EXPLORING TEACHERS’ USE OF PEDAGOGICAL SKILLS IN AGRICULTURE EDUCATION FOR THE SUSTAINABLE DEVELOPMENT OF THE KAVANGO EAST REGION OF NAMIBIA

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Ignatius Sitji
Agriculture is crucial for economic developments. For Namibia, agriculture is a major economic indicator. Teachers’ pedagogical skills in agricultural science education plays a significant role on the nation’s sustainable development. This study explored the influence of using pedagogical skills in agriculture education on sustainable development. Kavango East (KE), being one of the poorest regions in Namibia, was the research site in which 44 agriculture teachers provided data for this study via an online questionnaire.

Based on theory and reliability test; Information Communication Technology (ICT) skills, practical skills, presentation skills, and field trips emerged as pedagogical skills in agriculture education, whereas entrepreneurship skills and sustainable skills made the sustainable development construct. The use of these skills was descriptively analyzed. Mann-Whitney U tested the relationship of the pedagogic skills with teachers’ gender, and the Kruskal-Wallis H test analyzed the skills’ relationship with teachers’ qualifications and experiences. In addition, a multiple linear regression model analysed the influence pedagogic skills had on the sustainable development of the KE region of Namibia.

Agriculture teachers used the skills, except ICT skills. Pedagogical skills had an insignificant relationship with teachers’ gender. Practical skills’ relationship with teachers’ qualification was insignificant, whereas presentation skills insignificantly related with teachers’ experiences. Conversely, Practical skills significantly related to teachers’ experience, and presentations related significantly with teachers’ qualification. Field trips had a significant relationship with teachers’ qualification and experience. In addition, field trips and practical skills predicted a significant influence on the sustainable development of the KE region of Namibia, while that of ICT and presentation skills was insignificant.

The results’ implications were discussed, and suggested teachers involvement in ICT related programmes for professional developments, Educational Agriculture Council, and teaching facilities that support student-centred teaching approaches amongst others. The limitations of the study were stated along with suggestions for future research studies.
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1. INTRODUCTION

The value of agriculture on food production and economic development is crucial (Martin & Clapp, 2015). In Southern Africa, including Namibia, agriculture remains the main economic contributor (Thierfelder et al., 2015). Through agriculture education, the practice of farming continues to evolve from the tradition of farming land for food to commercial farming (Ciutacu, Chivu, & Andrei, 2015). These developments in agriculture industry challenges the pedagogies of agriculture education in the 21st century (Davis & Jayaratne, 2015). Recent studies in agriculture education revolves around the topics of pedagogical skills for the 21st century’s needs, Information Communication Technology (ICT), problem-based teaching approaches and sustainable agriculture education (Aholi, Konyango & Kibett, 2018; Francisca, & Samsudin, 2018; Maharaj-Sharma & Sharma, 2017; Zanders & MacLeod, 2018). Determinants such as teachers’ gender, qualification, and experience in agriculture education still leads as key variables in the effectiveness of teaching agriculture for sustainability (Musau & Abere, 2015; Smith, Rayfield, & McKim, 2015; Solomonson, Korte, Thieman, Retallick, & Keating, 2018). Internationally, agricultural science curricula focus on the topics of food sciences, forestry, land and soils, agronomics and entrepreneurship amongst other topics, aiming to stabilize the economy and develop food production of the nation (Mehlhorn, Bonney, Fraser, & Miles, 2015). In Namibia’s basic education system, agriculture is an elective pre-vocational subject from grade 5 to grade 12 (Ministry of Education, Arts and Culture [MoEAC], n.d.), focusing on general knowledge about agriculture, crop and livestock husbandry, farming, and financial agriculture (Ministry of Education [MoE], 2009).

In the Namibian 2011 Census, agriculture was an indicator for income source, and own account in relation to crop, livestock and poultry farming at different scales (Namibia Statistics Agency, 2013). 16.3% of the recorded cases indicated farming as their source of income, whereas 40.2% indicated to have owned agricultural accounts in crop, livestock and poultry farming (Namibia Statistics Agency, 2013). 67.6% of communal rural and semi-urban households in Kavango East (KE) were agricultural households (Ministry of Agriculture, Water, and Forestry, 2015). The statistics signifies the importance of agriculture regarding food security and economic development in Namibia. Prior to the division of the Kavango region into KE and Kavango West in 2014, Kavango region was classified as the poorest in Namibia, with 53% of the region's population classified as poor, and 34.4% recorded as living in severe poverty (National...
Planning Commission [NPC], 2012). NPC (2015) still referred to NPC report of 2011 on poverty indicators across the country, thus; did not reflect any significant difference.

Dewey’s pragmatism philosophy, Maslow’s hierarchical needs theory, and Foucault’s critical debate of institutional power effect on the society guided my motivation for this study (Bhaskar, 1998; Dewey, 1959; Maslow, 1993). Having taught agriculture as a subject for a year to the grade 9 students at a combined school, in the KE region of Namibia, I noticed that using different pedagogical skills that connects to the community’s reality in teaching agriculture develops students’ interest in the subject. Topics such as plant production in which students conduct cash crop case studies (MoEAC, 2015), for example; created a strong link between subject matter and the society, through food production and the finances involving the cash crop. Linking this scenario to poverty statistics in the KE region, I hypothesised that the use of pedagogical skills in agriculture education has a relationship with teachers’ gender, qualification, and experience, thus; influence the sustainable development of the KE region. Consequently, agriculture content comparisons at the international level, agriculture teachers training, sustainable development goals, and ministerial support for agriculture education in Namibia were diminished and degraded from the materials reviewed.

Francisca and Samsudin (2018) revealed that implementing the needed pedagogical skills of this century in education is the key for any development at all sectors. Alabi (2016) along with Aneke (2016) noted that using ICT skills in teaching extends teachers’ research and critical thinking skills. Despite the challenges still facing many developing countries on the facilities related to ICT use, the impact that ICT has on knowledge acquisition and skills attainment for economic transformations is valuable for development (Kehinde & Agwu, 2015). Other pedagogic skills such as practical skills, experiments, field trips, presentation skills, problem-based teaching skills, and integration of science, mathematics, technology, and engineering in agriculture education are some of the results from agriculture education researchers (Robinson-Pant, 2016; Zanders, & MacLeod, 2018; Ndem, & Akubue, 2016). Many studies, however; noted that at some extent, effective integration of these skills in agriculture education is affected by teachers’ gender, qualification and experience, among other variables at the school level (Blackburn, Robinson, & Field, 2015; Moodie, Wheelahan, Fredman, & Bexley, 2015; Musau & Abere, 2015). Some researchers further explored the extent to which some of these teaching skills in agriculture education affect the society (Gold, 2016; Velten, Leventon, Jager, & Newig, 2015).
Nevertheless, research objectives, methodological approaches, and the variables used in many studies in an attempt to address the use of pedagogic skills in agriculture education were influenced and generalised to the population of the studied samples. Wagner et al.'s (2005) evaluation study on the use of ICT in the education of Southern African countries, and Osakwe, Dlodlo and Jere’s (2017) study, focused specifically on ICT use and the availability of the needed facilities in general. Evidence of agriculture education studies in the Namibian context is lacking. Many recent studies in Namibia regarding the subject of agriculture, were conducted from the topics of agriculture and water, agriculture and economics, and; agriculture and land (Amadhila & Ikhide, 2016; Taapopi, Kamwi, & Siyambango, 2018; Woltersdorf, Scheidegger, Liehr, & Döll, 2016), and not in relation to agriculture education and sustainable development at the school level.

As a result, through the post-positivist philosophy, this nonexperimental study explored the pedagogical skills in agriculture education and their influence on the sustainable development of the KE region of Namibia. This philosophy integrates positivism and interpretivism thinking paradigms, making it a perfect fit for nonexperimental research studies (Prasad, 2015). Through this methodological approach, and the use of statistical techniques in data analysis, the study described teachers use of pedagogic skills in agriculture education. A description of these pedagogic skills can provide statistical evidence to educational planners on which skills to conduct more studies, and those that require implementation in tackling poverty issues in the KE region. The outcomes of pedagogic skills, in relation to teachers’ gender, qualification, and experience might create a pavement for curriculum reviews, assessments of teacher training and qualification, as well as monitoring and evaluation of policy implementation in agriculture, for a sustainable development of the region, and Namibia at large. The significant influence of these pedagogical skills on sustainability can be experimented further, with larger sample sizes, by science education researchers for validity reasons, in preponderance of Dewey’s pragmatism philosophy, Foucault’s power and society, and Maslow’s needs hierarchy (Bhaskar, 1998; Dewey, 1959; Maslow, 1993).

The concepts, context, theories and the review of literature are discussed in chapter 2. Chapter 3 states the research hypotheses and questions of the study. The methodological approach to answer the research questions and hypotheses are narrated in Chapter 4. The results are presented in Chapter 5 and their implications discussed in Chapter 6. The research’s limitations and areas for future research are stated in Chapter 7.
2. THEORETICAL FRAMEWORK

In this chapter, I define, compare and discuss the concepts of agriculture education, pedagogical skills, and sustainable development to clarify the conceptual scope for this research and provide the theoretical framework on which literature review in this study is built. Having defined the concepts and presented an overview of agriculture education in Namibia, a review of literature in relation to pedagogical skills in agriculture education, and topics on sustainability is presented and discussed to address the need for exploring pedagogical skills in agriculture education for the sustainable development of the KE region of Namibia.

2.1. Definition, comparison and discussion of concepts

2.1.1. Pedagogical skills

Pedagogical is an adjective of pedagogy and relates to the science of teaching theories, concepts, knowledge, content matter and their effect on the growth of a student (Van Manen, 2016a). Ozuah (2016) simplified pedagogy as the art of teaching a child, of which the teacher includes the parent, and other leaders. Pedagogy, according to Ozuah (2016), was a term referenced to the teaching of young male students in the art of priesthood and whose methods were teacher-centred, thus; contrasted pedagogy with andragogy. Pedagogy cannot be reduced merely on relating to teaching, but a process that accounts for political situations, cultural contexts, economic standings, and to some extent the geographical spheres of a nation (McLaren, 2015). Pedagogic and pedagogical are synonyms and can be used interchangeably.

Skills in general terms is an individual’s ability to effectively and efficiently perform a task, using their expertise, knowledge, talent, dexterity etc. (Rigby & Sanchis, 2007). Pedagogical skills are those teaching skills employed by teachers in their lessons to enhance learning, through gained skills and knowledge of a subject (Van Manen, 2016b). These pedagogical skills in teaching encompasses pedagogical content knowledge, enquiry and problem-solving skills, cooperative learning, curriculum knowledge, experimentation, professionalism, and accountability (Boettcher & Conrad, 2016; Quintana & Fernández, 2015). Pedagogic skills are compared and related to teaching methods. However, the difference between these two terms is that a teaching method is broad and includes teaching skills in it, whereas teaching skills are specific and focused and normally employ strategies to achieve them (Van Manen, 2016b). Pedagogical skills in the context of this research refers to those teaching skills used by
agriculture teachers to enhance mastery of students’ skills, which includes ICT skills, practical skills, presentation skills, entrepreneurship skills, fieldwork skills, and sustainable skills in agriculture education, to register food production and economic developments as needs of a society.

2.1.2. Agriculture education

The term ‘agriculture education’ constitutes two terms from two different disciplines, agriculture being from the natural sciences and education mainly linked with the social sciences. Consequently, the term is split and discussed separately, before combining the conclusions of the definitions constituting agriculture education for a better conceptual understanding of agriculture education in this study.

Agriculture is the science of working the soil to harvest crops and rear livestock for commercial gains (Larson et al., 2014). This practice in agriculture is associated with farming whereby products from the crops and those from the livestock are sold for profit making. Asouti (2013) on the other hand define agriculture historically, considering the anthropocentric nature of people with reference to the practice of agriculture. Historically, the hunter-gatherers domesticated plants and animals and had knowledge about taking care of them for production (Asouti, 2013). During that time, the hunter-gatherers would term those animals that were not wild as others for meat, transport and their skin. In the same vein, the hunter-gatherers stored, planted and harvested the products of the seeds according to seasons. In contrast, Rehman, Jingdong, Khatoon and Hussain (2016) define agriculture in a technological fashion, referring to the application of advanced techniques including machineries and other equipments in growing of crops and keeping of livestock to improve production. Agriculture products refer to the raw materials such as skin, hey, stalks and consumable products such as milk, meat, and seeds which can be processed in to different goodies for economic gains (Fu et al., 2018). The process of working the soil, rearing animals, and processing of agricultural products creates employment to people in the communities (Fu et al., 2018). The similarities in the definitions are that agriculture involves knowledge, crops, livestock, and their products. In the definitions, agricultural products are either consumed or marketed for profit making. To summarise the definition, agriculture in this study is viewed as the sustainable use of natural resources to grow crops and rear animals for the production of consumable goods and raw-materials for income generation purposes.
The concept of education is complex and varies in perspectives, from philosophical views to cultural contexts. From an etymological point of view, education is a Latin word ‘educare’ that means ‘to raise’ and ‘to bring up’, of which other scholars argue that education originate from a Latin word ‘educere’ that means leading forth, or from the term ‘educatum’ that implies teaching and training (National Council of Educational Research and Training, 2014). Biesta (2015) questioned why teaching matters, and in that regard, asked the purpose of education. Through critical analysis of the topic under discussion, ‘qualification’, ‘socialisation’, and ‘subjectification’ reflected the purpose of education, of which ‘judgment’ lie at the centre. In a broader sense, and based on these etymological backgrounds and analysis, education can be defined as the use of instructions to facilitate learning whose product influences the social context it takes place in (National Council of Educational Research and Training, 2005). However, this definition does not put into consideration who takes the education, how the education is undertaken, and with what forces it should be taken, accordingly; it is necessary to view education as a process and as a product (Thapan, 2006). Hence, education can be defined as a process of learning skills, values, knowledge through facilitation, guidance and other means of instructions to create ‘intellectuals’ and ‘critical thinkers’ that are socially and culturally sound (National Council of Educational Research and Training, 2014, p. 6).

In view of the above definitions, agriculture education can broadly be defined as the instructions or teachings given by both informal and formal organisations to people with the aim of providing knowledge and training about crop and animal husbandry for improved living standards (Gold, 2016). Agriculture education includes the study of other applied sciences such as biology, chemistry, and physics at an advanced level (Altieri, 2018). Sometimes, agriculture education is connected to agriculture extension (Sewell et al., 2017), with a thin line difference between the two terms lying in the assistance given to farmers by agriculture extension officers in the context of agriculture education (Prokopy et al., 2015). Primarily, agriculture education targets agribusiness industries, to tackle economic challenges and maintain the living standards of a nation through food production and income generation (Soy-Massoni et al., 2016; Reganold & Wachter, 2016). In this thesis therefore, agriculture education is defined as the teaching of knowledge, skills, values, and practices of crop and animal farming using natural resources sustainably, for the purpose of producing food and raw-materials for income generation to sustain the needs of a society.
2.1.3. Sustainable development

Ambiguity and oxymoroncity characterises the conceptualisation of sustainable development (Kates, Parris, & Leiserowitz, 2005). As a result, defining sustainable development is contextual. However, the contextualisation of sustainable development should have indicators such as what, how, and when to develop sustainably for sustainability (Barkemeyer, Holt, Preuss, & Tsang, 2014). Developing sustainably for sustainability in this regard is to use human resources such as skills and abilities economically, to reduce and end poverty, through equity in societies and environmental protection for human needs satisfaction (Holden, Linnerud, & Banister, 2017). In view of education, the skills for sustainable development are pedagogically inclined. Education is sustainable, therefore; pedagogical skills should contribute towards sustainability with regards to economic transformation to meet human needs (Andrews, 2015). In view of this conceptualisation, sustainable development in this study refers to teaching entrepreneurship skills and sustainable skills in agriculture education. Holden et al.’s (2017) model for sustainable development is used to map the concept (see Figure 1).

![Figure 1. Model for sustainable development (Holden et al., 2017)](image-url)
2.2. Agriculture education in Namibia

In Namibia, agriculture is a pre-vocational subject, selected amongst home ecology, accounting, and, design and technology offered from senior primary, through to senior secondary level (MoEAC, n.d.). Students elect a pre-vocational subject of their choice including agriculture from grade 5 to grade 12 based on the availability of teachers, availability of subject materials and the provision of the subject at the school (MoEAC, n.d.). In elementary agriculture, students are taught the general knowledge of agriculture, plant and animal production, and financial management. As outlined in the syllabus, agriculture teachers are required to employ student-centred teaching approaches to instil the skills and knowledge of the topics (MoEAC, 2014). Agriculture education at the primary level aims at producing agriculturalist with technical and scientific skills to be resourceful to the Namibian nation, through food production and employment creation (MoEAC, 2014). The aims stem from Namibia’s Vision 2030, in which agriculture is viewed as the catalyst for Namibia’s economic growth (NPC, 2004).

The junior secondary phase shares the same vision with the primary phase, however; with further considerations on the promotion of knowledge, attitudes, scientific skills, decision making and ICT skills. The end-of-phase competencies for the agriculture junior secondary phase are the expectations that students should have gained general knowledge of agriculture, and the understating of plant and animal studies, as well as skills and knowledge of farming structures and technologies upon exiting the phase (MoEAC, 2015). Agricultural science for the senior secondary students is a step-ahead of the junior phase, with advanced knowledge and skills regarding general agriculture, crop and livestock sciences, farming and technology, and agricultural economics (MoE, 2009). Figure 2, Figure 3 and Figure 4 presents the summary of agriculture content-knowledge and skills taught in Namibian schools that offer agriculture as a pre-vocational subject in primary and junior secondary. The contents in Figure 2 and Figure 3 are based on the reviewed curriculum (MoEAC, n.d.). Figure 4 shows the summary of agriculture learning content before the reform that included grade 10 in the junior secondary phase (MoE, 2010). In 2019 however, agriculture contents for grade 10 students is sought to emulate the structure for the senior secondary phase (MoEAC, n.d.)
Figure 2. Elementary Agriculture Learning Content (MoEAC, 2014)

Figure 2 outlines the themes and the learning contents for grade 5, 6, and 7 students (MoEAC, 2014). Observably, the learning content advances as students progress to a higher grade. For example, in the theme *general agriculture*, grade 5 students are taught about the importance of agriculture to the family, then region in grade 6, and the role agriculture plays at the national level in grade 7. It is worth to also note that these themes overlap in the way they are taught, and thus isolating some topics from others in the content delivery results in surface learning (MoEAC, 2014; Baas, Castelijns, Vermeulen, Martens, & Segers, 2015). At the core of the themes is the goal of achieving agriculturalists that have the scientific knowledge, entrepreneurship skills, and the technical know-how to challenge the economic status quo and poverty in Namibia. To achieve the goal, teachers of elementary agriculture are required to teach the components of the syllabus critically, through student-centred pedagogies. For example, the topic of soil in grade 5, demands students to know about the types of soils, soil requirements of different crops, and conduct experiments that will ensure that the students are
able to analyse plants growth rate in different soil types (MoEAC, 2014). Knowledge about practical skills, and the ability to carry out field trips in sought of experiencing reality, and to make learning meaningful, are the key skills that teachers should know for the successful execution of topics of these nature (Schröder, et al., 2017; Aneke, 2015). The practicality of this topic is to train the young students in gaining knowledge and skills on how to work the soil, improve it, so that the growth of plants is maximized, bettering their production rate. In the process, the students can learn the skills and practice at their places, thus; the production thereof, can be valuable to their families.

The summary of agricultural science for the junior phase does not differ much in the two grades in Figure 3, apart from the specificity that the learning content of grade 9 provides. Having acquired the basic knowledge of agriculture, junior secondary students learn different specific skills of farming different types of crops, their structures, soil, nutritional and climatic requirements, pests and diseases that affect the crops, remedials to such challenges, harvesting and storing, as well as marketization and record keeping of the products for these crops, among other skills (MoEAC, 2015). The grade 9 students for instance, select a cash crop of their choice, that would serve as a case study, in agreement with their teacher, and also in consideration of the cash crop’s requirements. A cash crop is a crop grown for the purpose of profit making (Anderman, Remans, Wood, DeRosa, & DeFries, 2014). The chosen cash crop needs to be grown based on the soil, nutritious and climatic requirements. Moreover, it is required that the students keep record of the process, from soil preparation, through to harvesting, storing and marketing of the cash crop by using record sheets and computers where possible (MoEAC, 2015). The agricultural science teacher needs to have the scientific knowledge and skills, knowledgeable about computer use, and have good command of pedagogical skills that will enable the students to prepare the crops for marketization, by using their entrepreneurship and communication skills, when marketing the products of the crop with the necessary support.
The current grade 10 syllabus extends the contents of cash crop to cereal crops, so that the content is socially and culturally sound and relates to the staple food of the majority of the Namibian people (MoE, 2010). In addition, students are expected to be taught about laws governing land use in Namibia, including farming. Figure 4 presents the old syllabus of the junior phase.
Table 1 is a summary of the themes and learning contents of agriculture at the senior phase, a two-year course from grade 11 to 12 (MoE, 2009).

Table 1. Agriculture Learning Content for Senior Secondary Phase

<table>
<thead>
<tr>
<th>Topic</th>
<th>Subtopic: Learning Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. General Agriculture</td>
<td>1.1. Importance of sustainable Agriculture in our country</td>
</tr>
<tr>
<td></td>
<td>1.2. Environmental influences on agricultural practices</td>
</tr>
<tr>
<td></td>
<td>1.3. General Principles of land tenure systems</td>
</tr>
<tr>
<td></td>
<td>1.4. The impact of HIV/AIDS on agricultural production in our country</td>
</tr>
<tr>
<td>2. Crop Husbandry</td>
<td>2.1. Soils</td>
</tr>
<tr>
<td></td>
<td>2.2. Principles of plant growth</td>
</tr>
<tr>
<td></td>
<td>2.3. Crop production</td>
</tr>
<tr>
<td>3. Livestock Husbandry</td>
<td>3.1. Livestock anatomy</td>
</tr>
<tr>
<td></td>
<td>3.2. Livestock physiology</td>
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<tr>
<td></td>
<td>3.3. Livestock health</td>
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<td></td>
<td>3.4. Livestock nutrition</td>
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<td></td>
<td>3.5. Livestock breeding</td>
</tr>
<tr>
<td></td>
<td>3.6. Pasture and range management</td>
</tr>
<tr>
<td>4. Farm Structure and Machinery</td>
<td>4.1. Fencing</td>
</tr>
<tr>
<td></td>
<td>4.2. Farm buildings</td>
</tr>
<tr>
<td></td>
<td>4.3. Farm water supplies</td>
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<tr>
<td></td>
<td>4.4. Farm tools</td>
</tr>
<tr>
<td></td>
<td>4.5. Intermediate technology</td>
</tr>
<tr>
<td>5. Agriculture Economics</td>
<td>5.1. Principles of Agricultural Economics</td>
</tr>
<tr>
<td></td>
<td>5.2. Farm records and accounts</td>
</tr>
<tr>
<td></td>
<td>5.3. Farm budgeting</td>
</tr>
</tbody>
</table>

The key purpose of the senior secondary syllabus for agriculture is to enable agriculture teachers to teach knowledge and skills through a student-centred approach in a practical manner that is business oriented and complies with the fundamentals of agriculture and the skills
thereof (MoE, 2009). Through the employment of the student-centred approach to teaching agriculture, skills such as problem-solving, enquiry, communication, numeracy, cooperative skills, entrepreneurship, etc. are sought to be cultivated in students upon completion of agriculture as a pre-vocational subject at the senior secondary phase (MoE, 2009). Teaching farm structures and machinery as a topic, demands both physical and technical skills from the teachers. However, the availability of the machineries and different farm equipments are not available at many schools, compromising the student-centred approach to teaching, and making teachers resort to the traditional teacher-centred approach, through presentation of theoretical knowledge (Stubbs & Myers, 2015; Ghavifekr & Rosdy, 2015).

2.3. Pedagogical skills in agriculture education in the 21st Century

The 21st Century is an era sought to realise modernisation, industrialisation, globalisation, and having the most of technology to efficiently and effectively perform tasks (Babaci-Wilhite & Geo-JaJa, 2018). In the education fraternity, and precisely in teaching, ultimate pedagogical skills in the 21st century are those considered productive for learning outcomes (Francisca & Samsudin, 2018), to curb the gap that exists between knowledge and reality, and between theory and practice (Longmore, Grant & Golnaraghi, 2018). These pedagogical skills should be grounded on philosophical, psychological and sociological undertones that are sound enough to address national issues of this century (Farquhar & White, 2014). From a philosophical point of view, Dewey’s pragmatism philosophy which emphasises that learning must be experienced through reality, and the use of ‘hands-on’ approaches to teaching (Dewey, 1959) frames the pedagogical skills discussed in this research. In addition, Maslow’s hierarchical needs theory (Maslow, 1943), serves the role of motivation for the selection and the use of these pedagogical skills in agriculture education. And lastly, Foucault’s theory of power and its effect on the society through institutions (Bhaskar, 1998), extends the social implications of these pedagogical skills through governmental structures such as schools for the sustainable development of a society.

Valtonen, Sointu, Mäkitalo-SiegI and Kukkonen (2015) discussed some of the needed 21st skills in education, and placed emphasis on ICT skills as well as skills related to “Technological Pedagogical Content Knowledge” (pp. 88-100). In science education, Kang and Keinonen (2016) examined the concept of enquiry-based learning and discussed it as a learning type, in which teachers facilitate the learning process of students to engage them in scientific skills, through experiments and discussions. Other studies explored the use and application of
practical skills, presentation skills, field trips and ICT skills in science education (Aholi, et al., 2018; Alabi, 2016; Aneke, 2015; Francisca & Samsudin, 2018; Longmore et al., 2018; Mehlhom, et al., 2017). In this study, I examined the use and the implications of using ICT skills, practical skills, presentation skills, and field trips in agricultural sciences at the school level for sustainable development.

2.3.1. ICT skills in agriculture education

In general, ICT refers to the use of computers, technical equipment, digitals, wires and wireless technologies in processing, converting, transforming and saving different information into digital databases for future use (Niebel, Kopp & Beerfeltz, 2013). Kehinde and Agwu (2015, p. 31) defined ICT as “technologies that provide access to information through telecommunications.” Aneke (2015) outlined the role ICT play as a skill in teaching by helping students in developing research skills through searching and organising information. ICT can further provide tools that can be used for ‘discussions’ and ‘problem-solving’ to help students develop their cognitive skills (Alabi, 2016). In view of these discussions, ICT in this research is viewed as the application of computer tools and programmes, and the use of internet to research and share information.

ICT in teaching allows students to search for information on the internet, which can be shared. Through the process of searching and sharing information, students construct knowledge, as a result, using ICT in teaching conforms to the constructivism theory of learning (Duffy & Jonassen, 2013). Through this construction of knowledge using ICT skills, students justify their findings to others through discussion and conclusions of their findings, such that answers to the topic under study is ascertained. When students have convinced their peers and their teachers enough, regarding their research findings, they find themselves very close to the pragmatic philosophy, in view of agriculture education. Additionally, constructing knowledge via social media platforms through ICT use is a social process, and in view of learning, Vygotsky termed this as a social constructivism theory (Amineh & Asl, 2015). It is the role of the teachers therefore, to assist these students in their knowledge construction, so that knowledge produced by these students is practical and attempts to solve the investigated problems. However, facilitating this learning process where students use ICT skills to produce knowledge that is practical and relevant to the society, in line with agriculture requires agriculture teachers to be ICT literate themselves (Francisca & Samsudin, 2018). In addition to being ICT literate, agriculture teachers should also have the motivation and confidence of
using ICT in their lessons. Teachers who have a good command of ICT skills and its application in agriculture also develop students’ attitudes that are technology-driven, hence; challenge the status quo of agriculture industries to accommodate ICT in future agricultural endeavours for rapid economic growth of a society (Kehinde & Agwu, 2015). An Iranian study on ICT use, and specifically on e-learning in agriculture, summarised the advantages ICT has in education as managing access to ‘place’ and ‘time’, ‘equity’, collaboration, and access to resources (Talebian, Mohammadi & Rezvanfar, 2014, pp.300-305). Ghavifekr and Rosdy (2015) also noted that ICT does not only replace the traditional way of teaching, but it brings into teaching a pedagogy that is ICT-based through educational facilities and tools that come with it for better developments.

Nevertheless, teachers in Namibia are hindered by the lack of technological devices in meeting up with the standards required of them to implement ICT as outlined in the educational policies related to ICT (Osakwe et al., 2017). In addition, gender issues, teacher’s qualification and experience also play a significant role on the use of ICT skills in teaching (Hlengwa, Chimbo & Buckley, 2018). Coley, Warmer and Stair (2015) noted that the availability of technology, cost and time affect the use of technology in agriculture education. Wagner et al. (2005) pointed out that the challenge of ICT implementation was observed in many Southern African countries, including Namibia. A similar challenge where technological devices and facilities attached to them lack in schools in the developing countries was noted by Kehinde and Agwu (2015). For effective implementation of ICT usage in agriculture, Francisca and Samsudin (2018) recommended teachers to engage in ICT-related workshops and programmes through in-service training to boost their confidence, awareness and motivation when using ICT skills.

2.3.2. Practical skills in agriculture education

Practical skills in teaching agricultural sciences is based on a hands-on approach that is student-centred, and thus conforms to the constructivism theory, and to some extent, the social constructivism theory when the activities under study requires research, group works and reporting. Practical skills encompass a number of skills that fall in the Cognitive domain of learning, Affective, and psychomotor (Bloom, Engelhart, Furst, Hill & Krathwohl, 1984). The focus of practical skills in teaching is to reflect a reality of the real world. Piaget argued that the best way to represent the real world in to our mental schemas is to act on it, based on what we know, so that we can either assimilate or accommodate the data we have gathered to reach a state of equilibrium in what we know and the reality (MacBlain, 2018). Peyton 1998’s model
of practical teaching skills that involves demonstration, deconstruction, comprehension, and performance as steps to follow in teaching practical skills to students is referenced by a number of researchers as an effective model to use (Schröder, et al., 2017).

In agricultural sciences at the school level, skills in gardening, ICT, technical work, communication, interpersonal, management and marketing are emphasised to be taught to students in agriculture practical lessons (Robinson-Pant, 2016). Teaching practical skills in agricultural sciences requires an integration of other skills and is effective when students are put to work in groups so that they can cooperate and collaborate (Robinson-Pant, 2016). Teaching practical skills extends from having the knowledge about different skills, how to recognise them, to their assessment based on the three learning domains by integrating science subjects (Stubbs & Myers, 2015). For example, while students maybe working on an agricultural project using their technical skills, they might need to use their mathematical reasons to justify the technicality of the tools used. Modelling a farm structure for example, would require students to know about ratio calculations. The goal is to ensure that students are taught the needed skills to attempt in solving societal issues. Nevertheless, the application of practical skills in agriculture education is implicated with many factors, including teacher’s knowledge, area of specialisation, experience in teaching and to some extent gender (Harlen, 2018).

2.3.3. Presentation skills in agriculture education

One of the basic scientific skills that a science teacher is required to have is the skill to communicate. When observations, classifications, inferences, measurements, predictions, and conclusions are made about a problem under investigation based on tested and justified hypotheses, the goal of a scientist would be to communicate the results to the world in proving a theory or adding knowledge in the scientific topic of interest (Alias & Osman, 2015; Chung, Yoo, Kim, Lee & Zeidler, 2016). Communication occurs in forms of oral presentation of the data and the use of charts and graphs to represent data (Alias & Osman, 2015). A subset of communication skills is the presentation skill. The similitude of communication and presentation lie in the conveyance of information, in which communication is more of how we present information, whereas presentation is focused on the objective of the data being presented (Zanders & MacLeod, 2018). In fact, the two are inseparable because presentation is a formal way to communicate to the audiences (Zanders & MacLeod, 2018). Presentation is an active skill, and through interaction with the audiences, the presenter integrates their cognitive,
linguistic, and social skills to communicate effectively, making presentation a perfect example of a social constructivism approach in teaching (Kiraly, 2014).

The use of ICT skills such as PowerPoints, spreadsheets, smart boards and projectors requires teachers to be knowledgeable and skilful enough in using these devises and programmes (Maharaj-Sharma & Sharma, 2017; Newhouse, 2017). Through these facilities, probable solutions that tackles the challenges and addresses the needs of a society are presented to the mass for implementation. Ineffective use of presentation skills may result in passive learning however, especially when teachers heavily depend on slides that are filled with texts and not critical enough in arising students’ interest (Uluyol & Sahin, 2016). The other challenge related to presentation skills using ICT is the lack of facilities that supports it, and this situation is prevalent in rural communities (Salemink, Strijker & Bosworth, 2017; Correa & Pavez, 2016) along with the demographic factors associated with teachers. Thus, Savery (2015) noted that effective communication skills occur through problem-based learning, where students go beyond the classroom to investigate, research and discover through observations, experimentations and communication. For countries whose medium of instruction is a second language, communication skills are key pedagogic strategies that would improve students’ linguistic competency of the second language (Liontas, 2018).

2.3.4. Field trips in agriculture education

Using field trips in teaching is social, constructive and pragmatic in its approach. It is a practical approach to teaching where students go out in the real world to observe, experiment and experience reality (Ndem & Akubue, 2016). Field trips are strategic skills and connects theory to reality, thus help the teacher to realize an objective when properly planned (Aneke, 2015). Sometimes, field trips and excursions are treated as synonyms, and this approach in teaching agriculture boost the interest of students through their induction to the real agriculture world (Nkereowajiro, 2014). The contribution field trips bring in teaching science-related subjects is unequivocally rewarding and a success towards achieving learning goals and teaching objectives. For instance, students use their five senses when doing observations as a scientific skill and familiarise themselves with the conditions of the workplace, thus; authenticating the learning process (Aneke, 2015). In addition, Okiror, Hayward and Winterbottom (2017) noted that linking students to agribusinesses and having the students reach out to local communities enables them to acquire realistic skills in agriculture, thus exposing them to the real-life situation, in which they learn to solve real life problems challenging the society.
In agriculture education, field trips include taking students to agricultural industries such as green-schemes, farms, factories, local communities, market places to mention but a few, whereby students workout designated tasks; prior, during, and after, to meet a desired objective (Aneke, 2015). For example, a teacher can organise a field trip to a dairy farm, so that students can observe how milk is produced, processed and marketed to provide food to the people, and in the process make an income. As a result, students may develop the interest of becoming future farmers in which they will not only produce agricultural products and make a profit, but also create employment for the locals, a scenario that would realise some of the aims of agriculture education in Namibia (MoE, 2010) for example. In that, field trips in teaching agricultural sciences is one skill and strategy that would promote the issues of science-technology-society and socio-scientific-issues in making scientific knowledge relevant to the society (Akcay, B. & Akcay, H., 2015; Sadler, Romine & Topcu, 2016).

Similar to other skills discussed earlier, it is no surprise that field trips may integrate presentation skills mainly when the objective of the excursion involve reporting (Ameru, Odero & Kwake, 2018). The use of field trips broadens the teacher’s understating, as they learn from experts through practice, discussion and observation (LaCharite, 2016). The hiccups for implementing this skill, however; is time, facilities such as transport, ethics, experience and qualification (Behrendt & Franklin, 2014). Figure 5 presents a model for organising an effective field trip, adopted from Stoddard (2009).

![Figure 5. Elements of authentic field trips (Stoddard, 2009)](image)

Figure 5. Elements of authentic field trips (Stoddard, 2009)
2.4. Sustainable agriculture education for sustainability

Sustainable agriculture is the practice of agricultural activities, and the maintenance of ecological balance, so that food production is improved, and the economic stability of the nation is sustainably maintained (Velten et al., 2015). These practices in sustainable agriculture includes conservation of water, rotational grazing system in farming, crop rotation, less use of inorganic fertilisers such as pesticides and herbicides, so that, over a period of time, food is produced on the land with practices that do not damage the environment to sustain the economy of a nation (Altieri, 2018; Velten et al., 2015). Sustainable agriculture requires skills, knowledge, finances and effective policies to be practiced. Through pedagogical skills in agriculture education, and the practice of a sustainable agriculture, a society’s future can be sustained economically (Velten et al., 2015). The practice of sustainable agriculture within a society for human needs’ satisfaction adjust to the propositions of Dewey’s philosophy, Foucault’s power and society, as well as the needs hierarchy of Maslow.

Gold (2016) termed sustainability as “a nebulous goal” when defining sustainable agriculture, and questioned rhetorically, the specificity of what needs to be sustained, how, when, and if sustainability is thus far possible. The questions that Gold (2016) asks in relation to sustainable agriculture are crucial in contextualising and applying sustainable agriculture in education in relation to sustainable development, and in this regard, the pedagogical aspects of agriculture as a school subject. In line with Gold (2016), Velten, et al. (2015) stressed on the ambiguity that exist in the many meanings of sustainable agriculture that makes its implementation process a tedious task. The goal for sustainable agriculture is to enable agriculture in providing food, raw materials, and tax revenues to the country’s economy while balancing with the challenges such as climate change, drought, poverty, and other human activities including change in political powers. (Velten et al., 2015). And as a result, Velten et al. (2015) summarised a framework that contribute to sustainable agriculture for developments, based on a content analysis from expertise in different agricultural fields of study, presented in Figure 6.
What is worth noting in this summary is the attempt the structure makes in response to some of the questions raised by Gold (2016). For example, it is the duty of political powers to create strategic policies that will assist in meeting the goals of tackling social issues. The ‘when’ question that Gold (2016) asked, in view of Figure 6, remains critical. If teaching is viewed as a tool that assist in meeting national demands such as political instability, economic challenges, malnutrition, and maintenance of ecological balance, then, Gold’s (2016) ‘when’ question of sustainability is beginning to get an answer, since, it is when teachers employ pedagogical skills that integrates collaboration, experimental research, and critical thinking (Valley, Wittman, Jordan, Ahmed & Galt, 2018) as strategies that would develop these skills in students to practice agriculture sustainably. The outlined skills and strategies reflect the social constructivism theory of learning. Galt, Clark and Parr (2016) noted that using teaching instructions that reflect reality such as experiments, and problem-based approaches limits positivistic methods compatible with passive learning that demands students to sit in the classrooms and obey instructions, and in the process, achieving skills related to sustainable practices in agriculture. However, experimentation is positivistic, thus; should be pondered.

2.5. Gender issues in agriculture education

By virtue of being human, and through cultural heritage, historically, gender issues affected the roles designated to men and women, and the extent, as well as the effectiveness of how those roles were performed (Stearns, 2015). Work that required physical strength was mostly associated with men, whereas that which required minimal strength was mostly attributed to
women (Stearns, 2015). To some extent, gender roles in some nations is culturally inclined and thus, requires a paradigm shift in thinking for sustainability purposes. The issue of gender extends to teaching, and many quantitative studies, examine gender as a dependent variable against the independent variables under study. In agriculture education for example, Blackburn et al. (2015) noted that male preservice teachers outnumbered their female counterparts in the enrolment of agriculture mechanic courses. However, these teachers were inconfident with their ability to teach welding skills, due to the fact that the skills were not taught to them in high school. The inability of teaching practical skills for example, is affected by many factors, one being teachers’ gender. Smith et al. (2015) found a significant difference among agriculture teachers, regarding their confidence to integrate the skills of mathematics, engineering, science, and technology in agriculture education. Based on their perceptions, female teachers did not value the integration of technology in agriculture education, compared to male agriculture teachers. Nonetheless, Smith et al. (2015) did not hesitate to point out that the significance level of difference could have been a result of the 56% of male teachers in the sample.

2.6. Teacher qualification and experience in agriculture education

Qualification and experience are two of the many factors that influence teaching, depending on knowledge, expertise, tactics, and skills. In most cases, teachers who are qualified tend to perform far better than those least qualified, and notwithstanding the fact that qualified teachers with many years of experience, at least from five years and above are even far better than novice teachers (Solomonson et al., 2018). Musau and Abere (2015) on the contrary, concluded in their study that the mean difference between teachers’ qualification and students’ performance in science, technology, and mathematics did not differ significantly, when teachers are trained, have a diploma, and a post graduate qualification. Nevertheless, the performance of students taught by teachers with post graduate qualification was higher than those taught by teachers with a diploma qualification. In addition, the significance of difference was even higher when compared to untrained teachers (see Figure 7). The Science subjects included physics, biology, chemistry and agriculture. On average, agriculture among the science subjects had the least number of students that scored highest symbols with regard to their performance (Musau & Abere, 2015).
In addition, Moodie et al. (2015) noted that qualification, particularly is of paramount importance. Agriculture teachers need to possess a wide range of technical skills and knowledge about agricultural trades. For the fact that agriculture spreads along economics, social issues, and being a science of knowledge itself, teachers’ qualification that is relevant to the agriculture market industry can be enhanced by creating an “Agriculture Education Council” constituting of school, vocational, and university education, along with agricultural industries from private and governmental sectors (Moodie et al., 2015, p. 28). The council is sought to work in coalition with agriculture teachers’ qualification in an attempt to address social issues such as poverty and economic crisis. Moreover, Mlangeni et al. (2015) noted the significance of agriculture towards economic growth of a nation, and thus emphasised that qualified agriculture teachers are key to economic growth, on agricultural spheres.

With regard to agriculture teachers’ experience, Solomonson et al. (2018) explained that experience in teaching agriculture was related to job satisfaction, professional development and compensation. In that, novice teachers that improved their pedagogical skills through training were better off in gaining more experience than those that did not. On the other hand, teachers who qualified to teach agriculture had the ability to continue growing their experience than those who did not qualify to teach the subject. Blackburn, Bunch and Haynes (2017) suggested that teachers with experience in teaching agriculture and have a sense of job satisfaction, should share their experiences of their pedagogical approaches in different topics to develop teachers that lack the skills. Furthermore, availability of teaching facilities at schools assist agriculture teachers in developing their skills through research and collaboration with their peers (Irungu, Mbugua & Muia, 2015).

Figure 7. Mean comparisons (Musau & Abere, 2015)
3. OBJECTIVES

In chapter 2, pedagogical skills such as presentation skills, practical skills, filed trips, and ICT skills were the main focus in this study on the premises of philosophy, psychology, and sociology. It emerged that these skills, including a few others that fell short from the scope of this study, overlap. Interestingly, most previous studies that were reviewed employed quantitative analyses, creating a critical analysis of the findings’ comparisons, against literature related to this study. What fell short from the review of literature, however; was the lack of studies conducted in the Namibian context about agriculture education.

As a result, this study focused on the use of pedagogical skills in teaching agriculture at the school level, to develop students’ agricultural skills that can influence the sustainability of the KE region of Namibia. Hence, a questionnaire subdivided into demographic information, teaching skills in agriculture, and sustainable practices in agriculture education contained questions that answered the hypotheses and research questions presented hereunder.

3.1. Research hypotheses

These hypotheses guided my study at the significant level of \( p < .05 \) constructed in Figure 8.

\( H_1 \) – Agriculture teachers in the KE region use ICT skills, practical skills, presentation skills, and field trips in agriculture education, for the sustainable development of the KE region of Namibia.

\( H_2 \) – There is a significant relationship between the use of pedagogic skills in agriculture education, in the KE region, with teachers’ gender, qualification, and experience.

\( H_3 \) – The use of pedagogic skills in agriculture education predict a significant influence on the sustainable development of the KE region of Namibia.

![Figure 8. Hypothetical structure](image-url)
3.2. **Research questions**

1. What pedagogical skills in agriculture education do agriculture teachers use for a sustainable development of the KE region of Namibia?

2. What is the relationship between the pedagogic skills used in teaching agriculture in the KE region of Namibia, with teachers’ gender, qualification, and experience?

3. To what extent is the use of these pedagogic skills in agriculture education influence the sustainable development of the KE region of Namibia?
4. METHODOLOGY

4.1. Research design and strategy

In view of the post-positivism philosophy, this study used a nonexperimental research design to describe the pedagogical skills used in agriculture education, analyse the relationship of the pedagogic skills’ use in accordance to the demographic features outlined in chapter 2, and predict the influence of the pedagogical skills on the sustainable future of the KE region using IBM SPSS Statistics version 25 software. With nonexperimental research design, varying observations, historical facts, existing data sets, and questionnaires are used in forming the methodology of the research (Muijs, 2011). Post-positivism integrates positivism and interpretivism paradigms, making it compatible with nonexperimental research designs (Prasad, 2015). In addition, the philosophy holds a notion of critical realism that considers epistemological relativism, ontological realism, and judgemental rationality of data analysis (Bhaskar, 1998). Nevertheless, the researcher should be careful with the way interpretivism informs positivism and vice versa in the post-positivist philosophy, so that the credibility of scientific data presentation is not compromised (Prasad, 2015).

4.2. Data collection method and process

I collected data using an online questionnaire (see Appendix 1). Muijs (2011) define a questionnaire as a sheet of coded information from research respondents with numeric data representation. All pedagogical skill related questions and the questions of sustainability in agriculture education were measured on a five-point scale, represented by (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, and (5) Strongly Agree. Questionnaires are good for collecting data in large quantities that can be analysed statistically and tested against their significance level to the population through the sample size (Bryman, 2016). Online questionnaires are easy to access, handle, and manage, provided there is an internet connection (Muijs, 2011). The questionnaire was subdivided into demographic information, use of pedagogical skills in agriculture education, and asked knowledge and skills of sustainable development in agriculture education.

The population for this study was agriculture teachers, including agriculture teachers that were heads of departments in the KE region, across senior primary, junior secondary, and senior secondary schools, of which 44 agriculture teachers in the region responded to the
questionnaire using a convenience sampling method (Etikan, Musa & Alkassim, 2016), due to the dispersion of the region’s population. Prior to data collection, I conducted a pilot study with 20 respondents to ensure that the questions were brief and free from errors to improve the results’ credibility. After the pilot study, I forwarded the link of the finished and tested questionnaire to agriculture teachers in the KE region via social media platforms. In total, the preparation of the questionnaire, piloting, and data collection lasted for four months (June – September 2018). The sample consisted of 25 male teachers who made up 56.8% of the sample, and (N = 19, 43.2%) identified themselves as female teachers (see Table 2).

Table 2. Research participants

<table>
<thead>
<tr>
<th>Gender of the teacher</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Male</td>
<td>25</td>
<td>56.8</td>
<td>56.8</td>
<td>56.8</td>
</tr>
<tr>
<td>Female</td>
<td>19</td>
<td>43.2</td>
<td>43.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

4.3. Data analysis

I exported the data received into IBM SPSS Statistics version 25 software for analysis. Data is easy to handle, manage and analyse using SPSS (Muijs, 2011). Using SPSS, I analysed the pedagogical skills that teachers in the KE region use for sustainable development when teaching agriculture descriptively. In addition, the software analysed the relationship of these pedagogic skills with teachers’ demographic information stated in chapter 2, and further predicted their significance level of influence on the sustainable development of the KE region (Nardi, 2018).

4.3.1. Descriptive statistics

Descriptive statistics, also known as univariate analysis, analyse basic statistics calculations such as the mean, mode, medium, standard deviations, variances, skewness and kurtosis, allowing the researcher to determine the multivariate analysis method to use for inference of the data to the population (Muijs, 2011). The measurement level of single variables such as nominals, ordinals, and scales determine the multivariate analysis compatible with it. Similar
to observations in qualitative research, descriptive analysis examines the nature of data case by case such that the nature of their variables is understood for further analysis (Jackson, 2015).

Sometimes the cases maybe too many and may share similar characteristics to be examined individually. Based on theoretical knowledge and reliability test Cronbach’s alpha (α), where (α ≥ .7), similar cases can be grouped into compound factors measuring the same construct using factor analysis methods (Muijs, 2011; Valtonen et al., 2015). As a result, I measured the internal consistency for all variables from goal1_1 to goal2_12, as named in my raw data, and the variables of the measured cases had an internal consistency of (α = .91) see (Table 3). Using sum variable factor analysis technique, an internal consistency for the pedagogical skills amounted to (α = .88). Having determined the internal consistency of the variables, (goal1_1 to goal1_6) formed the construct that measured ICT skills, with a reliability index of (α = .88). In addition, (goal1_7 to goal1_12) measured (practical skills [α = .82]); (goal1_13 to goal1_18) measured (presentation skills [α = .69]), and (goal1_19 to goal1_24) measured the field trips construct (α = .65), all measuring the use of pedagogic skills among agriculture teachers in the KE region.

Moreover, (goal2_1 to goal2_12) of which, (goal2_1 to goal2_6) measured entrepreneurship skills (α = .76), and (goal2_7 to goal2_12) measured the sustainable skills construct (α = .74). A combination of entrepreneurship skills and sustainable skills formed the sustainable development construct (α = .77), a dependent variable for the regression analysis. see (Appendix 4) for the reliability tests. The researcher should verify the statistical test with theoretical knowledge that is sound, so that the constructed factors are robust (Muijs, 2011). A descriptive analysis of these pedagogical skills determined the pedagogical skills used by agriculture teachers in the KE region which answered the research hypothesis of question 1.

Table 3. Internal reliability

<table>
<thead>
<tr>
<th>Reliability Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cronbach’s Alpha Based on Standardized Items</td>
</tr>
<tr>
<td>Goal 1</td>
</tr>
<tr>
<td>Goal 2</td>
</tr>
<tr>
<td>Field Trips</td>
</tr>
<tr>
<td>Sustainable Development</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

| Cronbach’s Alpha | .905 | .906 | 36   |


4.3.2. Normality tests and measures of central tendency

Inferential statistics extends descriptive analysis that primarily deals with the sample, to the population of the sample by analysing relationship patterns and possible predictions of the data (Adeyemi, 2009). For further inferential generalisations, the *mean* distribution of the data is tested to determine if the *mean* is normally distributed or not (Field, 2014). *Shapiro-Wilk* normality test tested the *mean* distribution of pedagogical skills. This test is compatible with sample sizes that are less than 50 and assumes that the *mean* distribution of the sample is normally distributed to the population (Field, 2014). Consequently, if the *p* – value of the tested *mean* distribution is insignificant (*p* > .05), parametric tests are used to infer generalisations to the population, otherwise nonparametric tests are used in case the test reveal that the *mean* distribution is significant (*p* < .05). Following this criterion, ICT skills had a significant value of (*p* = .009), practical skills (*p* < .05), presentation skills (*p* = .204), and field trips (*p* = .002), see (Table 4).

![Table 4. Shapiro-Wilk normality test](image)

As a result of the *Shapiro-Wilk* test, nonparametric tests were used to analyse the relationship between the use of pedagogical skills in the KE region, with agriculture teachers’ gender, qualification, and experience. The fact that presentation skills had an insignificant *p* – value, cannot disqualify the use of nonparametric tests, because it is outnumbered by other pedagogical skills which are highly insignificant (Larson-Hall, 2015). In this situation, the researcher should employ ‘judgemental rationality’ in search for answers, a critical realism characteristic of the post-positivism philosophy (Bhaskar, 1998). *Mann-Whitney U* test, therefore; tested the relationship between teachers’ gender, and the pedagogical skills. A *Mann-Whitney U* test is a nonparametric test equivalent to the parametric independent *t*-test (Field,
The test is suitable for analysing categorical variables with two groups (gender [Male and Female]), and scale variables (pedagogical skills). As opposed to testing the mean distribution with independent t-test, Mann-Whitney U on the other hand, test for differences in the median distribution of the sample, in relation to the population. Although some authors argue that nonparametric tests lack the statistical power compared to parametric test, the test accommodate the characteristics of parametric tests, by being free from the assumption that the mean distribution of the sample is normal in comparison to the population (Field, 2014).

The relationship between the use of pedagogical skills in agriculture education, with agriculture teachers in the KE region, regarding their qualifications and experiences were analysed with Kruskal-Wallis H test. Similar to Mann-Whitney U, Kruskal-Wallis H is a nonparametric test. The difference however, is that Kruskal-Wallis H accommodates more than two categorical variables when comparing the median distribution of continuous variables to the groups, doing exactly what the ANOVA test does with continuous variables that meets parametric assumptions (Muijs, 2011). Post-hoc analyses for these categories were not performed, due to the fact that the interest of the research question 2 was to test the significance of the hypothesis for the question, and not the degree of difference existing within the qualification or the years of experience groups. See (Table 5) and (Table 6) presenting the qualification and the experience of agriculture teachers respectively.

Table 5. Teachers’ qualifications

<table>
<thead>
<tr>
<th>Highest qualification of the teacher</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Grade 12</td>
<td>1</td>
<td>2.3</td>
<td>2.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Diploma in Education</td>
<td>2</td>
<td>4.5</td>
<td>4.5</td>
<td>6.8</td>
</tr>
<tr>
<td>Advanced Diploma in Education</td>
<td>11</td>
<td>25.0</td>
<td>25.0</td>
<td>31.8</td>
</tr>
<tr>
<td>Bachelor’s Degree in Education</td>
<td>28</td>
<td>63.6</td>
<td>63.6</td>
<td>95.5</td>
</tr>
<tr>
<td>Master’s Degree in Education</td>
<td>2</td>
<td>4.5</td>
<td>4.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
4.3.3. Multiple linear regression analysis

Multiple linear regression analyses are useful when the aim of the research question is to predict how one or more independent variables affect the dependent variable. It is a model that explains the influences of independent variables on the dependent variable (Muijs, 2011). The assumptions to conduct a multiple linear regression are that there should be a linear regression, meaning that at least one or more of the independent variables should explain the probability that the dependent variable is likely to occur in the generalised population, with no issues or minimal multicollinearity existing in the predicting variables (Chatterjee & Hadi, 2015). In addition, the distribution of the residuals for the predicting variables should be normal, and the variance of the errors following a homoscedasticity distribution (Field, 2014). The Durbin-Watson statistic had a value of 1.47, thus; was getting closer to 2, explaining that the model’s residuals did not correlate strongly, thus; improving the explanation of the model. Moreover, the VIF statistics for all pedagogical skills were less than 5 (see Table 10), thus, multicollinearity issues did not occur in the regression model. Figure 9 presents the histogram of the regression model and Figure 10, the homoscedasticity of the variance of the errors. In view of these assumptions, the prediction of the use of pedagogical skills on the sustainable future of the KE region did not violate any of these assumptions. Although some studies indicate that violating one or two of the assumptions is normal for educational research studies that are social, such violations create problems for the regression model, and may not produce credible results (Chatterjee & Hadi, 2015). Therefore, ICT skills, practical skills, presentation skills, and field skills were the predictor variables of the regression model, and sustainable development, the response variable, in response to the 3rd research hypothesis of the research question 3.

Table 6. Teachers’ experiences

<table>
<thead>
<tr>
<th>Years of experience in teaching agriculture</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Less than 1 year</td>
<td>7</td>
<td>15.9</td>
<td>15.9</td>
<td>15.9</td>
</tr>
<tr>
<td>1 - 2 years</td>
<td>7</td>
<td>15.9</td>
<td>15.9</td>
<td>31.8</td>
</tr>
<tr>
<td>3 - 5 years</td>
<td>14</td>
<td>31.8</td>
<td>31.8</td>
<td>63.5</td>
</tr>
<tr>
<td>6 - 10 years</td>
<td>10</td>
<td>22.7</td>
<td>22.7</td>
<td>86.4</td>
</tr>
<tr>
<td>10+ years</td>
<td>6</td>
<td>13.6</td>
<td>13.6</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Figure 9 show that the model’s errors were distributed normally.

Despite a visible error spreading away from other values, the variance of the errors was within the zero-value, thus being homoscedastic, refer to (Figure 10).
Figure 11 presents the methodological build-up of the regression model.

4.4. The validity and reliability of the research method

To ensure the methodological credibility of this study, my research supervisor examined, advised, and directed the construction of the questionnaire. He is an expert in quantitative methodological approaches, with experience in science education research studies. The questionnaire was further tested with a sample of 20 participants for editing and correcting, before positing it for responses to prove its workability. An internal consistency of .91, for all variables, and the sum variable constructs meeting Cronbach’s alpha of ($\alpha \geq .7$) is sufficient to justify the credibility of the research tool, refer to (Appendix 4). For generalisations, Shapiro-Wilk test determined the suitability of each median analysis used, whereas regression assumptions determined the applicability for using the regression model analysis, setting the significance level at ($p \leq .05$), and calculating the effect sizes where fit.
4.5. Ethical Considerations

Permission from the University of Eastern Finland with that of the regional director of the MoEAC in the KE region of Namibia authorised me for data collection from agriculture teachers in the region (see Appendix 2 & 3). The participation to answer the questionnaire was voluntary and questions revealing individual’s identity were not asked (refer to Appendix 1). As a result, all the responses are anonymous and confidential. I used the APA referencing system to refer similarities of ideas from other authors, confirmed with Turnitin plagiarism check-up tool.
5. RESULTS

In this chapter, I present the results in the order of the research questions in chapter 3. Question 1 asked for the use of pedagogical skills among agriculture teachers in the KE region, for the sustainable development of the region. As a result, I presented the description of the pedagogical skill constructs (ICT skills, practical skills, presentation skills, and field trips) along with sustainable development constructs (entrepreneurship skills and sustainable skills). Furthermore, I presented the results of question 2, that asked for the relationship between the use of these pedagogical skills with teachers’ gender, qualification, and experience in relation to the sample. Finally, the results for the influence of these pedagogical skills on the sustainable development of the KE region of Namibia were presented to answer research question 3.

5.1. Descriptive analysis

Table 7 shows that agriculture teachers in the KE region agreed to using practical skills ($M = 3.59$, $SD = 0.673$), presentation skills ($M = 3.29$, $SD = 0.654$), field trips ($M = 3.44$, $SD = 0.640$), entrepreneurship skills ($M = 3.43$, $SD = 0.708$), and sustainable skills ($M = 3.74$, $SD = 0.623$) when teaching agriculture. However, Table 7 further shows that agriculture teachers disagreed with the use of ICT skills ($M = 2.54$, $SD = 0.856$) when teaching agriculture.

<table>
<thead>
<tr>
<th>N</th>
<th>Gender of the teacher</th>
<th>ICT skills</th>
<th>Practical skills</th>
<th>Presentation skills</th>
<th>Field trips</th>
<th>Entrepreneurship skills</th>
<th>Sustainable skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Valid</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td>1.43</td>
<td>2.5417</td>
<td>3.5947</td>
<td>3.2917</td>
<td>3.4356</td>
<td>3.4316</td>
<td>3.7365</td>
</tr>
<tr>
<td>Median</td>
<td>1.00</td>
<td>2.3333</td>
<td>4.0000</td>
<td>3.1667</td>
<td>3.5000</td>
<td>3.6967</td>
<td>4.0000</td>
</tr>
<tr>
<td>Mode</td>
<td>1</td>
<td>2.00</td>
<td>4.00</td>
<td>3.00</td>
<td>3.33</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>0.901</td>
<td>0.85750</td>
<td>0.67294</td>
<td>0.65407</td>
<td>0.64019</td>
<td>0.70831</td>
<td>0.62299</td>
</tr>
<tr>
<td>Variance</td>
<td>0.901</td>
<td>0.85750</td>
<td>0.67294</td>
<td>0.65407</td>
<td>0.64019</td>
<td>0.70831</td>
<td>0.62299</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.285</td>
<td>0.560</td>
<td>-1.411</td>
<td>-2.92</td>
<td>-1.062</td>
<td>-0.814</td>
<td>-0.1065</td>
</tr>
<tr>
<td>Std. Error of Skewness</td>
<td>0.357</td>
<td>0.357</td>
<td>0.357</td>
<td>0.357</td>
<td>0.357</td>
<td>0.357</td>
<td>0.357</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-2.012</td>
<td>-1.449</td>
<td>1.740</td>
<td>1.375</td>
<td>1.203</td>
<td>0.002</td>
<td>0.666</td>
</tr>
<tr>
<td>Std. Error of Kurtosis</td>
<td>0.702</td>
<td>0.702</td>
<td>0.702</td>
<td>0.702</td>
<td>0.702</td>
<td>0.702</td>
<td>0.702</td>
</tr>
</tbody>
</table>

*Multiple modes exist. The smallest value is shown.*
5.2. Measures of central tendency: the median

5.2.1. Mann-Whitney U test (teachers’ gender and pedagogical skills)

A Mann-Whitney U test indicated that the median variation was statistically insignificant for the use of the pedagogical skills in agriculture education, with the gender of agriculture teachers in the KE region. ICT skills ($Mdn = 2.33$), $U = 183$, $p = .193$, $r = -.196$; practical skills ($Mdn = 4$), $U = 230$, $p = .855$, $r = -.027$; presentation skills ($Mdn = 3.17$), $U = 196$, $p = .322$, $r = -.149$; and field trips ($Mdn = 3.5$), $U = 216$, $p = .609$, $r = -.077$. see (Table 8).

Table 8. Mann-Whitney U test for gender and pedagogic skills

<table>
<thead>
<tr>
<th>Test Statistics$^a$</th>
<th>ICT skills</th>
<th>Practical skills</th>
<th>Presentation skills</th>
<th>Field trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mann-Whitney U</td>
<td>183.000</td>
<td>230.000</td>
<td>196.000</td>
<td>216.000</td>
</tr>
<tr>
<td>Wilcoxon W</td>
<td>508.000</td>
<td>555.000</td>
<td>521.000</td>
<td>406.000</td>
</tr>
<tr>
<td>Z</td>
<td>-1.362</td>
<td>-1.182</td>
<td>-1.990</td>
<td>-1.512</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.193</td>
<td>.655</td>
<td>.322</td>
<td>.609</td>
</tr>
</tbody>
</table>

$^a$ Grouping Variable: Gender of the teacher

5.2.2. Kruskal-Wallis H test (teachers’ qualification and pedagogic skills)

Kruskal-Wallis H test indicated that using presentation skills ($X^2(4) = 12.7$, $p = .013$) and field trips ($X^2(4) = 11.4$, $p = .023$) in teaching agriculture had a significant relationship with the qualification of agriculture teachers in the KE region of Namibia. However, using ICT skills ($X^2(4) = 5.41$, $p = .247$) and practical skills ($X^2(4) = 9.24$, $p = .055$) to teach agriculture education had no significant relationship with the qualification of teachers in the KE region of Namibia, see (Table 9).

Table 9. Kruskal-Wallis H test for qualification and pedagogic skills

<table>
<thead>
<tr>
<th>Test Statistics$^{ab}$</th>
<th>ICT skills</th>
<th>Practical skills</th>
<th>Presentation skills</th>
<th>Field trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kruskal-Wallis H</td>
<td>5.414</td>
<td>8.235</td>
<td>12.686</td>
<td>11.360</td>
</tr>
<tr>
<td>df</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
<td>.055</td>
<td>.013</td>
<td>.033</td>
<td>.023</td>
</tr>
</tbody>
</table>

$^a$ Kruskal Wallis Test  
$b$ Grouping Variable: Highest qualification of the teacher
5.2.3. **Kruskal-Wallis H test (teacher’s experience and pedagogic skills)**

The use of practical skills ($\chi^2(4) = 11.4, p = .023$) and field trips ($\chi^2(4) = 10.3, p = .036$) in teaching agriculture was statistically significant, when compared with the experience of agriculture teachers in the KE region of Namibia, using the **Kruskal-Wallis H test**. Nevertheless, the comparison was insignificant for ICT skills ($\chi^2(4) = 8.48, p = .075$) and presentation skills ($\chi^2(4) = 4.08, p = .395$) with regard to the years of experience of agriculture teachers in the KE region of Namibia, refer to (Table 10).

| Table 10. Kruskal-Wallis H test for experience and pedagogical skills |
|------------------------|----------------|----------------|----------------|----------------|
| **Test Statistics**\(^{ab}\) |
| ICT skills | Practical skills | Presentation skills | Field trips |
| Kruskal-Wallis H | 8.481 | 11.369 | 4.083 | 10.276 |
| df | 4 | 4 | 4 | 4 |
| Asymp. Sig. | .075 | .023 | .395 | .036 |

a. Kruskal Wallis Test  
b. Grouping Variable: Years of experience in teaching agriculture

5.3. **Multiple linear regression analysis (pedagogical skills and sustainable future)**

The use of practical skills ($b = .29, t(39) = 2.04, p = .048$) and field trips ($b = .38, t(39) = 2.41, p = .021$) in teaching agriculture predicted a significant influence on the sustainable development of the KE region of Namibia. As a result, the model found a linear regression ($R^2 = .45, F(4, 39) = 9.88, p < .001$). On the contrary, however; using ICT skills ($b = .19, t(39) = 1.53, p = .135$) and presentation skills ($b = .02, t(39) = 0.14, p = .891$) in agriculture education did not predict any significant influence on the sustainable development of the KE region of Namibia, see (Table 11 &12).

<p>| Table 11. Regression model for pedagogical skills and sustainable development |
|------------------------|---------------|---------------|---------------|---------------|
| <strong>Model Summary</strong>(^b) |</p>
<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>R Square Change</th>
<th>F Change</th>
<th>df1</th>
<th>df2</th>
<th>Sig. F Change</th>
<th>Durbin-Watson</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.709(^a)</td>
<td>.503</td>
<td>.452</td>
<td>.39354</td>
<td>583</td>
<td>9.879</td>
<td>4</td>
<td>39</td>
<td>.000</td>
<td>1.471</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Field trips, ICT skills, Presentation skills, Practical skills  
b. Dependent Variable: Sustainable development

36
Table 12 presents the Beta ($b$), t-tests ($t$) and the VIF values of the predictor variables against the response variable.

Table 12. Beta, t-tests, and the VIF of pedagogical skills

<table>
<thead>
<tr>
<th>Coefficients$^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

$^a$ Dependent Variable: Sustainable development
6. DISCUSSIONS

This study explored the use of pedagogic skills in agriculture education, and the influence of these skills on the sustainable development of the KE region of Namibia. The collected data from agriculture teachers in the KE region included their gender, qualification and experience in teaching the subject. Using sum variables as a factor analysis technique, ICT skills, practical skills, presentation skills, and field trips were the constructs that measured pedagogical skills, whereas entrepreneurship skills and sustainable skills in agriculture formed the sustainable development construct, a dependent variable of this study. A description of the pedagogical skills and sustainable development related constructs were analysed. Mann-Whitney U tested the relationship of these pedagogical skills and the gender of teachers, and Kruskal-Wallis tested that of teachers’ qualification and experience. A multiple linear regression on the other hand, analysed the influence of the described pedagogical skills on the sustainable development of the KE region of Namibia.

6.1. ICT skills in agriculture education

The hypothesis that agriculture teachers in the KE region use ICT skills for the sustainable development of the region was null. Moreover, the use of ICT skills was insignificant in relation to the gender, qualification, and the experience of agriculture teachers in the KE region, including an insignificant influence on the sustainable development of the region.

In line with Osakwe et al.’s (2017) findings that Khomasdal teachers and students in Namibia had no access to ICT devices supports this finding. Salemink et al. (2017) along with Correa and Pavez’ (2016) results that the lack of skills in ICT use among teachers is affected by the availability of technological facilities and is worse off in many developing countries and rural areas provides possible explanations for this finding.

With regard to gender, the findings are contrary to Smith et al. (2015). However, the findings are in agreement with Hlengwa et al. (2018) that demographic factors such as gender do not affect the use of ICT among teachers, especially in inclusive education. With regard to experience, Solomonson et al. (2018) contradict with the result of this study that was insignificant and concluded that novice teachers with improved pedagogical skills gained more experience than those that did not, on the basis that pedagogical skills were not uniquely inferred to ICT skills but rather general. Considering qualification, the results are in congruent
with Musau and Abere’ (2015) findings that qualified teachers had no significant difference with the application of technology in teaching agriculture.

Despite the use of ICT skills having an insignificant influence on the sustainable development of the KE region of Namibia, Francisca and Samsudin (2018) encourages teachers to partake in ICT related programmes and workshops in developing their skills. In addition, Ghavifekr and Rosdy (2015) reiterates further that ICT skills replaces the traditional teaching method, which is didactive other than constructive, and has proven unproductivity in terms of learning. Consequently, ICT skills centralises education on ICT facilities, which brings about developments. Teachers with ICT skills in the pedagogy of agriculture have the ability to develop students’ attitudes, that are research driven to challenge the status quo of agricultural industries, on economic grounds for the sustainable development of a nation (Kehinde & Agwu, 2015).

However, questions on governmental support, with reference to power effect on society (Bhaskar, 1998) in the Namibian context, on the use of ICT in teaching, policies, and their implementation strategies for sustainable developments of the regions in the country arises as questions needing answers on further developments of this study.

6.2. **Practical skills in agriculture education**

Teachers in the KE region of Namibia used practical skills in agriculture education. Nevertheless, this use did not relate to the gender and qualification of the teachers. Contrary, using practical skills in agriculture education among teachers had a significant relationship with the teacher’s years of experience, and predicted a significant influence on the sustainable development of the region.

Differing with Smith et al. (2015) on gender comparisons regarding teaching practical skills in agriculture, sample sizes and the specificity of the practical skills might explain this difference. While Smith et al. (2015) measured the confidence level among 280 agriculture teachers, from three different states, to integrate engineering, mathematics, technology and other science subjects in agriculture education as determining factors, this study measured the extent to which soils, crops and animal husbandry, and the use of equipment skills in agriculture education are taught as practical lessons.
Agreeing with Musau and Abere (2015) on the insignificant difference between teachers’ qualification and the use of practical skills in agriculture, the fact that 95% of the agriculture teachers in this study were qualified to teach agriculture, and 89.7% of teachers in Musau and Abere’s (2015) findings were trained and qualified, justifies this relationship. Meaning, agriculture teachers had the skills to teach practical skills in agriculture, since they had the needed knowledge received during their teacher training, thus; the difference in the applicability of practical skills based on their qualification was insignificant, Moodie et al. (2015).

The fact that 63.6% of agriculture teachers in this study had five years and below teaching experience in agriculture, aligns with Solomononson et al.’s (2018) finding that novice teachers who developed their pedagogical skills, gained experience than those that did not. The significant relationship between teachers’ experience and the use of practical skills maybe explained by this alignment. The practice of gardening, case studies of cash crops, teaching of technical skills, and exposing students to livestock farming, along with the marketing skills noted by Robinson-Pant (2016) could explain why there was a significant prediction of practical skills on the sustainable development of the KE region of Namibia. Nevertheless, post-hoc analysis would have ascertained these similarities.

As a result, Mlangeni et al. (2015) emphasised that at the centre of economic growth of a nation, on agricultural spheres, lies with agriculture teachers, who develop the minds of future entrepreneurs and farmers, the students. In the same vein, Moodie et al. (2015) strengthened that the qualification of agriculture teachers in particular, should be relevant to industrial agriculture. In that, an “Agriculture Education Council”, made up of personnel from schools, vocational trainings, universities, together with agricultural market sectors, should guide the qualification of agriculture teachers in addressing economic crisis and poverty on agricultural grounds (Moodie et al., 2015). Suppose this council was practical, in line with pragmatic approaches (Dewey, 1959) in the Namibian context, how would it be financed for its implementation in an attempt to connect agriculture education with agribusinesses at the school level? This may establish areas for further exploration and investigation, in view of the structural formation, funding and the governing of such a council.
6.3. **Presentation skills in agriculture education**

Agriculture teachers in the KE region acknowledged the use of presentation skills in agriculture education. The skill had a significant relationship with teachers’ qualification, but the relationship was insignificant when compared to the gender and experience of the teachers. In addition, using presentation skills in agriculture education had a very high insignificant influence on the sustainable development of the KE region of Namibia.

The significance of this skill with teachers’ qualification is contrary to Musau and Abere (2015). Possibly, it is due to the fact that most teachers nowadays are qualified and are exposed to various teaching approaches and are able to employ a number of them in their lessons (Solomononson et al., 2018). However, the significant level of this skill against teachers’ qualification cannot be established as to whether teachers with higher qualifications used the skill in teaching agriculture compared to those with lower qualification or it is the opposite, since; *post-hoc* analysis did not make-up the methodological build-up of this study. Musau and Abere (2015) might give us a hint in establishing the shortfalls to justify this significance difference with their *pair wise* comparisons which revealed that teachers that had post graduate qualification yielded higher performance of students in science subjects such as biology, chemistry, agriculture, mathematics, and physics compared to untrained teachers. This hint is not sufficient for this study, however; considering that teachers without a teaching qualification in this study only made up 4.5% of the sample, and no teacher with a post graduate qualification participated in this study. In view of critical realism through judgemental rationality (Bhaskar, 1998), it can be concluded that teachers with a better qualification such as a bachelor’s degree in education could have used this skill in comparisons to others, on the basis that the sample had 63.6% of agriculture teachers with a bachelor’s degree in education. This conclusion still begs statistical analysis for justifications in the differences between the groups of agriculture teachers’ qualification in relation to the use of practical skills.

With reference to gender, the results agreed with Hlengwa et al. (2018), but were in contradiction with regards to teachers’ experience in Hlengwa et al.’s (2018) findings. The results however, aligned with Solomononson et al., (2018) on the basis of teachers’ experience and not qualification. A high insignificant influence of presentation skills in agriculture education on the sustainable development of the KE region of Namibia can be explained by the direct involvement of the skill with ICT use, whose facilities were revealed to be lacking in many developing countries (Correa & Pavez, 2016; Salemink et al., 2017).
Agricultural sciences are practical and technical, thus; the use of this skill may not be prevalent as a pedagogical skill that would influence the sustainability of a nation, with regards to entrepreneurial skills and agriculture sustainable practices (Moodie et al., 2015). Maharaj-Sharma and Sharma (2017) along with Newhouse (2017) defend the need for presentation skills in teaching that the 21st century is an era of knowledge and information sharing, as a result, teachers should possess presentation skills for sharing ideas to their peers and their students and in the process, socially construct knowledge through discussions. Teaching presentations skills to students develops their language use competency, thus; the skill is more beneficial to the students whose medium of instruction in the lessons is a second language (Liontas, 2018). This debate develops further questions to determine the correlation between presentation skills and agriculture education, so that a relationship can be established. Should there be any, the relationships’ effect size should be considered.

6.4. Field trips in agriculture education

Similar to practical and presentation skills, agriculture teachers used field trips as a pedagogic skill and had no significant difference when compared between the teachers’ gender. However, field trip was the only pedagogic skill to have a significant relationship with teachers’ qualification and experience and predicted a significant influence on the sustainable development of the KE region of Namibia.

The significance of field trips across teachers’ qualification and experience coincides with Solomonson et al.’s (2018) study that qualified and experienced teachers, are far better than the novice and those less qualified. Due to the methodological approach and this study’s parameters, the significance of these differences is not known. Percentages on the basis of frequency in this study does not explore this significance of difference in view of judgmental rationality (Bhaskar, 1998), considering that the categorisation criteria for teachers’ experiences differed. Nonetheless, Irungu et al. (2015) explained in their study that teachers who had access to educational teaching facilities in their schools had time for research in developing their professional skills in teaching, supporting Solomonson et al.’s (2018) that qualified agriculture teachers had the passion for professional growth.

The significant influence of field trips on the sustainable development of the KE region of Namibia relates to Mlangeni et al.’s (2015) study in Malawi that qualified agriculture teachers
were the key economic drivers of the country, and compromising their qualification threatens economic developments with regards to agriculture, as their counterparts would not deliver the required knowledge needed for economic developments. Aneke (2015) in agreement with Ndem and Akubue (2016) outlined that field trips draws reality in the sights of a student, through experimentation, observation, enquiry, reflection and interactions with the experts of the topic under study. As a result, field trips are socially constructive in view of learning (Nkereowajiroy, 2014). Employing field trips in science subjects exposes students to reality, which develop their interest through the connection of theory to practice, thus; address social issues with scientific knowledge (Akcay, B. & Akcay, H., 2015; Behrendt & Franklin, 2014; Okiror et al., 2017). Considering that the successful use of field trips in agriculture education had a significant prediction on the sustainable development of the KE region of Namibia, with literature supporting the results, along with Foucault’s debate on society and power (Bhaskar, 1998), and knowing at the moment, that agriculture education in Namibia is an optional prevocational subject from senior primary schools through to senior secondary schools (MoEAC, n.d.), and not every student opt for the subject, is it worth the wait or it is time for a change to make it a compulsory subject in addressing national issues such as poverty? If yes, the time is now, are agriculture teachers ready for the challenge in proving the prediction, with regard to their pedagogical knowledge in agriculture, experience, and qualification? These questions open areas for further investigations.
7. LIMITATIONS AND SUGGESTIONS FOR FUTURE STUDIES

The sample size is only generalisable to the KE region of Namibia, and not Namibia at large. Internet accessibility, negative views about online questionnaires, ethical considerations to conduct research in all regions, and timeframe of the study contributed to this limitation. Future research studies should focus on collecting data from larger samples across the country so that the results are generalised to agriculture teachers in Namibia. Alternatively, printed questionnaire copies should be used to collect data from respondents that do not have access to the internet. Otherwise, secondary data can be used for sampling provided they are available.

Another limitation for this study is the lack of studies in Namibia to support the results in the context of this research study. Research articles, books and other scientific materials conducted in Namibia in relation to agriculture education were lacking. As a result, the study explored on the topic and did not investigate, using scientific international studies to support the study’s results. Namibian researchers in science education should examine and investigate a combined influence of science subjects at the school level such as mathematics, physics, chemistry, and biology, in extension to agriculture, on their contribution to the sustainable development of Namibia at large. The measurements for these investigations should include students’ performance in the subjects, and the types of pedagogical approaches used to determine their contribution to the sustainable development of Namibia, through quality education.

Differences within the qualifications and the teachers’ years of experience were not analysed, due to the methodological approach, the research objectives, and the nature of the data. Expertise in the methodological build-up of the research, hypothesising, and the number of variables making up construct factors could possibly explain the limit. As a result, other quantitative studies with alternative methodological approaches were used to justify the results for these comparisons. Future studies should employ advanced quantitative methodologies with larger samples for analysing associations using factor analysis methods such as exploratory factor analysis and confirmatory factor analysis in factors formulation and analysing the associations with structural equation modelling techniques. A quasi-experimental design would further extend the analysis of these differences.
8. REFERENCES


Ozuah, P. O. (2016). First, there was pedagogy and then came andragogy. Einstein journal of Biology and Medicine, 21(2), 83-87.


APPENDICES
Appendix 1

1. Ignatius Stijji (288332), a master’s degree student in education at the University of Eastern Finland (Joensuu Campus) is conducting a research in Science education on how pedagogical skills in agricultural sciences at the school level influence the realisation of a sustainable future for Kavango East region of Namibia. All responses will be treated with confidentiality and your name is not required thereof. Participation in this questionnaire is also voluntary.

EXPLORING TEACHERS’ USE OF PEDAGOGICAL SKILLS IN AGRICULTURE EDUCATION FOR THE SUSTAINABLE DEVELOPMENT OF THE KAVANGO EAST REGION OF NAMIBIA

Data collected in this questionnaire will allow agriculture teachers, advisors, policy makers and other educational stakeholders relating to agriculture education to identify teaching skills suitable for agriculture education in the Kavango East region. Agriculture teachers, teachers that took agriculture as their minor subject during teacher training and Head of departments for sciences will provide information about their experiences and qualifications in teaching agriculture, as well as their views and perceptions on the use of pedagogical skills in agriculture education, and agriculture for a sustainable future.

### BACKGROUND INFORMATION

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is your gender?</td>
<td>Male</td>
</tr>
<tr>
<td>3. What is your status in agriculture education as a subject?</td>
<td>Agriculture teacher</td>
</tr>
<tr>
<td>4. What phase do you teach agriculture?</td>
<td>Senior Primary Phase</td>
</tr>
<tr>
<td>5. What is your highest qualification?</td>
<td>Grade 12</td>
</tr>
<tr>
<td>6. How many years have you been teaching agriculture?</td>
<td>Less than 1 year</td>
</tr>
<tr>
<td>Experience</td>
<td></td>
</tr>
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</table>
## Pedagogical Skills for Agriculture Education in the 21st Century

### Information, Communication Technology (ICT) and Agriculture Education

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most of my students can access ICT devices during my lessons.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I include vocal, visual aids, animations and pictures in some of my lessons.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students use ICT devices in my lessons.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students have the required computer skills.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students know about Microsoft Office tools (Word, PowerPoint, Excel, and Outlook).</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students can access the Internet for information without problems.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### Practical Skills and Agriculture Education

<table>
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<tr>
<th>Statement</th>
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<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I provide my students with agricultural equipments necessary for practical skills.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I teach my students necessary skills regarding crop farming.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I teach my students necessary skills regarding animal farming.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students can use agricultural equipments efficiently and effectively.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students know how to work the soil and grow crops.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students have the knowledge and technical know-how of animal husbandry.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### Presentation Skills and Agriculture Education

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I teach my students on how to do presentations in agriculture topics.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I teach my students how to use PowerPoint slides for presentations.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I teach my students how to make presentations of projects they have conducted.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students have confidence in doing presentations in agriculture.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students do presentations of general knowledge in agriculture.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students have the opportunity to present their knowledge about agriculture in my lessons.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tbody>
</table>

### Field Trips and Agriculture Education

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I take my students on field trips to examine and report on agricultural activities happening in industries (e.g. Small scale, large scale, Gawauhwa, Farm dairy's etc.).</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I send my students in the nearby communities to observe, practice and report on agricultural activities they have learned.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I take my students on agriculture excursions to identify and report on agricultural activities they observe.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I ask my students to collect information based on agriculture activities they observe in the communities.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students report on the practices and observations about agriculture activities in the communities.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students report on agriculture activities after their excursions.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</table>
## Teaching Agriculture Education Skills for Sustainable Development

### Financial agriculture for a sustainable agriculture

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I teach basic entrepreneurial skills to assist my students in selling agricultural products to make a profit.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I organise events in which my students sell their agricultural products at school and in the nearby communities.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I invite experts in the field of agriculture to motivate my students about commercial agriculture and its importance to the region.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I send my students to local shops to identify agricultural products and give a report on them.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students are able to carry out basic entrepreneurial skills when they sell their products.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My students attend and give feedback on presentations made by experts in the field of agriculture.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</table>

### Practices necessary for a sustainable agriculture

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I teach my students farming skills and farming maintenance for a sustainable agriculture.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I teach my students knowledge and practices about conserving natural resources using sustainable methods in agriculture.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I encourage my students to practice their agricultural skills at home such as making up gardens to produce goods and sell in the communities.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I teach students about aorestation, contour ploughing, crop rotation, rotational grazing systems etc. to conserve natural resources needed in agriculture for future use.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I teach my students about the danger of improper agricultural practices to the environment.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I teach my students about maximizing production on a small piece of land using natural fertilizers and artificial fertilizers that are not hazardous to the environment.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

## PROCEED

Save

This is the end of the questionnaire.

Thank you very much for your cooperation!

Please, click save and submit.
Appendix 2

Philosophical faculty
School of Applied Education Science and Teacher Education

To Whom It May Concern

Namibian teachers, who are participating in Master’s Degree Programme in Primary Education as a part of their studies, are conducting dissertation research. These studies consist of three different parts: a) planning seminar, b) working seminar and c) research report. To be able to complete the dissertation, they have to conduct empirical data collection, which is recommended to be carried out in Namibia. As a supervisor of their master’s thesis, I ask for Your kind support for their data collection under all necessary ethical requirements.

In Joensuu, 15th November, 2017

Sari Havu-Nuutinen
Professor
Academic head of the Master’s Degree Programme in Primary Education
Supervisor of Thesis
Appendix 3

Mr. Ignatius Stiiji
RUNDU
NAMIBIA

Dear Mr. Stiiji

SUBJECT: PERMISSION TO CONDUCT RESEARCH IN KAVANGO EAST REGION

Kourdly be informed that approval has been granted to you to conduct research at School in Kavango East Region.

The normal teaching and learning activities should NOT be disrupted in the process.

Yours sincerely,

F. Kasapane
DIRECTOR, KAVANGO EAST REGIONAL COUNCIL

Date: 03.09.2018

All official correspondence must be addressed to the Direct Regional Officer.

Scanned by CamScanner
Appendix 4

pedagogical skills in agriculture education

Pedagogical skills internal consistency

<table>
<thead>
<tr>
<th>Reliability Statistics</th>
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<tbody>
<tr>
<td>Cronbach's Alpha</td>
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<td>.878</td>
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ICT constructs

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<tbody>
<tr>
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<td>.880</td>
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Practical skills constructs

<table>
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Presentation constructs

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Field trips constructs

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Sustainable development skills in agriculture education

Sustainable development constructs

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Entrepreneurship skills

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Sustainable skills

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