if they have a good-to-excellent idea or little-to-no idea how to do specific tasks. Teachers should also organize co-operative student groups that reflect intellectual, gender, and cultural diversity; members of the group must share and discuss their representations of the gap and proposed solution strategies. This arrangement is even more relevant for Level 4 Plant Production students when doing their practical work. The Plant Production guidelines require, among other things, that the presentations of practical work be in the form of role-play, self-initiated activity, judging the quality of farm produce, evaluation in field tests and research. During these activities, students should sometimes work in groups, which is an idea that supports the social learning theory.

It is further suggested that teachers can use guided-inquiry teaching strategies that lead learners to continue developing and modifying their knowledge. In addition to this, teachers should devise problem-solving instruction slightly beyond what students can do alone but within the boundaries of what they can do with assistance from others. These guidelines are relevant for all levels of Plant Production, especially when they are to be applied in field tests and research, as suggested.

Teachers are further encouraged to use science concepts and processes as contexts for students to write persuasive essays, engage in oral discussions, connect data with scientific theories, and solve problems requiring mathematical reasoning. Teachers must, in line with the Plant Production guidelines, design discussions and negotiations among students as ongoing learning experiences and provide opportunities for students to claim ownership of their learning.

Practical applications require that effective science teachers work together and align their work with appropriate science standards (if they exist). To do this, they use the following approaches (Lederman, 1999): Identify the core ideas of their science discipline across all grade levels; decide which core scientific ideas will be taught in the early, middle, and upper grades; outline how core scientific ideas that are introduced in the early grades will be developed further in the middle and upper

grades; select science curricula for the early, middle, and upper grades that focus on core scientific knowledge and include scientific inquiry as part of the core of scientific knowledge; concentrate on the core scientific ideas that have the greatest importance; select science curricula for the early, middle, and upper grades that emphasize scientific inquiry as a method of teaching and maintain a high level of consistency among the goals and objectives, instruction, and assessment of each lesson, unit of instruction, course and program.

2.11 Beliefs in the Nature of Science and Responses to Socio-Scientific Dilemmas

Zeidler, Walker, Ackett, and Simmons (2002) conducted research on students' beliefs in the nature of science and their responses to socio-scientific dilemmas. To assess beliefs in the nature of science and responses to socio-scientific dilemmas, the researchers took a sample of 248 high-school and college students who were given open-ended questions eliciting their views on the nature of science. Students were allowed to discuss the issue with each other and were probed by an interviewer. Finally, they were presented with data anomalous to their own views and were probed again on their confidence in the data and their willingness to change their views.

There were situations in which a student would express a belief that scientists interpret data to suit their personal opinion, and then, correspondingly, the student would selectively accept or reject evidence according to whether it supported his or her opinion. In addition, many students seemed to believe that all opinions are equally valid and immune to change regardless of the scientific evidence. The authors concluded that instruction on the nature of science should be incorporated throughout science courses and should include discussions in which students are asked to contrast different viewpoints on socio-scientific issues and evaluate how different types of data might support or refute those positions. This practice should be encouraged in Plant Production exercises so as to generate scientifically proven facts than going with the whims and preferences of individual students as opposed to scientific reasoning.

In order to teach effectively, teachers must have the understanding that effective science teaching is a purposeful means to an important end, not the end itself.

These are teachers who embrace the principle that they take some measure of responsibility for their students' struggles and failure to learn. The teachers in this instance help the students by modifying instruction to help struggling and failing students improve. The practical applications listed below describe specific expressions of the beliefs and dispositions of effective science teachers.

The practical applications are that effective science teachers believe and act in ways that respect and accept the unique perceptions of individual learners. Teachers have to reflect on and consider learners' prior knowledge and interests when selecting and using specific teaching strategies and techniques, and they must believe that all students can and will learn. In order for students to learn effectively, teachers should create a challenging but non-threatening learning environment. For their teaching to be successful, teachers must commit to the learning and intellectual growth of all learners. All the applications above are useful for Plant Production, but when applied, they should take into cognizance the restricted time constrains available to complete whatever content and practical work to be covered within a given period.

All of this is based on the belief that one can teach effectively and that effective teaching will lead to positive learning outcomes

2.12 Revising Instruction to Teach the Nature of Science

Lederman and Lederman (2004) conducted research on revising instruction to teach the nature of science. At the end of the research, they came up with the following conclusions that are important for students to understand science:

- There is a difference between observation and inference;
- There is difference between laws and theories;
- Science is based on observations of the natural world;
- Science involves creativity;
- Scientific knowledge is partially subjective;
- Science is socially and culturally embedded; and
- Scientific knowledge is subject to change

The researchers argue that most lessons can be modified to emphasize one or more of these ideas and provide an example from biology instruction. Many teachers use

an activity in which students study a slide of growing tissue and count cells at different stages of mitosis in order to estimate the lengths of these stages. They recommend modifying this activity in these ways:

- Asking students to reason about how they know when one stage ends, in order to emphasize the sort of subjectivity with which scientists must deal
- Asking students to grapple with ambiguity in their data
- Asking students to reason about why different groups came up with different estimates and how confident they are in their estimates, in order to emphasize the tentativeness of scientific knowledge

On ‘active construction of scientific knowledge’, Lederman and Lederman (2004) found that when new knowledge is constructed, it sometimes fits well with the existing knowledge. In some cases, new and old ideas are in conflict and are, therefore, retained and used separately. Learning is also a social and cultural process. This idea fits well with the social learning theory, which this study deems a good fit for the Plant Production modules. Teachers should capitalise on the idea of students in groups and, thus, sharing social and cultural values. The idea can be applied at all levels of Plant Production modules during lectures, demonstrations, group discussions and activities, practical work, observation, role-play, independent activities and exhibitions. The student group activities can assist to screen socio-scientific controversies and dilemmas.

During the learning process, individual students interact with their peers. The construction of deep scientific knowledge results from actively practising science in structured learning environments; therefore learning environments should support students’ active construction of knowledge. Teachers should employ teaching strategies that help learners recognize conflicts and inconsistencies in their thinking, as these experiences catalyse the construction of new, more coherent knowledge.

To apply the principle properly, teachers should present science as a process of constructing and empirically testing models for their ability to explain and predict.
They need to devote time to diagnosing learners’ alternative conceptions and employ a repertoire of teaching approaches that range from open and guided inquiry to direct instruction. It is both important and necessary to use teaching strategies and assessment formats that are consistent with the goals of the lesson.

Strategies used in teaching should help learners become aware of inconsistencies in their thinking, and be able to raise students' awareness of how they construct knowledge together and as individuals.

Teachers should at all times teach with strategies and techniques that help learners become active thinkers. They need to employ discrepant events to engage learners with concrete phenomena, activate their interest, and help them become aware of the conflicts between their thinking and accepted scientific concepts.

When determining the order in which to introduce scientific concepts in a given domain, teachers should consider how those concepts are interdependent, and use teaching strategies that include familiar analogies, metaphors, and physical models to guide learners towards accepted scientific concepts.

They should also adapt available curriculum materials and teaching strategies to fit the diverse needs of all students. This should be done to accommodate students who have not taken agricultural science as a subject at school level. To uphold and apply the theory of social learning, TVET colleges should organize co-operative student learning groups that reflect intellectual, gender, and cultural diversity.

Colleges should conduct frequent assessments as a seamless part of teaching and use the results to modify instructional experiences for groups and individual learners.

2.13 Student Conceptualizations of the Nature of Science in Response to Socio-Scientific Issues

Sadler, Chambers, and Zeidler (2004) studied student conceptualizations of the nature of science in response to socio-scientific issues by asking a group of average- to below-average-achieving high-school students to read contradictory reports about the status of the global warming debate and answer a series of open-ended questions that related to the nature and process of science. Each report included data to support its conclusions. The researchers analysed and coded students' oral and written responses. On the positive side, the researchers found that:

- Most students understood that science and social issues are intertwined.
- Most students were comfortable with the views that scientific data can be used to support different conclusions and that ideological positions may influence data interpretation.

However, they also found that:

- Almost half of the students were unable to accurately identify and describe data, and some conflated expectations and opinions with data.
- There was a tendency for students to view the interpretation consistent with their prior opinion as the most persuasive argument—even in cases where they judged the opposite interpretation to have the most scientific merit. This suggests that students may not incorporate scientific information into their decision-making process, thus dichotomizing their personal beliefs and scientific evidence.

The researchers suggest that instruction should focus on the above two issues and that teachers should encourage students to consider scientific findings when making decisions. In addition, students should be encouraged to deeply reflect on socio-scientific issues and consider them from multiple perspectives.

On the related subject Moss (2001) examined student conceptions of the nature of science. Five 11th and 12th grade students, with a range of academic achievement, taking an environmental science class, were interviewed six times over the course of a year. The class was project-based and engaged students in data collection for real scientific research using interviews that focused on students' views on selected aspects of the nature and process of science. The researcher coded and interpreted transcripts of the interviews, and the major findings included that:

- In contrast to previous studies, most students understood that scientific knowledge builds on itself and is tentative. Students also seemed to understand science as a social activity.
- Many students didn't know what makes science and had trouble distinguishing science from other ways of knowing.
- Many students viewed science as merely procedural.
- Most students didn't understand that scientists regularly generate new research questions as they work.
- Despite the authentic, project-based nature of the course, there were few shifts in student views of the nature and process of science.

This research supports the view that explicit instruction is necessary to improve students' understanding of the nature/process of science. Moss suggested that this can be done by having students develop their own descriptions of the fundamentals of the nature and process of science. The researcher also suggested that teachers need to focus on helping students understand the boundaries of science, probably by explicitly discussing how science compares to other human endeavours.

Kang, Scharmann and Noh (2004) examined students' views on the nature of science. A multiple-choice survey (supplemented by open-ended questions) on the nature and process of science was given to a large group of 6th, 8th, and 10th grade students in Korea. Most students thought that:

- Science is mainly concerned with technological advancement
- Theories are proven facts
- Theories can change over time
- Scientific knowledge is not constructed but discovered (that is, it can be read off nature)

Interestingly, Korean students don't tend to hold the common Western misperception of theories as "just hunches." The researchers found little improvement in understanding in older students, which suggests that special attention is needed to help students learn about the nature of science. The researchers argue that institutions of learning should begin instruction in this area early in elementary school.

2.14 The Process of Learning by Students

2.14.1 Changes Made to Engage Students in Learning

Hipkins, Cowie, Boyd, Keown and McGee (2011) conducted curriculum-implementation exploratory studies in several TVET colleges in New Zealand. Below is a summary of the report from their study.

There was a wide recognition in all the schools involved that there was a need to do more to engage students in learning. This fact is equally important for the TVET colleges offering Plant Production. This research indicated some major deficiencies

in the curriculum, which means that there is a need to engage students in learning. Hipkins et.al. (2011) came up with a conclusion that multiple strategies had to be designed to change different areas, which included:

- Increasing student attendance at school;
- Lifting achievement;
- Creating a sense that learning matters; and
- Focusing on the quality of students' learning experiences.

In all TVET colleges researched, poor student attendance and, consequently, student achievement are major problems. The Primary Agriculture programme's throughput rates were extremely low. Means accommodative of the students' needs had to be made. The researchers suggested that in order to solve these problems, the following points could be considered:

- Provision of student leadership opportunities;
- Introduction of new processes for student consultation;
- Use of inquiry learning or other pedagogies that allow for aspects of students' wider lives to be included in learning;
- Provision of opportunities and support for student self-regulation and learning to learn; and
- Adoption of culturally responsive pedagogies

2.14.2 The Benefits and Challenges Posed by Community Engagement

Hipkins et al. (2011) highlighted that it is beneficial to:

- inform parents about curriculum developments at the school,
- involve parents in a two-way exchange of information to better support students' learning,
- consult parents about the vision, values and overall direction of the school's curriculum, and
- include parents' input in the processes used to shape relevant documents and school-wide practices.

These facts are even more valuable for Plant Production classes because some, if not most, of the practical work takes place in the communities. This has been more

evident in colleges A and B, where there are no adequate facilities for practical work, like the college farm prescribed by the subject guidelines.

Furthermore, Hipkins et al. (2011) noted, however, that gaining active participation of parents is not easy, and the schools' well-intended efforts are not always rewarded with high participation levels. One challenge not mentioned by schools, but evident from the analysis, is that some schools may be hampered in certain aspects of community engagement by a lack of clarity about the purposes and the ultimate goal of such an activity.

2.14.3 Iterative Exploration of the Key Competencies

A powerful cycle of iterative learning takes place when schools connect ongoing exploration of the key competencies to earlier professional learning. One consequence of ongoing exploration might be recognition that the key competencies can be developed throughout all aspects of school life, both inside and outside classroom programmes. Another change might be recognising that assessment and reporting practices need to change. Schools and teachers also recognise that the focus on lifelong learning competencies applies to both teachers and students

2.14.4 The Principles at Work in the School Curriculum

There is an evident display of high teacher expectations clearly reflected in the attention being paid to student engagement, and high expectations are often communicated to the whole school community through each school's vision for learners. The future focus principle is arguably the one that has received the least attention. Another challenge in working with principles is that they can be read in isolation or as an interconnected set.

Clough (2006) evaluated learners' responses to the demands of conceptual change. The researcher concluded that student learning can be a process of conceptual change. The author introduces the idea that many aspects of student learning about the nature and process of science can be explained, and also improved, by viewing it as a process of conceptual change.

2.14.5 Thinking of Science Teaching as a Purposeful Means to an Important End in Student Learning

Staver (2007) conducted research on 'thinking of science teaching' as a purposeful means to an important end in student learning. The research findings were that learning is a process with a purpose in which internal, mental processes take place. Teachers can monitor learning by observing and gathering data on changes in students' behaviour or potential performance. Motivation becomes important in the learning process, as it is important for starting and continuing learning. Learners become motivated if a topic is interesting to them. A topic is interesting when a teacher connects science with students' interests, personal lives, societal issues, cultural backgrounds, and other school subjects. Cognitive learning theory emphasizes the importance of learning something new by relating it to things that are already meaningful and familiar.

The practical applications were that effective science and plant production teachers use these techniques to connect content with student interests. The Plant Production guidelines require that an enabling environment needs to be established for proper learning to take place. Staver (2007) suggested factors that can assist in the establishment of such an environment, which included that teachers should:

- connect science concepts and instruction explicitly to learners' personal experiences;
- use specific examples, analogies, and metaphors;
- plan lessons to emphasize themes of science, technology, and society;
- have students organize data into diagrams, tables and graphs;
- have students use data in tables and graphs (bar, line, histogram) to identify patterns and make predictions;
- have students use mathematical operations, fractions, decimals and percentages to calculate results of investigations;
- connect science content with students' interests and personal lives with societal issues and other school subjects;
- have students read passages in science textbooks and trade books, identify major and minor ideas, summarize what they have read, and make predictions; and

- have students develop and take part in role-play scenes in which they use scientific thinking or play roles of scientists.

2.14.6 The Complexity of Learning

Blum (1996) unpacked the concept of ‘transfer of learning’ for agricultural teachers. The concept addresses the question “How much does learning in one area serve to improve a learner's performance in other areas?” A clear answer to this question might further address the question “How far will instruction in soil chemistry and plant physiology influence a learner's ability to plan crop fertilization?”

It should be noted, however, that not all students have the same capability to transfer learning from one area to another. The age, mental ability, attitude towards learning and acceptance of the method of instruction have been found to influence the transfer of learning. Older and intellectually brighter students transfer their learning more readily than their younger and less intelligent peers. Especially important for teaching agriculture is the fact that when students regard what they have learned as useful beyond the classroom, the transfer of learning is enhanced. This is another reason to integrate practical examples in the teaching of agricultural principles.

A transfer of learning is more likely to occur when the two situations are similar and when the new situation occurs shortly after the knowledge to be transferred has been learned. Moreover, directions given by the teacher can enhance students' chances of being able to transfer learning effectively. Teachers can provide students with a diversity of problems in which they practise the application of newly learned skills and principles to varied life situations; for example, situations which typically occur on farms. These problems can be at different levels of similarity: similarities which are quite apparent, similarities which exist but are not readily identified by students, and similarities which exist but are not really useful.

Concepts and generalizations which the learner derives from investing personal effort (gathering data from different sources, drawing conclusions) transfer better than those that the student was taught in the form of verbal definitions. When students have to find a solution to a problem themselves or with only partial guidance, the transfer of learning can be expected to be better than when students

learn passively by listening to a lecture or even observing a demonstration by a teacher.

The transfer of technical skills seems to be more restricted. In most cases, it was found that, with practice, the speed and quality of a given technical task can be improved without improving other practices. However, the transfer of practical training can be enhanced to some extent when students understand the principles which underlie the practices. In agriculture, this means that teachers can enhance the teaching of practices when they make sure that students understand why they should do things the way they are taught. For instance, a student who has understood that in cleft grafting, the most important thing is to bring the cambium of scion and stock in close contact, and has got used to doing this, will adapt to the parallel procedure in whip grafting more quickly than a student who has not received training in a previous type of grafting and who does not understand why the two tissues should be closely joined together.

Tyler (1933) showed that within a year, students had forgotten 77 percent of the specific facts they had learned (the names of animal structures in a diagram). At the same time, the students' ability to apply a principle to a new situation was unchanged, and the skill to interpret new experiments even improved by 25 percent, probably owing to the additional experience gained in using this intellectual skill.

Teachers have to concentrate on the teaching of principles and using specific facts mainly to demonstrate how the principles work. Of course, specific facts may be most important; however, instead of letting students learn these specifics by rote (which is not conducive to long-term retention), it would be better to teach students how to find the details if and when they need them. Thus, practice in the use of dictionaries, technical handbooks, agricultural compendiums and extension publications become an important educational goal.

Bloom (1956) discussed the concept of learning to apply principles, and concluded that the term "application" as a mental skill stands above "knowledge" and "comprehension," because only a piece of knowledge (for example, a principle) that has been comprehended by students (and has not only been learned by rote) can be applied to a new situation. The fact that most of what we learn, especially in agriculture, is intended for application to problem situations in real life is indicative of

the importance of application objectives in the curriculum and of training students in applying principles. Much of what was discussed under the transfer of learning has to do with the application of principles. Training is needed to develop the skill and ability to apply generalizations in problem-solving situations.

Experiential learning is a combination of "finding out" and "taking action". The process involves feelings, attitudes and values which markedly affect the disposition of a learner. These factors are to be found in any decision-making situation, although their importance is not always acknowledged. The idea of experiential learning is close to Freire's concept of "empowerment of the learner in action" (Freire, 1972). This concept is important in learning plant production.

2.14.7 The importance of Prior Knowledge in Learning

Based on research findings, Staver (2007) recommended that before teachers start teaching, they should give a pre-test before starting a unit of instruction. Pre-test results should be used to learn what students know and do not know, and then plan appropriate lessons. Teachers should use concrete, manipulative materials and familiar events to help students directly experience scientific phenomena and to encourage their active construction of abstract concepts.

When designing and teaching science lessons, teachers should consider the complex interaction of learners' biological maturation, prior knowledge and experience, and reasoning abilities. Teachers can ask a blend of high-level, low-level, open-ended, and closed-ended questions to activate students' thinking. Questions should not be rephrased immediately, but the teacher should wait at least three seconds after asking a question before rephrasing it. A three-second time lapse should be allowed in between the questions. The level of instruction should be aimed slightly beyond the capabilities of individual learners but within the capabilities of groups of learners.

2.15 Teaching Agriculture

2.15.1 The Philosophy and Rationale for Teaching Plant/Crop Production

Saskatchewan is a world leader in traditional primary production agriculture. Saskatchewan (2004) records that there is an ever-increasing and intense global competition for primary agricultural products. This means that Saskatchewan agricultural producers and employees need to have knowledge, skills and abilities in a variety of areas in order to maximize production and remain viable. In order to be able to do this, there is a need to provide students with practical knowledge, skills and abilities in crop production, which will in turn help students make meaningful contributions to their family farming operations, or pursue related career and educational opportunities. The aim of Field Crop Production is to provide students with knowledge, skills and abilities in field crop production, including farm safety procedures, communication skills, and basic knowledge of equipment operation and procedures.

Teaching should also be aimed at providing students with an awareness of the nature of field crop production, including the knowledge, skills and abilities required for field crop production. There is a need to create for students a connection between the world of school and the world of work. When teaching crop production, instructors have to do so with the aim of developing the skills and abilities that encourage students to understand the business of field crop production and markets. Agriculture teaching should be able to:

- use relevant community examples that will help develop students' skills and abilities as well as encourage a sense of pride and community,
- develop social and communication skills as potential employees or employers in field crop production,
- encourage the development of employability skills in field crop production, and
- promote self-esteem, confidence and a proactive attitude towards time management, communication, and technical capabilities.

2.16 The Sustainable Agricultural Policy

Egun (2009) wrote a paper with the aim of changing the method of instruction, effective funding, suggesting a curriculum that would offer equal opportunities for male and female members of society to participate in agricultural activities and abide by a national sustainable agricultural policy. For this participation to take place, the following are important:

- A deeper understanding of phenomena in one's environment, which affects the individuals' attitude and ability to deal with such phenomena.
- An enhanced reasoning ability, which leads to a better understanding of situations. This enables the individual to be analytical and systematic in problem-solving, decision-making and choice from different options; such a person develops a constructively critical mind.
- Creativity: The art of devising and implementing new and better ways of doing things and thus contributing to the development of society.

The facts outlined above are relevant for the TVET college set-up. One of the founding principles of the FET colleges was to promote equal access to learning for both male and female students.

Most agricultural activities that were performed by the home in agricultural practices are now transferred to the school. During the years of schooling, many personality characteristics are acquired. The Nigerian National Policy on Education (2004) had to address the changing role of agricultural education, and the following objectives were generated as important because they affect the teaching and learning of agricultural science:

- To stimulate and sustain students' interest in agriculture
- To enable students to acquire basic knowledge and practical skills in agriculture
- To prepare students for occupation in agriculture
- To prepare students for further studies in agriculture

There is a need to acquire and train the youth in urban agriculture, which will ensure steady development and increase the supply of food and some needed raw materials for industries. This could be achieved through supervised home projects.

Agricultural science as a core course in the school curriculum should be forward-looking. The curriculum should be such that graduates of schools are equipped with saleable skills, not only in the traditional culture of agricultural practices but also in other spheres of human and financial management.

School agricultural programmes should be opened, child-centred in approach and more flexible, thus enabling the learner to be educated rather than merely passing through a school system. The curriculum should be that which will enhance the adoption of agriculture as a rewarding occupation by the youth and enable them to adjust to rural living. The outlined facts are well aligned and relevant to the objectives of the TVET college plant production modules.

The new curriculum initiatives need to change from the current rote learning and lecture methods of instruction towards those that allow the child/learner to explore the environment and interpret it as he/she sees and feels, and be able to integrate various experiences into a comprehensive whole. The use of methods which recognize various differences and capabilities in learning ability of individuals should be encouraged. The use of project and individualized teaching methods could bring about positive effects in teaching for futuristic education.

Agriculture and its various practices have been going through changes, and are expected to change in the future, especially with the increase in technological and scientific knowledge. Egun (2009) further states that the evaluation of the learning process and achievement by use of written examination on a group of learners should be avoided. Rather a progressive assessment technique that will be able to provide comparative data on the basis of an individual's current state and point of programme entry can be applied to determine and interpret whatever changes that have taken place over time.

2.17 Strategies for the Implementation of Agricultural Science Curriculum

Amadi (2012) came up with strategies for implementing agricultural science curriculum. In the discussion, the researcher states that for teachers of agriculture to be effective in the teaching of manipulative skills knowledge, they must possess both academic and professional qualifications. They must be pedagogically competent while possessing special attributes such as humaneness, being sympathetic but firm and resolute. They must be of high mastery of the discipline because, in the words of

Okorie (1997), “a teacher cannot teach a skill which he has not mastered.” This statement is somewhat in line with Alaja (1985), who opined that the effectiveness of skills acquisition by students depends on the extent available human resources are used.

It is only a good teacher who can comfortably mobilize resources for effective teaching. Amadi (2012) indicated in the findings that involving students in real projects, either individually or in groups, use of field trips, and involvement of students in homestead farming are proven ways by which students can acquire basic agricultural occupational skills and knowledge. By extension, it implies that teachers of agriculture should, as much as possible, teach students by demonstration and by practical hands-on experiences. It was further indicated that effective skills acquisition will be possible if the curriculum is modulated, and if the evaluation of skills-learning programmes is performance-based. Each module should contain enough skills to be acquired, delivery system as well as methods, or techniques of evaluation (Amadi, 2012).

That study came up with the following major findings:
On teacher characteristics, it was indicated that:

- Requisite academic and professional qualifications are imperative;
- Teachers of agriculture must be able to demonstrate mastery of the skills and knowledge of agriculture; and
- Teachers must be humane and sympathetic but firm and resolute in terms of moral discipline.

On ways of using instructional resources for effective teaching and learning of agricultural occupational skills, the following were highlighted:

- Involving students in supervised live projects individually or in groups.
- Use of demonstration in task analysis.

On effective ways of harnessing community-bound resources, the following were highlighted:

- Use of successful farmers as resource persons,
- Establishing a healthy school–community relationship,
- Regular use of field trips and excursions, and
- Involving students in homestead farming and live projects

In the absence of adequate practical work facilities, proper partnership with successful farmers becomes important. Out of the three colleges researched, only one was towards meeting the Plant Production guidelines, but others needed to heavily rely on farmers as a resource. The question of well-trained and well-qualified lecturers in Plant Production was emphasised throughout this research. Greater emphasis came mainly from Plant Production subject advisors. The above facts become even more relevant when the question of social learning, which was discussed earlier, is applied in teaching agriculture. In handling all forms of task supervision, college lecturers should take all these into account.

2.18 Innovative Teaching in Agriculture

Davis, Ekboir, Mekasha, Oching, Spielman and Zerfu (2007) investigated the role of post-secondary agricultural training in sub-Saharan Africa. The paper assessed how innovative capacities can be engaged in improving AET, and the researchers concluded the mandates of AET organizations need to be aligned with the aspirations of national development. This can be achieved through promoting educational programs that are strategically attuned to different aspirations of the larger society. If this is to be applied to the South African context, the national aspirations as expressed in the National Development Plan have to be taken into consideration.

2.19 Reforming the Agricultural Education Curricular in Africa

Rivera (2013) asserts that there is an urgent need for Africa to augment the human resource and institutional capacities. There is a greater need than ever to reform the institutional systems, curricular and pedagogy that compose the agricultural education at the level of post-secondary education. Furthermore, Rivera (2013) found that AET institutions are ineffective because policies are lacking or not enforced. This fact is evident in the current research, as the HET has come up with subject guidelines for Plant Production, but these are clearly not enforced. Other forms of gross negligence that were revealed by Rivera (2013) are the following:

- The lack of the enforcement of class attendance: The class attendance policy is not enforced at all in the majority of the cases
- Governance is overly centralized
- Curriculum content is not oriented to human capacity needs;
- Institutional linkages are either non-existent or without significant development;
- Computer and internet connectivity is meagre; and
- Physical infrastructure is deteriorating and inadequate for the increasing population of students.

The problem of the deteriorating infrastructure is no longer applicable in the South African TVET colleges sector. From 2007, the South African government started the recapitalization of colleges, a program through which all the colleges in the country were renovated and upgraded to cater for the new curriculum demands.

2.20 Teaching and Learning Agriculture in Sub-Saharan Africa

Davis et al. (2007) noted that for a long time, there had been a question as to how AET could contribute to agricultural development in the sub-Saharan African region. Perspectives have emerged that agricultural education and training can indeed contribute to agricultural development. This can be achieved by strengthening innovative capabilities of agents, or the ability to introduce new products and processes that are socially and economically relevant to smallholder farmers and other agents in the greater sector. The study concluded that agricultural VET has other values, including that agriculture has a role in building human and scientific capital.

This value is even more necessary to the South African situation, as there is Green Agrarian Revolution. Students should be able to adapt to the ever-changing agricultural practices. This can assist in building new organizational cultures and behaviours

Rivera (2006) conducted a study on transforming post-secondary AET in an attempt to find solutions for sub-Saharan Africa. The findings were as follows:

- A need for increased attention to post-school AET in sub-Saharan Africa. The South African education system has tried to address this question. (The problem with the South African AET system is that training is handled by different training sectors, leading to the lack of coherence in service delivery: academic universities, universities of technology, agricultural schools under the Department of Basic Education, TVET colleges under the Department of Higher Education and Training, and agricultural colleges under the Department of Agriculture)
- There were little or no institutional linkages, or linkages without oriented significance. The South African education system seems to be forging significant linkages at inter-departmental level among government departments. The recent example is the signing of the skills accord between Higher Education and Economic Development.
- Most physical structures were deteriorating and inadequate for increasing the population of students. The South African national department made a significant contribution through the FET College Recapitalization Program, and through that initiative, colleges were able to cater for the newly introduced agricultural programs.
- Development of employable human resources in agricultural disciplines is a necessary requirement in Africa's advancement. Parents looked at agriculture as an unpromising career option.
- Students are usually driven to agricultural studies by supply-driven admission procedures. Changing this negative attitude is critical for effective agricultural development.
- There was a huge challenge posed by students and the community at large in the sense that their attitude towards agriculture tends to be negative in much of Africa.

2.21 Challenges in the Teaching and Learning of Practical Agriculture

Blum (1996) has noted that teachers have to take into account the stage of development and previous learning experiences of their students when deciding what, when and how to teach a certain topic. This is in agreement with works by

Piaget (1969) and many other researchers after him who studied the intellectual development of children as they progress from one developmental stage to another.

At the critical age of adolescence, students move from the concrete-operational to the formal-operational stage. At the concrete-operational stage, students develop an internalized, conceptual structure for the things they encounter, but they are not yet able to deal with possibilities not directly before them or not already experienced.

It is for this reason, among others, that the learners' previous knowledge has to be taken into account when deciding what and how to teach a particular topic. Typically, children cannot go systematically beyond the information given to them. When students pass into the formal-operational stage, they are able to operate on hypothetical propositions as they are no longer constrained to what they have experienced or what is before them. They can now think of possible variables and even potential relationships which can later be verified by experiment or observation. At this stage, students can express their thoughts in abstract terms without needing to refer to concrete events.

Several factors influence the intellectual development of individuals. Genetic and environmental factors influence the transition from the concrete to the formal stage. It is for this reason that this study has taken into account the importance of social learning. This statement is true when dealing with social learning as discussed in this report. Teachers can help students to pass progressively from concrete thinking to using more conceptually adequate modes of thought. The problem for practising teachers lies in the difficulty of knowing where each of their students is in this developmental process. It is for this reason that in the plant production course, as in all other TVET college modules, individual attention is emphasized for teachers to assess the intellectual development of each child. Based on their age, students in agricultural schools should be at the formal-operational stage, but the teacher cannot assume this to be true for all students

One of the advantages of teaching agriculture is that it deals mainly with concrete, real-life situations. When one wants to come to generalizations, one must work at a higher level of formal thinking. We can bring students who are only at the threshold of formal thinking to grasp generalizations at an "instrumental" level.

2.22 Training Agriculture Graduates for the Place of Work

As much as this study is not focussed on the employability of plant production graduates, it is worthy of briefly looking into the employment of some plant production graduates. The agricultural sector, like all other sectors of the economy, requires skilful human resources who are capable of working in agricultural and rural centres, and who know about producing, processing, and supplying various agricultural products.

Universities and higher agricultural institutes typically prepare the main part of specialists, researchers, change agents, and farmers. Over the years, the world has changed, and in many of the developing countries, agricultural education has failed to adapt and respond to the realities of rural societies. Curricula, teaching methods and tools which are developed are often not relevant to the development objectives of individual countries and do not necessarily suit the needs of farmers and the labour market.

Movahedi, Mantashloo and Ali (1997) noted that in many developing countries, the public sector used to absorb the large majority of agricultural graduates and, consequently, agriculture graduates are now finding it increasingly difficult to become employed. Their education in agriculture has not been oriented to the needs of an increasingly sophisticated commercial sector.

The lack of co-ordination and co-operation between employers and higher education institutes is another reason for unemployment in developing countries (Sabouhi, 2000). All the agricultural graduates, whether employed by someone or self-employed, must be able to articulate a vision and provide a direction for change, pointing unequivocally to the future (Johnson, 2003). Today, jobs for graduates are no longer guaranteed and the government can only hire a small number of agricultural graduates (Shao and Bruening, 2005).

The foregoing reason (among others) is the main reason why TVET colleges should also train for entrepreneurship. Now that governments cannot employ huge numbers of agricultural graduates, some graduates need to find jobs in the private sector or be self-employed (Movahedi et al., 2011).

UCONN (2012) noted that there are some requirements for graduate programs to be meaningful. A graduate of a plant production program should be able to understand

basic fundamentals of plant growth and relationships between the soil and plants. It is imperative for the program's students to also understand plant–water relationships and understand integrated pest management related to plant management. The latter need was highlighted by the three TVET colleges during this research, which also expressed the need of training students in this regard. Colleges mainly end by teaching from the book, and most students end up not seeing pests and pesticides.

Understanding plant–environment interactions and how plant management practices/strategies affect water quality and the environment is highly important. Students should be able to identify and describe insect, disease and physiological problems of plants and develop control strategies.

Communicating effectively, both orally and in writing, is important because it is one of the skills students need in the place of work. The Plant Production guidelines require of students to conduct research. In order for students to be able to conduct research, they should be able to demonstrate skills in accessing information. Below are some additional skills needed by Plant Production students:

- Ability to demonstrate mathematical skills used by today's Green Industry;
- Understanding how cultural practices influence the growth and quality of turf grass;
- Understanding how environmental conditions influence the growth and quality of turf grass;
- Recognizing important pests (weeds, insects, diseases) of turf grass and understanding how to develop environmentally responsible control programs for these pests;
- Understanding how soil chemical and physical properties influence the growth and quality of turf grass;
- Demonstrating a professional attitude in relationships with employers, customers, fellow employees, and professional peers and understanding the importance of professional development, continuing education, and life-long learning as components of a successful career; and
- Understanding the biology, ecology, and taxonomy.

2.23 Sustainable Agriculture in Practical Farming and Community Involvement

Central Carolina Community College (2002) outlines the college programs that involve communities. Programs involving local communities and the college were initiated and the Sustainable Agriculture program attracted students from many American states. The program provided both the small-business and technical skills needed to develop and manage a profitable, environmentally sound and community-based small farm or agricultural business. Students worked with classmates to plant, cultivate, and harvest a variety of produce. They learn to use a variety of tools and equipment, including tractors and tillers. Programs of this nature (field trips, farm tours, and internships) enhance the learning experience.

The college initiated a research farm used for demonstration and crop production. The site includes a greenhouse and student-built farm structures, including a pole barn, a packing shed and a masonry pizza oven. The instructors are a group of agriculture professionals with years of experience in the field and classroom. By maintaining close ties to a vibrant local farming community, they are able to assist students with internships as well as job placements. Some students use their education to build sustainable farms, while others seek employment at established sustainable operations. Employment opportunities are found through schools, parks and environmental centres.

Students successfully completing the Sustainable Agriculture program will be able to:

- Recognize the characteristics of sustainable systems, and understand some of the challenges to sustainability in our present system of agriculture;
- Identify crops that are suitable for organic production in the Southeast and be able to outline a management plan from start-up to market;
- Apply critical and creative thinking skills in farm management issues;
- Select appropriate breeds for farm needs and demonstrate an understanding of the role of livestock in a sustainable production system;
- Select, create and maintain the appropriate technology and structures needed for a successful, small-scale farming operation;
- Write a business plan for a current or future farm business that includes such details as whole farm and enterprise budgets as well as marketing strategies appropriate to skill level and farm scale.

- Create and present a written marketing plan appropriate for sustainable, organic production;
- Summarize the challenges to sustainability in our present system of agriculture, orally and in writing;
- Create and maintain an appropriate computational/accounting plan using technology for enterprise management and other record-keeping requirements for a sustainable farm or agricultural business.

2.24 The Implementation of Plant Sciences Curriculum

In the implementation of a plant sciences curriculum, the Cambridge University (2013) highlighted some important aims, which relate well with those of plant production.

The aims are:

- To learn and understand the fundamental scientific concepts relating to a broad range of topics in animal, plant and microbial physiology;
- To become familiar with basic factual information concerning the mechanisms and functioning organisms that biology students will require; and
- To gain practice and confidence in applying knowledge in a quantitative manner to actual experiments, where appropriate

2.25 Why Advanced Plant Production Is Important in the Primary Agriculture Programme

Advanced Plant Production is one of the NQF levels 2–4 vocational subjects in the National Certificates (Vocational). Students studying and gaining competence in this subject will fulfil one of the pass requirements in the Primary Agriculture qualification. Gaining skills and understanding techniques in the establishment and management of crops and fruits creates better employment or self-employment opportunities for

students when they have completed the programme. It further enables students to enter into higher education.

On the same topic relating to the aims of education, Gauri (2012) is of the view that if teaching science is to be made effective, the aims should be in line with the general aim of education. In general, the aims of education include assisting students to acquire knowledge, skills, abilities, attitudes, reflective thinking, and habits. In addition, the education should be able to create appreciation in the minds of students and assist students in providing work for leisure and using educational training to form the basis of a career.

UCONN (2012) emphasises the fact that the teaching of plant production should produce students who are able to understand the basic fundamentals of plant growth. Plant production students should be able to understand the relationship between soil and plants and be able to comprehend integrated pest management as it relates to plants. There are a number of things that bother teachers when teaching plant production.

Vehid and Branko (2009) were bothered by how to encourage plant production students to independently and freely express creativity in the plant production class. In the attempt to achieve this, they used creative techniques including provocation, mind maps, brainstorming, random stimuli and freedom of choice. The results demonstrated that the application of creative techniques is not enough to spur pupils' creativity. The research found that there are other factors involved in influencing students' creativity, which include the length of lessons, teaching methods used in other classes other than the plant production class, and pupils' previous experiences. The study proved that the freedom to choose activities is the most inspiring to pupils.

In a case study for potted plant production, Neil (1999) determined students' fluency in terminology for potted plant production. The study also looked into the ideal production time and labour inputs for potted crops, and also the limiting factors preventing each crop from reaching the goal of production. The researcher further demonstrated that students who integrate with the actual work environment learned better.

2.26 Agriscience Curriculum

Peasley and Henderson (1992) outline the challenges of teaching agriscience curriculum in Ohio agricultural education. They argue that the teaching of agriculture in the United States has always been under science faculties, which include the fields of physical, chemical and biological sciences. The concern of teaching agriculture was mainly the production of food and fibre. As the curriculum of secondary agricultural education developed over the years, the content of the instruction emphasized more on the “how” of agricultural production practices, rather than the “why” (Williams, 1990).

The changes in the technology of production agriculture meant that changes had to be effected in the content taught to agriculture students. There has been little research conducted to investigate if teachers of high-school agriculture are teaching agriscience curriculum content correctly. If agriscience content is essential for the improvement of agricultural education programs in the state, then research should be conducted to determine if agriscience curriculum is being taught correctly.

Peasly and Henderson (1992) of the Ohio State University conducted a study to investigate teacher usage and knowledge of as well as attitude towards an agriscience curriculum. The following research objectives were developed to guide the study:

- To describe the level to which high-school agriculture teachers in Ohio teach using the agriscience curriculum.
- To describe the attitudes of Ohio high-school agriculture teachers towards the notion of an agriscience core curriculum and the term “agriscience.”
- To describe the level of knowledge of Ohio high-school agriculture teachers of Ohio agriscience curriculum development efforts.
- To determine the relationships between the level of agriscience curriculum being taught and select demographic characteristics of Ohio high-school agriculture teachers: age, years of teaching experience in current position, and educational level.
- To determine the relationship between the level of agriscience curriculum being taught and teacher attitudes towards the agriscience core curriculum and the term “agriscience.”

- To determine the relationship between the level of agriscience curriculum being taught and teacher knowledge of Ohio agriscience curriculum development efforts.

In general, high-school teachers of production agriculture in Ohio teach a moderate level of agriscience content. Teachers may be teach more of the agriscience objectives, but they may be unable to teach all of the objectives in one school year. Eighty-three (68%) of the teachers in the sample were teaching between 51% and 84% of the content in the agriscience curriculum.

It was found that nearly 25% of the teachers taught less than 50% of the content objectives of the agriscience curriculum, while 25% of the teachers taught more than 75% of the content objectives of the curriculum. Ohio teachers of high-school production agriculture could be described as having a positive attitude towards the notion of an agriscience core curriculum and the term “agriscience.” Teachers of high-school agriculture in Ohio are very well informed about the Ohio agriscience curriculum development efforts, and they have a high level of knowledge of trends affecting the implementation of the agriscience core curriculum in Ohio.

Negligible relationships exist between demographic characteristics of the teachers of high-school agriculture in Ohio and the level of agriscience curriculum being taught. Slight relationships exist between attitudes towards agriscience and its core curriculum and the level of the curriculum being taught. A negligible relationship also exists between the knowledge level of state-wide agriscience curriculum development efforts and the level of agriscience curriculum being taught. Based on open-ended responses, Ohio teachers of high-school agriculture desire the development of agriscience curriculum materials and want leadership from the state’s Agricultural Education Service on agriscience curriculum development.

The study conducted by Peasley and Henderson (1992) does not support research conducted by Rogers (1971). Rogers (1971) reported that attitudes should be significantly related to the level of teaching of a curricular change, and also identified knowledge and educational level as significant factors in the teaching of a curricular change. The study by Peasley & Henderson (1992), however, found slight to negligible relationships between knowledge and the level of agriscience curriculum

being taught. Though teachers of high-school agriculture in Ohio teach some of the agriscience content, they do not teach all of the content. The agriscience curriculum may not be considered an innovation by Ohio teachers of high-school agriculture. The fact that the agriscience curriculum may not be seen as an innovation by teachers could account for the slight relationships found during the study. The agriscience curriculum may reflect more of a shift of emphasis in curriculum content than an outright change. The fact that there were slight to negligible associations indicates the need to conduct further research to identify other factors that may help explain the teaching of agriscience in Ohio agricultural education.

From their study Peasly and Henderson (1992) recommended that leaders of agricultural education in Ohio should work with teachers of high-school agriculture to further develop, conceptualize, and implement an agriscience core curriculum. Teachers want to move towards the development of a core curriculum, but they want more leadership at the state level. A similar situation in South Africa calls for the involvement of TVET college lecturers to be part of curriculum development. It has been seen from this research that when some state officials work by themselves, they tend to produce a universal curriculum for the entire country, yet it has been seen in some cases that the planting seasons do not necessarily favour colleges at the same time and not all colleges can acquire vast-sized lands.

2.27 Teachers' Perceptions of Agriscience and Natural Resources Curriculum

Connors and Elliot (2010) conducted a study on teacher perceptions of Agriscience and Natural Resources (ANR) Curriculum. The study found that Michigan ANR teachers taught a large percentage of the objectives of the Michigan Agriscience and Natural Resources curriculum. Over 78 percent of the Michigan agriscience and natural resources teachers and 60 percent of Michigan horticulture teachers cover at least 75 percent of the science objectives of the Michigan Agriscience and Natural Resources Curriculum.

Michigan agriscience and natural resources and horticulture teachers had a slightly positive attitude towards the concept of "agriscience." They agreed that the curriculum was useful and had to be recommended to all high-school students. The

teachers only had an average knowledge of the Michigan ANR curriculum development project activities. It is recommended that in-service and technical update sessions should be planned to assist teachers with developing instructional lesson plans that incorporate more objectives of the Michigan ANR Curriculum. Teachers should be encouraged to attend professional development training and incorporate more hands-on activities into the curriculum. Greater emphasis needs to be placed on disseminating curriculum development information throughout Michigan.

The next chapter will address the question of the Research Methodology, which includes Research Paradigm, Research Approaches, Research Design and Research Instruments used during the research. The section will also address the questions of validity and reliability of instruments. The chapter concludes with the data collection procedure.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The preceding chapter gave an overview of the South African TVET system and its past and present outlooks, which include knowledge production at the TVET colleges as a tool for transformation. The chapter also outlined the challenges facing the TVET college system, and the historical perspective of the system was outlined. Some important aspects of agricultural education have been discussed. The section specifically discussed the policies relating to the implementation of Plant Production curriculum. The policies relating to NC (V) Plant Production curriculum have also been outlined and reflected upon.

3.2 Research Paradigm

The research Paradigm for this study is pragmatism. As a research paradigm, pragmatism is a deconstructive paradigm advocating as possible the use of mixed methods in research. Rebecca (2011) writes, “When one is doing research engaging mixed methods, necessarily, the researcher is taking pragmatic Approach”. The Merriam Webster Learners’ Dictionary (2009) defines pragmatism as a reasonable and logical way of doing things or thinking about problems that is based on dealing with specific situations instead of on ideas and theories. The Cambridge Dictionary (2013) views pragmatism as the quality of dealing with a problem in a sensible way that suits the conditions that really exist, rather than following fixed theories, ideas or rules. It is for this reason that Mackenzie and Knipe (2006) say that pragmatism as a paradigm is not connected to any one system of philosophy or reality. Creswell (2003) states that pragmatism focuses on “what” ? or “how” ?, of the research problem. Tashakkori and Teddie (2003) had earlier stated that pragmatism was seen as providing the underlying philosophical framework for mixed methods research. Biesta (2007) states that pragmatism assists to establish proper relationship between educational research and educational practice. There is usually an assumption that there exists a gap between educational research and practice. It is believed that pragmatism as a research paradigm is in a position to fill that gap**.**

This paradigm is relevant to this study in the sense that the collection and analysis of both quantitative and qualitative data were concurrently done in a single study which was found to be time saving.

3.3 Research Design

The research design for this study is Concurrent Triangulation. The term triangulation in research was first used by Denzil (1978) where triangulation is said to describe bringing together complementary methods or data sources to offset weaknesses in each. Creswell and Clark (2007), Morse (1991) state that in concurrent triangulation, data are collected concurrently in one phase and interpretation involves comparing the results of each to best understand the research question. In this study the concurrent triangulation was used to evaluate the credibility of responses given by the respondents. The questions that were asked in the questionnaire forming the quantitative part of the research were repeated in the qualitative interview section to see if the respondents gave similar responses for both sections. The relevant college documents were analysed to evaluate the credibility of information obtained during interviews. The researcher of this study applied concurrent triangulation because he is in full agreement with the views held by Maura, Elliot and Catherine (2009) that there is no particular method qualitative, quantitative or mixed privileged over any other.

3.4 Research Approach

This study has adopted the mixed-methods approach. It includes both a survey and case study. Creswell (1994) noted that surveys are usually associated with quantitative studies. In this study, questionnaires and structured interviews were used for data collection. The questionnaire data collection was with the intent of generalizing from a sample to a population. The survey tried to elicit information from a limited number of individuals presumed to have the information the study was looking for. It was presumed that the individuals would be willing to communicate. The sampled individuals were intended to be representatives of a larger group.

As a case study, this research assessed a TVET college ‘case’. Furthermore, Creswell (1994) states that case studies are applicable to qualitative studies. The examination of the case was in a structured way. The case study is conducted with

the hope that one will find principles that can be extrapolated to similar cases. Hofstee (2011) advises that extreme caution should be exercised when applying case studies on their own as it is difficult to obtain unbiased results that can be generalised confidently. It is for this reason that they can be successfully used when combined with other techniques as it is the case with this research.

3.5 Population

According to Mouton (2000), a population is defined as a collection of objects, events or individuals having some common characteristics that the researcher is interested in studying. The population of this study consisted of plant production graduates from three colleges, the graduates' employers, plant production lecturers in the three colleges, and plant production subject advisors responsible for these colleges.

3.6 Sample and Sampling Technique

Guarte and Barrios (2006) state that purposive sampling takes place when random selection of sampling units within the segment or a cohort of respondents with the most information is selected. The selected cohort of respondents has the most information on the characteristics of interest. The purposive sampling was applied to the entire cohort of respondents in this study since they were presumed to be having relevant information for the research purpose. The approach of this study was a mixed-method approach, so both probability and non-probability sampling of simple random and purposive sampling methods, respectively, were applied. Simple random sampling for the quantitative part and purposive sampling for the qualitative part were applied. The sample for this study consisted of three TVET colleges, one deep rural, one semi-rural/urban and one urban in terms of geographical location. The reason for this sampling was that it is more representative of the study respondents. A total of 18 people were interviewed. One would have loved to interview more people, but, because of constrains with respect to time, finances and other resources, the numbers were restricted as outlined here: 2 subject advisors engaged by the colleges, 1 lecturer from College A, 3 lecturers from College B, 2 lecturers from College C, 4 graduates from College B

3 graduates from College C and 3 employers

The criteria for selecting subject advisors was that they should be involved in continuous assessment in the Plant Production student performance activities and they were expected to have practical knowledge of agriculture and farming. The lecturers had to be currently employed at college level for the duty of teaching and assessing student performance. The graduates had to have completed their NC (V) training at level 4. The employers had to have as their employees the graduates who had completed NC (V) Level 4 in Primary Agriculture.

Only a sample of selected members of the population were interviewed and tested. The information was inferred about the population without examining every member of the population. This was a non-probability sampling (more specifically, Convenience) sampling. It was convenience to engage respondents that were easily available than using the long-drawn research strategies which might have been time-consuming and expensive.

3.7 Instruments

The research engaging mixed methods is useful in many respects. By 1978, Denzin used the term ‘triangulation’, which is commonly used in navy and military to refer to a combination of methodologies in the study of the same phenomenon. Triangulation can be used to keep in check the possible biases which may exist in data sources, investigator and method. This study has, therefore, used the questionnaires, which are traditionally associated with quantitative research, and interviews, which are traditionally associated with qualitative research. The questions appearing in the questionnaire are repeated as interview questions to keep in check the possible biases which may exist in the data sources, investigator and method. It is the advantage of the mixed methods that the quantitative data can be used to support the qualitative data.

The mixed method approach uses document analysis, questionnaires and interviews for data collection. Questionnaires have their advantages and disadvantages. Milne (1999) outlined some disadvantages, which include that:

- Questionnaires, like many evaluation methods, occur after the event, so participants may forget important issues.
- Questionnaires are standardized, so it is not possible to explain any points in the questions that participants might misinterpret.
- Open-ended questions can generate large amounts of data that can take a long time to process and analyse.
- Respondents may answer superficially especially if the questionnaire takes a long time to complete. (The common mistake of asking too many questions should be avoided.)
- Students may not be willing to answer the questions. They might not wish to reveal the information, or they might think that they will not benefit from responding, perhaps even be penalized for giving their real opinion.

Furthermore, Milne (1999) outlined some advantages of questionnaires, which include that:

- The responses are gathered in a standardized way, so questionnaires are more objective, certainly more so than interviews.
- Generally, it is relatively quick to collect information using a questionnaire. However, in some situations they can take a long time not only to design but also to apply and analyse. Potentially, information can be collected from a large portion of a group. (This potential is not often realized, as returns from questionnaires are usually low.)

The Portsmouth University (2012) outlined the advantages and disadvantages of document analysis.

The advantages were that the documents make it possible to: Access inaccessible subjects, eliminate the 'research effect', access the larger sample size, contain spontaneous data and access confessional style information

The disadvantages were that the documents:

- Can be viewed as too subjective
- Can be time-consuming
- Depend on the role of the researcher
- Can be overt—may affect the situation and thus the validity of findings
- Can be covert—ethical principles may be contravened
- Can allow for high-potential role for conflict for practical researchers

Wyse (2014) outlines some advantages and disadvantages of interviews, which she calls face–to-face data collection. The advantages include the following:

Accurate screening

Face-to-face interviews help with more accurate screening. The individual being interviewed is unable to provide false information during screening questions such as gender, age, or race. It is possible to get around screening questions in online and mobile surveys. The answers the individual provides may all be truthful, but for the purpose of data analysis, the data will be inaccurate and misleading.

Capture of verbal and non-verbal cues

A face-to-face interview is, without a doubt, going to capture verbal cues, but this method also affords the capture of non-verbal cues including body language, which can indicate a level of discomfort with the questions. Conversely, it can also indicate a level of enthusiasm for the topics being discussed in the interview.

Keeping focus

The interviewer is the one who has control over the interview and can keep the interviewee focused and on track until completion.

Capture of emotions and behaviours

Face-to-face interviews can accurately capture an interviewee's emotions and behaviours.

Cost

Cost is a major disadvantage for face-to-face interviews. They require a number of people to conduct the interviews, which means there will be personnel costs.

Quality of data by interviewer

The quality of data you receive will often depend on the ability of the interviewer. Some people have the natural ability to conduct an interview and gather data well.

Some interviewers may also have their own biases that could impact the way they input responses.

Manual data entry

If the interview is administered on paper, the data collected will need to be entered manually, or scanned. A staff of data entry personnel will need to be hired. Additionally, data entry can prolong the analysis process

Limit sample size

The size of the sample is limited to the size of your interviewing staff, the area in which the interviews are conducted, and the number of qualifying respondents within that area. It may be necessary to conduct several interviews over multiple areas, which again can increase costs.

3.7.1 Interviews

Structured interviews were conducted with respondents from the following categories: subject advisors in Plant Production; college lecturers in Plant Production; college graduates in Primary Agriculture, of which Plant Production is a part; and employers of Plant Production graduates.

3.7.2 Observations

It was not possible to conduct observations since the researcher did not have adequate time to establish long-term relations with the respondents. The researcher is of the view that had he tried to observe, the respondents would not have been realistic in their performances. What probably could have happened is that they could have acted out conformities and display what is expected of them than acting out their ‘real selves’.

3.7.3 Questionnaires

The questionnaires were administered to the respondents, who included graduates, lecturers, subject advisors and employers of Plant Production graduates.

Each of the respondents had to respond to a questionnaire that included one or more question relating to the following research sub-questions.

The research sub-questions:

- What opinions in terms of strengths and weaknesses do the plant production graduates from the TVET colleges have on the course that prepared them for employment or entrepreneurship opportunities?
- What opinions in terms of strengths and weaknesses do the employers of plant production graduates from the TVET colleges have on the course that prepared their employees for employment?
- What is the nature of strengths and weaknesses of the subject guidelines for plant production modules for levels 2–4 in terms of level content suitability and optimal content sequence from one level to the next higher level?
- What are the strengths and weaknesses of the curriculum implementation in terms of subject and assessment guidelines for plant production modules for level 2–4 equipping learners with expected outcomes?
- Are there any notable strengths and weaknesses of the implementation of assessment guidelines and how they affect expected outcomes?

3.8 Validity and Reliability of Instruments

Types of Validity

Johnson (1997) outlines three types of validity of research instruments. First, there is Descriptive Validity. This refers to factual accuracy of accounts as reported by a qualitative researcher. Second is Interpretative Validity. This one is based on the notion that the participants' viewpoints, thoughts, intentions and experiences are understood and reported by the qualitative researcher. Third, there is Theoretical Validity. This one is based on the understanding that a theory or theoretical explanation developed from a research study fits the data and is, therefore, credible and defensible. . The first two types of validity were of interest to the researcher and the third one not so much since the researcher had no interest in developing theory.

To validate the research instruments of this research, the instruments were presented to the University of Fort Hare (UFH) Higher Degrees Committee, to the stats unit of the Fort Hare Research Foundation for validation. The data and instruments were also presented to the Alice Fort Hare Research Unit for verification and validation, and, finally, to the study supervisors for content validity.

3.8.1 Reliability and Validity of the Questionnaire

Cooper and Schindler (2006: 214) note that instrumental validity is used to demonstrate the accuracy of a measure or procedure by comparing it with another measure or procedure, which has been demonstrated to be valid. In simple terms, "validity refers to whether an instrument actually measures what it is supposed to measure given the context in which it is applied" (Cooper and Schindler, 2006: 214). In order to confirm the validity of the data collection instruments, a reliability analysis was done to check whether the questionnaire can possibly be used to collect data from similar cases and provide acceptable outcomes. Table 3.1 presents the reliability test of the data collection instrument.

Table 3.1 Reliability test of the questionnaire

Variables	**No. of items**	**Coefficient analysis**
Questionnaire items	24	0.814

The reliability of the scales for the data collection instrument was measured using the Cronbach's alpha coefficient. A coefficient above 0.55 (55%) is desirable. For this research, the Cronbach`s alpha coefficient is 0.814 (81%) indicating that the data collection instrument was appropriate for the continuation of the research.

There is also the question of internal and external validity. When qualitative researchers speak of research, they are usually referring to qualitative research that is plausible, credible, trustworthy and, therefore, defensible. To attain a credible valid study, the low inference descriptors were used to define the participants' accounts and in the researcher's field notes. This was done in a way of recording the accounts *verbatim.* Data triangulation was applied: The questions that were asked in the questionnaires were also asked during the interviews. Reflexivity was also

accommodated: Here the researcher had self-awareness of potential biases and predispositions, as these could possibly affect research processes and conclusions.

Types of reliability

According to Trochim (2008), there are four general classes of reliability estimates. These are Inter–Rater or Inter–Observer reliability, Test–Retest Reliability, Parallel Forms of reliability and Internal Consistency Reliability, and they are defined as follows:

The Inter-Observer Reliability is used to assess the degree to which different observers give consistent estimates of the same phenomenon.

The Test–Retest Reliability is used to assess the consistency of measure from one time to another.

The Parallel–Forms of Reliability is used to assess the consistency of the results of two tests constructed in the same way from the same content domain.

The Internal Consistency Reliability is used to assess the consistency of results across items within a test. This is the type of reliability test that was used for this study.

3.9 Ethical Considerations

References were made to Siber (1982), Merriman (1988), Jefferie (1999), McMillan and Schumacker (2001) and Whittington (2004) on ethical requirements for research. From these references, it was found that the following aspects needed to be complied with: UFH ethical clearance; DHET permission; College Head's permission; Signed "Informed Consent" from each respondent. The anonymity of the respondents was ensured, and they were offered a choice of freedom to participate or not, and continue to participate or withdraw from the study at any time.

3.10 Data Collection Procedure

The Research Experience Itself

Each of the three colleges was visited twice. The first visit was to administer the questionnaires and conduct interviews. These were completed and responded to by the college lecturers, graduates, subject advisors and employers. Questionnaires

were administered face-to-face with the respondents, except for one subject advisor, one employer and three graduates who were contacted telephonically.

The data was collected from the before-outlined categories of respondents using the interviews, questionnaires and analysing documents. In collecting data, the researcher was guided by the guidelines put forward by various researchers. Bulmer and Warwick (1993) noted that in developing countries, there is a commonality that some of the respondents fail to understand the whole idea of social research. The researcher in this study was, throughout the research, aware of the cautions by Bulmer and Warwick (1993) that:

- It becomes a challenge if the respondents are not going to understand the purpose of the research.
- They might fear repression if they don't co-operate.
- If telephones are going to be used, the sampled population should have a telephone or a mobile phone and be willing to answer the phone for the purposes of the interview.

The researcher in this study faced the following challenges:

The distance between provinces

- The distances between the provinces to be researched were a problem. Three provinces that are far apart were visited.

Funding

- Funding the research was a challenge because funds were not readily available and the researcher had to fund from his own pocket for travel, accommodation and meals, and each college had to be visited twice.

Other challenges

- The targeted group, especially one employer, were not as receptive and articulate in their encounter with the researcher, whom they were not familiar with.
- In some cases, the researcher was seen as demanding to know too much, especially with the session on document analysis.

- Some respondents did not have good reporting skills.
- Because of limited time, the researcher did not have enough time to make meaningful observations to couple with interviews.
- Some of the places that needed to be researched were out of reach for the researcher, so the researcher had to phone the respondents.
- Some of the documents might not have been accurate, and sometimes with dubious authenticity.

The research experience was exciting and disappointing at the same time. During the first visit, the excitement was brought about by the experience of visiting different provinces that are outside the researcher's own. The farms and a variety of agricultural enterprises in different provinces were a great source of refreshing experience. The disappointing part, however, was the agriculture and farming facilities in the colleges themselves. The colleges' agriculture facilities are in no way near in quality to the facilities of the surrounding private farms. The situation makes one wonder if the training is effective and relevant enough to teach and guide the advanced and successful farmers in the surrounding farms. Comparing the colleges' and the surrounding farmers' facilities, it gives one some thought that the colleges are not spending enough to be on par with, or even more advanced than the surrounding farming communities.

The first visit to College A was on 11/08/2014. It was at this college where the data collection process started. The college is about 350 km (single trip) from the researcher's hometown. The researcher had already secured an appointment through the office of the college campus head. the researcher left his hometown on 10/08/2014 to put up in Johannesburg, which is about 300km away from my home town. In the morning of 11 August 2014, he proceeded to College A, which is an hour's drive from Johannesburg. Since he did not know the place well, he was met by the college rector in a nearer town who took me to the colleges' Central Office, where he interviewed the college subject advisor who later accompanied me to the campus, which is about 50km from the Central Office, where Plant Production is taught.

On his way to the campus he noticed the college environs of advanced commercial farms. These are mainly hydroponics and cattle feed-producing pastures and some fruit and vegetable-producing farms. Upon arrival at the campus, he was introduced

to the plant production lecturer, with whom he spent about 7 minutes completing the questionnaire, another 20 minutes on the structured questions and another ten minutes or so on the teaching of agriculture in general in the country. He secured an appointment for the second visit with the campus head and discussed what the second visit will entail, specifying the documents that will be required for analysis with the college. Unfortunately, the second appointment was not communicated well to the lecturer.

The first visit to College B was on the 14th August 2014; the college is about 400km (single trip) from his hometown. He had to leave his hometown on 13/08/2014, which is a day before, and put up in Nelspruit the night before to leave the following morning to the college. Driving to the college was a refreshing experience. Driving past the country towns and villages surrounded by foresters and extremely large lands of commercial beef and maize farming was such a wonderful experience. He was assisted by the campus head to secure an appointment, and she assigned the college senior lecturer to assist me, who was of great assistance. The college campus itself is in the township, confined within the township infrastructure, which makes it a great challenge for the college to effectively offer the program as they would have liked to. The senior lecturer was helpful with providing the information for both the first and the second visits. The researcher later met two junior lecturers of the college (individually), and the time spent with the three lecturers was about one and half hours. And we took another two hours with college graduates who had been arranged by the college to meet with him there from their place of the learnership program. This arrangement helped me a great deal, since it would have been a problem to visit students individually in their place of ‘work’. He had to phone the other students who were to be interviewed as graduates from this college. I managed to interview them over the phone. The college had assisted by giving their contact numbers to him

The first visit to College C was on 25th August 2014. I had to make a return trip to this college since it is nearer my hometown, which is 250 km away. The college is in a deep rural, mountainous area. The surroundings are large-scale commercial farms that mainly produce beef and maize. As one drove from a bigger regional town, about 25 km towards the college, one was able to identify a college farm among other farms. This was a refreshing experience which brought some hope and

courage. The acting principal had assisted me secure the appointment since the appointed principal was on leave. He was able to meet with two lecturers who teach Plant Production within the Primary Agriculture program. It took about 30 minutes to complete the questionnaire and interview with each lecturer. He highlighted the need for me to make the second visit and specified what it would entail. They assisted him with the names and contact numbers of their graduates whom I could contact for interviews.

All the second visits to colleges were conducted with the aim of conducting the analysis of documents on the following documents:

- assets, equipment and stock registers
- plant production class attendance registers
- throughput rates and student drop-out rates
- college class attendance policies
- financial course subsidies
- the POEs (portfolios of evidence)
- WBEs (Work-Based Experiences) schedules
- internship programs
- student placement programs
- service level agreements with industry and other sectors of society including government departments

The next chapter will discuss the analysis of data and discuss the findings. Topics covered in the chapter will include quantitative data analysis, which will include the response rate, normality of data, and reliability and validity of instruments. There will be a section dealing with qualitative data analysis, which classifies data into themes, and there is also a part dealing with the document analysis. The last part in the next chapter will be the discussion of findings.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Introduction

The preceding chapter dealt with research methodology, which includes the research paradigm, research approaches, research design and research instruments used during the research. The chapter also addressed the validity and reliability of instruments. It concluded with the data collection procedure. This chapter will discuss matters in the sequence as outlined in the following sections.

4.2 Quantitative Data Analysis

Before the finer details of data analysis were conducted, tables as shown below were constructed from the responses on the closed-ended sections of the questionnaires.

Table 4.1 Primary Agriculture subject advisors' collated questionnaire responses

Subject Advisor	Institution	Question 1	Question 2	Question 3	Question 4
A	College A	3	2	3	2
B	Exams Unit	2	2	2	3

The numbers in Table 4.1 represent responses of the respondents to the questionnaires, wherein 4 means "Strongly Agree", and 1 means "Strongly Disagree".

Table 4.2 Primary Agriculture college lecturers' collated questionnaire responses

Lecturer	College	Question One	Question Two	Question Three	Question Four	Question Five	Question Six
A	A	3	2	3	3	3	4
B	B	3	4	3	2	3	3
C	B	4	4	3	3	3	3
D	B		4	3	2	4	3
LE	C	3	3	3	3	3	2
LF	C	3	3	3	4	3	2

Table 4.3 Primary Agriculture college graduates' collated questionnaire responses

Graduate	College	Question One	Question Two	Question Three	Question Four	Question Five
A	B	3	3	4	3	1
B	B	2	2	3	2	2
C	B	3	3	3	3	3
D	B	4	3	4	3	2
E	C	4	3	3	2	2
F	C	3	3	3	2	2
G	C	3	4	3	2	2

Table 4.4 Primary Agriculture graduate employers' collated responses

Employer	Employed graduate from College	Question One	Question Two	Question Three	Question Four	Question Five
A	B	2	2	4	2	2
B	C	4	4	3	2	2
C	B	2	2	1	1	1

4.2.1 Response Rate

The response rate for the survey was 18; this figure was arrived at by comparing the number of respondents who provided feedback during the research. As suggested by Babbie and Mouton (2010), in order to continue with the analysis and interpretation of data, the response rate should be above 50%. This is done in order to ensure validity and reliability of the data. If the response rate is below 50%, the results will not be trusted to be a true representation of the outcomes of the subject of investigation. For the purpose of this study, the response rate was acceptable to allow the researcher to continue with data analysis and interpretation and to make conclusions. Table 4.5 presents the response rate.

Table 4.5 Response rate

Expected number of responses	**Number of actual responses**	**Response rate (%)**
18	18	100 %
Response Rate		**100 %**

Table 4.5 above presents the response rate as 100%. The response rate was calculated as the total number of actual responses received as a percentage of the total number of number of expected responses.

4.2.2 Normality of the Data

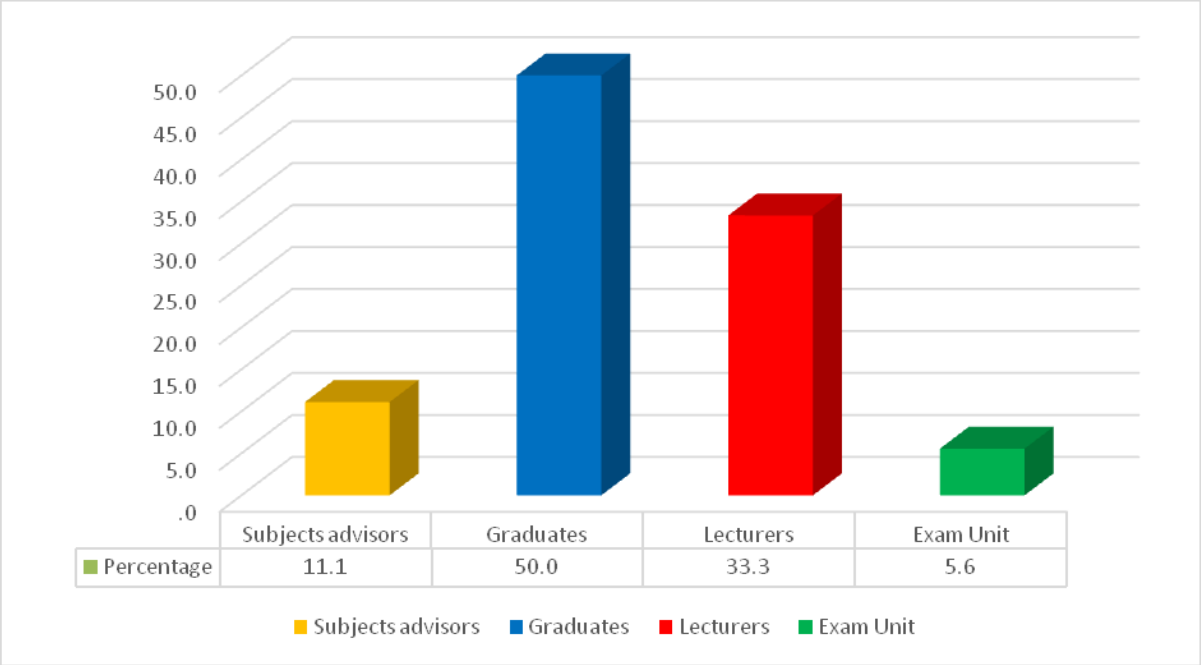
Coakes (2005: 35) asserts that “every research should ensure that the data is normally distributed before conducting a statistical analysis”. In order to check whether the data is normally distributed, Coakes suggests that the Shapiro-Wilks test be done for a sample size less than one hundred (100) respondents. Otherwise, if the data is from a sample size equal to or greater than 100, Kolmogorov-Smirnov test (KMO) test is applicable (Coakes, 2005: 35). For this research, the sample size was eighteen (18); hence, the Shapiro-Wilks test was used to test the normality of the data.

In addition, Coakes (2005: 35) states: “The normality of data is assumed when the significance level is greater than 0.05.” The significance of the Shapiro-Wilks test for this data was greater than 0.05, suggesting that all the variables of the data points were normally distributed.

4.2.3 Demographic Profiles of Respondents

Demographic assessment of respondents was meant to establish the distribution of demographic information in terms of occupation, work environment and level of study. The purpose of this section was to establish variations in respondents` perceptions of plant production training across those demographic groupings. Figure below presents the distribution of respondents’ profiles.

Figure 4.1 Respondent profiles.



The majority of respondents (50%) were graduates from different colleges. Lecturers and subject advisors contributed about 44% of respondents.

4.3 Qualitative Data Analysis

4.3.1 Thematic Classification of Data

The information was analysed using the thematic approach through categorization and coding. Ezzy (2002) is of the view that qualitative data analysis is an interpretive task. Interpretations are not found but are made and actively constructed through the social process. As a researcher, the researcher interacted with respondents conducting interviews. Gretchen (2003) sees analysing and interpreting qualitative data as a process of deep immersion in the interview transcripts when data are organized into chunks (analysis) and a meaning is brought to these chunks (interpretation). Data analysis, which begins at the same time as the study, is a process of sorting, categorizing, grouping and regrouping the data into piles of chunks that are meaningful (Gall & Borg, 1989)

Gall and Borg (1989) state that different forms of data and the themes that might emerge, based on the research questions asked, are combined with the literature survey through a process of triangulation. This means that the different

methodological perspectives complement each other with the resultant elimination of weaknesses and oversights. The same approach was adopted in this study to improve the reliability.

4.3.2 Steps for Consideration in Qualitative Data Analysis

When conducting this research, the guide by Terr (2008) was followed. Terr suggested the following five specific steps that should be considered in data analysis:

Step 1: Familiarization and immersion

By the time the data collection stage comes to an end, data analysis should already be underway. The researcher has to read text many times over. By the time one finishes reading the data, one should know roughly what kinds of things can be found.

Step 2: Inducing themes

Here the researcher tries to work out what natural organizing pattern can be identified from the material. The researcher tries to use the language of the respondents to label the categories. In categorizing data, the researcher also thinks in terms of processes, functions, tensions and contradictions rather than merely summarizing content. The researcher must formulate a reasonably small number of themes.

Step 3: Coding

During the process of developing themes, coding can also take place. This involves marking different sections of data as relevant to the established themes. Sometimes pieces of information might be physically cut and be pasted under the categories to which they belong.

Step 4: Elaboration

There is usually a need to re-examine the themes, and this process is called elaboration. Slight differences emerge during the process of elaboration. This also becomes the opportunity to revise the coding system.

Step 5: Interpretation and checking

Here the account of the studied phenomenon is written down. The guide is the categories or themes that had been established earlier on.

During the process of data collection themes were established and data of similar or related essence was grouped together. The data was organized into chunks (analysis), and simultaneously the meaning began to emerge (interpretation). The analysis began and progresses at the same time as the study. The information below was analysed using the thematic approach through categorization and coding.

4.3.3 Collated Subject Advisors' Responses Relating to the Practical Work

The sub research question below led to the responses by the subject advisors and lecturers.

What is the nature of strengths and weaknesses of the subject guidelines for plant production modules from level 2 to 4, in terms of content level suitability and optimum content sequence from one level to the next level to equip learners with expected outcomes?

Research sub-question on the 'Practical Work' theme

Both subject advisors expressed a concern about students lacking exposure to practical work.

Research sub-question: Are there any notable strengths and weaknesses of the implementation of assessment guidelines and how they affect the achievement of expected outcomes?

Subject advisor A from College A

First statement:

"The possible practical facilities are far away. This situation leads to students missing out on other subjects because the distance that has to be travelled makes it impossible for students to attend other subjects on the day...this situation can be avoided by having a college farm attached to the college."

Second statement:

"The possible practical facilities are far away. You see, here we combine some classes; for example, maths students are combined with students in hospitality studies and in agriculture. When the agricultural students have to go for practical work on the farm far way, other students have to wait for the agriculture group or continue without them. This arrangement is a disadvantage. The college has no farming land of its own and we use church land and we cannot do all practicals on that land alone. The church land is about 9km from the college and travelling takes its own time. Sometimes we arrange with commercial farmers for students to experience valuable exposure there, but what do farmers get in return? Nothing."

The situation above can be avoided by establishing a sound agricultural facility. It is clear that in most cases, colleges and the farming communities do not have a well-established working arrangement, which is something colleges have to look into if, as yet, they cannot establish farms of their own.

Subject advisor B from National Exams

First statement:

"The knowledge is not adequate. In most cases, colleges lack resources for practical work. The plant production program is expensive and requires adequate resources."

Second statement:

"No, as I have already stated, there is a lack of adequate and in-depth knowledge amongst most lecturers and the scarce resources; hence, the difficulty in proper implementation of the course content."

4.3.4 Collated college lecturers' responses relating to the practical work

Common theme: 'Practical work'

Like the subject advisors, lecturers expressed concern about students lacking exposure to practical work.

Lecturer A from College A

First statement:

"...the disadvantage is that there is no farming equipment."

Second statement"

"The disadvantage is the lack of equipment for practical work. Because of the lack of land, we are accommodated by the willing farmers for some of the practical work."

Lecturer B from College B

First statement:

"Students at level 2 do not have that much of practical work. Poor infrastructure at the college delays the expected outcomes among students."

Second statement:

"Yes, Level 4s; we have ±10 students taken by college. Private firms are not as interested. There is a challenge with the internships. There is shortage of equipment. Students are deprived of the practical experience. We do not have pack houses, dispatch houses, laboratories, and greenhouses. The one we have does not have fans for regulating temperature."

Lecturer C from College B

First statement:

"The practical part is the problem. We do not have enough equipment and implements. We have the WBE (work-based education) students have to work for 10 days during the holidays."

Lecturer E from College C

"Practical's are our strength because of the college farm. In addition to our farm, we have a good partnership with a local agricultural and hotel high school."

As stated and seen above (from the asset and stock registers at College C), the situation is comparatively better and the college has its own farm where the practical work is conducted.

Lecturer F from College C

"It does. The college has a farm where students do practicals. The farm is big enough and has some necessary big equipment. We have three tractors and harrows. What we do not have…like big combine harvesters we hire. We plant maize, sunflower and oats."

As stated above, at college C the situation is comparatively better, although there is a concern by both graduates and the lecturers on the need for advanced farming equipment, which is a requirement to meet the growing needs of advanced farming required in the world of entrepreneurship.

4.3.5 Collated Graduate Responses Relating to the Practical Work

The sub research question below led to the responses by the plant production graduates.

What opinions in terms of strengths and weaknesses do the plant production graduates from the TVET colleges have on the course which prepared them for employment or entrepreneurship opportunities?

Common theme: 'Practical work'

Like subject advisors and lecturers, graduates expressed a concern about them lacking adequate exposure to practical work

Research sub-question: What are the strengths and weaknesses of the curriculum implementation in terms of subject and assessment guidelines for plant production modules from level 2 to 4 equipping learners with expected outcomes?

Graduate A from College B

First statement:

"Yes, but the use of chemicals is problematic. We do theory only and there are no practicals"

Second statement:

"Yes, I can go to the field, but I need some training in using major equipment which the college does not have."

Third statement:

"The lecturers are good. The problem is the equipment. Teaching is 100% good; the problem is the practical work."

Fourth statement

"Practicals are a weakness."

Graduate B from College B

'Students require the practicals"

Graduate C from College B

"No practical skill relating to big equipment."

Graduate D from College B

"Yes, training was adequate. It is in agro-chemicals where we need more training and more practical's I am not confident when it comes to agro-chemicals. One still needs exposure in the agro-chemicals."

Graduate E from College C

First statement:

"There are no major weaknesses. The problem is that the chemicals for treating pests and plant diseases are not easily obtainable at the college. One has to move from that person to the next before one is able to get these chemicals."

Second statement

"If there can be more practical's, since plant production and agriculture in general are practical subjects. If, for example, they can divide a year into two, ½ year for practical work and ½ year for theoretical work, this should apply to all the levels."

Graduate F from College C

"They should include more practical's and more plant facilities like greenhouses and hydroponics for students to be able to control temperature." Note: Even students at the college where there is a farm feel advanced practical work like greenhouses should be added.

Graduate G from College C

First statement:

"Yes, I was trained, but I think the college should do more to train students for entrepreneurship. For example, they should include in the curriculum hydroponics, greenhouses and nurseries with controlled temperatures, because these you find in the world of entrepreneurship. More advanced practicals are needed."

Second statement:

"It is practical's. We did a lot of practicals, but, like I have indicated, they need to add some more projects to the practicals."

4.3.6 Employer Responses Relating to the Practical Work

Common theme: 'Practical work'

Employers, like all the respondents mentioned above, expressed concern about students lacking exposure to adequate practical work

Research sub-question: What opinions in terms of strengths and weaknesses do the employers of plant production graduates from the TVET colleges have on the course that prepared their employees for employment?

Responses by Employer A

"The material is adequate to educate learners and make them fit for the industry. But I am worried by the practical part.

No, the practical aspect is behind.

Practical. Students are not ready as employees. They are not committed to what they are doing. They might not be fully motivated to work in agriculture. Maybe they are confused."

Responses by Employer B

"Relating to theory, they are very good. What needs to happen is that they be exposed to more practical work. Like in the old system of teaching, students should do practical work while still in training. Previously, the college did not have its place

of conducting practicals. Now they have the farm of their own. Students there should write practical tests.

Practical part: this is what is lacking."

Reponses by Employer C

"Yes. She is adequate; she wants to do more. She still needs more knowledge on the technical side. More knowledge on the practical side is required.

The shortcomings are in the course product knowledge, like in the fertiliser field knowledge.

More training is required in the chemical area. The graduates have a general idea, like at school a child is given a total picture but has to colour in to give a total meaning. These graduates have a general idea of the scheme of things but lack detailed practical knowledge."

4.4 Document Analysis

Research sub-question**:** Are there any notable strengths and weaknesses of the implementation of assessment guidelines and how they affect the achievement of expected outcomes?

All the second visits to colleges were conducted with the aim of conducting the analysis of documents on the following

- assets, equipment and stock registers
- plant production class attendance registers
- through put rates and student 'dropout rate'
- college class attendance policies
- financial course subsidies
- the POEs (portfolios of evidence)
- examine WBEs (Work-Based Experiences) schedules
- internship programs
- student placement programs
- service level agreements with industry and other sectors of society including government departments

4.4.1 Document Analysis at College A

The second visit to College A was undertaken on the 6th November 2014. Unfortunately, upon arrival Lecturer A who would have assisted was attending a course somewhere, and I was assisted by admin staff members, which was not a major problem since this section is mainly admin. The outstanding sections were completed and verified through email and phone with the lecturer concerned.

4.4.1.1 Subject Policy Guidelines

Further education and training: A guide to opportunities for further learning, 3rd Edition, revised and updated (Prescripts by the Department of Higher Education and Training

The above-mentioned document prescribes that for South African TVET colleges to be able to train students properly in the Plant Production course, they need to offer training in the methods outlined below:

- Presentations (practical work, observation, role-play, self-initiated activity, judging the quality of farm produce. and evaluation)
- Field tests and research in a structured environment

In order for the above practical assessments and implementation to take place, the following should be available:

General agricultural facilities

- Established pastures
- Irrigation
- Farm tools and agro-chemicals
- Seedling nursery (vegetables, trees and shrubs)
- Water reticulation

Vehicles

- 1 tonne pickup and a canopy
- 1 medium-sized tractor
- 1 minibus for transporting learners
- Tractor trailer and implements

Fencing

- External security fence: 2 km
- Internal fence: 1.6 km

Miscellaneous

- Laboratory with equipment for plant and soil science
- Laboratory with equipment for animal and poultry science
- Teaching aids (data projectors, screen, DVD player, etc.)
- Computers with internet links
- Library with relevant books and magazines

4.4.1.2 Factors Contributing to Achieving the Agribusiness Learning Outcomes

- Enabling environment: This subject should be presented in the context of small, medium and micro enterprises (SMMEs), emerging small-scale farmers and personal needs.

- Resources: Students should have access to all the necessary resources needed for the chosen practical activities at hand.

- Experiential exposure: Students should be exposed to real work and simulated work environments.

- Suitably qualified lecturers: Lecturers should have a solid command of subject knowledge and skills and be well informed about legislation, community issues and accessing support systems; for example, systems provided by the Department of Agriculture.

4.4.1.3 Average Class Attendance of the NC (V) Plant Production Students from January to November 2014 at College A

College A Level 2 Average Class attendance in January–November 2014

±50% of students attended 80–100% of their classes

±35% of students attended about 60–70% of their classes

±15% of students attended less than 60% of their classes

College A Level 3 Average Class attendance in January–November 2014

±90% of students attended 80–100% of their classes

±10% of students attended about 60–70% of their classes

±0% of students attended less than 60% of their classes

College A Level 4 Average Class attendance in January–November 2014

±100% of students at this level have attended classes between 80–100% *

±0% of students attend about 60%–70% of their classes

±0% of students attend less than 60% of their classes

Table 4.6 Student throughput and drop-out rates at College A

Year	Level 2	Level 3	Level 4
2012	17	00	00
2013	16	07	00
2014	21	09	06

4.4.1.4 College Class Attendance Policy (Based on the Attendance and Punctuality Policy by the DHET)

Among other things stated in the policy are that the department expects public Further Education and Training TVET colleges must set and enforce, and our students must comply with, high levels of attendance and punctuality to improve students' chances for success and prepare them for the professional culture of the workplace.

The expectation is for students to be 100% 'present' in all scheduled classes. The focus is on 'presence' rather than absence. Students should know their own attendance levels, and the regular review and reporting of attendance must be part of the student monitoring process.

FET college principals must ensure that all classes are delivered and students have the opportunity to attend all classes.

Expectations of college staff and students

Quality improvement is the responsibility of college lecturers as well as programme managers. The actions required by college staff and students to improve attendance and punctuality are specified below.

College staff is expected to:

- Communicate clearly the department's expectations that students are to be present in 100% of classes and to arrive before the start of class, ready to learn. It is recommended that students sign a code of conduct document, which includes a commitment to attend classes and be punctual, at the start of the academic year.
- Consistently reinforce the message that poor attendance or lateness is not acceptable and where it falls below an agreed level, this will lead to action, including possible disciplinary action, cancellation of entry to a final examination or even exclusion.
- Provide students with clear instructions on how to communicate their intended absence.
- Accurately and fully complete each class register by the end of each session. Ensure that when a student returns, they complete a Student Absence Form to be signed by the lecturer, processed and filed with the class register. Attendance should only be 'authorized' for absences agreed in advance or for exceptional personal circumstances. Sickness without a medical/registered traditional healer's certificate is not authorized but must be marked as sickness on the Student Absence Form.
- Engage any student who arrives 10 minutes after the stipulated starting time of the class and record this student on the attendance register as being late, and follow this up with the student after the class has ended. Lateness must be recorded in the register with an 'L'. Late students should not be excluded from the class unless it affects health and safety or disrupts the class.
- Ensure that attendance and lateness is monitored weekly by a specific member of the college staff, and the guidelines given below are followed.
    - Openly and regularly discuss the trends in attendance and lateness levels of a group or individual students in class sessions.
    - Directly address issues of attendance and punctuality in individual progress reviews, and set and monitor targets for improvement.

- Regularly obtain attendance reports for each group and discuss trends and concerns with other lecturers, and program and academic managers.

Students are expected to:

- Ensure that they attend all classes and arrive before the start of the class properly equipped and prepared to participate in the session.
- Inform their lecturer in person, or by an agreed contact route, before the start of class if they have genuine reasons for lateness or absence.
- Understand the expectations of attendance, the levels at which follow-up action will happen and what the consequences will be.
- Always schedule medical and other appointments out of college hours, if possible.
- Not take on work commitments that clash with scheduled class times at the college. Any absence for work will constitute unauthorized absence.
- Commit to complete outstanding work as homework from classes missed due to lateness or absence.

Examinations

A student shall be allowed to write the examination for every subject for which he/she has attained a minimum of 80% attendance (including authorised absence and sickness) per subject.

National Student Financial Aid Scheme (NSFAS) payments

In terms of the department's FET College Bursary Guidelines, the disbursement of tuition, travel and accommodation allowances is intended to promote student attendance and ensure student academic performance. Paragraph 17 of the guideline states: "Allowances must be disbursed in tranches after thorough analysis of student attendance."

NSFAS tuition, travel and accommodation disbursements can only be made to students if they have a minimum of 80% attendance (including authorised absence and sickness) for classes.

Table 4.7 Primary agriculture training cost

Year	Total Training Cost	80% (State Subsidy)	20% (Student Payment)
2013	R78 004	R62 403	R15 601
2014	R84 482	R67 585	R16 896
2015	R90 312	R72 250	R18 062
Total	R252 798	R202 238	R50 559

4.4.1.5 Miscellaneous College Documents

The POEs (portfolios of evidence): Available
Examine WBEs (Work-Based Experiences) schedules: Not available

Career guidance: Not available

Career exhibitions: Not available

Student tracking systems: Work in progress

Internship and student placement programs: Not formalised yet

Service level agreements with industry and other sectors of society including government departments**:** Not formalised yet

Table 4.8 Assets, equipment and stock registers at College A

Equipment	**Availability/Unavailability**
1. Established pastures	Not available
2. Irrigation	Not available
3. Farm tools and agro-chemicals: ▪ Wheel barrow ▪ Knapsacks ▪ Mower ▪ Spades	 Available Available Available Available

▪ Forks ▪ Farm shed	Available Available
4. Seedling nursery ▪ Vegetables ▪ Trees ▪ Shrubs	 Available Not available Not available
5. Water reticulation ▪ To paddocks ▪ Livestock units	 Not available Not available
6. Vehicles ▪ 1 ton pickup and a canopy ▪ Medium-sized tractor ▪ Minibus for transporting students ▪ Tractor and trailer ▪ Implements: Ploughs, harrows, planters, combine harvesters, bailers	 Not available Available Not available Available Some available, some not
7. Fencing ▪ External fences: 2 km ▪ Internal fences: 1.6 km	 Not available Not available
8. Miscellaneous ▪ Laboratory with equipment for plant and soil science.	 Available (partially)

9. Teaching aids ▪ Data projectors and screens ▪ DVD players ▪ Computer with internet links	 Available Not available Not available
10. Library with relevant books and magazines	Not available

4.5.1 Document Analysis at College B

4.5.1.1 Subject policy guidelines

This is the same as for College A; it is the same for all the colleges and is provided by the DHET.

4.5.1.2 Factors that contribute to achieving Agribusiness learning outcomes

This is the same as for College A; it is the same for all the colleges and is provided by the DHET.

4.5.1.3 Class attendance registers of the NC (V) Plant Production students between January and November 2014 at College B (Average class attendance in Jan–Nov 2014)

College B Level 2 Average Class attendance in January–November 2014

±10% of students attended 80–100% of their classes

±15% of students attended about 60–70% of their classes

±65% of students attended less than 60% of their classes

College B Level 3 Average Class attendance in January–November 2014

±30% of students attended 80–100% of their classes

±35% of students attended about 60–70% of their classes

±35% of students attended less than 60% of their classes

College B Level 4 Average Class attendance in January–November 2014

±20% of students at this level have attended classes between 80–100% *

±40% of students attend about 60%–70% of their classes

±40% of students attend less than 60% of their classes

***** Note: At College B, the attendance is very poor at the senior level: Level 4

Table 4.9 Student throughput and drop-out rates at College B

Year	Level 2	Level 3	Level 4
2012	138	42	38
2013	253	65	26
2014	390	90	50

Table 4.10 Primary agriculture training cost

Year	Total Training Cost	80% (State Subsidy)	20% (Student Payment)
2013	R78 004	R62 403	R15 601
2014	R84 482	R67 585	R16 896
2015	R90 312	R72 250	R18 062
Total	R252 798	R202 238	R50 559

4.5.1.4 College class attendance policy

This is the same as for College A; it is the same for all the colleges and is provided by the DHET.

4.5.1.5 Miscellaneous college documents

POEs (portfolios of evidence): Available
WBEs (Work-Based Experiences) schedules: Available

Career guidance: Not available

Career exhibitions: Not available

Student tracking systems: Not formalised

Internship programs: Available

Student placement programs: Available

Service level agreements with industry and other sectors of society including government departments: Available

Table 4.11 Assets, equipment and stock registers at College B

Equipment	**Availability/Unavailability**
1. Established pastures	Not available
2. Irrigation	Not available
3. Farm tools and agro chemicals. ▪ Wheel barrow ▪ Knapsacks ▪ Mower ▪ Spades ▪ Forks ▪ Farm shed	Available Available Available Available Available Available Not available
4. Seedling nursery ▪ Vegetables ▪ Trees	 Available Not available

▪ Shrubs	Not available
5. Water reticulation ▪ To paddocks ▪ Livestock units	 Not available Not available
6. Vehicles ▪ 1 ton pickup and canopy ▪ Medium size tractor ▪ Minibus for transporting students ▪ Tractor trailer 7.Farming Implements • Ploughs • Harrows • Planters • Combine harvesters • Bailers • Boom sprayer	 ▪ Available ▪ Available ▪ Not available ▪ Available • Available • Available • Not available • Not available • Not available • Not available
8. Fencing ▪ External fences: 2 km ▪ Internal fences: 1.6 km	 Not available Not available
9. Miscellaneous ▪ Laboratory with equipment for plant	 Not available

and soil science.	
10. Teaching aids ▪ Data projectors and screens ▪ DVD players ▪ Computer with internet links ▪ 11. Library with relevant books and magazines	 Available Available Available Not available

4.6.1 Document Analysis at College C

4.6.1.1 Subject policy guidelines

This is the same as for College A; it is the same for all the colleges and is provided by the DHET.

4.6.1.2 Factors that contribute to achieving Agribusiness learning outcomes

This is the same as for College A; it is the same for all the colleges and is provided by the DHET.

4.6.1.3 Average class attendance registers of the NC (V) Plant Production students from January to November 2014 at College C

College C Level 2 Average Class attendance in January–November 2014

±10% of students attended 80–100% of their classes

±40% of students attended about 60–70% of their classes

±50% of students attended less than 60% of their classes

College C Level 3 Average Class attendance in January–November 2014

±15% of students attended 80–100% of their classes

±60% of students attended about 60–70% of their classes

±25% of students attended less than 60% of their classes

College C Level 4 Average Class attendances in January–November 2014

All students at this level attended 80–100% of their classes.

Table 4.12 Student throughput and drop-out rates at College C

Year	Level 2	Level 3	Level 4
2012	166	30	23
2013	166	23	16
2014	200	56	11

Table 4.13 Primary agriculture training cost

Year	Total Training Cost	80% (State Subsidy)	20% (Student Payment)
2013	R78 004	R62 403	R15 601
2014	R84 482	R67 585	R16 896
2015	R90 312	R72 250	R18 062
Total	R252 798	R202 238	R50 559

4.6.1.4 College class attendance policy

This is the same as for College A; it is the same for all the colleges and is provided by the DHET.

4.6.1.5 Miscellaneous documents examined at the colleges

POEs (portfolios of evidence): Available
WBEs (Work-Based Experiences) schedules: Available

Career guidance: Not available

Career exhibitions: Not available

Student tracking systems: Not available

Internship programs: Work in progress

Student placement programs: Not available

Service level agreements with industry and other sectors of society including government departments: Work in progress

Table 4.14 Assets, equipment and stock registers at College C

Equipment	**Availability / non availability**
1. Established pastures	Available
2. Irrigation	Available
3. Farm tools and agro chemicals. ▪ Wheel barrow ▪ Knapsacks ▪ Mower ▪ Spades ▪ Forks ▪ Farm shed	 Available Available Available Available Available Available
4. Seedling nursery ▪ Vegetables ▪ Trees ▪ Shrubs	 Available Not available Not available
5. Water reticulation ▪ To paddocks ▪ Livestock units	 Available Available

6. Vehicles ▪ 1 ton pickup and canopy ▪ Medium size tractor ▪ Minibus for transporting students ▪ Tractor trailer	 Available Available Available Available
7. Farming Implements • Ploughs • Harrows • Planters • Combine harvesters • Bailers • Boom sprayer	 Available Available Available Available Available Available
8. Fencing ▪ External fences: 2 km ▪ Internal fences: 1.6 km	 Available Available
9. Miscellaneous ▪ Laboratory with equipment for plant and soil science.	 Not available
10. Teaching ads ▪ Data projectors and screens ▪ DVD players ▪ Computer with internet links	 Available Available Available
11. Library with relevant books and magazines	Not available

4.7 Quantitative Data Interpretation

Research sub-question determining the perceptions of employers:

What opinions in terms of strengths and weaknesses do the employers of plant production graduates from the TVET colleges have on the course that prepared their employees for employment?

Research sub-question determining the perceptions of students:

What opinions in terms of strengths and weaknesses do the plant production graduates from the TVET colleges have on the course that prepared them for employment or entrepreneurship opportunities?

Research sub-question determining the perceptions of lecturers:

What are the strengths and weaknesses of the curriculum implementation in terms of subject and assessment guidelines for plant production modules for levels 2–4 equipping learners with expected outcomes?

Research sub-questions determining the perceptions of subject advisors:

What is the nature of strengths and weaknesses of the subject guidelines for plant production modules for levels 2–4 in terms of content level suitability and optimum content sequence from one level to the next higher level to equip learners with expected outcomes?

Table 4.15 Perceptions of respondents on the Plant Production course

Employers		
Variable	**Mean**	**St-Dev**
Weaknesses of plant production course content based on your experience with graduates	3.33	0.577
Recommend changes to be made for the improvement of the training course	3.33	0.577
Course content offered by college relevant to the needs of your agricultural industry.	2.67	0.577
Strong feature of the course content that was taught to the graduates	2.67	0.577
Graduates produced by the FET college are adequately trained for your production needs.	2.33	1.528
Graduates		
Variable	**Mean**	**St-Dev**
The plant production training is a very strong and relevant program.	3.29	0.488
NC (V) Plant Production course for levels 2–4 prepared you adequately for employment.	3.14	0.69
Based on the training, do you feel you are ready to engage in the business world as an entrepreneur?	3	0.577
Consider as the weaknesses of the training program	2.43	0.535
There is a lot lacking in the plant production curriculum content; consider review.	2	0.577
Lecturers		
Variable	**Mean**	**St-Dev**

The plant production subject guidelines are appropriate and relevant for each of the training levels 1 and 2.	3.33	0.516
The subject guidelines and course content articulate well from one level to the next, and there is synergy.	3.33	0.816
The course content and subject guidelines for each level have notable strengths.	3.17	0.408
The course content does equip the learners at each level with expected outcomes	3	0
The course content at all levels does prepare students for employability and entrepreneurship.	2.83	0.753
There are remarkable weaknesses of the course content and subject guidelines at each level.	2.83	0.753
Subject Advisors		
Variable	**Mean**	**St-Dev**
The NC (V) levels 2 to 4 assessment guidelines are implemented correctly.	2.5	0.707
There are identifiable strengths in the implementation of assessment guidelines.	2.5	0.707
There are glaring and identifiable weaknesses in the implementation of the assessment guidelines.	2.5	0.707
The course content is at all levels implemented correctly.	2	0

From Table 4.15, lecturers, employers and students are of the opinion that the plant production training programme provides the basics for students to participate in the field. This is indicated by higher mean scores in each group of respondents. Subject advisors are still sceptical of the content of the plant production course. However, when lecturers, employers and students reflect on their support of the state of the plant production course, their mean scores are slightly the above average of 2.5,

meaning that there is need to improve the course content to improve the competencies of graduates.

Employers

Question 1: Is the course content offered by the college relevant to the needs of your agricultural industry?

This theme was brought about by the following research sub-question: *What opinions in terms of strengths and weaknesses do the employers have on the course that prepared their employers for employment?*

This question sought to establish whether the employers are satisfied by the quality of the college graduates based on the content of the course offered by the college. This is very important to know since the competencies of the graduates in the field of work is determined by how much knowledge they acquired from the college that is relevant to the field of work. Accordingly, Table 4.16 and Figure 4.2 present the employers' feelings about the course content.

Table 4.16 Course content meets agricultural industry needs

	Percent	**Cumulative Percent**
Agree	33.3	33.3
Disagree	66.7	**100.0**
Total	**100.0**	

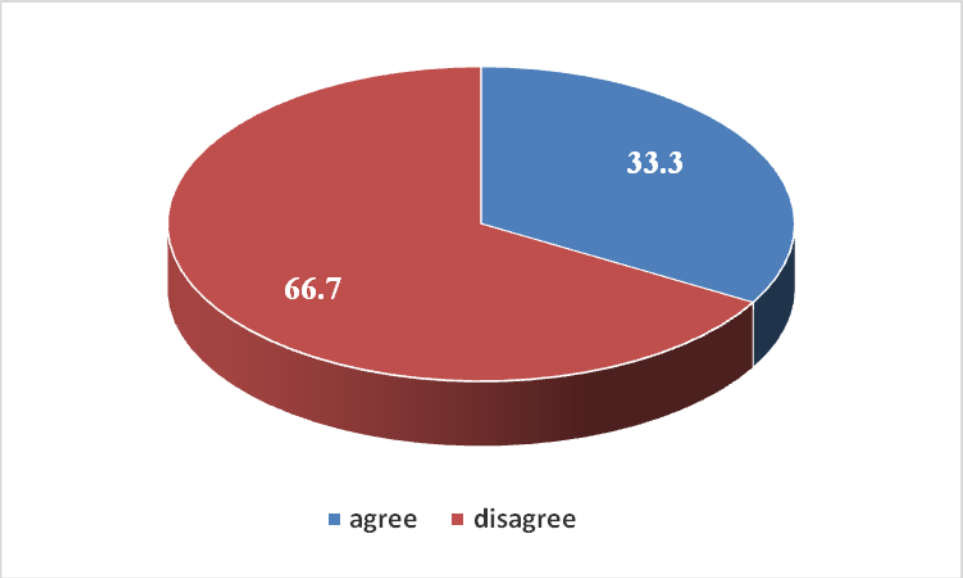


Figure 4. 2 Course content meets agricultural industry needs.

Table 4.17 Graduates produced by the TVET colleges adequately trained for employers' production needs

Graduates produced by the TVET colleges are adequately trained for employers' production needs		Valid Percent	Cumulative Percent
Response	Strongly agree	33.3	33.3
	Agree	33.3	66.7
	Strongly disagree	33.3	100.0
	Total	100.0	

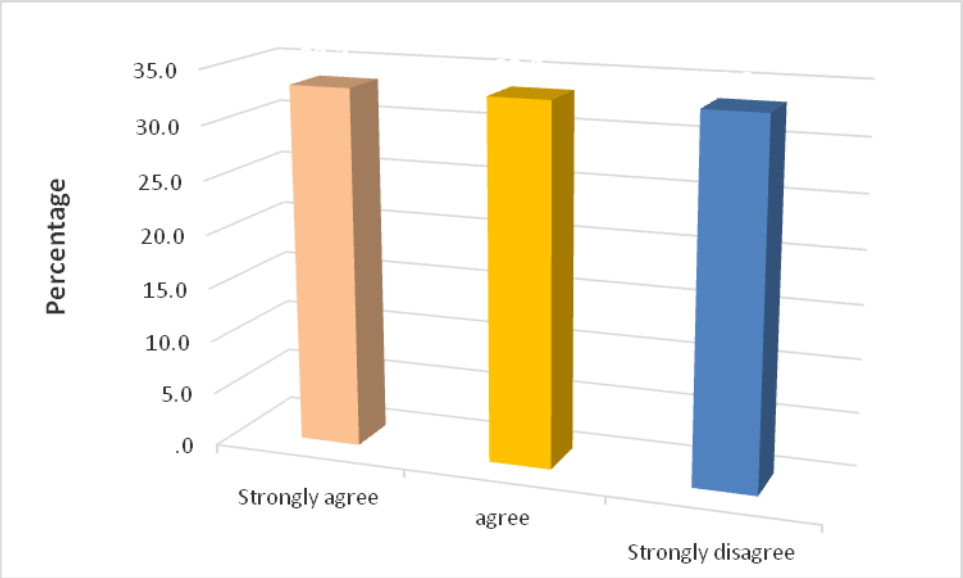


Figure 4.3 Views of employers on the quality of training offered to Graduates by the TVET colleges

Table 4.16 was brought about by the research sub-question that sought to establish whether there were any weaknesses of plant production course content based on the employers' experience with the graduates.

The research sub-question: What opinions in terms of strengths and weaknesses do the employers of plant production graduates from the TVET colleges have on the course that prepared their employees for employment?

Table 4.18 Weaknesses of the plant production course content based on employers' experience with the graduates

Weaknesses of plant production course content based on your experience with graduates			
		Valid Percent	Cumulative Percent
Valid	Disagree	66.7	66.7
	Strongly disagree	33.3	100.0
	Total	100.0	

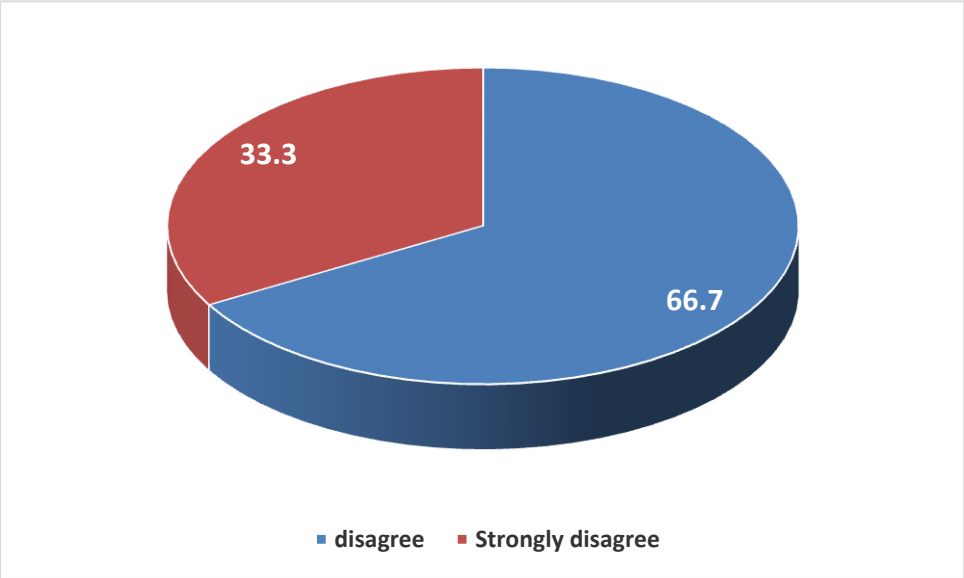


Figure 4.4 Responses concerning weaknesses of the course content.

Table 4.19 Recommended changes to be made for the improvement of the training course

		Valid Percent	Cumulative Percent
Valid	Disagree	66.7	66.7
	Strongly disagree	33.3	100.0
	Total	100.0	

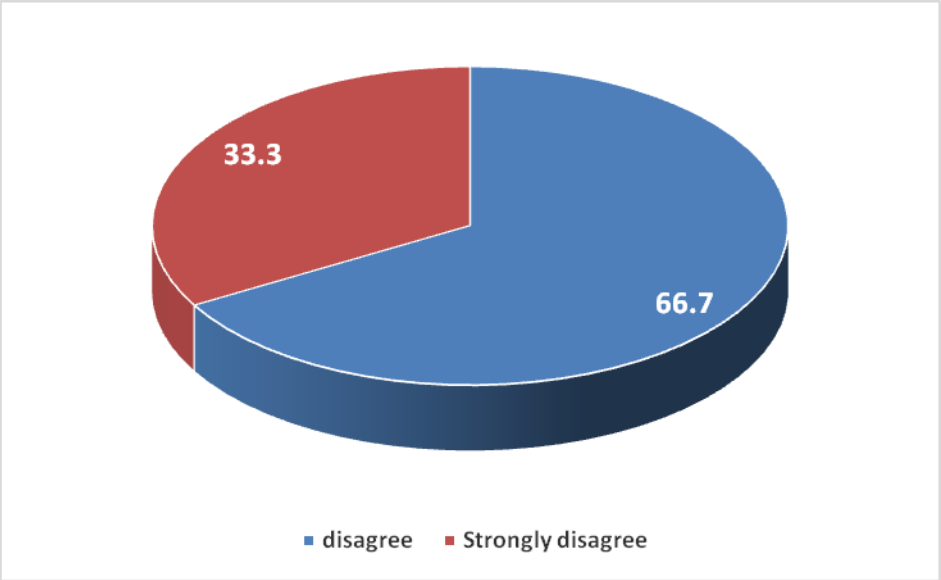


Figure 4.5 Percentage of those who 'Disagree'

Graduates

Table 4.20 Understanding whether the Plant Production course from levels 2 to 4 prepared graduates adequately for employment

Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?			
		Valid Percent	Cumulative Percent
Valid	Disagree	14.3	14.3
	Agree	57.1	71.4
	Strongly Agree	28.6	100.0
	Total	100.0	

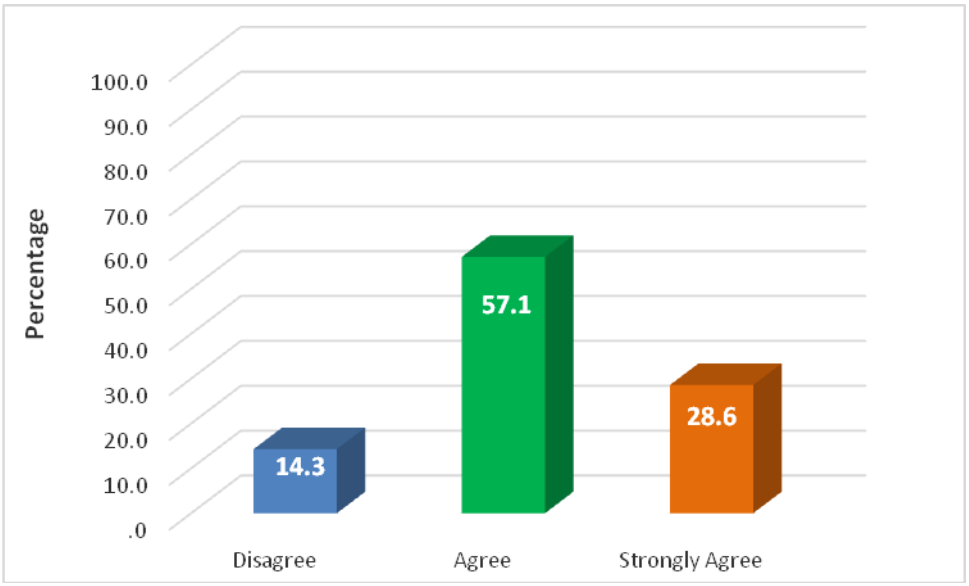


Figure 4. 6 Responses to whether the course prepared graduates for employment.

Table 4.21 Graduates' preparedness for entrepreneurship

Based on the training, do you feel you are ready to engage in the business world as an entrepreneur?			
		Valid Percent	Cumulative Percent
Valid	Disagree	14.3	14.3
	Agree	71.4	85.7
	Strongly Agree	14.3	100.0
	Total	100.0	

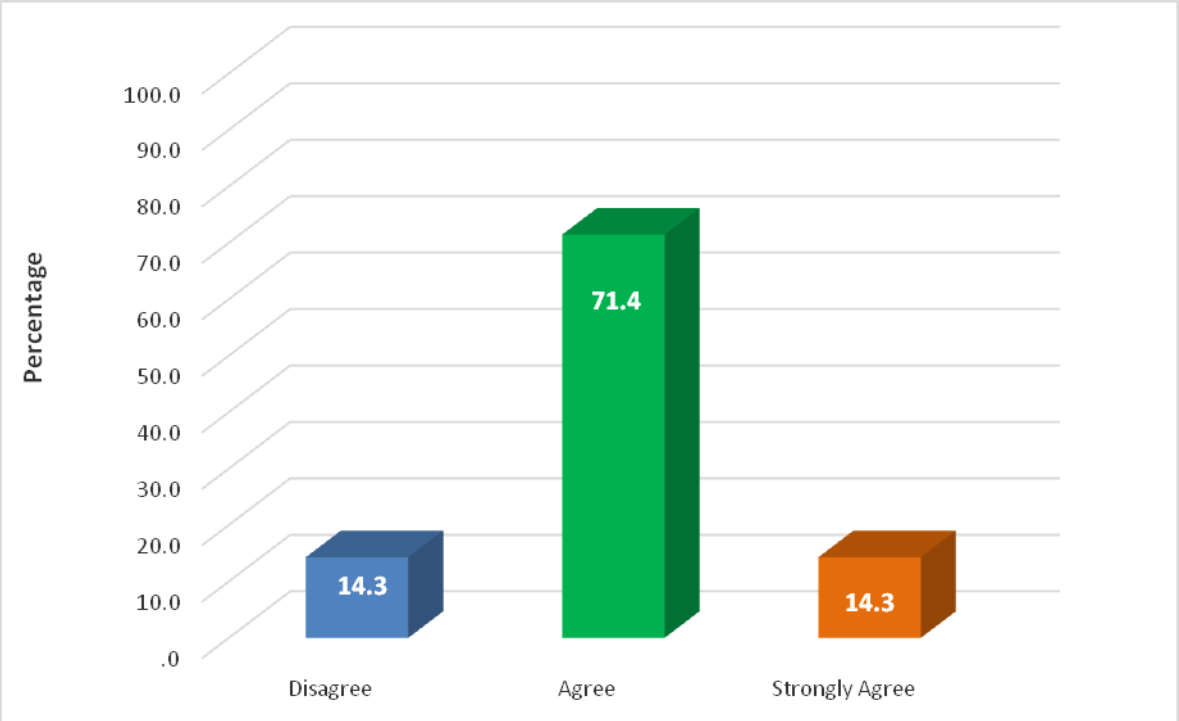


Figure 4.7 Graduates' responses on their preparedness for entrepreneurship..

Table 4.22 The plant production training is a very strong and relevant program

The plant production training is a very strong and a relevant program			
		Valid Percentage	Cumulative Percentage
Valid	Agree	71.4	71.4
	Strongly Agree	28.6	100.0
	Total	100.0	

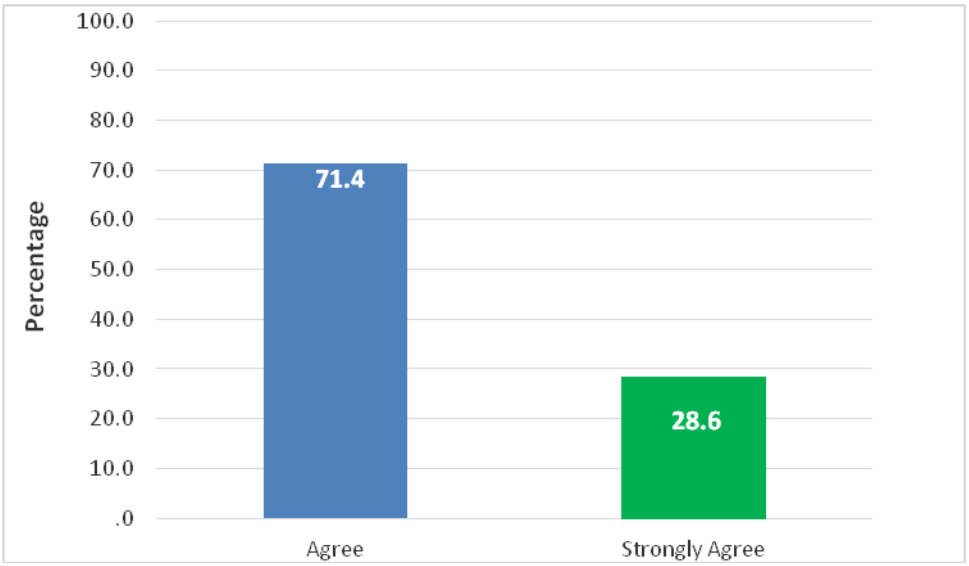


Figure 4.8 How graduates feel about the relevance of the plant production course.

Table 4.23 There are aspects considered as weaknesses of the training program

Considered as the weaknesses of the training program			
		Valid Percentage	Cumulative Percentage
Valid	Disagree	57.1	57.1
	Agree	42.9	100.0
	Total	100.0	

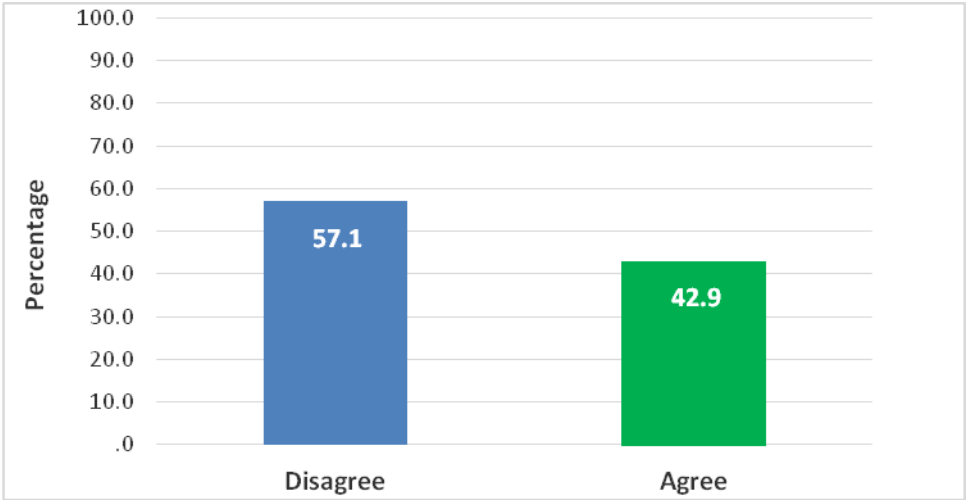


Figure 4.9 Graduates who see weaknesses in the training program.

Table 4.24 What is lacking in the Plant Production curriculum content? Consider a review.

There is a lot lacking in the plant production curriculum content; consider review.			
		Valid Percentage	Cumulative Percentage
Valid	Strongly Disagree	14.3	14.3
	Disagree	71.4	85.7
	Agree	14.3	100.0
	Total	100.0	

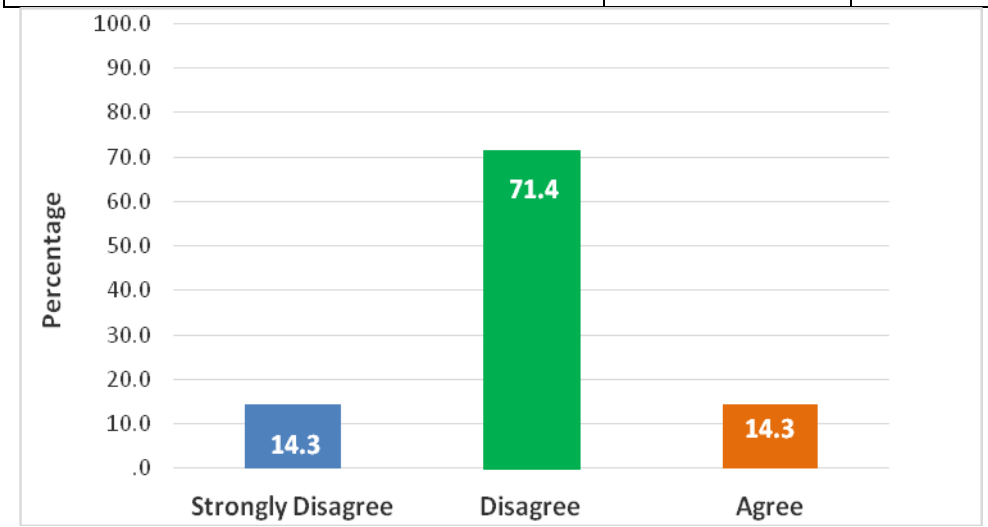


Figure 4.10 Graduates who feel the course's curriculum needs a review.

Lecturers

This research sub-question sought to establish whether the plant production subject guidelines are appropriate and relevant for each of the training levels 2 to 4.

What are strengths and weaknesses of the curriculum implementation in terms of the subject and assessment guidelines for plant production modules from level 2 to 4 equipping learners with expected outcomes?

Research sub-question: What is the nature of strengths and weaknesses of the subject guidelines for plant production modules for levels 2–4 in terms of level content suitability and optimal content sequence from one level to the next higher level from one level to the next higher level to equip learners with expected outcomes?

Table 4.25 The plant production subject guidelines as appropriate and relevant for each of the training levels 2 to 4

The plant production subject guidelines are appropriate and relevant for each of the training levels 2 to 4			
		Valid Percentage	Cumulative Percentage
Valid	Agree	66.7	66.7
	Strongly Agree	33.3	100.0
	Total	100.0	

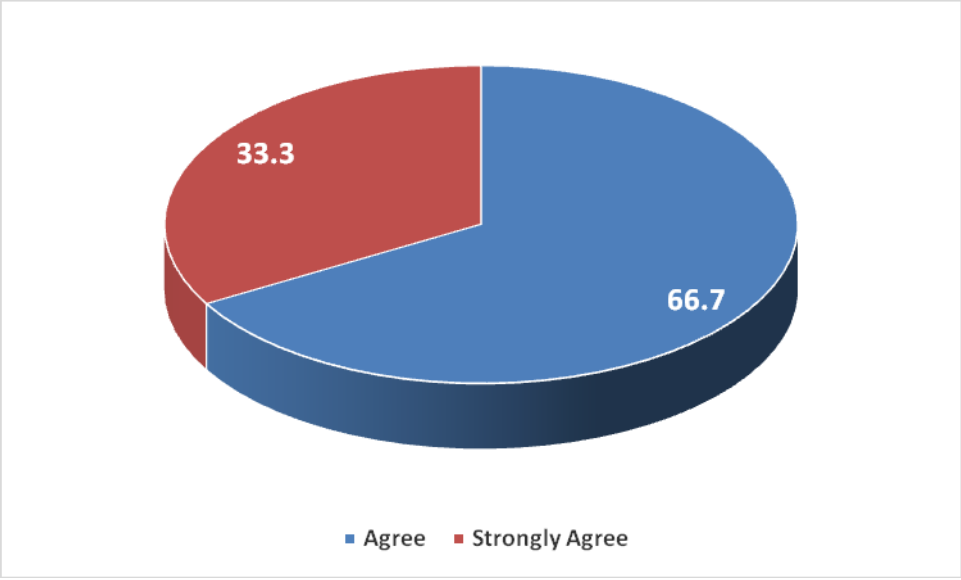


Figure 4.11 Responses concerning the relevance of the plant production guidelines.

Table 4.26 The subject guidelines and course content as articulating well and with synergy from one level to the next

The subject guidelines and course content articulate well from one level to the next, and there is synergy.			
		Valid Percentage	Cumulative Percentage
Valid	Disagree	16.7	16.7
	Agree	33.3	50.0
	Strongly Agree	50.0	100.0
	Total	100.0	

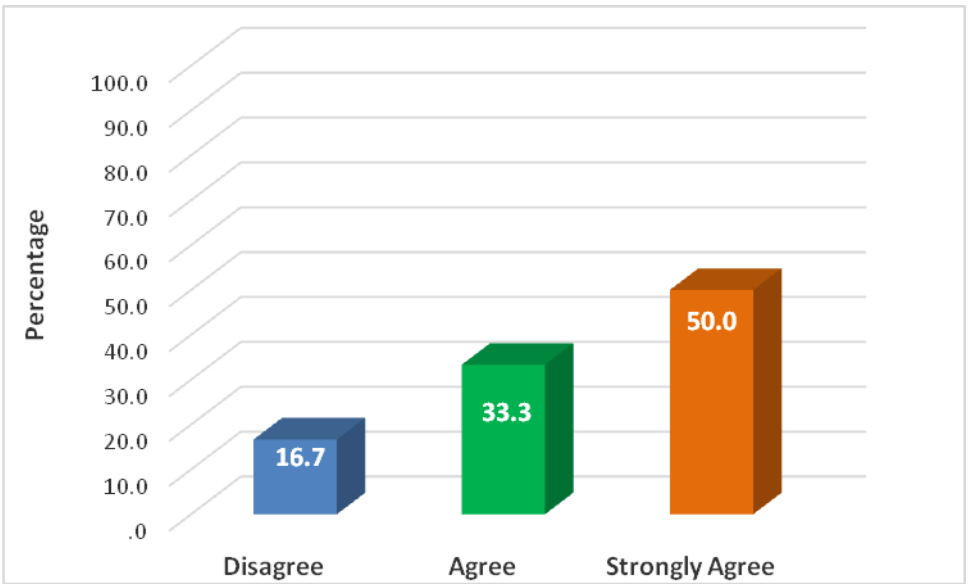


Figure 4.12 Lecturers' responses on whether subject guidelines and course content articulate well and with synergy from one level to another..

Table 4.27 The course content as equipping the learners at each level with expected outcomes

The course content does equip the learners at each level with expected outcomes.			
		Valid Percentage	Cumulative Percentage
Valid	Agree	100.0	100.0

Table 4.28 The course content at all levels preparing students for employability and entrepreneurship

The course content at all levels does prepare students for employability and entrepreneurship.			
		Valid Percentage	Cumulative Percentage
Valid	Disagree	33.3	33.3
	Agree	50.0	83.3
	Strongly Agree	16.7	100.0
	Total	100.0	

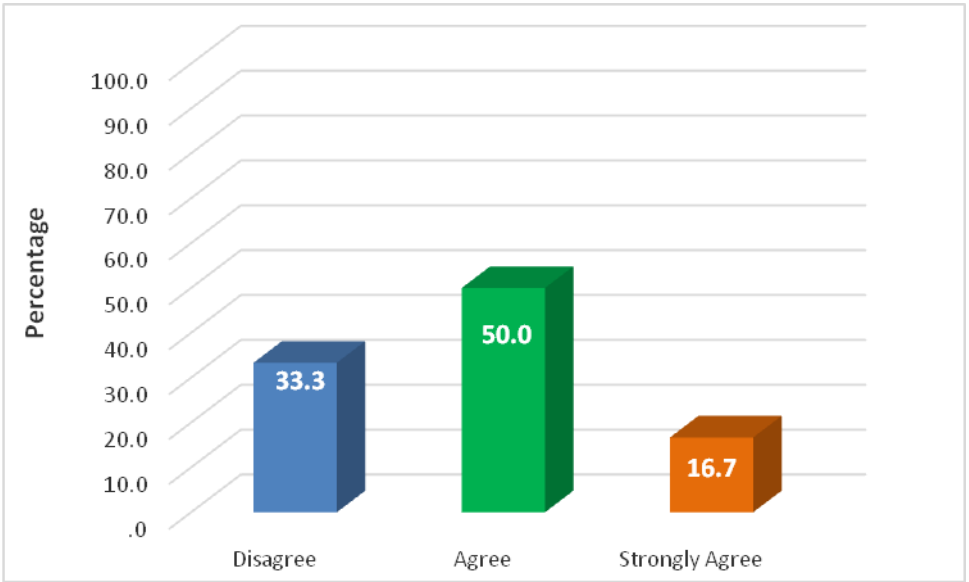


Figure 4.13 Lecturers' views on whether the course prepares students for employability and entrepreneurship.

Table 4.29 Notable strengths of the course each content and subject guidelines for each level

The course content and subject guidelines for each level have notable strengths.			
		Valid Percentage	Cumulative Percentage
Valid	Agree	83.3	83.3
	Strongly Agree	16.7	100.0
	Total	100.0	

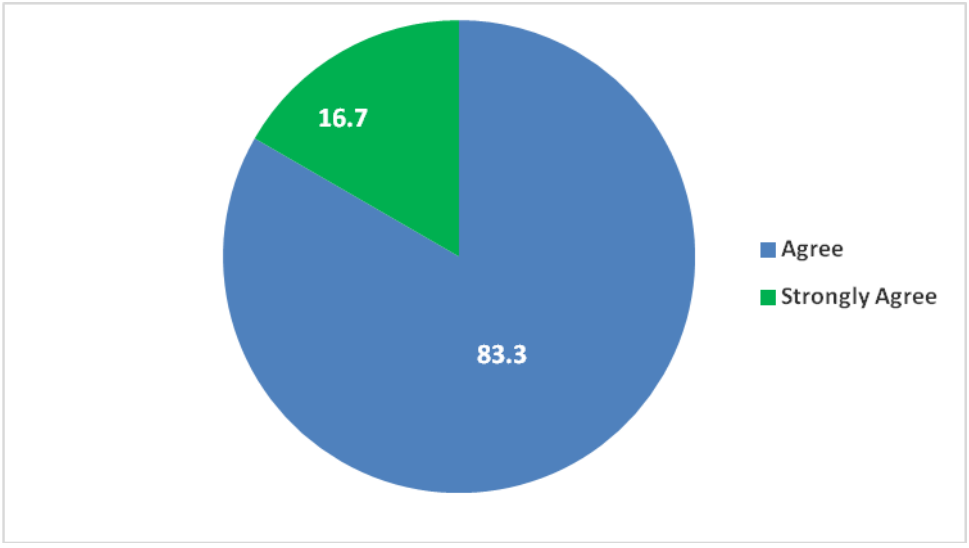


Figure 4.14 Lecturers' responses to whether the course content and subject guidelines have notable strengths.

Table 4.30 Remarkable weaknesses of the course content and subject guidelines at each level

There are remarkable weaknesses of the course content and subject guidelines at each level.			
		Valid Percentage	Cumulative Percentage
Valid	Disagree	33.3	33.3
	Agree	50.0	83.3
	Strongly Agree	16.7	100.0
	Total	100.0	

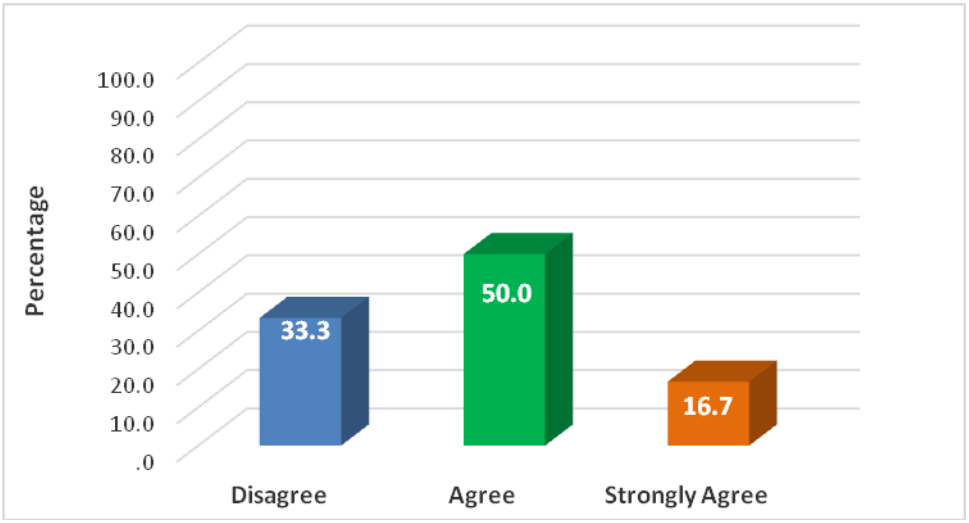


Figure 4.15 Lecturers' responses to whether there are remarkable weaknesses in the course content and subject guidelines.

Subject Advisors

The research sub-question below sought to establish whether the NC (V) levels 2 to 4 are implemented correctly.

Research sub-question: What are the strengths and weaknesses of the curriculum

implementation in terms of subject and assessment guidelines for plant production modules from level 2 to 4 equipping learners with expected outcomes?

What is the nature of strengths and weaknesses of the subject guidelines for plant production modules level 2 to 4 in terms of content level suitability and optimum content sequence from one level to the next higher level to equip learners with expected outcomes?

Table 4.31 The NC (V) levels 2 to 4 assessment guidelines as implemented correctly

The NC (V) levels 2 to 4 assessment guidelines are implemented correctly			
		Valid Percentage	Cumulative Percentage
Valid	Disagree	50.0	50.0
	Agree	50.0	100.0
	Total	100.0	

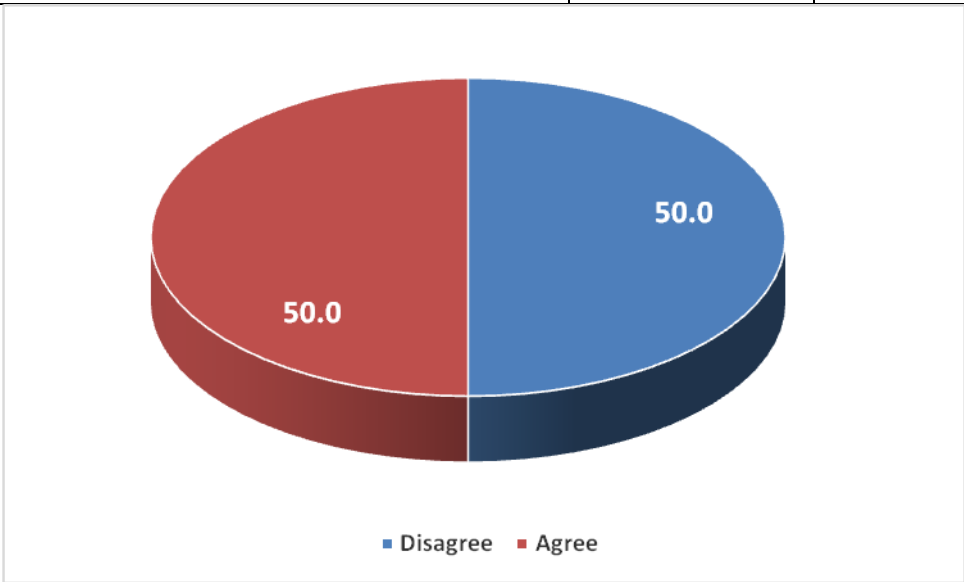


Figure 4.16 Subject advisors' views on the correct implementation of assessment guidelines at all NC (V) levels..

Table 4.32 The course content as implemented correctly at all levels

The course content is at all levels implemented correctly			
		Valid Percentage	Cumulative Percentage
Valid	Disagree	100.0	100.0

Table 4.33 Identifiable strengths in the implementation of assessment guidelines

There are identifiable strengths in the implementation of assessment guidelines			
		Valid Percentage	Cumulative Percentage
Valid	Disagree	50.0	50.0
	Agree	50.0	100.0
	Total	100.0	

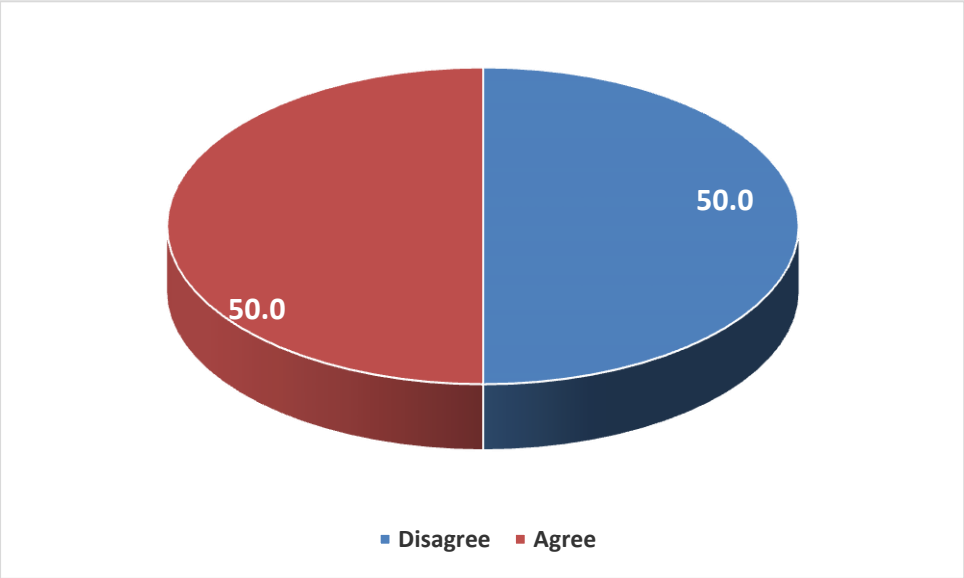


Figure 4.17 Subject advisors on the existence of identifiable strengths in the implementation of assessment guidelines..

Table 4.34 Glaring and identifiable weaknesses in the implementation of the assessment guidelines

There are glaring and identifiable weaknesses in the implementation of the assessment guidelines			
		Valid Percentage	Cumulative Percentage
Valid	Disagree	50.0	50.0
	Agree	50.0	100.0
	Total	100.0	

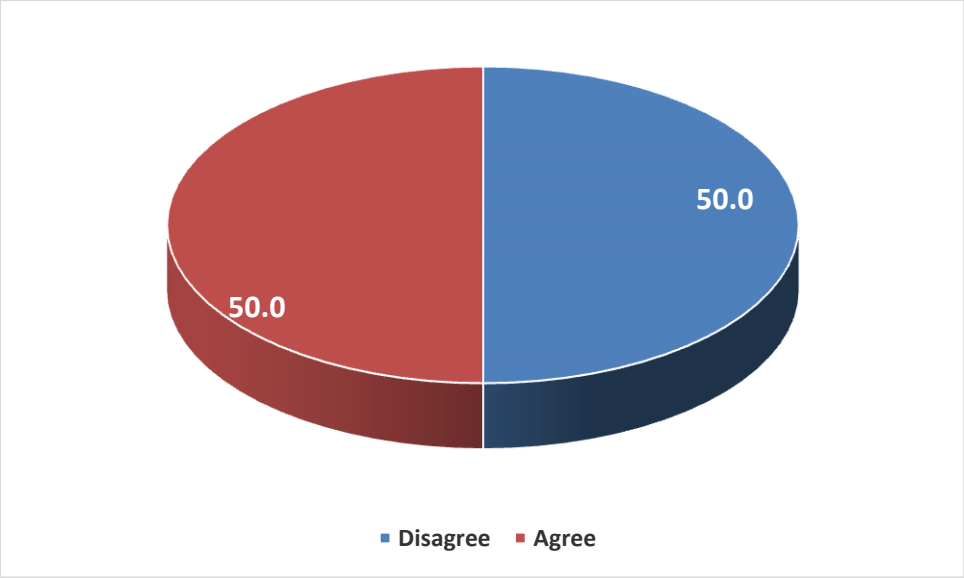


Figure 4.18 Subject advisors on the existence of glaring and identifiable weaknesses in the implementation of assessment guidelines.

4.7.1 Quantitative Interpretation of Results

Descriptive statistics was used to establish the general perceptions of employers, subject advisors, students and lecturers with regard to the plant production training programme. A higher mean score indicates the importance of the plant production course as perceived by the respondents. Table 4.34 above presents the outputs from the analysis of descriptive statistics for:

- perceptions of employers on the plant production course;

- Perceptions of students on the plant production training program;
- Perceptions of lecturers on the plant production course and
- Perceptions of subject advisors on the plant production course.

In order to analyse differences in the importance of the factors that determine the quality of the plant production course, a ranking table was produced showing the mean score of each factor. The mean scores are ranked in the order of the highest importance to the lowest importance.

Employer

This question sought to establish whether the employers are satisfied by the quality of the college graduates based on the content of the courses offered by the college.

Research sub-question: What opinions in terms of strengths and weaknesses do the employers of plant production graduates from the TVET colleges have on the course that prepared their employees for employment?

This is very important to know since the competencies of the graduates in the field of work is determined by how much knowledge they acquired from the college that is relevant to the field of work. Accordingly, Figure 4.19 presents the employers' feelings about the course content.

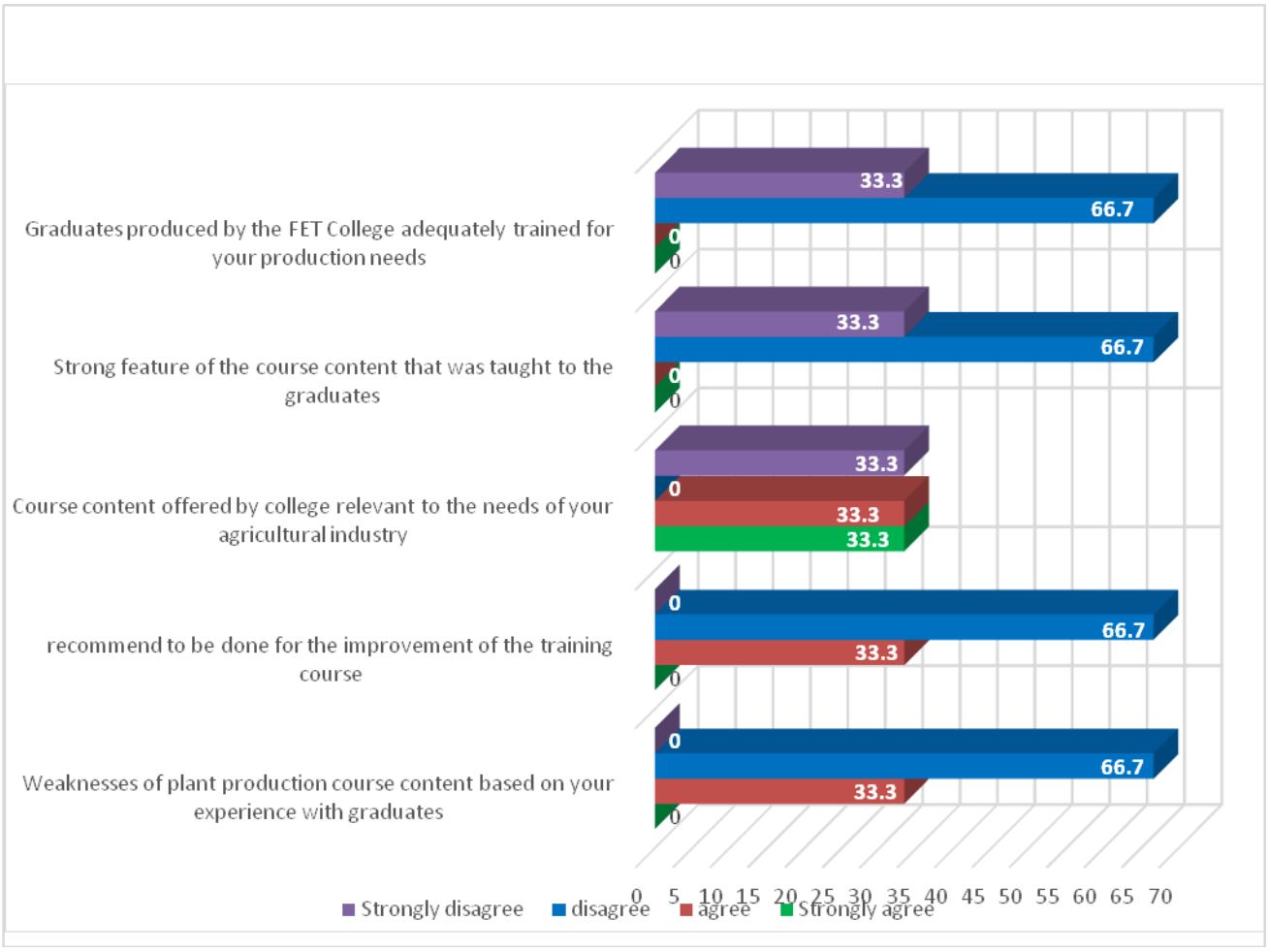


Figure 4.19 Employers' perceptions of the plant production course.

The background information regarding the employers' assessment of the course content indicates that more must be done to improve the quality of the course content to get the best graduates who fit perfectly in the field of work. From the visual representation shown in Figure 4.19, on average, about 67% of employers disagree with authenticity of the course content, whereas only 33% feel the course covers the necessary information needed to perform in the field of work. Based on these results, it is important to consider adjustments to the content of the plant production training course to meet the employers' expectations, since they have more experience with the practical work in the field of agriculture.

Graduates

This question sought to establish whether the graduate students perceive the plant production training to be well packaged in terms of the necessary training needs applicable in the agriculture field. Rather than seeking the view of the employers alone, it was important to gather the perceptions of the subjects involved (students) to determine the quality of the training. This is very important to ascertain the link between acquisition of knowledge (theory) and implementation in the field of agriculture (practice). Accordingly, the following Figure 4.20 present the graduates` perceptions of plant production training.

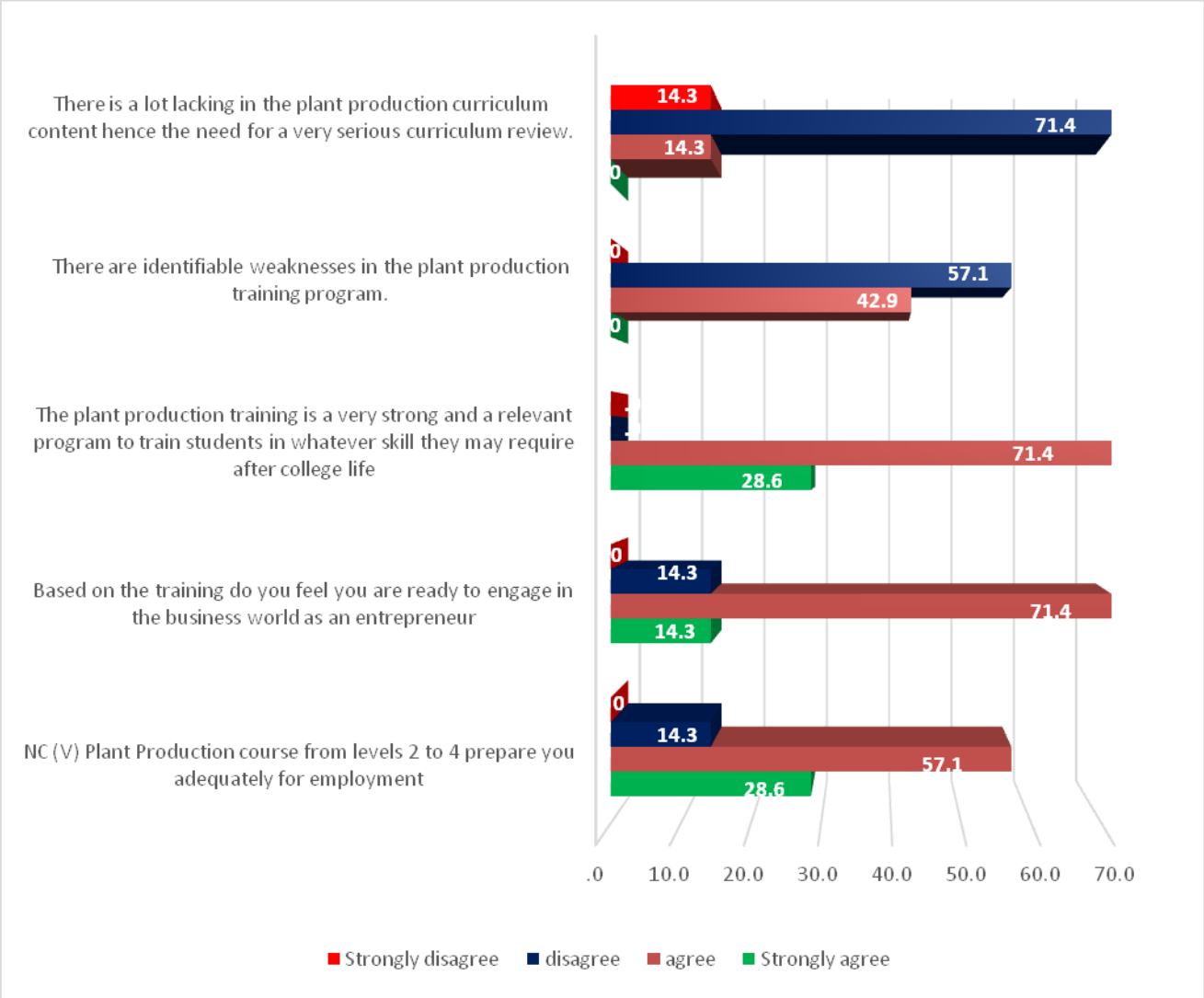


Figure 4.20 Perceptions of graduates of the plant production course.

According to Figure 4.20, students strongly believe that plant production training programme provides all the necessary information needed to perform in the field of agriculture. Although an average of 70% of the students believe that the programme is complete, about 42% of students still feel that there are few identifiable weaknesses that need attention. Consequently, we can conclude that the majority of students are happy with the composition of the plant production programme. Nevertheless, the outcomes from the graduates contradict with the view of the employers. In order to gain a detailed understanding of the trends, the research captured the perceptions of the lecturers.

Lecturer

This question sought to establish whether the lectures were satisfied with the composition of the plant production programme. Since lecturers are the ones who have a significant contribution towards the curriculum development, it is vital to seek their opinion about the plant production curriculum. Lecturers do assess the work environment and the nature of the students when they prepare course content. This is very important to determine the link between knowledge creation and knowledge use. Hence, Figure 4.21 presents the lecturers` perceptions of the plant production training programme.

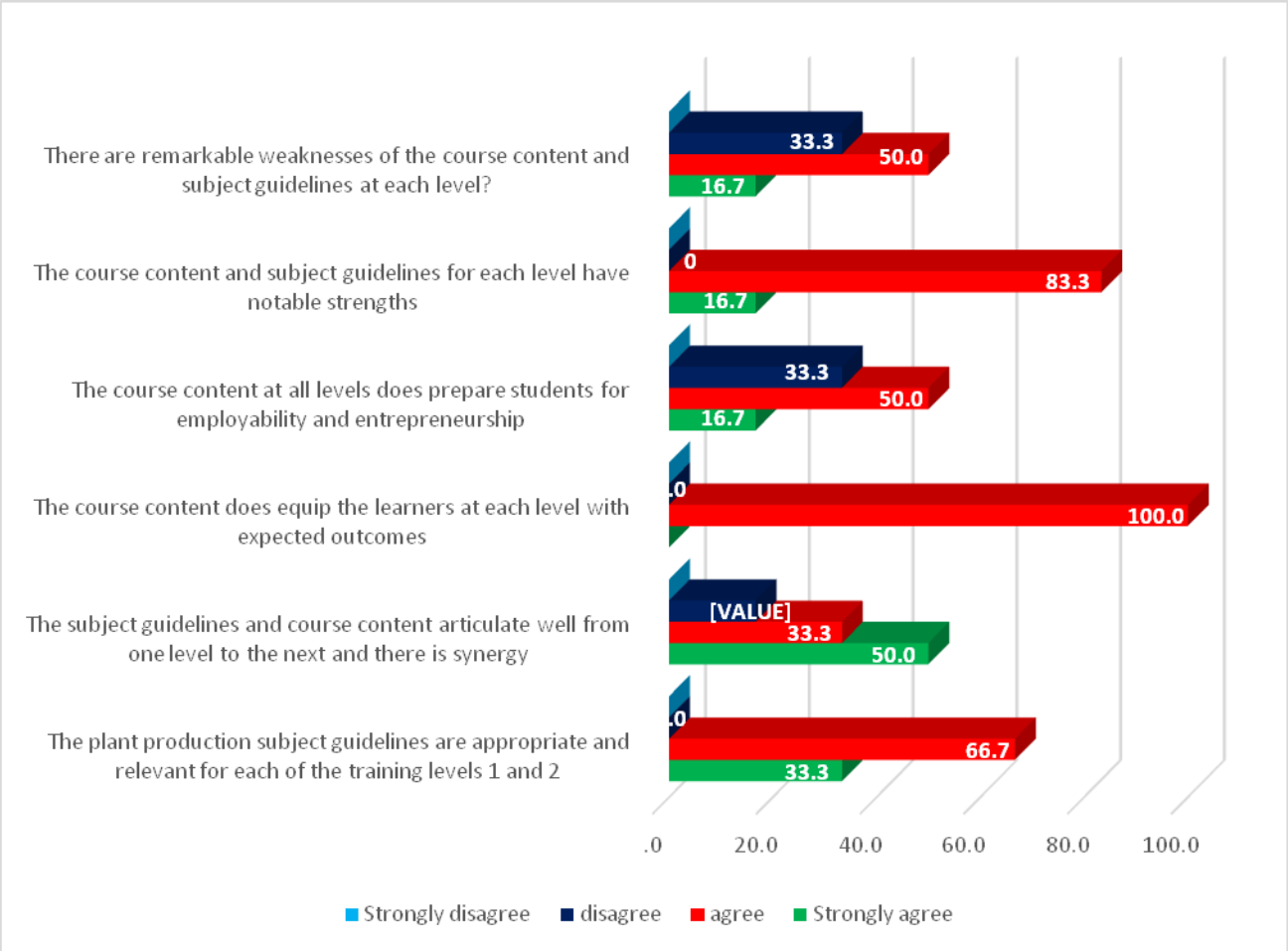


Fig 4.21 Perceptions of lecturers of plant production course.

According to Figure 4.21, lecturers do not have any reservations about the quality of the plant production programme. They strongly believe that the plant production training programme shares all the necessary information needed to perform in the field of agriculture. On average, about 90% of the lecturers believe that the course covers all the necessary lessons that are needed for students to effectively perform in the field of agriculture. The results obtained from the students support the perceptions of lecturers with regard to the plant production course. On the other end, perceptions of lecturers and students differ from those of employers. This means that the employers expect a lot more from the students.

Subject Advisor

Course review and curriculum review are also the functions of the subject advisors. Therefore, the section sought to establish the position of the subject advisors with regard to the structure and composition of the plant production programme. The assessment of the subject advisors assisted the research to establish the equilibrium in terms of the perceptions of all the stakeholders who have an interest in the quality of the course and the quality of the graduates (lecturers, graduates, employers and subject advisors). Figure 4.22 presents the lecturers' perceptions of the plant production training programme.

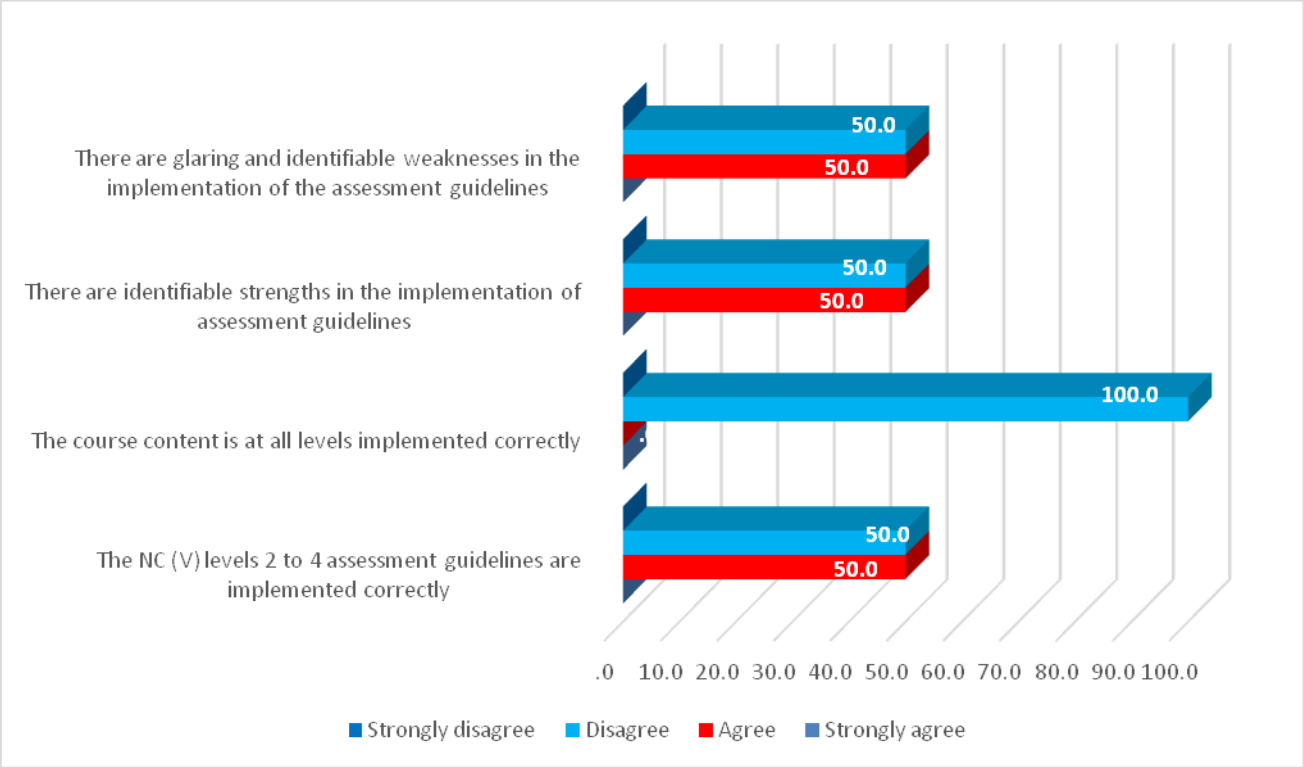


Fig 4.22 Perceptions of subject advisors of the plant production course.

According to Figure 4.22, subject advisors are highly satisfied with the course content. This entails that the programme is complete to equip the students with adequate skills and knowledge to practise agriculture. About 100% of subject advisors do not have any reservations about the quality of the plant production programme. They strongly believe that plant production training programme covers all the necessary information needed to equip students with the right combination of

skills to perform in the field of agriculture. In essence, the subject advisors, graduates and lectures agree on authenticity of the plant production programme. Although employers feel the course still needs attention, it can be concluded that the employers are overstating their targets with regard to what they expect from the college graduates.

4.8 Qualitative Data Interpretation

4.8.1 Qualitative Data from the Field

4.8.1.1 Responses from the Subject Advisors

Research sub-question: What are the strengths and weaknesses of the curriculum implementation in terms of subject and assessment guidelines for plant production modules from level 2 to 4 equipping learners with expected outcomes?

Are there any notable strengths and weaknesses in the implementation of assessment guidelines and how they affect the achievement of expected outcomes?

Question1: In your view, are the NC (V) levels 2–4 assessment guidelines implemented correctly?

An interview schedule for college Subject Advisors

The questions below relate to Plant Production NC (V) levels 2 to 4 course assessment and implementation guidelines.

Responses from Subject Advisor A

"The implementation is as correctly as possible but there are challenges."

Probe: What challenges?

"The practical's are a challenge."

Probe: How so?

"The possible practical facilities are far away. You see, here we combine some classes, for example, maths students are combined with students in hospitality studies and in agriculture. When the agricultural students have to go for practical

work on the farm far way, other students have to wait for the agriculture group or continue without them. This arrangement is a disadvantage. The college has no farming land of its own, and we use church land. so we cannot do all practical's on that land alone. The church land is about 9 km from the college and travelling takes its own time. Sometimes we arrange with commercial farmers for students to experience valuable exposure there, but what do farmers get in return? Nothing."

Probe: How else are practical's a challenge?

"The region's and January enrolments are another problem. For example, the winter in Gauteng limits the planting period. Bean planting encourages and motivates students. but shortly after registration it is winter time and most vegetables and crops cannot be planted for students to see, unlike the coastal regions which are not affected by winter frost. We can plant oats, but it is not quick growing and it is not easy to use it to motivate and excite students."

Question 2: Is the course content at all levels implemented correctly?

"We try to. Some methods are aimed not at commercial farming. There is no emphasis on large-scale farming. The methods are for backyard gardening; "Door frame"-gardening, so to speak. There is no emphasis on large-scale farming. It is only at level 4 where they are introduced to the theory of big farming machines. Levels 2 and 3 are equally important. They, too, like level 4, are equally important, and that is where we should start."

Question 3: Would you say there are identifiable strengths in the implementation of assessment guidelines?

"Yes, there are. Go home, do college work in engineering. Parents can see what is done and how it is done, for example, compost making."

Question 4: In your view, are there any glaring and identifiable weaknesses in the implementation of the assessment guidelines?

"Ja. The methods are slightly outdated. The practices are aimed at micro and small scale for household use. The aim should be to prepare students to become entrepreneurs and successful established farmers."

Probe: How do we solve this?

Identify students to be mentored while studying. This can do well for the land reform strategy.

Responses from Subject Advisor B

Question 1: In your view, are the NC (V) levels 2 to 4 assessment guidelines implemented correctly?

"No, I think it is difficult for some lecturers to understand the content. In my view, some of them do not have enough subject content knowledge. The knowledge is not adequate. In most cases, colleges lack resources for practical work. The plant production program is expensive and requires adequate resources."

Question 2: Is the course content at all levels implemented correctly?

"No, as I have already stated, there is a lack of adequate and in-depth knowledge amongst most lecturers, and there are scarce resources; hence, the difficulty in proper implementation of the course content."

Question 3: Would you say there are identifiable strengths in the implementation of assessment guidelines?

"Certain things are easier to implement. There are resources and knowledge, which are requirements for proper curriculum implementation. As soon as the knowledge part lacks, which seems to the case in this situation, there shall be improper implementation. The other problem leading to the failure of proper implementation is the lack of creativity by some lecturers. When teachers lack creativity, they cannot work around challenges where there are no resources."

Question 4: In your view, are there any glaring and identifiable weaknesses in the implementation of the assessment guidelines?

"Yes. Most teaching staff are not adequately qualified and, therefore, cannot assess accurately. The staff we have need clearer and simplified guidelines. As soon as something needs more interpretation there are usually some problems with the staff members who have some superficial knowledge."

4.8.1.2 Responses from College Lecturers

Responses from Lecturer A (College A)

Question 1: In your view, are the plant production subject guidelines appropriate and relevant for each of the training levels (that is,. levels 2 to 4)? Does the prescribed course content fit each level for which it was designed?

"Level 2 is low, Level 3 is better, and level 4 is very appropriate. Level 2 is brief and less scientific. The scientific concepts are of about grade 8; below grade 9. Level 3 also deals with insects; its ok. Level 4 is wonderful, and it leads to tertiary education."

Question 2: Do the subject guidelines and course content articulate well from one level to the next? Is there synergy?

"Between levels 2 and 3 there is no link. Level 3 is loaded. Level 4 is advanced and there is generalisation. In level 2 one would expect the students to deal with scientific concepts as well, which is not the case."

Question 3: Does the course content equip the learners at each level with expected outcomes?

"According to the new definition, we are now TVET. I understand Vocational. It means students should be able to work to produce something and I am not so sure about technical. The department is trying to address their side by providing content At the second level, it is not enough. At the exiting point, I can say yes, but Level 2 cannot lead to production on the farm. Only the 4th level covers this. In level 4, there is farm planning and mechanisation and, therefore, it is possible for them to produce."

Question 4: Does the course content at all levels prepare students for employability and entrepreneurship?

"Yes, especially entrepreneurs. At level 2 we expect them to be hands-on but this only happens at the end. The program can assist them kick-start their businesses. They have the theoretical part, which has equipped them with theoretical knowledge. They can produce as entrepreneurs because of the knowledge they have. The disadvantage is that there is no farming equipment."

Question 5: What do you consider to be the strengths of the course content and subject guidelines for each level?

"Generally, the exit point is of higher strength because learners experience technology and on their own they can explore. The disadvantage is the lack of equipment for practical work. Because of the lack of land, we are accommodated by the willing farmers for some of the practical work. These farmers have land and they have the equipment. They are commercial farmers. We lack basic equipment; we struggle with land, and we need to produce hydroponics; we can't."

Question 6: What do you regard as weaknesses of the course content and subject guidelines of each level?

"Weaknesses?

Textbooks: If you look at the textbooks, they do not have the concepts they are supposed to discuss

Level 2 textbook is without cohesion. The book has less information, less cohesion and less scientific information. Level 3 is far better but the calculations and fertilisers are higher and students have not been prepared for these at level 2. Laboratories are not adequate, especially for soil science."

Responses from Lecturer B (College B)

Question 1: In your view, are plant production subject guidelines appropriate and relevant for each of the training levels (that is, levels 2 to 4)? Does each of the prescribed content of each course fit the level for which it was designed?

"Yes. Level 2 is just introduction.

Level 4 is detailed. Students should not be piled too much. Grade 10 information in the school set-up is much more than Level 2. Students at level 2 do not have that much of practical's."

Question 2: Do the subject guidelines and course content articulate well from one level to the next? Is there synergy?

"Synergy is there. For example, at Level 2 they deal with diseases and pests. Level 2 is not detailed. Level 3 is deeper and deals with the susceptibility of plants, and Level 4 deals with vulnerability of plants."

Question 3: Does the course content equip the learners at each level with expected outcomes?

"Yes, there is a challenge; for example, in exports and imports. The college does not have pack houses and there is no level of exposure among students. Sometimes, a lecturer knows these things and students don't; maybe only 1% understands when these things are explained. Poor infrastructure at college delays the expected outcomes among students."

Question 4: Does the course content at all levels prepare students for employability and entrepreneurship?

"Yes; Level 4s. We have ±10 students taken by the college. Private firms are not as interested. There is a challenge with the internships. There is shortage of equipment. Students are deprived of the practical experience. We do not have pack houses, dispatch houses, laboratories and greenhouses. The one [greenhouse] we have does not have fans for regulating temperature."

Question 5: What do you consider to be the strengths of the course content and subject guidelines for each level?

"Crops of specialisation are tropical crops and favour all seasons. These vegetables thrive in all seasons and are, therefore, planted throughout the year. And this applies to all the levels."

Question 6: What do you regard as weaknesses of the course content and subject guidelines of each level?

"Poor infrastructure and poor exposure to practical work."

Responses from Lecturer C (College B)

Question 1: In your view, are plant production subject guidelines appropriate and relevant for each of the training levels (that is, levels 2 to 4)? Does each of the prescribed course content fit the level for which it was designed?

“The guidelines are appropriate. The problem is the quality of learners enrolled at Level 2. Most of the students enrolled at level 2 are not suitable for the material used at the level. The teaching at Level 2 should be 70% practical, and this applies to all levels.”

Question 2: Do the subject guidelines and course content articulate well from one level to the next? Is there synergy?

“Yes, it is appropriate.”

Question 3: Does the course content equip the learners at each level with expected outcomes?

“Yes.”

Question 4: Does the course content at all levels prepare students for employability and entrepreneurship?

“Not really employability. They can be employed as supervisors. The college teaching has good theory. The practical part is the problem. We do not have enough equipment and implements. We have the WBE (work-based education); students have to work for 10 days during the holidays. Students are sometimes a problem; they go to the commercial farmers and waste time of farmers there by not doing work and farmers do not have time to waste, and, therefore, refuse to assist the college because of uncooperative students. At one stage our students were sent back.”

Question 5: What do you consider to be the strengths of the course content and subject guidelines for each level?

“The course content itself is ok. The problem is the selection and big numbers, which is not good for agriculture, especially the practical work.”

Question 6: What do you regard as weaknesses of the course content and subject guidelines of each level?

“Student numbers are too large for an agricultural program. In 2014, we enrolled 390 students at Level 2. At Level 3 we have 90, and at level 4 we have 50. This situation is problematic for practical work; you can give individual attention and individual projects. Students end up not watering gardens. As a lecturer, you end up taking and working with the serious students even over the weekends.”

Responses from Lecturer D (College B)

Question 1: In your view, are plant production subject guidelines appropriate and relevant for each of the training levels (that is, levels 2 to 4)? Does each of the prescribed course content fit the level for which it was designed?

"In the main, it is ok. Textbooks are full of highlights. They need to add some more information. Books are summarising. It becomes difficult, especially for students who did not do the subject in the previous grades or classes."

Question 2: Do the subject guidelines and course content articulate well from one level to the next? Is there synergy?

"There is synergy between levels 2 and 3, but we need to add more information; we add more information by writing notes on the board."

Question 3: Does the course content equip the learners at each level with expected outcomes?

"Yes, to levels 3 and 4. To Level 2, it is partly so. Maybe what is wrong is the method of recruitment. There is a lack of proper career guidance."

Question 4: Does the course content at all levels prepare students for employability and entrepreneurship?

"Yes. The equipment and land for large-scale farming. The farms around this place are visited for these children to see. The information is there. We made no formal arrangements with farmers if farmers agree. Sometimes the exercise is time wasting, especially with commercial farmers who do not have time to waste with student who do not use time seriously and efficiently."

Question 5: What do you consider to be the strengths of the course content and subject guidelines for each level?

"Theory add-ons are necessary. The practical's are a challenge."

Question 6: What do you regard as weaknesses of the course content and subject guidelines of each level?

"Resources are a challenge to doing practical's. The experienced farmers are white. This is sometimes a challenge; some look into the whole thing along racial lines, which makes this a challenge in gaining access to the private farms."

Responses from Lecturer E (College C)

Question 1: In your view, are plant production subject guidelines appropriate and relevant for each of the training levels (that is, levels 2 to 4)? Does each of the prescribed course content fit the level for which it was designed?

"Yes, at the same time it is challenging. Other students have completed Grade12, and it is ok with those. The challenge is with students who have not completed grade 12."

Question 2: Do the subject guidelines and course content articulate well from one level to the next? Is there synergy?

"There is a link."

Question 3: Does the course content equip the learners at each level with expected outcomes?

"Yes, we offer a lot of practical's.

At Level 2, we have 200 students, at Level 3 we have 50, and at level 4, 10.It is mostly students with grade 12 who do better. At this place I suspect most high schools do not have agriculture; that is why most students are not performing well in agriculture. Most students experience difficulties when completing assignments because they do not understand basic concepts. It is also possible that the department is not advertising the course accurately. Students just come to agriculture hoping that it is going to be easy.

Question 4: Does the course content at all levels prepare students for employability and entrepreneurship?

"They can be entrepreneurs at local level. They have knowledge in agriculture. If they have to go big, they might have to top up what they have learnt here. They have some experience. The college farm is big and the implements are available. The graduates can be self-employed. These students can do a variety of things."

Question 5: What do you consider to be the strengths of the course content and subject guidelines for each level?

"Practical's are a strength because of the college farm. In addition to our farm, we have a good partnership with a local agricultural and hotel high school."

Question 6: What do you regard as weaknesses of the course content and subject guidelines of each level?

"The glaring weakness is student selection. We suggest a bridging course for students without grade 12."

Responses from Lecturer F (College C)

Question 1: In your view, are plant production subject guidelines appropriate and relevant for each of the training levels (that is, levels 2 to 4)? Does each of the prescribed course content fit the level for which it was designed?

"Appropriate. Level 2 deals with weeds, fertilisers and pests; Level 3 deals with fertiliser application; and Level 4 deals with plant propagation"

Question 2: Do the subject guidelines and course content articulate well from one level to the next? Is there synergy?

"Levels link well. At Level 4, some things from Level 2 come back and link well with level 4."

Question 3: Does the course content equip the learners at each level with expected outcomes?

"It does. The college has a farm where students do pract's. The farm is big enough and has some necessary big equipment. We have tree tractors and harrows. What we do not have, like big combine harvesters, we hire. We plant maize, sunflower and oats. The problem is the big numbers for practical's. At level 2 we have 200, Level 3 we have 58. and at level 4 we have 10. The drop-out rate is high. Maybe at Level 2, they register for bursaries and money also, there is no connection and synergy between school and college."

Question 4: Does the course content at all levels prepare students for employability and entrepreneurship?

"Yes, at Level 4 students are placed on different farms. They work daily and sign the attendance registers. Ninety percent of the reports we receive are positive. The monitoring of student work on the farms is done by lecturers."

Question 5: What do you consider to be the strengths of the course content and subject guidelines for each level?

"The strength is the farm, we take students to the farm for practical's."

Question 6: What do you regard as weaknesses of the course content and subject guidelines of each level?

"(Hesitant) Nothing generally. The textbook at Level 2 is weak. The content is scant at all levels. The Level 2 book does not define basic concepts like weed and others."

Note, college A did not as yet have graduates who had completed Level 4 at the time of the research.

4.8.1.3 Responses from the College Graduates

Graduate A (College B)

Question 1: Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

"Yes, but the use of chemicals is problematic We do theory only and there are no practical's."

Question 2: Based on the training you received at the college, do you feel you are now in a position to engage in the business world as an entrepreneur?

"Yes, I can go to the field but, I need some training in using major equipment that the college does not have."

Question 3: What would you regard as the strengths of the plant production training from levels 2 to 4?

The lecturers are good. The problem is the equipment. Teaching is 100% good the problem is the practical work.

Question 4: What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

"Practical's are a weakness. We need to form partnerships for practical activities. There are no job opportunities; most students are not working in what they graduated. Teachers need to negotiate with farmers. The farmers do not know about colleges."

Question 5: What would you love to have been included to and or excluded from the course content at all the training levels?

"Agro-chemicals [to be included]"

Graduate B (College B)

Question 1: Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

"The course did not. It is so difficult to find a job with this qualification."

Question 2: Based on the training you received at the college, do you feel you are now in a position to engage in the business world as an entrepreneur

"The training is sometimes ok, but we lack experience because the government does not help."

Question 3: What would you regard as the strengths of the plant production training from levels 2 to 4?

"The lecturers do everything they can with the limited resources. Students require the practical's to be done, but there is no work for students outside. The government should establish partnerships with the farming community."

Question 4: What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

"We lack employment. There are no job opportunities out there. I do not know whether or not this course was properly planned, or there were disagreements

among the people in government. The course does not seem to have been marketed correctly. There is no proper advertising of the course. Most people do not know about the course."

Question 5: What would you love to have been included to and or excluded from the course content at all the training levels?

"The course should be marketed properly before it is taught. Students should be given options whether they want to proceed to university or want to go to the work situation after graduation. The government should give farms and support to the students who do not want to go to universities to further their studies."

Graduate C (College B)

Question 1: Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

"The program does prepare graduates for employment, but the employers do not want to employ graduates with a certificate. They prefer students with diplomas and the N courses."

Question 2: Based on the training you received at the college, do you feel you are now in a position to engage in the business world as an entrepreneur?

"Yes, I can be an entrepreneur. I have studied Agribusiness, and I can work with employers and other people."

Question 3: What would you regard as the strengths of the plant production training from levels 2 to 4?

"The training was not strong enough. There was more theory and not enough practical work."

Question 4: What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

"Like I have said, we did more theory than practical work. …if the college can add more practical work in the training."

Question 5: What would you love to have been included to and or excluded from the course content at all the training levels?

"If the colleges can include more practical work... For example, if out of a year, four months can be theory and eight months be practical work."

Graduate D (College B)

Question 1: Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

"Yes, training was adequate. It is in agro-chemicals where we need more training and more practical's. I am not confident when it comes to agro-chemicals. One still needs exposure in the agro-chemicals."

Question 2: Based on the training you received at the college, do you feel you are now in a position to engage in the business world as an entrepreneur?

"Yes, with the knowledge I have."

Question 3: What would you regard as the strengths of the plant production training from levels 2 to 4?

"Domestic small practical's. We are strong in the marketing knowledge."

Question 4: What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

"No practical skill relating to big equipment,"

Question 5: What would you love to have been included to or excluded from the course content at all the training levels?

"Agro-chemicals. Sometimes we go to the Low Veld Agricultural College; they have some of the equipment like the pivots."

Graduate E (College C)

Question 1: Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

"Yes. When you get employment, you can apply some of the theory of what you learnt… can be put into practice."

Question 2: Based on the training you received at the college, do you feel you are now in a position to engage in the business world as an entrepreneur?

"Yes. Because I can work as a consultant and a plant production agent. I can work to teach farmers the new things I have learnt from the program. Some farmers do not understand the new things that are available in the market."

Question 3: What would you regard as the strengths of the plant production training from levels 2 to 4?

"The training itself. The training gives a lot of information. I can start assisting from the family level by planting a garden at home. I can also assist the community to start a community garden. They can be taught to market their products and sell to the local community vegetable markets."

Question 4: What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

"There are no major weaknesses. The problem is that the chemicals for treating pests and plant diseases are not easily obtainable at the college. One has to move from that person to the next before one is able to get these chemicals."

Question 5: What would you love to have been included to or excluded from the course content at all the training levels?

"If there can be more practical's, since plant production and agriculture in general are practical subjects. If, for example, they can divide a year into two, ½ year for practical work and ½ year for theoretical work. This should apply to all the levels."

Graduate F (College C)

Question 1: Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

"Yes. I have done a lot of practical training and I am pretty sure of the plant production training."

Question 2: Based on the training you received at the college, do you feel you are now in a position to engage in the business world as an entrepreneur?

"Yes, because I know plant production and practical training was adequate."

Question 3: What would you regard as the strengths of the plant production training from levels 2 to 4?

"The teaching part of it. We were taught what plant to plant during which seasons and what tilling methods to apply and what chemicals to use when plants are affected."

Question 4: What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

"There was insufficient equipment for doing practical work"

Question 5: What would you love to have been included to or excluded from the course content at all the training levels?

"They should include more practical's and more plant facilities like greenhouses and hydroponics for students to be able to control temperature."

Graduate G (College C)

Question 1: Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

"Yes, the programme trained me adequately for the work experience. As we speak, I am managing an agricultural programme and I feel I am doing ok."

Question 2: Based on the training you received at the college, do you feel you are now in a position to engage in the business world as an entrepreneur?

"Yes. I was trained, but I think the college should do more to train students for entrepreneurship. For example, they should include in the curriculum hydroponics, greenhouses and nurseries with controlled temperatures because these you find in the world of entrepreneurship."

Question 3: What would you regard as the strengths of the plant production training from levels 2 to 4?

"It is practical's. We did a lot of practical's, but, like I have indicated, they need to add some more projects to the practical's."

Question 4: What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

"For me, I did not do agriculture at school, and it was difficult to adjust to college curriculum, so I need more introduction at entry level."

Question 5: What would you love to have been included to or excluded from the course content at all the training levels?

"*Actual work experience. The college should arrange time so that the students can go to the producing farms and spend some time there to gain the actual work experience."*

4.8.1.4 Responses from Employers of College Graduates

Employer A

Question 1: Based on your experience when working with the graduates, was the course content that was offered by the college relevant to the needs of your agricultural industry?

"Yes it is, based on experience. What the students were taught is relevant to the needs of what the industry expects. One part that is lacking is producing learners who are 'hands-on'. The campus training is theoretically based."

Question 2: What would you regard as the strong feature of the course content that was taught to the graduates?

"The material is adequate to educate learners and make them fit for the industry. But I am worried by the practical part."

Question 3: Do you find the graduates produced by the FET college to be adequately trained for your production needs?

"No, the practical aspect is behind."

Question 4: What would you regard as shortcomings and weaknesses of the plant production course content based on your encounter or experience when working with the graduates?

“Practical. Students are not ready as employees. They are not committed to what they are doing. They might not be fully motivated to work in agriculture. Maybe they are confused. They get employment in other industries.”

Question 5: What do you recommend to be done for the improvement of the training course for the graduates?

“Register learners with businesses at Level 2. College students have no exposure to the real materials and situations. By the end of training, they should be registered with businesses. Colleges need to have linkages with communities to get students engaged after completion.”

Employer B

Question 1: Based on your experience when working with the graduates, was the course content that was offered by the college relevant to the needs of your agricultural industry?

“Yes, immediately the student arrived, she fitted well in the section because she has love for agriculture.”

Question 2: What would you regard as the strong feature of the course content that was taught to the graduates?

“The graduate is a former student of this school. For her, it was a continuation of what we had already taught her. She has no brought some new information she did not have before. She now has information on chemicals and weed killers.”

Question 3: Do you find the graduates produced by the FET college to be adequately trained for your production needs?

“Relating to theory, they are very good. What needs to happen is that they be exposed to more practical work. Like in the old system of teaching, students should do practical work while still in training. Previously the college did not have its place of conducting practical’s. Now they have the farm of their own. Students there should write practical tests.”

Question 4: What would you regard as shortcomings and weaknesses of the plant production course content based on your encounter or experience when working with the graduates?

"Practical part."

Question 5: What do you recommend to be done for the improvement of the training course for the graduates?

"Firstly learners should go there when they have passed Grade 12 with relevant subjects. The training should be a three-year course (2 years theory and 1 year practical). Learners at that college are not serious with learning at a later stage; they strike when they are not given money. Students who are interested in their work will not strike. Preference should be given to students with farming experience and interest."

Employer C

Question 1: Based on your experience when working with the graduates, was the course content that was offered by the college relevant to the needs of your agricultural industry?

"Yes. Basically, it is relevant. She knows certain things."

Question 2: What would you regard as the strong feature of the course content that was taught to the graduates?

"She is able to think independently and sorts out problems quickly and is able to work independently. And she is well spoken."

Question 3: Do you find the graduates produced by the FET college to be adequately trained for your production needs?

"No, Yes. She is adequate; she wants to do more. She still needs more knowledge on the technical side. More practical knowledge on the practical side is required."

Question 4: What would you regard as shortcomings and weaknesses of the plant production course content based on your encounter or experience when working with the graduates?

"The shortcomings are in the course product knowledge, like in fertiliser field knowledge."

Question 5: What do you recommend to be done for the improvement of the training course for the graduates?

"More training is required in the chemical area. The graduates have a general idea, like at school, a child is given a total picture but has to colour in to give a total meaning. These graduates have a general idea of the scheme of things but lack detailed practical knowledge."

4.9 Subject Policy Guidelines

Further education and training: A guide to opportunities for further learning, 3rd Edition, revised and updated (Prescripts by the Department of Higher Education and Training

The above-named document prescribes that for South African TVET colleges to be able to train students properly in the Plant Production course, they need to offer training in the methods outlined below:

- Presentations (practical work, observation, role-play, self-initiated activity, judging the quality of farm produce, and evaluation)
- Field tests and research in a structured environment

In order for the above practical assessments and implementation to take place, the following should be available:

General agricultural facilities

- Established pastures
- Irrigation
- Farm tools and agro-chemicals
- Seedling nursery (vegetables, trees and shrubs)
- Water reticulation

Vehicles

- 1 tonne pickup and a canopy
- 1 medium-sized tractor
- 1 minibus for transporting learners

- Tractor trailer and implements

Fencing

- External security fence: 2 km
- Internal fence: 1.6 km

Miscellaneous

- Laboratory with equipment for plant and soil science
- Laboratory with equipment for animal and poultry science
- Teaching aids (data projectors, screen, DVD player, etc.)
- Computers with internet links
- Library with relevant books and magazines

Factors that contribute to the achievement of Agribusiness learning outcomes

- An enabling environment: The subject should be presented in the context of small, medium and micro enterprises (SMMEs), emerging small-scale farmers and personal needs.
- Resources: Students should have access to all the necessary resources needed for the chosen practical activities at hand.
- Experiential exposure: Students should be exposed to real and simulated work environments.
- Suitably qualified lecturers: Lecturers should have a solid command of subject knowledge and skills and be well informed about legislation, community issues and access to support systems (for example, systems provided by the Department of Agriculture).

Table 4.35 Collated information from stock and asset registers at the three colleges.

Equipment	College A	College B	College C
1. Established pastures	Not available	Not available	Available
2. Irrigation	Not available	Not available	Available
3. Farm tools ▪ Wheel barrow ▪ Knapsacks ▪ Mower ▪ Spades ▪ Forks ▪ Farm shed	• Available • Available • Available • Available • Available • Not Available	• Available • Available • Available • Available • Available • Not available	• Available • Available • Available • Available • Available • Available
4. Seedling nursery ▪ Vegetables ▪ Trees ▪ Shrubs	• Not available • Not available • Not available	• Available • Not available • Not available	• Available • Not available • Not available
5. Water reticulation ▪ To paddocks ▪ Livestock units	• Not available • Not available	• Not available • Not available	• Available • Available

6. Vehicles ▪ 1 ton pickup and canopy ▪ Medium size tractor ▪ Minibus for transporting students ▪ Tractor trailer	• Not available • Not available • Not available • Not available	• Available • Available ▪ Not available ▪ Available	• Available • Available • Available • Available
7.Farming Implements • Ploughs, • Harrows • Planters • Combine harvesters • Bailers • Boom sprayer	• Not available • Not available • Not available • Not available • Not available • Not available	• Available • Available • Not available • Not available • Not available • Not available	• Available • Available • Available • Available • Available • Available

8. Fencing ▪ External fences 2km ▪ Internal fences 1.6km	• Not available • Not available	• Not available • Not available	• Available • Available
9. Miscellaneous Laboratory with equipment for plant and soil science.	• Not available	• Available	• Not available
10. Teaching ads ▪ Data projectors and screens ▪ DVD players ▪ Computer with internet links	• Available • Available • Not available	• Not available	• Available • Available
11. Library with relevant books and magazines	▪ Not available	• Not available	• Not available

The situation at college C was comparatively better with respect to the availability of infrastructure for doing practical work. To a larger degree, this college can implement and assess the content better. As much as the college compares better, it should be noted, however, that it is not on par with the scientific agricultural advancement in terms of modern farming equipment. For example, it does not have combine harvesters, advanced irrigation system, greenhouses, hydroponics, tunnels and other modern agricultural facilities. In terms of the Corvallis Farm Handbook (2016), some of the above are requirements for advanced scientific farming.

The colleges that are not providing the facilities as prescribed by the DHET are in direct violation of the departmental prescripts. The DHET prescribed the facilities and equipment required by colleges to be able to offer a plant production course. It is, however, disturbing to find that in most cases, some of the basic requirements are not met by some of the colleges. From the very initial entry level, students studying plant production at these colleges are disadvantaged. With all the good intentions, which are clarified in the documents outlined above, one had to scan the college environment where some of these good intentions ought to have been realised. Upon investigating the implementation of the NC (V) Plant Production curriculum, one found the set-up as outlined above and discussed below. Obviously, the\

proper implementation of the subject content and assessment guidelines is not correctly implemented because not all the required specified facilities and assets are available. An Economics Training Manual (1988) prescribes that for the agricultural training to be proper, all the necessary facilities are to be made available to the trainees.

What can be seen, especially from colleges A and B stock registers, is the availability of basic garden tools like wheel barrow, knapsacks, mowers, spades and forks. The colleges do not have major farming tools that could lead to students being trained as entrepreneurs. It should be noted that the practical work sites are a *sine qua non* for the efficacy of the plant production teaching.

Table 4.36 Collated throughput and student drop-out rates at the three colleges

College	A	B	C
2012 Level 2 And Students registered	17	138	166
2013	07	65	23

Level 3 And Students registered			
2014 Level 4 And Students registered	06	50	11
Number Passed at Level 4 at the end of 2014	04 = 23.5%	16 = 11.59%	00 = 00%

4.10 Attendance and Punctuality Policy by the DHET

Among other important expectations on absenteeism, the Department of Higher Education and Training requires that: A student shall be allowed to write the examination for every subject for which he/she has attained a minimum of 80% attendance (including authorised absence and sickness) per subject. The expectation is for students to be 100% 'present' at all scheduled classes. The focus is on 'presence' rather than absence.

College staff is expected to:

- Communicate clearly the department's expectations that students are to be present in 100% of classes and to arrive before the start of class, ready to learn. It is recommended that students sign a code of conduct document, which includes a commitment to attend classes and be punctual, at the start of the academic year.
- Consistently reinforce the message that poor attendance or lateness is not acceptable and where it falls below an agreed level, this will lead to action, including possible disciplinary action, cancellation of entry to a final examination or even exclusion.

- Provide students with clear instructions on how to communicate their intended absence.
- Accurately and fully complete each class register by the end of each session. Ensure that when a student returns, they complete a Student Absence Form to be signed by the lecturer, processed and filed with the class register. Attendance should only be ‘authorised’ for absences agreed in advance or for exceptional personal circumstances. Sickness without a medical/registered traditional healer’s certificate is not authorised but must be marked as sickness on the Student Absence Form.
- Engage any student who arrives 10 minutes after the stipulated starting time of the class and record this student on the attendance register as being late, and follow this up with the student after the class has ended. Lateness must be recorded in the register with an ‘L’. Late students should not be excluded from the class unless it affects health and safety or disrupts the class.
- Ensure that attendance and lateness is monitored weekly by a specific member of the college staff, and the guidelines given below are followed.
    - Openly and regularly discuss the trends in attendance and lateness levels of a group or individual students in class sessions.
    - Directly address issues of attendance and punctuality in individual progress reviews, and set and monitor targets for improvement.
    - Regularly obtain attendance reports for each group and discuss trends and concerns with other lecturers, and program and academic managers. (DHET: Public Further Education and Training College Attendance and Punctuality Policy, pp. 1–7).

Students are expected to:

- Ensure that they attend all classes and arrive before the start of the class properly equipped and prepared to participate in the session.
- Inform their lecturer in person, or by an agreed contact route, before the start of class if they have genuine reasons for lateness or absence.
- Understand the expectations of attendance, the levels at which follow-up action will happen and what the consequences will be.
- Always schedule medical and other appointments out of college hours, if possible.

- Not take on work commitments that clash with scheduled class times at the college. Any absence for work will constitute unauthorised absence.
- Commit to complete outstanding work as homework from classes missed due to lateness or absence. (DHET: Public Further Education and Training College Attendance and Punctuality Policy, pp. 1–7)

Examinations

A student shall be allowed to write the examination for every subject for which he/she has attained a minimum of 80% attendance (including authorised absence and sickness) per subject.

Colleges will be required to verify and provide attendance information to the department before the release of examination entry permits to students at the start of an examination session. A student may not be given access to the examination room without this permit.

National Student Financial Aid Scheme (NSFAS) Payments

In terms of the department's FET College Bursary Guidelines, the disbursement of tuition, travel and accommodation allowances is intended to promote student attendance and ensure student academic performance. Paragraph 17 of the guideline states: "Allowances must be disbursed in tranches after thorough analysis of student attendance."

NSFAS tuition, travel and accommodation disbursements can only be made to students if they have a minimum of 80% attendance (including authorised absence and sickness) for classes.

Student absenteeism

Table 40 presents absenteeism, or class attendance, of students in the three TVET colleges.

Table 4.37 Collated student absenteeism at the three colleges

College	A	B	C
Level 2	±50% Attended 80–100% of classes	±10% Attended 80–100% of classes	±10% Attended 80–100% of classes
	±35% Attended 60–70% of classes	±15% Attended 60–70% of classes	±40% Attended 60–70% of classes
	±15% Attended less than 60% of classes	±65% Attended less than 60% of classes	±50% Attended less than 60% of classes
Level 3	±90% Attended 80–100% classes	30% Attended 80–100% classes	15% Attended 80 – 100% classes
	±10% Attended 60–70% of classes	35% Attended 60–70% of classes	60% Attended 60–70% of classes
	0 % Attended less than 60% of classes	35% Attended less than 60% of classes	25% Attended less than 60% of classes
Level 4	±67% Attended 80 – 100% of classes	±20% Attended 80 – 100% of classes	100% Attended 80 – 100% of classes

	±15% Attended 60–70% of classes	±40% Attended 60–70% of classes	0% Attended 60–70% of classes
	±18% Attended less than 60% of classes	±40% Attended less than 60% of classes	0% Attended less than 60% of classes

Table 4.38 Total training cost (covered by government subsidy and other funders)

Year	Total TR Cost	80% (Government Subsidy)	20% (Other Funding)
2013	R78 004	R62 403	R15 601
2014	R84 482	R67 585	R16 896
2015	R90 312	R72 250	R18 062

4.11 Miscellaneous College Documents

4.11.1 The Availability or Unavailability of Miscellaneous Documents and/or Activity at College A

The POEs (portfolios of evidence): Available
Examine WBEs (Work-Based Experiences) schedules: Not available
Service level agreements with industry and other sectors of society including government departments: Available

4.11.2 The Availability or Unavailability of Miscellaneous Documents and/or Activity at College B

The POEs (portfolios of evidence): Available
Examine WBEs (Work-Based Experiences) schedules: Available
Service level agreements with industry and other sectors of society including government departments: Available

4.11.3 The Availability or Unavailability of Miscellaneous Documents and/or Activity at College C

The POEs (portfolios of evidence): Available
Examine WBEs (Work-Based Experiences) schedules: Available
Service level agreements with industry and other sectors of society including government departments: Work in progress

4.12 The Importance of Practical Work in the Teaching and Learning of Primary Agriculture and the Subsequent Plant Production

Fucke (1996) noted that since the industrial revolution and increased specialization of work, practical work has been increasingly marginalized as something to be done only by those who do not possess mental faculties which allow for intellectual work. However, practical work, the transformation of materials, unifies mental and physical creativity in a process that challenges both mental and physical faculties and leads to their refinement and development. One finds it hard to understand the reasons why most TVET colleges disregard the importance of making agricultural practical sites available to students. It is important to highlight below why practical work is important.

- For any person to function effectively, one has to first formulate thoughts (which is the mental process), and once this has taken place, then there is concretization of the thoughts in the real world.
- Each person has the capacity to unfold both these complementary aspects for the interaction with and transformation of the world around him/her. During practical work, intellectual and physical activities are combined.

- The transformation of materials or practical work allows for learning by doing and is an important experience of own productivity and provides opportunities for significant learning about oneself and the world. After the necessary interaction of the two processes, one can say that learning has taken place.

Because of these straightforward facts, no one can deny the importance of practical work.

When some practical work has to take place, materials being used in practical work will somehow resist transformation. It is necessary to learn how best to transform something according to one's intentions when one does practical work. For this to happen, one has to co-ordinate one's mind with a particular physical activity and tune it to the requirement of the task at hand. At the beginning, it is typically difficult to adapt actions and individual movements to achieve what we have in mind, but continuous training and insistence help to acquire the capacities to do the work properly. When individuals finally master a technique, they have learned much about themselves and the world. Practical work is a challenge and opportunity for personal development and self-education. So depriving students of the opportunities to do practical work in agricultural plant production effectively means that those students are deprived of opportunities to think realistically and holistically. Practical work is the manifestation of the mental processes; therefore, students should be afforded opportunities to do practical work to fully express their minds. From the above views relating to practical work, it is important and necessary that one discusses the text relating to the importance of practical work in general and agriculture, plant production in particular.

The year 2007 was a year of curriculum change when the NC (V) qualification was introduced among the former FET colleges. Among other changes in curriculum, agriculture, of which plant production is part, was offered. At the introduction of the course, the Department of Education prescribed that each college offering Plant Production had to have a farm for doing practical work. There could have been the thinking that each college wishing to offer plant production would adhere to the prescripts. On the contrary, some colleges did not. This situation can subscribe to the view put by Fullan and Pomfret (1977) that earlier curriculum developers presumed that whatever curriculum innovation that had been initiated would be widely and readily accepted. The idea was that if the requirement is good and widely

disseminated, it will be adopted in the realm of practice. However, history has shown that many curriculum projects of the ‘60s and ‘70s have not been put into practice the way curriculum developers had hoped. When the new NC (V) curriculum was introduced in 2007, all the affected colleges had to scan their environments to assess if the conditions were suitable for the implementation of the new envisaged curriculum. Colleges that did not have adequate facilities for teaching Plant Production should have known that they would teach the course with bias towards the theoretical part.

The City Guilds (2008) concluded that vocational education that is taught with academic bias, or assessed on an entirely academic basis, will not properly fulfil the intended purpose of the course. This situation is evident among TVET colleges who do not have adequate agricultural facilities for teaching practical work. When the new curriculum was to be introduced, a study that would be concerned with implementation processes had to be conducted. It would be concerned with “the nature and extent of actual change, as well as the factors and processes that influence how and what changes are achieved" (Fullan, 1994). Thereby, it would be aimed at finding out what type of extra support in the 'project phase' is appropriate to promote actual use of the innovation.

Would it be correct to assume that some colleges, like colleges A and B, did not bother taking into account the extra support needed to effect the new curriculum change as suggested by Fullan (1994)? Was there a conscious effort by the TVET colleges A and B to receive innovative curriculum change? Did the colleges change related structures to accommodate the envisaged curriculum change? If the latter two questions can be answered positively, then it would be difficult to comprehend how it happened that so many prescribed requirements are unavailable. What was the role of the Department of Education? In their own prescription, they prescribed what has to be made available when the Plant Production course is introduced. What was their response when they realised that the prescripts are not met? Remember, these are prescriptions and not recommendations.

Bradely (2012) states that when it comes to knowledge, there are two different kinds of knowledge: theoretical and practical. Both make a student better in what she/he does. There is the thinking that those who advance furthest in life are those who

acquire knowledge at both ends of the spectrum, and they acquire knowledge in a variety of ways.

The theoretical part of knowledge teaches why things happen and also assists the learner to understand why one technique fails where others have succeeded. It helps individuals set strategies. Theory helps to deliver to the learner the experiences of others. Theoretical knowledge can lead to deeper understanding of a concept through seeing it in context of a greater whole and understanding the 'why' behind it.

That some TVET colleges offer theoretical knowledge extensively, and that does not make them entirely bad. Theoretical knowledge is important and necessary. What becomes problematic is when it is not coupled with practical knowledge, especially in practical vocational subjects like Plant Production. Practical knowledge helps students acquire specific techniques that become tools of their trade. Practical training sits much closer to one's daily work. There are some things one can only learn through doing and experiencing.

City Guilds Centre (2008) is of the view that whether based in the office or out in the field, employment is by its very nature vocational and largely practical. Practical tasks and practical decisions are an everyday part of work. Negative perception about practical work should be eliminated. It is for this reason, among many, that the TVET colleges and the Higher Education and Training Department should not prescribe practical work sessions and not ensure that the facilities for such are not ignored and overlooked. Further, the Guilds recorded that in a CBI survey conducted in the UK, 62% of employers said that having relevant work experience is vitally important for job seekers. This calls for training institutions to ensure that the training they offer to students comes with relevant experience. It should be noted that practical learning is not just for less academic students but for all in training. In medical schools and engineering universities, practical work in training is valued by academics, policy-makers and employers alike.

City Guilds (2008) have noted that the workers in practical sectors such as hairdressing and beauty therapy have, for the fifth year running, rated themselves among the happiest workers in the UK. This statement is true when the response at College C Level 2 to practical work is noted. The attendance in practical work was

far better and it far exceeded attendance in theory classes. The Guild sees as important the following points in practical learning:

- Vocational education and training is best taught by practical methods in a practical setting.
- Vocational education and training that is taught with an academic bias or assessed on an entirely academic basis will not properly fulfill the intended purpose of the course.
- The resources provided for practical training should be proper. The equipment used should be of similar standard to that of industry, although this has particular cost implications for the delivery centre.
- Practitioners need to be fully engaged in the design of the curriculum at all stages, and continue to be responsible for delivery.
- Expected quality standard for practical learning needs to be applied rigorously.
- The model for practical learning needs to be tested in a range of settings: urban, rural and in companies.

The scholars of agricultural curriculum implementation have emphasised the importance of experiential learning on several occasions. Blum (1996) informs that experiential learning in agriculture was developed mainly at Hawkesbury College in Australia. An evaluation of the college's experience showed that graduates were more employable and that their employers believed that their approach to problems was more open-minded and comprehensive, thus enabling them to be good problem-solvers and communicators, to be more creative, and to be experienced in teamwork.

Recently, the "experiential learning" approach has been developed for teaching agriculture. This approach views learning and the farming environment as "soft systems," meaning systems that are not fixed. When one tries to separate the elements of a system in order to study each element in isolation, something important is lost, even if an attempt is made later to reintegrate the parts. Therefore, the "wholeness" of a system (for example, the agricultural environment as a whole) should be studied. Without looking at the whole, the parts cannot be fully understood. It is for this reason that this study emphasises the total engagement of plant production students in the practice of the full-scale agricultural practice.

The attributes mentioned above are of great necessity if the TVET colleges are to produce entrepreneurs in agriculture. This, therefore, highlights more the need for colleges to have farms of their own. The other greater advantage of colleges to have farms is the opportunity afforded to students to understand and conceptualise the learning in its totality. Simulations are good, there is no question about that, but the shortcoming of simulations is that they do not present the 'farm learning experience' in its totality.

This situation requires flexible teaching schedules; the DHET should not have a 'one size fits all' approach but should allow colleges to offer subjects in line with their regional climatic conditions. There needs to be curriculum review committees to align curricula offered along regional lines.

Some colleges have stated that more extensive practical work is done at Level 4. The question of large-scale farming should cover the entire training spectrum and not only be introduced at Level4. This late introduction is not in line with the content implementation requirements. The guidelines in Plant Production Level 2 have outlined the factors that contribute to achieving Plant Production learning outcomes. They are:

• Enabling environment: Plant Production should be presented in a context of small, medium and micro enterprises (SMMEs), emerging small-scale farmers and personal needs.
• Resources: Students must also have access to all the necessary resources, depending on the task.
• Experiential exposure: Students must be exposed to practical and appropriately simulated work environments.
• Suitably qualified lecturers: Lecturers should be well informed about legislation, community issues and available support systems from, for example, the departments of Agriculture and Environmental Affairs. They should also possess technical knowledge of Plant Production.

The challenge relating to practical training is massive for College A. As early as Level 2, the college should already be introducing students to the real practical farming.

In terms of the curriculum prescripts, nothing suggests that Level 3 can be excluded from large-scale practical training. The Department of Education in 2007 prescribed that all the training facilities should be made available at all levels. Not making the facilities and equipment available at Level 3 makes the implementation and assessment of both content and practical work compromised and improperly implemented.

The departmental guidelines of the Plant Production subject implementation state that the subject is taught among other reasons to teach students in "*gaining skills and techniques in the establishment and management of crops and fruits," and it "creates better employment or self-employment opportunities for students when they have completed the programme."* It is, therefore, unfortunate that the colleges do not provide appropriate equipment and facilities to train the students as entrepreneurs as well. The training of students as entrepreneurs is not something that happens per chance.

According to Zamani (2001), poor practical abilities of agricultural graduates and irrelevance of university subjects and curricula to labour market needs are some causes of agricultural graduates' unemployment.

Movahedi, Mantashloo and Ali (1997) noted that in many developing countries, the public sector used to absorb the large majority of agricultural graduates and, consequently, agriculture graduates are now finding it increasingly difficult to become employed. Their education in agriculture has not been oriented to the needs of an increasingly sophisticated commercial sector (FAO, 1997).

Trexter (2006) conducted a study of agricultural practitioners' opinions and necessary experiences for inclusions in an undergraduate program.

The findings stated that:

- Practitioners expressed the importance of on-farm experiences to complement classroom learning.
- There was a need to build experiences in areas such as identification of field problems and field practices.
- There was a need for students to gain experience in a variety of agricultural enterprises including conventional and sustainable practices and large- and small-scale farms.

- Field experiences were seen as a means to evaluate innovations and practices in various conditions.

It was therefore concluded that a sustainable agricultural major should include the following:

- Farm visits: These are important and can include field trips and farm internships.
- Students' engagement in the relationship of the entire agro-foods system with experiences of conventional and organic management settings.
- Experiences that extend beyond the agronomic production disciplines into environmental and social sciences.

It was recommended that students should be afforded an opportunity through programs to construct understanding of the complexities of sustainable agriculture. Undergraduate curriculum should infuse student farm experiences, job shadowing and internship of the curriculum that broach all aspects of the agro-foods system. There is a need to develop curriculum that is designed to expose students and connect them with people who are actively engaged in the continuum of sustainable agriculture professions.

4.13 Absence of Nurseries and Other Practical Work Facilities

Michael et al. (2007) noted that some TVET colleges offering the plant production course do not have nurseries for training purposes, even if this is prescribed by the DHET. Plant trialling and marketing assistance programs have become popular in recent years, with several state and some regional programs emerging. Michael et al. (2007) noted that in order to be successful in teaching plant production, the implementation process requires considerable labour, facilities, and monetary resources for evaluation of large numbers of taxa over several years to ensure that plants are well adapted to the region of interest. Obviously, if the colleges are to advance in the teaching of plant production, they have to try new varieties in various places and regions and take note of the recommendations so that their trials are not in vain. They also need to secure research and development funds, dedicated facilities, and commitment to keep trialling.

Programs can be limiting during their early years. Involvement in plant trialling programs allows students to be exposed to plot layout planning, statistical design, plant maintenance, data collection and analysis, and professional communication of trial results.

Construction of facilities for conducting plant trials, growing plants for use in trials, trial installation, and maintenance of plants all provide practical hands-on horticultural training. The practical component is of utmost importance because students are able to learn by doing. Replicated plant trials provide the latest information on regionally adapted taxa for inclusion. The idea of trialling provides a new dimension in the learning of plant production at the TVET colleges. The question of trying new things and ideas in the TVET college curriculum does not seem to be a trend. These research recommendations can, therefore, bring this long desired and outstanding dimension of the college education.

In the USA, some plant trialling programs benefit from labour assistance, development of dedicated facilities, and the opportunity to share equipment and supplies among teaching, trialling, and student research projects. This view maybe of great advantage to the South African TVET college education system in the sense that not every college will have to develop its own separate trialling facility but the colleges can share. In the South African context, what can also be done is to have the SETAs in the Education and Agriculture departments develop the facilities to be shared by all.

In addition, in the US, some trialling programs are run independently by industry trade organizations or university personnel, others are joint efforts between university and industry. Co-operative ventures provide a framework to capitalize on the research and communication skills of university personnel and the marketing expertise present in industry organizations. In the South African education system, a remarkable effort has been put to establish some linkages between the industry and TVET colleges through the SETAs. Over and above these initiatives, the partnerships can be further diversified not only to be restricted to labour issues but to also include research, which is crucial in education.

4.14 Distances between the Practical Work Sites and Theory Classes

McCombs and Van Syckle (1994) found the distance between the place of practical work and that of the theory part to be advantageous. The situation usually affects both students and administrators in the following way:

Programming, time, and cost: Should there be poor relationship between an industry and students doing practical work in that private industry, there will be problematic relations between the college or university and that particular industry. This situation proved true when a subject advisor at College A stated the following during an interview: "*The possible practical facilities are far away. You see, here we combine some classes for example the maths students are combined with students in hospitality studies and in agriculture. When the agricultural students have to go for practical work on the farm far way, other students have to wait for the agriculture group or continue without them. This arrangement is a disadvantage. The college has no farming land of its own; we use church land, and we cannot do all practical's on that land alone. The church land is about 9 km from the college and travelling takes its own time. Sometimes we arrange with commercial farmers for students to experience valuable exposure there, but what do farmers get in return? Nothing."*

In addition, Lecturer C at College B stated that: "*Students are sometimes a problem; they go to the commercial farmers and waste the farmers' time by not doing work, and farmers do not have time to waste; therefore, farmers refuse to assist the college (because of uncooperative students). At one stage our students were sent back."*

So to avoid all these sorts of problems, colleges need to have their own farms.

The next chapter will give the summary of the findings in relation to the research question and plant production guidelines. The chapter will also display collated information from stock and asset registers at the three colleges. The responses to some research questions will be discussed and recommendations will be made. The last part will be suggestions for further research.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, RECOMMENDATIONS FOR IMPLEMENTATION AND SUGGESTIONS FOR FURTHER RESEARCH

5.1 Introduction

The preceding chapter covered the analysis of data and discussed the findings. Topics covered in the chapter include Quantitative Data Analysis, which includes respondents' responses, the normality of data, reliability and validity of instruments. Moreover, the chapter covered qualitative data analysis, which classifies data into themes, and document analysis. The last part in the previous chapter is the discussion of findings. This chapter will discuss topics that follow below.

5.2 Summary of background to the findings and conclusion

This research was initiated with the aim of finding answers to the questions outlined below.

5.2.1 The Research Question

Is there a disparity between NC (V) Plant Production subject guidelines and their implementation and assessment?

Pertaining to the above question, the research revealed that there was a disparity between NC (V) Plant Production subject guidelines and their implementation and assessment.

Plant Production Guidelines

The research arrived at this conclusion because the Plant Production Guidelines prescribe that for South African TVET colleges to be able to train students properly in the Plant Production course, they need to offer training in the methods outlined below:

- Presentations (practical work, observation, role-play, self-initiated activity, judging the quality of farm produce, and evaluation)
- Field tests and research in a structured environment

In order for the above practical assessments and implementation to take place, the following should be available:

General agricultural facilities

- Established pastures
- Irrigation
- Farm tools and agro-chemicals
- Seedling nursery (vegetables, trees and shrubs)
- Water reticulation

Vehicles

- 1 tonne pickup and a canopy
- 1 medium-sized tractor
- 1 minibus for transporting learners
- Tractor trailer and implements

Fencing

- External security fence: 2 km
- Internal fence: 1.6 km

Miscellaneous

- Laboratory with equipment for plant and soil science
- Laboratory with equipment for animal and poultry science
- Teaching aids (data projectors, screen, DVD player, etc.)
- Computers with internet links
- Library with relevant books and magazines

Factors that contribute to the achievement of Agribusiness learning outcomes

- Enabling environment – this subject should be presented in the context of small, medium and micro enterprises (SMMEs), emerging small-scale farmers and personal needs.
- Resources: Students should have access to all the necessary resources needed for the chosen practical activities at hand.
- Experiential exposure: Students should be exposed to real and simulated work environments.
- Suitably qualified lecturers: Lecturers should have a solid command of subject knowledge and skills and be well informed about legislation, community issues and access to support systems (for example, systems provided by the Department of Agriculture).

Table 5.1 shows the availability and or non availability of resources that are prescribed by the subject guidelines.

Table 5.1 Collated information from stock and asset registers at the three colleges

Equipment	College A	College B	College C
1. Established pastures	Not available	Not available	Available
2. Irrigation	Not available	Not available	Available
3. Farm tools ▪ Wheel barrow ▪ Knapsacks ▪ Mower ▪ Spades ▪ Forks ▪ Farm shed	• Available • Available • Available • Available • Available • Not Available	• Available • Available • Available • Available • Available • Not available	• Available • Available • Available • Available • Available • Available
4. Seedling nursery			

▪ Vegetables ▪ Trees ▪ Shrubs	• Not available • Not available • Not available	• Available • Not available • Not available	• Available • Not available • Not available
5. Water reticulation ▪ To paddocks ▪ Livestock units	• Not available • Not available	• Not available • Not available	• Available • Available
6. Vehicles ▪ 1 ton pickup and canopy ▪ Medium size tractor ▪ Minibus for transporting students ▪ Tractor trailer	• Not available • Not available • Not available • Not available	• Available • Available ▪ Not available ▪ Available	• Available • Available • Available • Available
7.Farming Implements	• Not		

• Ploughs, • Harrows • Planters • Combine harvesters • Bailers • Boom sprayer	available • Not available • Not available • Not available • Not available • Not available	• Available • Available • Not available • Not available • Not available • Not available	• Available • Available • Available • Available • Available • Available
8. Fencing ▪ External fences: 2 km ▪ Internal fences: 1.6 km	• Not available • Not available	• Not available • Not available	• Available • Available
9. Miscellaneous Laboratory with equipment for plant and soil science.	• Not available	• Available	• Not available
10. Teaching ads ▪ Data projectors and screens	• Available	• Available	• Available

▪ DVD players ▪ Computer with internet links	• Available • Not available	• Available • Available	• Available • Available
11. Library with relevant books and magazines	▪ Not available	• Not available	• Not available

The conclusion is that the guidelines are not properly implemented because of inadequate facilities at the colleges. In the absence of proper facilities, no proper implementation and assessment can take place.

After the research question, various sub-questions displayed below were asked.

5.2.2 The Research Sub-Questions

5.2.2.1 First Research Sub-Question

What opinions in terms of strengths and weaknesses do the plant production graduates from the TVET colleges have on the course that prepared them for employment or entrepreneurship opportunities?

Interview extract from a questionnaire directed to the graduates with regard to the first research sub-question

Question 3

What would you regard as the strengths of the plant production training from levels 2 to 4?

Question 4

What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

Answers by graduates on strengths and weaknesses of their training

Graduate A (College B)

Answer to Question 3

"The lecturers are good. The problem is the equipment. Teaching is 100% good; the problem is the practical work."

Answer to Question 4

"Practicals are a weakness. We need to form partnerships for practical activities. There are no job opportunities; most students are not working in what they graduated. Teachers need to negotiate with farmers. The farmers do not know about colleges."

Graduate B (College B)

Answer to Question 3

"The lecturers do everything they can with the limited resources [strength]. Students require practical's to be done, but there is no work for students outside. The government should establish partnerships with the farming community."

Answer to Question 4

"We lack employment. There are no job opportunities out there. I do not know whether or not this course was properly planned, or there were disagreements among the people of government. The course does not seem to have been marketed correctly. There is no proper advertising of the course. Most people do not know about the course."

Graduate C (College B)

Answer to Question 3

"The training was not strong enough. There was more theory and not enough practical work."

Answer to Question 4

“Like I have said, we did more theory than practical work. …if the college can add more practical work in the training.”

Graduate D (College B)

Answer to Question 3

“Domestic small practicals - we are strong in the marketing knowledge.”

Answer to Question 4

“No practical skills relating to big equipment”

Graduate E (College C)

Answer to Question 3

“The training itself. The training gives a lot of information. I can start assisting from the family level by planting a garden at home. I can also assist the community to start a community garden. They can be taught to market their products and sell to the local community vegetable markets.”

Answer to Question 4

“There are no major weaknesses. The problem is that the chemicals for treating pests and plant diseases are not easily obtainable at the college. One has to move from that person to the next before one is able to get these chemicals.”

Graduate F (College C)

Answer to Question 3

“The teaching part of it. We were taught what plant to plant during which seasons and what tilling methods to apply and what chemicals to use when plants are affected.”

Answer to Question 4

“There was insufficient equipment for doing practical work.”

Graduate G (College C)

Answer to Question 3

"It is practical's. We did a lot of practical's, but, like I have indicated, they need to add some more projects to the practical's."

Answer to Question 4

"For me, I did not do agriculture at school, and it was difficult to adjust to college curriculum, so I need more introduction at entry level."

Relating to the *plant production graduates' opinions in terms of strengths and weaknesses on the course having prepared them for employment or entrepreneurship opportunities,* the course does have some strengths, which include good teaching staff. The major weakness identified by the majority of students, except for College C, was the lack of proper facilities for practical work.

5.2.2.2 Second Research Sub-Question

What opinions in terms of strengths and weaknesses do the employers of plant production graduates from the TVET colleges have on the course that prepared their employees for employment?

Interview extract from a questionnaire directed to the employers with regard to the second sub-question

Question 2

What would you regard as the strong feature of the course content that was taught to the graduates?

Question 4

What would you regard as shortcomings and weaknesses of the plant production course content based on your encounter or experience when working with the graduates?

Employer A

Answer to Question 2

“The material is adequate to educate learners and make them fit for the industry. But I am worried by the practical part.”

Answer to Question 4

“Practical. Students are not ready as employees. They are not committed to what they are doing. The might not be fully motivated to agriculture. Maybe they are confused. They get employment in other opportunities.”

Employer B

Answer to Question 2

“The graduate is a former student of this school. For her, it was a continuation of what we had already taught her. She has no brought some new information she did not have before. She now has information on chemicals and weed killers.”

Answer to Question 4

“Practical part.”

Employer C

Answer to Question 2

“She is able to think independently and sorts out problems quickly and is able to work independently. And she is well spoken.”

Answer to Question 4

“The shortcomings are in the course product knowledge, like in fertiliser field knowledge.”

From the responses, it appears that the employers do not have a problem with the course content itself, but their major problem is the fact that the graduates lack practical work exposure.

5.2.2.3 Third Research Sub-Question

What is the nature of strengths and weaknesses of the subject guidelines for plant production modules from level 2 to 4 in terms of content level suitability and optimum content sequence from one level to the next higher level to equip learners with expected outcomes?

Interview item from a questionnaire directed to the lecturers with regard to the third research sub-question

Question 1

In your view, are plant production subject guidelines appropriate and relevant for each of the training levels (i.e. levels 2 to 4)? Does each of the prescribed course content fit the level for which it was designed?

Question 2

Do the subject guidelines and course content articulate well from one level to the next? Is there synergy?

Response from Lecturer A (college A)

Answer to Question 1

"Level 2 is low, Level 3 is better, and level 4 is very appropriate. Level 2 is brief and less scientific. The scientific concepts are of about grade 8; below grade 9. Level 3 also deals with insects; its ok. Level 4 is wonderful, and it leads to tertiary education."

Answer to Question 2

"Between levels 2 and 3 there is no link. Level 3 is loaded. Level 4 is advanced and there is generalisation. In level 2 one would expect the students to deal with scientific concepts as well, which is not the case."

Responses from Lecturer B (College B)

Answer to Question 1

“Yes. Level 2 is just introduction.

Level 4 is detailed. Students should not be piled too much. Grade 10 information in the school set-up is much more than Level 2. Students at level 2 do not have that much of practical’s.”

Answer to Question 2

“Synergy is there. For example, at Level 2 they deal with diseases and pests. Level 2 is not detailed. Level 3 is deeper and deals with the susceptibility of plants, and Level 4 deals with vulnerability of plants.”

Responses from Lecturer C (College B)

Answer to Question 1

“The guidelines are appropriate. The problem is the quality of learners enrolled at Level 2. Most of the students enrolled at level 2 are not suitable for the material used at the level. The teaching at Level 2 should be 70% practical, and this applies to all levels.”

Answer to Question 2

“Yes, it is appropriate.”

Responses from Lecturer D (College B)

Answer to Question 1

“In the main, it is ok. Textbooks are full of highlights. They need to add some more information. Books are summarising. It becomes difficult, especially for students who did not do the subject in the previous grades or classes.”

Answer to Question 2

“There is synergy between levels 2 and 3, but we need to add more information; we add more information by writing notes on the board.”

Responses from Lecturer E (College C)

Answer to Question 1

"Yes, at the same time it is challenging. Other students have completed Grade12, and it is ok with those. The challenge is with students who have not completed grade 12."

Answer to Question 2

"There is a link."

Responses from Lecturer F (College C)

Answer to Question 1

"Appropriate. Level 2 deals with weeds, fertilisers and pests; Level 3 deals with fertiliser application; and Level 4 deals with plant propagation."

Answer to Question 2

"Levels link well. At Level 4, some things from Level 2 come back and link well with level 4."

These responses indicate that the lecturers have different views on strengths and weaknesses of the level modules. While about half of the lecturers feel that Level 2 content is appropriate, the others feel the modules are of a low standard. Level 4 seems satisfactory to most lecturers, as they unanimously agree that there is synergy between the levels.

5.2.2.4 Fourth Research Sub-Question

What are the strengths and weaknesses of the curriculum implementation in terms of subject and assessment guidelines for plant production modules from level 2 to 4 equipping learners with expected outcomes?

Interview item from a questionnaire directed to the subject advisors with regard to the fourth sub-question

Question 1

In your view, are the NC (V) levels 2 to 4 assessment guidelines implemented correctly?

Question 2

Is the course content at all levels implemented correctly?

Question 3

Would you say there are identifiable strengths in the implementation of assessment guidelines?

Responses from Subject Advisor A

Answer to Question 1

"The implementation is as correctly as possible but there are challenges."

Probe: What Challenges?

"The practicals are a challenge."

Probe: How so?

The possible practical facilities are far away. You see, here we combine some classes, for example, the maths students are combined with students in hospitality studies and in agriculture. When the agricultural students have to go for practical work on the farm far way, other students have to wait for the agriculture group or continue without them. This arrangement is a disadvantage. The college has no farming land of its own, and we use church land. so we cannot do all practical's on that land alone. The church land is about 9 km from the college and travelling takes its own time. Sometimes we arrange with commercial farmers for students to experience valuable exposure there, but what do farmers get in return? Nothing."

Probe: How else are practicals a challenge?

"The region's and January enrolments are another problem. For example, the winter in Gauteng limits the planting period. Bean planting encourages and motivates students. but shortly after registration it is winter time and most vegetables and crops cannot be planted for students to see, unlike the coastal regions which are not affected by winter frost. We can plant oats, but it is not quick growing and it is not easy to use it to motivate and excite students."

Answer to Question 2

"We try to. Some methods are aimed not at commercial farming. There is no emphasis on large-scale farming. The methods are for backyard gardening; "Door frame"-gardening, so to speak. There is no emphasis on large-scale farming. It is only at level 4 where they are introduced to the theory of big farming machines. Levels 2 and 3 are equally important. They, too, like level 4, are equally important, and that is where we should start."

Answer to Question 3

"Yes, there are. Go home, do college work in engineering. Parents can see what is done and how it is done, for example, compost making."

Responses from Subject Advisor B

Answer to Question 1

"No, I think it is difficult for some lecturers to understand the content. In my view, some of them do not have enough subject content knowledge. The knowledge is not adequate. In most cases, colleges lack resources for practical work. The plant production program is expensive and requires adequate resources."

Answer to Question 2

"No, as I have already stated, there is a lack of adequate and in-depth knowledge amongst most lecturers, and there are scarce resources; hence, the difficulty in proper implementation of the course content."

Answer to Question 3

“Certain things are easier to implement. There are resources and knowledge, which are requirements for proper curriculum implementation. As soon as the knowledge part lacks, which seems to the case in this situation, there shall be improper implementation. The other problem leading to the failure of proper implementation is the lack of creativity by some lecturers. When teachers lack creativity, they cannot work around challenges where there are no resources.”

The first subject advisor noted some strengths, but the one saw a lot of weaknesses as opposed to strengths. However, both advisors felt that there were major weaknesses in implementation because of the lack of practical work facilities.

5.2.2.5 Fifth Research Sub-Question

Are there any notable strengths and weaknesses of the implementation of assessment guidelines and how they affect the achievement of expected outcomes?

Interview item from a questionnaire directed to the subject advisors with regard to the fifth research sub-question

Question 3

Would you say there are identifiable strengths in the implementation of assessment guidelines?

Question 4

In your view, are there any glaring and identifiable weaknesses in the implementation of the assessment guidelines?

Responses from Subject Advisor A

Answer to Question 3

“Yes, there are. Go home, do college work in engineering. Parents can see what is done and how it is done, for example, compost making.”

Answer to Question 4

“Ja. The methods are slightly outdated. The practices are aimed at micro and small scale for household use. The aim should be to prepare students to become entrepreneurs and successful established farmers.”

Probe: How do we solve this?

Identify students to be mentored while studying. This can do well for the land reform strategy.

Responses from Subject Advisor B

Answer to Question 3

“Certain things are easier to implement. There are resources and knowledge, which are requirements for proper curriculum implementation. As soon as the knowledge part lacks, which seems to the case in this situation, there shall be improper implementation. The other problem leading to the failure of proper implementation is the lack of creativity by some lecturers. When teachers lack creativity, they cannot work around challenges where there are no resources.”

Answer to Question 4

“Yes. Most teaching staff are not adequately qualified and, therefore, cannot assess accurately. The staff we have need clearer and simplified guidelines. As soon as something needs more interpretation there are usually some problems with the staff members who have some superficial knowledge.”

5.2.3 The findings and conclusion

From the above outlined responses it was found that various categories of respondents had varying views relating to the questions asked. Below are some of the findings. Some lecturers felt that there was a lack of discipline among students which was evident in the rate of absenteeism at the three colleges at all levels. There was a feeling among some lectures that the huge student intake at level 2 contributed to the lack of discipline and high failure rate among students. There was also dissatisfaction among some lecturers about the quality and standard of some prescribed text books and they felt that some were of low quality. Colleges with inadequate training facilities could be assisted by the neighbouring communities but

some were white farmers with negative racial attitudes and could therefore not accommodate college students who are black in the main. On the same point, some lecturers pointed out that in some cases when students are granted opportunities by farmers, they absent themselves from the farms because of the lack of discipline. The nature of student absenteeism is not accommodated by farmers. Most lecturers were satisfied about the quality of the content taught to students only if the training facilities for practical work could be made available.

Some graduates felt that the curriculum content was sufficient for them to be trained as entrepreneurs. They expressed mixed feelings about the quality of teaching. Others felt that teachers are trying hard from inadequate training facilities while others felt that most teachers in the TVET college sector were no properly trained and qualified. There was a feeling by some that the government is not doing enough to support graduates towards starting their own businesses. Some graduates also felt that the colleges are not properly marketed hence many people do not know much about colleges. Most colleges lacked facilities for doing practical work.

Employers had mixed feelings about graduates. Others expressed hope that as time progresses, students will improve but did express a concern that most TVET colleges do not have adequate facilities for doing practical work.

Both subject advisors in the main, mention the weaknesses identified in the TVET training program. Their main concern was the lack of proper training facilities for doing practical work and some inadequately trained lecturers who often lack creativity when confronted by challenges. They did not seem to be having major problems with subject content taught at the colleges. The concern though for one subject advisor was the rigid and restrictive curriculum which does not allow flexibility to accommodate the varying regional seasons. Colleges should be allowed to teach as the regional climates allow. For example, inland colleges cannot grow frost affected plants in winter while frost free coastal regions can grow most vegetables throughout the year. Inland frost affected college miss a lot in vegetable production. By the time summer kicks in, it is time to prepare foe examinations and by the time the crop is ready for harvest, most students are already home for summer vacation.

The plant production and assessment guidelines prescribe the facilities, equipments and the resources that should be made available in order for the colleges to be able to teach plant production properly. In addition to the above mentioned prescripts, the

code of conduct for students which includes class attendance, completion of college tasks and assignments, is prescribed. Using all the above mentioned prescripts, the researcher determined whether or not the plant production modules are correctly implemented and assessed. The conclusion was that the National Certificate (Vocational) plant production modules are not properly implemented at all NC (V) levels 2 to 4. In the main, there are three major factors that negatively affect the implementation and assessment of plant production modules.

- Poor or inadequate infrastructure for doing practical work.
- High rate of student absenteeism within the investigated categories.
- The high drop-out rate within the packaged program from Level 2 to Level 4.

All the points above were evaluated and discussed in relation to:

- The responses by subject advisors, the graduates, college lecturers and the employers.
- The theoretical framework of the study, which incorporates constructivism, social learning theory and expectancy theory.
- The general text on curriculum implementation and the teaching of agriculture as a subject and as science; specifically, the teaching of Plant Production

The situation above indicates that students are deprived of practical learning in a major way. It is both important and necessary for colleges to make available all the prescribed requirements if they are to offer plant production as a module. The theory of constructivism explains extensively why it is important to construct knowledge in the practical subjects. Students should therefore not be deprived of opportunities to construct knowledge by not providing proper facilities for practical work.

5.2.4 Recommendations for implementation

Since some colleges cannot afford purchasing large sizes of land, the government and the DHET should link the Primary Agriculture training to the land reform program. The DHET should identify a significant number of Plant Production students to train specifically to venture as entrepreneurs to work in the redistributed agrarian lands. Training in Primary Agriculture should accommodate the aspirations

of the government National Development Plan which, among other things, aims at improving the livelihoods of communities through improved agricultural practices

The Plant Production guidelines intend offering training that will produce entrepreneurs. Because of the views of some employers in the agricultural industry, it is clear that some individual employers are not convinced by the training that takes place in the TVET colleges. Colleges should therefore identify individuals and bodies that show interest in agricultural training and work with them fulfill the training aspirations of these bodies and individuals. (for example, Gwede Mantashes' agricultural training needs of the youth, the agricultural training needs for agricultural co-operatives as outlined by Dr Zweli Mkhize, and a host of other individuals who have expressed views on appropriately trained practitioners in the field of agriculture).

There is a need for colleges to establish formal and proper links with commercial farmers, other government departments, especially with the departments of agriculture, trade and industry, science and technology, NGOs, CBOs, private industry and all other relevant departments. The aim of establishing formal partnerships should be to share good practices and training facilities.

In order not to waste huge sums of monies, colleges should prescribe admission requirements so that only students with potential to complete the course are enrolled. They should also get suitably qualified teachers in agriculture. Senior positions in agricultural units of the college should be offered to people with practical agricultural experience.

TVET colleges offering agriculture should invest in agricultural resources, including purchasing farms preferably attached to the agricultural unit of the college. The DHET has heavily subsidized primary agriculture. From the current subsidies, with good saving investments over the years, colleges should be able to purchase farms for practical work. The DHET should not allow the colleges without proper agricultural infrastructure to offer primary agriculture and, subsequently, plant production. TVET colleges should first meet the departmental infrastructure, resources and equipment requirements before they are allowed to offer primary agriculture. Site visits to verify the availability of all the requirements should be conducted by the DHET before permission is granted for the colleges to offer primary agriculture and, hence, plant production.

The DHET should re-assess the current colleges offering plant production to see if they are capable of continuing to offer the program, if not, they should be given time to correct the deficiencies and make available all the unavailable teaching and learning requirements as prescribed by the DHET. Lastly, TVET colleges should drastically reduce intake at Level 2 to about 50 students. Below are recommended numbers acceptable in agriculture classes. The Technical Education Requirements (CET) (2015) 8VAC20 prescribes that in agriculture and related module classes, the maximum number of students should not exceed 20. An Act relating to maximum class size by General Assembly of the Commonwealth of Kentucky (2015) stipulates a maximum of 31 students for grades 7 to 12 in agricultural clases.

Suggestions for Further Research

- Reasons for student absenteeism in Primary Agriculture classes
- Wasteful expenditure in government-subsidized training programs at the TVET colleges. The case of Primary Agriculture
- Linkages of TVET colleges with private industry, particularly the private farming sector
- Employment opportunities for Primary Agriculture graduates
- The quality of Primary Agriculture graduates
- The quality of the principals of TVET colleges offering Primary Agriculture
- The attitudes and views of commercial white farmers towards NC (V) graduates
- The motives of TVET colleges for offering Primary Agriculture

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APPENDICES

APPENDIX A: Interview Schedule of Employers of College Graduates

All the questions relate to Plant Production NC (V) FET College graduates. These graduates have studied and passed Plant Production course at Levels 2 to 4. These graduates shall henceforth be referred to as ‘graduates’.

1. Based on your experience when working with the graduates, is the course content which was offered by the college relevant to the needs of your agricultural industry?

2. What would you regard as the strong feature of the course content that was taught to the graduates?

3. Do you find the graduates produced by the FET College to be adequately trained for your production needs?

4. What would you regard as shortcomings and weaknesses of the plant production course content based on your encounter or experience when working with the graduates?

5. What do you recommend to be done for the improvement of the training course for the graduates?

Questionnaire for Employers

All the questions relate to Plant Production NC (V) FET College graduates. These graduates have studied and passed Plant Production course at Levels 2 to 4. These graduates shall henceforth be referred to as ‘graduates’.

Please mark with an X within the box below to indicate your response to the statements below.

Key:

4 Means = Strongly Agree

3 Means = Agree

2 Means = Disagree

1 Means = Strongly Disagree

1. Based on your experience when working with the graduates, the course content which was offered by the college is relevant to the needs of your agricultural industry.

4	3	2	1

2. The course content that was taught to the graduates was very strong for the agricultural industry.

4	3	2	1

3. The graduates produced by the FET College to be adequately trained for your production needs.

4	3	2	1

4. The training offered by the FET Colleges in agriculture is full of shortcomings and weaknesses.

4	3	2	1

5. There is a lot more to be seriously done for the improvement of the training course for the graduates.

4	4	2	1

APPENDIX B: Interview Schedule for College Graduates

All the questions are directed to Plant Production NC (V) FET College graduates. These graduates have studied and passed Plant Production course at Levels 2 to 4. The graduates are of 3 categories viz. Employed in the field of agriculture, employed in any other field and the entrepreneur.

1. Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

2. Based on the training you received at the college, do you feel you are now in a position to engage in the business world as an entrepreneur?

3. What would you regard as the strengths of the plant production training from levels 2 to 4?

4. What do you consider as the weaknesses of the training you had to undergo from plant production levels 2 to 4?

5. What would you love to have been included and or deducted in the course content at all the training levels?

Questionnaire for the College Graduates

Please mark with an X within the box below to indicate your response to the statements below.

Key:

4 Means = Strongly Agree

3 Means = Agree

2 Means = Disagree

1 Means = Strongly Disagree

1. Did the NC (V) Plant Production course from levels 2 to 4 prepare you adequately for employment?

4	3	2	1

2. Based on the training you received at the college, you are now in a position to engage in the business world as an entrepreneur?

4	3	2	1

3. The plant production training is a very strong and a relevant program to train students in whatever skill they may require after college life.

4	3	2	1

4. There are identifiable weaknesses in the plant production training program.

4	3	2	1

5. There is a lot lacking in the plant production curriculum content hence the need for a very serious curriculum review.

4	3	2	1

APPENDIX C: An Interview Schedule for the College Lecturers

All the questions relate to Plant Production NC (V) FET College graduates. These graduates have studied and passed Plant Production course at Levels 2 to 4.

1. In your view, are plant production subject guidelines appropriate and relevant for each of the training levels (i.e. levels 2 to 4)? Does each of the prescribed course content fit the level for which it was designed?

2. Do the subject guidelines and course content articulate well from one level to the next? Is there synergy?

3. Does the course content equip the learners at each level with expected outcomes?

4. Does the course content at all levels prepare students for employability and entrepreneurship?

5. What do you consider to be the strengths of the course content and subject guidelines for each level?

6. What do you regard as weaknesses of the course content and subject guidelines of each level?

Questionnaire for the College Lecturers

All the questions relate to Plant Production NC (V) FET College graduates. These graduates have studied and passed Plant Production course at Levels 2 to 4. These graduates shall henceforth be referred to as ‘graduates’.

Please mark with an X within the box below to indicate your response to the statements below.

Key:

4 Means = Strongly Agree

3 Means = Agree

2 Means = Disagree

1 Means = Strongly Disagree

1. The plant production subject guidelines are appropriate and relevant for each of the training levels (i.e. levels 2 to 4) and the prescribed course content fits the level for which it was designed.

4	3	2	1

2. The subject guidelines and course content articulate well from one level to the next and there is synergy.

4	3	2	1

3. The course content does equip the learners at each level with expected outcomes.

4	3	2	1

4. The course content at all levels does prepare students for employability and entrepreneurship.

4	3	2	1

5. The course content and subject guidelines for each level have notable strengths

4	3	2	1

6. There are remarkable weaknesses of the course content and subject guidelines at each level?

4	3	2	1

APPENDIX D: An interview schedule for College Subject Advisors

The questions below relate to Plant Production NC (V) levels 2 to 4 course assessment and implementation guidelines.

1. In your view, are the NC (V) levels 2 to 4 assessment guidelines implemented correctly?

2. Is the course content at all levels implemented correctly?

3. Would you say there are identifiable strengths in the implementation of assessment guidelines?

4. In your view, are there any glaring and identifiable weaknesses in the implementation of the assessment guidelines?

A questionnaire for the College Subject Advisors

The questions below relate to Plant Production NC (V) levels 2 to 4 course assessment and implementation guidelines.

Please mark with an X within the box below to indicate your response to the statements below.

Key:

4 Means = Strongly Agree

3 Means = Agree

2 Means = Disagree

1 Means = Strongly Disagree

1. The NC (V) levels 2 to 4 assessment guidelines are implemented correctly.

4	3	2	1

2. The course content is at all levels implemented correctly.

4	3	2	1

3. There are identifiable strengths in the implementation of assessment guidelines.

4	3	2	1

4. There are glaring and identifiable weaknesses in the implementation of the assessment guidelines

4	3	2	1

APPENDIX E: Letter to the College Asking for Permission to Conduct Research

The College Campus Manager/Principal

Name of the college

Date

PO Box 20569

Newcastle

2940

(Applicable date)

Dear Sir/Madam

I hope all is well with you.

I am Phakama Langa registered at the University of Fort Hare (East London Campus) for a PhD (Education). My research topic is "***An Assessment of the implementation of the National Certificate (Vocational) Plant Production Modules."*** I sought and was granted permission by the Department of Higher Education and Training to conduct this research. I therefore write to seek further permission and cooperation from yourself and other staff members who might be of assistance to me while I conduct this study. I will phone you or a person assigned by yourself to finalise the logistics and the dates for the commencement of my research at your college.

In anticipation of your co-operative response, I thank you.

Kind regards,

Phakama Langa

APPENDIX F: Application to Conduct Research

Sent: Wednesday, April 02, 2014 8:23 PM
To: Maharaswa.Maboreng
Cc: nkosi.w.@dhet.gov.za<javascript:_e(%7B%7D,'cvml','nkosi.w.@dhet.gov.za');>
Subject: Re: Application to be granted permission to conduct research in three FET colleges

Dear Madam/Sir

Please be informed that I am registered at Fort Hare University and my research topic is *An Assessment of the Implementation of the National Certificate (Vocational) Plant Production Modules. *

I intend conducting this research in three colleges namely ***(the names of the three colleges were mentioned but have now been removed).***

I ask your Department to grant me permission to conduct the research or direct me to the relevant office which can grant such permission.

Kind regards,

Phakama Langa

APPENDIX G: Letter of Consent to Respondents to Participate in Research

University of Fort Hare
Together in Excellence

Ethics Research Confidentiality and Consent Form

Please note:

This form was completed by the researcher as well as by the interviewee before the commencement of the research. Copies of the signed form were filed and kept on record.

Our University of Fort Hare / Department is asking people from your community / sample / group to answer some questions, which we hope will benefit your community and possibly other communities in the future.

The University of Fort Hare / Department/ organization is conducting research regarding the consistency between the National Certificate (Vocational) NC(V) and the Assessment Guidelines and their Implementation. We are interested in finding out more about the value added by the training program to the graduates who have gone through the program, to the employers of these graduates, the views from the lecturers, and the views by subject advisors .We are carrying out this research to help identify gaps if they exist and add to the body of the academic knowledge.

Please understand that you are not being forced to take part in this study and the choice whether to participate or not is yours alone. However, we would really appreciate it if you do share your thoughts with us. If you choose not take part in

answering these questions, you will not be affected in any way. If you agree to participate, you may stop me at any time and tell me that you don't want to go on with the interview. If you do this there will also be no penalties and you will NOT be prejudiced in ANY way. Confidentiality will be observed professionally.

I will not be recording your name anywhere on the questionnaire and no one will be able to link you to the answers you give. Only the researchers will have access to the unlinked information. The information will remain confidential and there will be no "come-backs" from the answers you give.

The interview will last around 40 minutes. I will be asking you a questions and ask that you are as open and honest as possible in answering these questions. Some questions may be of a personal and/or sensitive nature. I will be asking some questions that you may not have thought about before, and which also involve thinking about the past or the future. We know that you cannot be absolutely certain about the answers to these questions but we ask that you try to think about these questions. When it comes to answering questions there are no right and wrong answers. When we ask questions about the future we are not interested in what you think the best thing would be to do, but what you think would actually happen.

If possible, our organisation would like to come back to this area once we have completed our study to inform you and your community of what the results are and discuss our findings and proposals around the research and what this means for people in this area.

Principal Investigator Name:

Signature

Contact Details

CONSENT

I hereby agree to participate in research regarding ***An Assessment of the implementation of the National Certificate (Vocational) Plant Production Modules*** .I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively.

I understand that this is a research project whose purpose is not necessarily to benefit me personally.

I have received the telephone number of a person to contact should I need to speak about any issues which may arise in this interview.

I understand that this consent form will not be linked to the questionnaire, and that my answers will remain confidential.

I understand that if at all possible, feedback will be given to my community on the results of the completed research.

……..

Signature of participant **Date**:……..

I hereby agree to the tape recording of my participation in the study

……..

Signature of participant **Date**:……..

APPENDIX H: Permission to Conduct Research from the DHET

higher education
& training
Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

Private Bag X174, PRETORIA, 0001, 123 Francis Baard Street, PRETORIA, 0002, South Africa
Tel: (012) 312 5911, Fax: (012) 321 6770
Private Bag X9192, CAPE TOWN, 8000, 103 Plein Street, CAPE TOWN, 8001, South Africa
Tel: (021) 469 5175, Fax: (021) 461 4761

Enquiries: Renay Pillay **Email**: Pillay.r@dhet.gov.za **Telephone**: 012 312 6191

Mr P Langa
PO Box 20569
NEWCASTLE
2940

By email: Phakama.langa@gmail.com

Dear Mr Langa

REQUEST TO UNDERTAKE RESEARCH IN THREE TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) COLLEGES: ASSESSMENT OF THE IMPLEMENTATION OF THE NATIONAL CERTIFICATE (VOCATIONAL) PLANT PRODUCTION MODULES

I acknowledge receipt of your request for permission to conduct research in three Technical and Vocational Education and Training (TVET) Colleges namely, the Ehlanzeni TVET College in Mpumalanga, Westcol TVET College in Gauteng and Maluti TVET College in the Free State on the topic "*Assessment of the implementation of the National Certificate (Vocational) Plant Production Modules.*"

Your request has been evaluated by the Department and it is my pleasure to inform you that your request for permission to undertake the above research has been granted. You are advised to obtain further permission from principals of the three TVET Colleges before commencing any research activities.

You are further requested to attach the Ethics Clearance Certificate from the University of Fort Hare to correspondence addressed to the three TVET Colleges when communicating with principals.

The topic of your research is of great interest to the Department. It will therefore be appreciated if you could share the findings of your research with the Department upon completion of your research.

I wish you all of the best in your research study.

Yours sincerely

Mr GF Qonde
Director-General
Date: 01/08/2014

APPENDIX I: Ethical Clearance Certificate

University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE
REC-270710-028-RA Level 01

Certificate Reference Number:	MAM031SLAN01
Project title:	**Assessment of the implementation of the National Certificate (NCV) plant production modules**
Nature of Project:	PhD
Principal Researcher:	Phakama Perry Macmillan Langa
Supervisor:	Prof KJ Mammen
Co-supervisor:	Prof EO Adu

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

The Principal Researcher must report to the UREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

Special conditions: Research that includes children as per the official regulations of the act must take the following into account:

Note: The UREC is aware of the provisions of s71 of the National Health Act 61 of 2003 and that matters pertaining to obtaining the Minister's consent are under discussion and remain unresolved. Nonetheless, as was decided at a meeting between the National Health Research Ethics Committee and stakeholders on 6 June 2013, university ethics committees may continue to grant ethical clearance for research involving children without the Minister's consent, provided that the prescripts of the previous rules have been met. This certificate is granted in terms of this agreement.

The UREC retains the right to

- Withdraw or amend this Ethical Clearance Certificate if
  - Any unethical principal or practices are revealed or suspected
  - Relevant information has been withheld or misrepresented
  - Regulatory changes of whatsoever nature so require
  - The conditions contained in the Certificate have not been adhered to
- Request access to any information or data at any time during the course or after completion of the project.
- In addition to the need to comply with the highest level of ethical conduct principle investigators must report back annually as an evaluation and monitoring mechanism on the progress being made by the research. Such a report must be sent to the Dean of Research's office

The Ethics Committee wished you well in your research.

Yours sincerely

Professor Gideon de Wet
Dean of Research

18 July 2014

APPENDIX J: Language Editing Certificate

PROOF OF EDITING AND PROOFREADING

I hereby declare that I thoroughly edited the PhD (Education) report by the undersigned student.

The following aspects of the report were covered:

1. Editing and proofreading of chapters 1 to 5
2. Correction of grammatical and typographical errors in these chapters
3. Ensuring consistent flow of sentences
4. Ensuring that all graphs and tables in the chapters are clearly presented and labelled

I also made some suggestions (through comments made in the document) whose implementation lies entirely with the student.

Editor: Thembinkosi Ngwenya

Signature: TNgwenya

Date: 31/05/2016

Contact Number: 011 073 0557

Student: Lelingoana B. Lerotholi

Signature:

Date: 31/05/2016