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From Theory to Practice: Teachers' Pedagogical Experiences in Animal Studies

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Abstract. The South African educational curriculum has significantly been changing subsequent to the apartheid regime, which had a lot of restrictions on content coverage of Agricultural Science. With such evolution in the curriculum, there has been an amendment and introduction of new Agricultural Sciences' content and concepts review as well as alignment. There is, however, a limited number of studies exploring educators' knowledge and experience of teaching Animal Studies. Therefore, it is against this background that the present study explores grade 12 educators' experience in the content and pedagogy in eight selected schools in Mohlaletse Circuit, Limpopo Province. The study employed a qualitative research approach to develop an explanatory framework representing the lived experiences of Animal Studies grade 12 educators. In addition, the study adopted Shulmans' 1986 (PCK) Pedagogical Content Knowledge as a theoretical framework to guide the experiences in teaching Animal Studies to learners in grade 12. Twelve (n=12) grade 12 Agricultural educators were purposively selected from Mohlaletse Circuit, Limpopo Province. The data was collected through semi-structured interviews, which included one-on-one interviews. Thereafter, the data was thematically analysed through the following themes: challenges of teaching animal studies, strategies employed by educators when teaching animal studies and unpreparedness to teach some of the aspects of animal studies. The

study's findings revealed challenges and the experiences encountered by Animal Studies educators. These challenges and experiences include a lack of resources, which limited learners to perform practical experiences, and limited content knowledge. The study concluded with the recommendation that professional development programmes should be tailored to address the gaps and areas of development among Animal Studies educators.

Keywords: animal studies; agricultural sciences; teaching strategies; pedagogical content knowledge; curriculum studies

1. Introduction

Agriculture is a broad concept that refers to the practice of maintaining human life by ensuring the availability of food through the cultivation of crops and domestication of animals (McCarthy et al., 2018). As a broad field which plays a significant role in South Africa, Agriculture is thus vital for the growth of the economy, alleviation of poverty and straightening of food security (Majokweni, 2018). The knowledge and basic understanding of Animal Studies is important as livestock forms part of agriculture and food production. However, it is worrisome that most learners are ignorant about the agricultural aspect of food production, by only perceiving agriculture as farming while its significance in poverty alleviation is ignored (Majokweni, 2018; Modebelu & Nwakpadolu, 2013). Agricultural Sciences is an integrated science and a vocational subject hence it contributes to guiding learners to attain both knowledge and abilities that can be relevant to real life. This subject prepares learners to be knowledgeable citizens in the production of agricultural commodities including livestock.

According to the Curriculum Assessment Policy Statement (CAPS) document, Animal Studies include the study of the general management of farm animals, reproduction, nutrition and health. This content area of Animal Studies prepares learners to have basic skills and fundamental understanding of career advancement related to Animal Studies in case they decide on furthering their studies. According to Mavhungu (2004), the pass rate in grade 12 Agricultural Sciences is critically low moreover the animal studies section. Poor performance rate is linked to countable motives, which can range from teaching skills and learners' approach regarding the subject. With references to the CAPS document, it is clear that Animal Studies cover most of the grade 12 syllabus when compared to soil science, agro-ecology, agricultural economics and crop science. Passing Agricultural Sciences in grade 12 is crucial, however passing animal studies is still a constraint to some learners as much as it is a constraint to some educators in teaching the subject (Mavhungu, 2004). Taking the above statement into consideration, the study aims at exploring educators' experiences in the teaching of Animal Studies and the result of the study will immensely contribute immensely to the current curriculum, as well as the quality of teaching Agricultural Sciences as a whole, including Animal Studies.

1.1. Research Problem

In line with the Sustainable Development Goal 2 (SDG2) which aims to eradicate hunger, achieve food security and improve nutrition, it is inevitable to understand teachers' pedagogical competences in the promotion of sustainable agriculture. Educators' ways of teaching should strive to foster the interconnectedness between sustainable agriculture, empowering small-scale farmers, promoting gender equality, eradicating rural poverty, fostering healthy lifestyles, addressing climate change, and other challenges outlined within the comprehensive set of the 17 Sustainable Development Goals in the Post-2015 Development Agenda. For sustainable agriculture and food security to achieve SDG2, there is a need for educators to play a role in transferring food production knowledge and skills to learners (Ncisana et al., 2023). Ending hunger is a call for everyone, particularly educators who are at the center of capacitating the next generation of food producers (Masha & Maphutha, 2022). Equally, the Curriculum Assessment Policy Statement for Agricultural Sciences stipulates that the teaching of the subject should include practical activities to enable learners to master the concepts. With the evolution of the curriculum, there has been an amendment and introduction of new Agricultural Sciences content and concepts (Gumede & Biyase, 2016). However, it is observable from Diagnostics report 2022, which indicates that, a majority of learners encounter difficulties in learning Genetics, which is part of the Animal Studies subsections. Reflecting from Mavhungu, (2004) who discovered that educators are improperly trained to adapt to the new curriculum that requires practical teaching, it seems that the challenge of teaching animal studies has been long standing, thus requiring urgent attention. Based on the findings of the aforementioned study, it is befitting to state that for the past two decades, there has been a huge challenge in educators' capacity to teach animal studies. This study, therefore, seeks to explain what has been challenging for the teaching of animal studies. We must remember that the concept of animal production is important in gauging future officer's competence about food security so that they may be better prepared for the future and streamline teachers' pedagogical competence to transfer necessary skills. professionally qualified Agricultural Sciences educators are exposed to minimal practical exposure which is a huge setback for skills progression in animal studies. Hence, the study is aimed at investigating the experiences of educators in the Mohlaletse circuit, particularly during the teaching of Animal Studies.

1.2. Aim and objective of the study

The aim of the study is to explore the experience of educators teaching animal studies to grade 12 learners in the Mohlaletse Circuit. The study also aims to assess educators' perceptions in teaching animal studies to the identified learners. The objective of the study is to determine educators' experiences and practices of teaching animal science to grade 12 learners.

2. Review of Literature

The literature review assessed a wide collection of scholarly sources covering books, journal articles, peer-reviewed papers, unpublished manuscripts, periodicals, government reports, and statistics. It focused on the pedagogical experiences of educators in teaching animal science within agricultural contexts,

covering works published between 2002 and 2023. The objective was to gather a comprehensive insight into previous research pertinent to the current study. The search for relevant information involved using search engines like Google Scholar, Science Direct, and Scopus, with a specific focus on English-language publications. Keywords used in the search included "teaching animal studies," "teachers' pedagogical experience," "teaching methods," and "agriculture in secondary school."

2.1 Global Overview of Agriculture

Agriculture plays a vital part in the process of economic development globally, with the greatest impact being seen in developing countries (Perez-Escamilla, 2017). Agriculture is also the primary source of food, income, and employment for rural populations. McCarthy et al., (2018) elucidate the point that food security is a state where everyone has equal access to food. In view of the above statement, Agriculture is a sector that potentially contributes to the production of food and ensures food security hence the need to impart agricultural knowledge to children with regard to growing food. There is a fall behind in terms of food security in Africa and although South Africa as a country is food secured at the national level, the country is still facing food insecurity at the household level (Statistics South Africa, 2019). Recently, South Africa has been reported to have a shortage of eggs which is the cheapest source of protein for many households, particularly poor people. Consequently, the prices of eggs increased by 100% which affected economically disadvantaged populations. With reference to the aforementioned, it is necessary for educators to efficiently teach agriculture in high schools so that learners are well equipped in food production and farming.

2.2 Importance of Learning Agricultural Sciences

The Department of Agriculture (2020) report on the economic review of the South African Agriculture revealed that the global farming income earned from all agricultural commodities has increased by 15.8% to R327138 million in 2020, compared to R282 419 million in 2019 due to the increase in income from field crops, horticulture and animal production. With the view of the statement above, it is then important for learners to learn agriculture in schools, so that they can gain the necessary knowledge and skills that are significantly aligned to the field. A study conducted by Mwiria (2002) has revealed that high school Agricultural education expands learners' capacity, influences them to be more resourceful and enables them to solve farming problems at a young stage. Education and training enable learners to acquire the required knowledge, skills, and values and to learn their appropriate application in the process of production and processing (Kidane, 2013). According to Agricultural Sciences CAPS document, learning agriculture is important as it contributes to the awareness towards the care and management of natural resources and creates personal development in different levels of farming enterprises.

2.3 Overview of Challenges in Teaching Agriculture

There are ongoing challenges that educators experience in the teaching of Agricultural Sciences. These challenges include among others curriculum change, educator's qualification and experience, as well as the availability of relevant resources. According to Nkohla (2017), curriculum evolution is executed with the

aim of improving the educational system; however, educators are always left behind (Nkosi, 2014). Rajagopalan's (2019) study indicated that appropriate educator qualification in the subject is an essential requirement for progressive learning. As supported by (Baumert et al., 2010), educators' qualifications are generally not well suitable to successfully teach their assigned subjects.
In expatiating on the challenges, Masha and Maphutha (2021) indicate that available teaching resources influence teaching and learning, furthermore, that novice educators find it difficult to teach with limited resources as compared to traditional educators. A study conducted by Nzama (2021) which investigated educators' views and experiences in teaching grade 12 learners Agricultural Economics in KwaZulu Natal, South Africa, registered a similar concern and flagged that those educators have not been sufficiently trained on the novice content. Therefore, a need to investigate educators' experience in the teaching of animal studies is inevitable.

2.4 Integration of Technology in Animal Studies Education
Johnson and Anderson (2022) suggest that online multimedia platforms provide dynamic visual representations and real-world examples, fostering deeper comprehension and knowledge retention. Bangroo and Amir (2023) emphasise the significance of well-crafted visual aids in education, particularly in enhancing the understanding of intricate scientific concepts. Integrating technology into animal studies education has the potential to greatly enhance the learning experience for both learners and teachers, as noted by Onyema (2020), who highlights the necessity of incorporating emerging technologies in the teaching and learning process due to the evolving educational landscape.

Palanivel (2020) identifies several emerging technologies, including machine learning, virtual reality, simulations, robotics, and tablets that could be integrated into teaching and learning practices. Proper implementation of these technologies, as mentioned by Palanivel (2020), holds promise for enriching the learning experience. While studies on technology integration in animal studies are limited, Weng et al., (2020) found that incorporating technology into biology education significantly improves learning outcomes. Similarly, Ncisana et al., (2023) study on Agro-ecology highlights how YouTube videos can enhance the understanding of grade 10 learners. Given these findings, it is crucial for teachers to consider integrating technology into animal studies as part of their teaching strategies and methods to enhance the learning experience.

2.5 Teaching Approaches and Strategies in Agricultural Sciences
Classroom teaching is an event wherein an educator exchanges knowledge with learners. Rajagopalan (2019) describes teaching as the process of imparting knowledge and experiences through communication such as a lecture. For educators to start teaching, they need to select an appropriate instructional strategy that will inform their teaching. Issac and Jerin (2010) point out that the following are some of the approaches that inform teaching: interaction, collaborative, experiential and facilitation. Therefore, instructional strategies are the techniques educators employ to assist learners in becoming independent and strategic.

Agricultural Sciences CAPS document stipulates that a school should be equipped with Agricultural Science laboratory where various practical work or experiments could be carried out or demonstrated. In view of the above statement, it is apparent that Agricultural Sciences support instructional strategies that are aligned with learning by doing. In addition, making use of active methods and strategies of teaching employs critical thinking and collaborative problem solving which encourages learners to be creative (Onanuga et al., 2021). The subject advocates for instructional strategies that encourage learning by doing however, this has been impossible due to limited resources, hence most educators use lecture methods to teach. Ncisana et al., (2023) report that learners who were taught using project-based and demonstration methods showed enhanced academic performance proposed that integrating project-based teaching methodologies into secondary school education could bolster learners' capabilities and proficiency in Agricultural Sciences._Moreover, in a study conducted by Manu (2018), there was evidence that learners perform well when activity-based strategies are employed in teaching. In a separate study conducted by Onanuga et al., (2021), learning by doing proved to have improved the overall performance as well as enhanced attitude towards Agricultural Sciences.

The study explored educators' experiences in teaching animal studies to grade 12 learners from 8selected schools in Mohlaletse Circuit, Limpopo Province. The main rationale of the study was to explore educators' experiences in teaching animal studies to grade 12 learners. The background and the literature review indicated that there are few studies exploring educators' experiences in teaching animal studies. Hence, the study contributed to the literature on animal studies. The literature also indicated that livestock equally contributes to the South African economy making Animal Science studies a significant subject to equip learners with skills.

2.6. Theoretical Framework

Shulman's (1986) theory was adopted to analyse educators' experiences in teaching animal studies. Shulman (1986) defines pedagogical content knowledge as a type of knowledge which is unique to each teacher. This pedagogical content knowledge is based on how to define teaching and curriculum. This implies that teachers' pedagogical content knowledge influences how they teach and organise content knowledge (Sanders et al., 1993). This theory is based on the following seven components: pedagogical knowledge, curriculum knowledge, content knowledge, knowledge of learners, knowledge of context, knowledge of educational aims and objectives (Loughran et al., 2004). The current study's interview questions were based on these components in order to have a deeper understanding of teachers' experience in teaching animal studies. Pedagogical knowledge focuses on the strategies that educators use to teach and why such strategies are deemed relevant in teaching animal studies. Curriculum knowledge refers to the level of knowledge that the teachers have on animal studies. Knowledge of learners and knowledge on the context influence teachers' choice of teaching strategies. Lovat and Mackenzie (2003) pinpoint that teaching is an art that requires a complex blend of practical skills and deeper understanding of a subject matter. This is because lack of these construct may lead to distorted teaching and learning experiences. In essence, the Pedagogical Content

Knowledge theory is based on the premises that content knowledge is essential in achieving successful teaching and learning. The Pedagogical Content Knowledge theory denotes the incorporation of subject content knowledge and pedagogy (Jacobs & Frickel, 2009). Furthermore, Shulman's Pedagogical Content Knowledge Theory's conception encompasses two main elements, which are the method of teachers in delivering the content knowledge including their knowledge about the content, and challenges encountered by learners regarding certain content (Loughran et al., 2004). The Pedagogical Content Knowledge Theory covers a broad range of significant elements which include content knowledge, teaching methods, insights to the learning processes of the learners and the curriculum knowledge. The theory stresses the need for teachers to possess a deep and comprehensive understanding of the content, curriculum and effective ways to impart knowledge.

Against this background, this study explored the experiences of grade 12 Agricultural Science teachers in understanding how the acquisition of content knowledge spans across different facets of Agriculture with reference to animal studies. The study explored how teachers simplify and impart knowledge using effective methods to the learners. This includes teaching and learning that is accessible and comprehendible to learners. Therefore, PCK was used to guide the study in exploring teachers' experience in teaching animal studies, because its concept is related to key fractions to this study. The seven components of the theory were used to analyse and explain teachers experience in teaching animal studies.

3. Methodology

3.1. Research Design

A qualitative research approach was employed to explain educators' subjective experiences in teaching Animal Science. This approach enabled the researcher to explain the meanings that educators attached to their experiences in teaching Animal Production among grade 12 learners. Qualitative research entails the collection and analysis of no numerical data to better understand participants' thoughts, or experiences about the phenomena of interest (Denzin, 1989). A qualitative research approach was used in the current study to get an in-depth understanding of Agricultural Science educators' experiences in teaching Animal production. The study employed phenomenology research design because it explored educators' experience in teaching animal studies in Agricultural Sciences classes. Phenomenology is relevant to this study because it studies reality as subjectively experienced and aims to give a description of the phenomena as it appears to the subject (Zahavi & Gallagher, 2005). This study put an emphasis on the significance and meaning of lived experience when teaching animal studies. A deeper understanding of teachers' subjective experience on teaching animal studies remains important in equipping learners with relevant skills and knowledge. Mohlaletse circuit was purposively selected as a case in this study because, the failure rate in animal science was more prevalent in this particular Circuit's schools which also host more Agricultural science learners than their counterparts. It was therefore befitting to study a case that affects a larger part of the population of Agricultural Science learners and put explanations that have not been recorded in literature for the past decade.

3.2 Participants

The Limpopo province consists of five districts, where at least one school in each district specialising in Agricultural Science exists. However, Lebowakgomo district which houses Mohlaletse circuit is host to eight schools offering agriculture. This circuit accounts a larger portion of learners enrolled for Agricultural Science than the other circuits - making it the epicentre of Agricultural Science schools in the Limpopo province. Purposive sampling was used in the selection of participants. The Mohlaletse Circuit has a total of 12 educators (population) and all the educators in the circuit were sampled. The inclusion criteria for selecting participants were primarily based on a circuit that holds more Agricultural Science schools in order to favour explanatory design. Also, teachers' qualification, grade and subject taught were part of the inclusion criteria. The exclusion criteria were schools outside Mohlaletsi circuits. With this in mind, a total of 12 participants were thus selected from the identified in favour of the chosen design. The names of the schools were not mentioned to ensure the confidentiality and privacy of participants his was the requirement of ethical conducts as propagated by the institution(s) which the researchers are affiliated to.

Table 1: Participants profile information

Teacher	Circuit	Qualifications	Teaching experience	Grade
P1	Mohlaletse	Diploma in Education (Agricultural Sciences)	22 years	12
P2	Mohlaletse	BEd (Life Sciences)	10 years	12
P3	Mohlaletse	BSc Agriculture (Soil Science and PGCE)	2 years	12
P4	Mohlaletse	BEd (Agricultural Sciences)	5 years	12
P5	Mohlaletse	BSc Agriculture (Agricultural Economics and PGCE)	2 years	12
P6	Mohlaletse	BSc Agriculture (Animal Production and PGCE)	1 year	12
P7	Mohlaletse	BEd (Life sciences)	15 years	12
P8	Mohlaletse	Diploma in Education (Agricultural Sciences)	20 years	12
P9	Mohlaletse	BSc Agriculture (Plant Production and PGCE)	5 years	12
P10	Mohlaletse	BSc Agriculture (Animal Production and PGCE)	3 years	12
P11	Mohlaletse	BSc Agriculture (Soil Science and PGCE)	4 years	12
P12	Mohlaletse	BEd (Life Sciences)	10 years	12

Table 1: Participants' demographic information, P1 to P12; represent participant number.

3.3 Data Collection Instruments and Procedures

The goal of the study was to explain the views, beliefs, and experiences of Agricultural Science educators on teaching Animal Studies thus semi-structured interviews were deemed appropriate. According to Gill et al. (2008) semi-structured interviews are the most applicable tool in obtaining a comprehensive

understanding of participants' opinions and experiences. A total of 12 educators were interviewed at their respective schools and the duration of the interviews ranged from 30-45 minutes. In addition, the interviews were recorded after a written consent was sought from the participants. The interviews were facilitated in English. During the interviews, the researcher(s) took a non-directive approach to avoid bias. An interview schedule was developed in line with the PCK framework used in this study to guide the researcher on the relevant information to focus on. At no particular point were participants coerced to respond to the questions, this may be due to the fact that prolonged engagements were done prior to the conduction of the study. The data collection process took three weeks, since all schools were in the same district.

3.4 Data Analysis

A thematic analysis technique was employed to decipher and categorise the collected data, aiming to identify recurring patterns, as discussed by Lester et al. (2020). Following the Clarke et al. (2015) approach, this method allowed for the discernment, examination and interpretation of patterns within the data. The analysis proceeded through several key steps:

Familiarisation with the data: We immersed ourselves in the transcripts and recordings, taking detailed notes to comprehend the content, as recommended by Brown and Stockman (2013). Engaging with the research material involved extensive reading, viewing, and listening to audio recordings.

Generating initial codes: After gaining a comprehensive understanding of the data, we initiated codes that highlighted significant attributes pertinent to our research question, aligning with Braun and Clarke's (2014) coding principles.

Identifying and reviewing themes: Codes were organised, and similar ones were grouped to form coherent themes. Braun and Clarke (2014) emphasise the process of grouping codes that share commonalities to unveil meaningful patterns within the data. These themes were carefully examined in relation to the coded data, allowing us to discern logical patterns and construct a narrative that weaved these themes together.

Defining and naming themes: Once the themes were consolidated, they were given distinct names that encapsulated their essence. This approach resonates with Friese et al., (2018) notion that themes should be clearly defined and descriptive to offer readers a comprehensive understanding.

This thorough analytical process enabled us to craft a report that seamlessly integrated the narrative derived from analysis with pertinent data excerpts. By bridging the analytical narrative and data, we aimed to present a cohesive and meaningful portrayal of the data within the context of existing literature.

3.5. Trustworthiness

Four criteria were followed to enhance trustworthiness in the study namely: credibility (internal validity), dependability (reliability), conformability (objectivity) and transferability (external validity) (Shenton, 2004). Credibility was

insured by using a team-based approach for data analysis to improve inter-coder reliability. Transferability was enhanced through a thorough description of the research context and the assumptions which were central to the current study. Dependability was enhanced by permitting other researchers to replicate the study. Conformability was insured by documenting all procedures for the purpose of checking and rechecking the data throughout the study.

3.6. Ethical Consideration

The researcher(s) were committed to ensuring that the participants in the study are protected. All participants were given informed consent forms to indicate their willingness to participate in the study. The informed consent forms ensured that participants fully understand what it entails to participate in the study. The anonymity of the participants was ensured through the use of pseudo names instead of real names in the analysis of data. The data collected was kept confidential and the school names were not mentioned as they would have been the identifiers and threaten the privacy of the participants. Consent forms and transcripts were kept in a safe lockable space and recordings from interviews were stored in encrypted files and a password protected device.

3.7. Limitations of the Study

Theofanidis and Fountouki (2019) define the limitation of a study as any concern or potential weakness that is out of the researcher's control or an imposed restriction which is clearly out of the re-searcher's control. The current study only focused on eight schools in South Africa which limited the generalisability of the results. The geographical scope was also limited. The study focused on a specific geographic area (all schools are in rural areas with limited resources and technology) as a result, the findings may not be applicable to geographic regions with different contexts. The other limitation was the focus on educator's perspective only without involving the learners and their experience in Animal Studies.

4. Data Presentation and Analysis

The findings of this study are presented as themes and sub-themes, supported by congruent findings between the current research and existing literature. Verbatim quotes, used to exemplify the findings, were translated into English for the purposes of this study. The data obtained from interviews were transcribed into meaningful codes which were utilised in the classification of linked data. During the coding process, verbatim quotes from transcripts that had similar characteristics were coded and grouped into themes.

Four main themes were identified. The first theme indicates educators' understanding of Agricultural Sciences. The sub-theme includes the educators' knowledge of Animal Studies. The second main theme presents strategies employed to teach Animal Studies among grade 12 learners. The third main theme provides an overview of challenges experienced by grade 12 Agricultural Science educators in animal science and the last theme identified relates to educators' unpreparedness to teach some content.

Table 2: Qualitative Analysis of the results

Themes generated from the interviews	Summary of the themes
Educators' understanding of Agricultural Sciences	Educators understanding of Agricultural Sciences
Educators' understanding of Animal Studies	Educators knowledge of fundamental concepts in Animal Studies
Challenges of teaching Animal Studies	Broad spectrum of challenges experienced by educators in the curriculum and teaching Animal Studies
Teaching methods used for Animal studies	Common teaching methods employed by grade 12 Agricultural Science teachers in teaching Animal Studies
Educators Unpreparedness for teaching Animal Studies Content	Educator's pedagogical confidence in teaching animal studies and the underlying factors on educator's preparedness

4.1. Educators' understanding of Agricultural sciences

Educators were asked about their understanding of Agricultural Science. Educators shared a common understanding that Agricultural Science is the study of plants, animals, soil and how they reproduce and are marketed. Participant B and Participant X consecutively mentioned that:

Agricultural science is a science that describes the interactions between animals, environment, plants and soil factors, its further study on how these are being produced and processed into valuable goods. (Participant B)

Agricultural science is a science shows the relationship between, the land, soil, animals and plants, it further demonstrates how each are produced, how they reproduce and how are they processed into consumable goods. (Participant X)

This links with Tilman et al.'s (2002) definition of Agricultural Science as the study of the link and significant aspects of the soil and ecosystems on which humans rely for food, fibre and energy. The South African Department of Education (2011) similarly defines Agricultural Sciences as the study of the relationship between soils, plants and animals in the pro-duction and processing of food, fibre, fuel and other agricultural commodities that have an economic, aesthetic and cultural value.

Likewise, participant E described Agricultural science as a

Multidisciplinary subject that integrates the knowledge of different disciplines to understand and practice agriculture.

This is similar to the finding of Jacobs and Frickel (2009) who posit that Agricultural Sciences is a multidisciplinary field that considers the work in both the natural and social sciences and interlinks. The South African Department of Education (2011) also confirms that Agricultural Science is an integrated science which combines knowledge and skills from Physical Sciences, Life Sciences, Social Sciences, Earth Sciences, Engineering, Mathematics and Economics.

4.2. Educators Understanding of Animal Studies

The participants shared their understanding of Animal Studies. Based on their understanding, Animal Studies is a study of livestock animals including how they reproduce, their nutrition and health. The supporting comments are presented below.

Animal studies is the study of animals, including how they reproduce, their nutrition and health. (Participant A)

Other participants defined Animal Studies as the
Study of animals which includes housing, handling, feeding, reproduction and animal diseases. (Participant B)
Animal studies is the biology and the management of livestock animals. Animal studies is a study that focuses more on animal production, nutrition, animal health and diseases. (Participant C)

The comments presented above imply that educators have an understanding of what Animal Studies entail. The comments further indicate that educators comprehend the major concepts in Animal Studies and how they relate with each other. In line with the Pedagogical Content Knowledge Theory which places an emphasis on the content knowledge, educators demonstrated a profound understanding of both Animal Studies and Agricultural Science. Loughran et al. (2004) reflect on the point that content knowledge is first element that is essential in teaching which makes content knowledge a domain of learning.

4.3. Challenges of Teaching Animal Studies

Educators were asked about the challenges and their experiences of teaching Animal Studies in Grade 12. The identified challenges mentioned by educators included insufficient resources and how that impedes the teaching and learning of Animal Studies. All educators mentioned that they only depend on textbooks to teach the subject due to lack of resources.
Participant V mentioned that

The challenges that I am facing with, when teaching animal studies to the grade 12 learners is the insufficient resources or lack of resources, I rely only on the text book to teach even though is not enough and some of the lesson objectives cannot be met as they require practical exposure.

Participant B stated that

Animal studies requires lots of practical more than any content in Agricultural sciences, for some learning objectives to be attained is necessary to demonstrate the lesson or present the lesson in form of practical, however the practical part is always impossible to the lack of resources such as small-scale farm and science laboratories. Agriculture requires practical and the lack of resources is one of the limiting factors.

Participant F highlighted that
Animal studies include animal nutrition, animal handling and animal health. Learners can better comprehend these topics if the practical exposure was incorporated as part of their learning. To improvise I sometimes make use of the videos audios to teach some aspects that requires the practical. I believe that if the learning and teaching resources were sufficient it was going to be easier to teach Animal Studies than now.

According on the educators' responses, lack of resources to teach animal studies is major constraint. This suggests that educators are unable to teach some of the content fully because there are minima to no resources.
Participant A mentioned that

Lack of resources when teaching animal studies is a serious challenge, sometimes when I teach about animal handling facilities, I wish that I could be teaching while demonstrating with the real facilities like the crush pens, loading pens so that learners can learn by doing.

Participant W further added that
Whenever I teach about digestive tract of animals, I wish learners can learn it with the real animals, however they are no resources and facilities to carry out the practical and is always not conducive to carry out the practical in the classroom.

The response above clearly indicates that educators cannot effectively teach animal studies topics. This may result in inefficient learning. Masha and Maphutha (2021) support the statement by pointing out that teaching and learning resources are important factors that permit educators to effectively deliver a lesson therefore, schools should have Agricultural Sciences laboratories, small farms, and school gardens for effective teaching of the subject. It is also difficult in most cases to achieve the set learning outcomes of the lesson under these circumstances.

4.4. Teaching Methods Used for Animal Studies
Educators were further asked about the different methods that they employ to effectively impart knowledge to the learners. This was done to acquire a deeper understanding of various pedagogical techniques and methods used by educators in teaching and learning with specific reference to Animal Studies. Participant Y mentioned that

I employ the direct method of teaching when I teach my learners, I tell learners about the objectives of the lesson I continue to teach until if maybe they could be question and after the lesson, I give the work to do.

Other participants mentioned that
I use the direct method of teaching or what is known is the lecture methods to teach. I think it works well for me, as I could be able to explain the content I am teaching. It also works well with me managing the time during my teaching period. (Participant B)

My method of teaching depends on the topics that I am teaching, most of the time I use learners centered methods of teaching which include interaction in the classroom such as discussions and debates on case studies. (Participant Z)

I believe in learner centered method of teaching, and I also believe in learning by doing. Most of the time I used experiential strategies, problem solving strategies, I want learners to take ownership of their own learning. I believe they understand better, when they learn on their own. (Participant F)

The above responses suggest that different educators use different types of teaching strategies and for some educators, the choice for a teaching strategy depends on the set of objectives that they intend to achieve at the end of the lesson. For instance, Participant Z mentioned that for a new content in which learners have a minimal prior knowledge to, he opts to use a direct strategy of teaching. Teaching strategy is defined as comprehensive design for teaching and learning and covers a skeleton of planned methods, necessary to implement the strategies. Furthermore, teaching strategies are defined as a way in which a teaching and learning environment can be approached, and it is also influenced by educators' style, personality and creativity (Issac & Jerin, 2010).

Educators Unpreparedness for Teaching Animal Studies Content
The other theme that emerged from the data collected was lack of preparedness in certain aspects of Animal Studies. Educators also mentioned aspects of animal studies which they consider challenging to teach. Most of the educators mentioned that they feel unprepared to teach animal nutrition.
Participant A mentioned that

I don't have problem with most of the content however I am having a challenge in teaching scientific feeding of animals and digestibility of feeds.

Similarly, participant B mentioned that
I am not confident to teach animal nutrition as whole, is difficult for me. The problem is that I never majored in Agricultural Sciences during my academic years, I teach Agricultural Sciences because the school allocated me the subject.

Participant X mentioned that
Even though I did my initial degree in BSc Agriculture I am not so confident in teaching the calculations related to animal nutrition. I majored in soil sciences on my initial degree I did one module in animal production, and it was not that much of calculations.

Other participants stated that
I am not confident in teaching the scientific feeding and digestion, I always need to practice the topic before I can teach it, and most of the time when I teach it I make the class to be teacher cantered so learners can have minimum interaction with me. (Participants V)

Animal nutrition is the challenge for me, more especially the scientific feeding and digestion calculations, I always have to enquire with fiends before teaching the topic. (Participant E)

I always feel ready and prepared to teach any aspect related to Animal studies, animal studies is the area of my speciality. I did BSc in Agriculture and I majored in Animal Science; hence I am more familiar with most of the animal content. (Participant T)

The responses therefore imply that majority of the participant have a limited pedagogical content knowledge in some of the aspects in the animal studies, especially the aspects that involve the animal nutrition calculation. As much as the Pedagogical Content Knowledge Theory stresses the importance of improved content knowledge for effective teaching and learning, the findings of the current study show a gap on animal nutrition aspect of Animal Studies. Moreover, recent literature demonstrates that many educators do not possess adequate knowledge of the concepts they teach, which reflects a gap that exists not only in South Africa but in other countries (Brunetti et al., (2023); Mailizar & Fan, (2020); Reid & Reid, (2017) & Shing et al., 2018). Only one participant showed that they are confident to teach any content of the animal studies. When further asked on the factors that contribute to the challenges experienced, participant T pointed out that she majored in animal science in her first qualification hence she is familiar with all the concepts, and she studied them in depth. On the other hand, Participant V and E associated their challenges with their subject majors highlighting soil science and agricultural economics as their areas of expertise.

Therefore, the above indicates a gap in the Post Graduate Certificate in Education (PGCE). The overall focus of the programme is to equip graduates who want to branch into the field of teaching which ignores different dynamics in participant's prior academic background. The preparedness of the graduates with different majors in agriculture is therefore limited. This underscores the need to include advanced modules in all aspects of agricultural science to cater for students' different academic backgrounds for instance, the programme should equip the graduates with all fields in agriculture including animal science, soil science, crop science, pasture science and agricultural economics. Baumert et al., (2010) indicate that pedagogical content knowledge is more essential for quality teaching and learning as compared to content knowledge, which is mainly subject knowledge. Maharajh et al. (2017) further indicate that educators' Pedagogical content knowledge positively affects the quality of learning for learners.

5. Discussion of Findings

According to the findings of the current study, educators encounter a variety of challenges when teaching some of the components of animal studies. The study explored educators' understanding of Agriculture and Animal Studies. Moreover, the study explored the challenges faced by educators in teaching Animal Studies

where unpreparedness was a major concern. Teachers' lack of preparedness and confidence to teach certain content has been consistently found from previous studies (Kim, (2021); Chaney et al. (2020); Shank & Santiague, 2022). In a study conducted by Chang and Viesca (2022), teachers reported lack of preparedness to teach all topics in the curriculum. This lack of preparedness has been linked with the avoidance of important discussions in teaching and learning. This also necessitates the need for professional development programmes to enhance teachers' knowledge and confidence in teaching all aspects of the curriculum.

The current study found that one of the most significant barriers that exist for teaching and learning in animal studies is a lack of teaching re-sources that are important in enabling the effective delivery of the content. Educators also highlighted that there are educational goals that cannot be met due to the lack of science laboratories or large enough plots of land to carry out the necessary practical lessons. Additionally, educators mentioned that they improvise by utilising videos to fill the gap of lack of practical activities. Despite their best efforts, educators mentioned that some of the subject content is still not fully understood by learners due to resource limitations. Our findings align with the study conducted by Masha and Maphutha (2022) which reveals that the lack of resources in schools compromises the competence of educators and prevents students from completing assessments that require them to engage in experiential learning and this is similar to the findings of the current study. The performance of the learners is often hindered by a lack of resources. Some learners thrive when learning is combined with practical application. According to the findings of a study conducted by Manu (2018), a positive correlation exists between teaching resources and the performances of learners. This in coherence with the study by Onanuga et al., (2021) who found that learners taught with sufficient resources have higher performance levels than learners taught with limited or no resources.

This study indicated that different educators employ different strategies to teach Animal Studies. The findings revealed that experienced educators prefer the use of direct strategies, which involve the lecture method and textbooks. Contradictorily, novice educators prefer the use of indirect, interactive and experiential strategies. Participants mentioned that the choice of strategy depends on the content and aspect that they are teaching. One novice educator mentioned that they only use the direct strategy to teach new content with which the learners are not familiar or have minimal prior knowledge. The study found that the choice of teaching strategy depends on the content. A study conducted by Ranford et al., (2015) indicates that most high school novice educators use indirect methods of teaching while experienced educators use direct strategies of teaching. The choice of a teaching strategy also influences the learners' participation in the classroom. Participants reported using a learner-oriented approach to maintain order in the classroom and mentioned that their students learn best using indirect methods, real-world applications, and other forms of active participation.

The findings of the current study further indicated educators' unpreparedness regarding the delivery of specific content in animal nutrition. Precisely, educators mentioned lack of confidence in teaching content with mathematical calculations which is integral in animal nutrition. In contrast, the results also found the link

between robust academic background and confidence in teaching all aspects of Animal Science. For example, one participant from the study indicated that they are confident to teach any aspect of animal studies, as she majored in animal science in her initial degree. In view of the above statement, there is evidence that content knowledge plays a significant role in teaching. From the findings, it was evident that educators with a diploma or degree in education have limited knowledge compared to the educators with BSc in Agriculture and Postgraduate Diploma in Education (PGCE). For instance, Participant D who holds a B.Ed. qualification indicated unpreparedness to teach some concepts, while participant F who holds BSc in Agriculture and PGCE qualification indicated that she is confident and always prepared to teach aspects of animal studies. This is supported by the study undertaken by Mavhungu (2004), who indicates that most of the agricultural educators have minimal content knowledge; the researcher further stated that educators with minimal content knowledge typically yield poor performance.

6. Conclusions

Animal studies allows learners to obtain fundamental livestock farming knowledge and abilities. Animal farming is an important aspect of agricultural sectors as it contributes towards the economic growth of the country. This research explored how educators effectively teach Animal Studies as it plays an important role in equipping and shaping learners with relevant and essential knowledge as well as skills on livestock farming. The aim and objectives of the current study were obtained as educators shared comprehensive information on their understanding of Animal Studies, the challenges they face while teaching Animal Studies and the methods they use to facilitate their lessons. It was pertinent to conduct the study of this nature, to investigate and explore educators' experiences when teaching Animal Studies to Grade 12 learners in Mohlaletse Circuit, Limpopo province. The findings from the study disclosed the challenges and the experiences that educators encounter when teaching animal studies, the challenges identified include a lack of resources and limited content knowledge. In addition, educators shared their experiences on teaching methods and unpreparedness to teach some aspects of Animal Studies.

7. Recommendations

The study focused on the exploration of educators' experience in teaching animal studies to grade 12 learners in Mohlaletse circuit, Limpopo province.

Recommendations: South African Context

- In South Africa, the bachelor's degree programme in Agriculture is marked by distinct specialisation. It is therefore important to acknowledge that PGCE graduates may have limited expertise in certain topics in the broader field of Agriculture. Drawing from the results of the study, it is evident that those who specialise on Animal Science have greater understanding of the topic while those who specialises in Soil Science have limited knowledge. The study therefore recommends the inclusion of comprehensive advance content modules in the PGCE programme to equip Agricultural Science educators in all aspects of Agriculture.

- The study recommends that further research should be done in other parts of South Africa for a broader understanding of educators' pedagogical methods in Animal Studies in different contexts.
- The study recommends that the Department of Basic Education should ensure that each public school has basic agricultural facilities for practical learning, as well as a science laboratory. Alternatively, the Department of Education can build a science laboratory and small farm in each circuit so that learners from different schools may be able to access such facilities.
- The study recommends that educators should create study groups so that they can share teaching strategies and assist each other on the aspects which they find difficult to teach or they feel unprepared to teach which, is a cost-effective method of professional development.
- The study recommends that educators should be annually trained on the subject content through the attendance of workshops facilitated by specialists such as Animal nutritionists (Lecturers/Researchers).
  Recommendations: Broader research community
- The study recommends the development of professional development programmes for educators that will address knowledge gaps and enhance their pedagogical content knowledge.
- The study also recommends research aimed at exploring teaching and learning in Animal Studies from different stakeholders including perspectives from learners and teachers.

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Appendix 1 (start on a fresh page)

One-on-one semi-structured Interview

Interview Questions

1. What qualification do you hold, BEd Agric. or BSc Agric. with PGCE?
2. How long have you been practicing as an Agricultural Science teacher? And why did you choose teaching Agricultural Science as your profession?
3. The CAPS is the current operating curriculum after NSC and OBE. If you taught during the NSC, were there educator's enrichment workshops or any workshop related to Agricultural Science for enrichment of teaching and learning offered to you?
4. If yes, how did your personal capacity as an educator become enhanced as you went through the Educators Enrichment Workshop? Explain.
5. What essential skills and competencies do you believe are needed to improve the quality of teaching and learning in Agricultural Science subjects
6. In your own understanding, how can you describe the concept of Agricultural Sciences?
7. Which part of animal studies do you face challenges in teaching and which one you find the easiest? If there is any part you find challenging, what do you do to make sure that learners understand it very well.
8. In your own words, can you explain the concept of Animal studies and its components?
9. What are the teaching strategies that you employ when teaching animal studies?
10. Do your strategies work? Explain.
11. Are there any aspects that you feel unprepared to teach in animal studies?

Focus group discussion

1. What are your experiences of teaching animal studies?

2. Why do you have the experiences that you have in animal studies?

3. What do you do when you do not understand a certain aspect of animal studies?

4. In your years of experience, which aspect or topic of animal studies has been a challenge for you to teach?

5. What resources are you using to teach animal studies?

6. Do you have a problem with appropriate resources to support teaching and learning animal studies? Can you please explain?