



Enhancing Academic Performance in Agricultural Sciences: The Impact of Inquiry-Based Learning on Learners

Perfect Mbhanyisi^a, Lusanda Ncisana^{*a}, Malesela Mashishi^a, Mmapake Florence Masha^a & Michael Mbongiseni Buthelezi^b

* Corresponding author

Email: lusanda.ncisana@ul.ac.za

a. Department of Mathematics, Science and Technology Education, University of Limpopo, South Africa

b. Department of Educational Studies, University of Limpopo, South Africa



10.46303/ressat.2025.37

Article Info

Received: December 02, 2024

Accepted: May 04, 2025

Published: October 29, 2025

How to cite

Mbhanyisi, P., Ncisana, L., Mashishi, M. D., Masha, M. F., & Buthelezi, M. M. (2025). Enhancing Academic Performance in Agricultural Sciences: The Impact of Inquiry-Based Learning on Learners. *Research in Social Sciences and Technology*, 10(3), 40-60.

<https://doi.org/10.46303/ressat.2025.37>

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ABSTRACT

The Curriculum Assessment Policy Statement document indicates that Animal Studies comprise a substantial part of the Grade 12 syllabus, more so than topics like soil science, agro-ecology, agricultural economics, and crop science. This highlights the importance of exploring diverse teaching approaches in the beginning of Grade 10, as a strong foundation in earlier grades could improve understanding of Animal Studies in Grade 12. This study explored the effectiveness of inquiry-based learning (IBL) in teaching Grade 10 learners about poultry breeds. A mixed-method approach was used to compare IBL with traditional teaching methods. Forty-six Agricultural Sciences learners were randomly assigned to a quasi-experiment, with 23 learners in the experimental group taught through IBL and 23 in the control group taught using the traditional lecture method (TLM). Both groups underwent pre-test and post-test. The quantitative data was analysed using a paired t-test, while qualitative data was thematically analysed through document analysis of the learners' assessment scripts. Results from the paired t-test indicated that the experimental group achieved significantly higher mean scores than the control group ($p < 0.05$). Furthermore, the document analysis revealed that IBL fosters higher-order thinking, active participation, and critical thinking skills. Consequently, the inquiry-based learning approach proves to be an effective tool for enhancing learners' academic performance. These findings suggest that educators and policymakers should consider integrating inquiry-based learning strategies into the teaching of Agricultural Sciences curriculum to improve achievement of academic outcomes. Emphasis on active engagement and critical thinking can lead to more meaningful learning experiences for learners.

KEYWORDS

Teaching methods; learner-centred; document analysis; agriculture; science education.

INTRODUCTION

To align with Sustainable Development Goal 2 (SDG2), which focuses on eradicating hunger, achieving food security, and improving nutrition, it is essential to understand teachers' pedagogical skills in promoting sustainable agriculture. Educators should foster sustainable agriculture by empowering learners, promoting gender equality, reducing rural poverty, encouraging healthy lifestyles, and addressing climate change goals that are central to the 17 Sustainable Development Goals outlined in the Post-2015 Agenda (Ncisana et al., 2024). Achieving SDG2 requires educators to impart critical knowledge and skills in food production (Ncisana et al., 2023) and to guide learners through each step of the design process during problem-solving. This approach fosters creative thinking, as highlighted by Nkosi and Mtshali (2024).

The Curriculum Assessment Policy Statement (CAPS) highlights that Animal Studies encompasses the management, reproduction, nutrition, and health of farm animals. This area equips learners with foundational skills and insights for potential careers in Animal Studies, particularly if they pursue further education in agricultural-related fields (Nduku, 2024). Mavhungu (2004) notes that the pass rate for Grade 12 Agricultural Sciences is mainly low in Animal Studies, a problem often attributed to various factors, including teaching methods and learners' engagement with the subject. According to the CAPS document, Animal Studies cover a significant portion of the Grade 12 syllabus compared to other topics such as soil science, agro-ecology, agricultural economics, and crop science. This suggests a need to explore different teaching approaches starting in Grade 10, as foundational knowledge in lower grades could enhance understanding of Animal Studies in Grade 12.

The traditional lecture method is commonly used in the teaching of Agricultural Sciences (Ntimane et al., 2025; Ogunkunle & Hanrietta, 2014). Often called the "talk-and-chalk" or "textbook" approach (Daluba, 2013), this method relies heavily on teacher-led instruction, limiting learners' engagement and understanding and ultimately impacting their academic performance. While this approach may benefit non-vocational subjects, its effectiveness in scientific, hands-on fields like animal studies is debatable (Baldock & Murphy, 2020). Given the prevalent use of traditional methods, there is a strong need to explore alternative strategies that promote curiosity, inquiry, and critical thinking in Grade 10 animal studies, especially regarding poultry breeds. Although similar studies exist, to the best of our knowledge, no research has specifically examined the impact of inquiry-based learning on Agricultural Sciences in relation to poultry breeds (Baldock & Murphrey, 2020; Baldock et al., 2022; Chen, 2021). This study seeks to address this gap by investigating how inquiry-based learning would enhance learners' understanding and performance in this area.

This study aims to identify effective instructional methods to enhance learners' academic achievement in animal studies. Many science teachers currently rely on the traditional lecture method (TLM) to convey essential information and scientific terminology required for standardized assessments (Cunningham, 2024; Khubhayi et al., 2024; Strat et al., 2024;

Twizeyimana et al., 2024). However, these conventional methods primarily encourage memorization, limiting learners' ability to apply knowledge effectively. Consequently, learners taught through TLM often struggle with applying concepts beyond simple recall. We hypothesized that (i) inquiry-based learning will significantly improve the academic performance of Grade 10 Agricultural Sciences learners in the topic of poultry breeds compared to traditional lecture-based instruction.

Context and Significance of instructional methods in Agricultural Science Education

Using academic databases such as Google Scholar, JSTOR, and PubMed, a methodical search strategy was used to conduct the literature review. The search was limited to sources published between 1978 and 2025, providing a thorough overview of recent advancements in the field. Keywords associated with the research topic were used to find pertinent studies, articles, and reviews. Agricultural education is an important subject in secondary schools in South Africa, especially in rural regions where agriculture is the major source of income for many households. Agricultural education strives to improve learners' agricultural knowledge, abilities, and attitudes, as well as to prepare them for professions in agriculture or related sectors. The agricultural education teaching style utilized can have a substantial influence on the learners' academic success. Numerous studies have looked at the effects of learner-centred and teacher-centred approaches on learners' academic performance (Barkley et al., 2014; Maphakane et al., 2025; Nkambule & Mavuso, 2021; Twizeyimana et al., 2024). This literature review investigates the influence of instructional strategies comparing learner-centred and teacher-centred methods on animal studies in Agricultural Sciences academic achievement in secondary school in Limpopo Vhembe district.

Learner-centred vs teacher-centred methods on learners' academic performance

Various approaches have fostered learner-centred learning, emphasizing active participation and engagement. For example, collaborative learning encourages learners to work together on projects, enhancing their teamwork skills. Inquiry-based learning allows learners to explore questions and conduct research, promoting curiosity and critical thinking (Rusell, 2023). The findings of a study by Yue (2021) found that the learner-centred instructional method significantly improved learners' academic performance in Agricultural Sciences. These findings are in line with Maphosa et al. (2018) who also found that the learner-centred instructional method had a positive impact on learners' attitudes towards agricultural science in Zimbabwe, the learner-centred teaching strategy improves academic success in agriculture education. These studies above indicate the contribution of inquiry-based learning on the general level not linking it with specific learning area. Hence, this study focused on the contribution of inquiry-based learning linking it to poultry breeds. Linking the specific teaching method to the learning area has significance of identifying the relevant methods for teaching that particular topic.

Treve (2024) discovered that as compared to the teacher-centred technique, the learner-centred instructional strategy significantly improves academic performance of the learners. The study revealed that the learner-centred teaching strategy promotes learners grasp of

Agricultural Sciences subjects more effectively than the teacher-centred method. As a result, a learner-centred approach to teaching Agricultural Sciences is more effective than a teacher-centred approach at fostering deep learning and enhancing learners' academic performance (Barkley et al., 2014). Active learning, teamwork, and problem solving are prioritized in learner-centred techniques, which are regarded to be more successful because they foster a collaborative environment and learners' engagement, motivation, and self-regulation (Vygotsky, 1978). Khoza and Mavuso (2019) investigated the impact of learner-centred instruction on academic achievement in Agricultural Sciences in South African secondary schools. The strategy boosted academic performance and raised learners' interest in the topic, according to the study. Similarly, Nkambule and Mavuso (2021) discovered that using a learner-centred approach increased their understanding of Agricultural Sciences subjects as well as their problem-solving abilities.

The effects of teacher-centred approach on learners' academic performance

Teacher-centred instructional method is a teaching approach, which the teacher is the primary source of knowledge and is in control of the learning process (Buseri & Dorgu, 2011). Several studies have found that the teacher-centred teaching technique has a detrimental impact on Agricultural Sciences learners' academic achievement, such as Oyekanmi et al. (2020) who discovered that the teacher-centred instructional style had a substantial detrimental influence on learners' academic performance and achievement of curriculum goals in Agricultural Sciences in Nigeria. Similarly, Zeng et al. (2019) discovered that the teacher-centred instructional technique had a detrimental influence on learners' motivation and engagement in Agricultural Sciences classroom. The explanation for this negative effect might be that the teacher-centred method does not allow learners to take an active role in their education. A study by Ogunjobi and Owoseni (2025) found that learners who were taught using the teacher-centred method had lower academic performance in Agricultural Sciences than those taught using the learner-centred method. These traditional practices of teaching lead to learners not developing the intended knowledge and skills.

Agricultural Sciences is a vocational subject, implying that teaching should be centred on learners and learning should involve learners in all stages. Mthembu and Mavuso (2019) maintained that the continued use of presentations and textbook learning might increase learners' dependency on a teacher as the primary source of information. This practice is likely to affect learners as they proceed to institutions of higher learning. The study further indicates that teacher-centred education helps to enhance learners' academic performance in cases where learners know a lot about the subject already.

Animal Studies in Grade 10: Examining Teaching Methods and Their Effects on Poultry Breeds

The study focuses on comparing the effects of the learner-centred and teacher-centred instructional methods on learners' academic performance in Agricultural Sciences in the context of the poultry breed topic. Mhlanga et al. (2017) and Adediwura and Tayo (2007) demonstrated that learner-centred teaching methods outperformed teacher-centred instructional methods in

enhancing learners' attitudes toward Agricultural Sciences. In contrast, Oyekanmi et al. (2020), teacher-centred instructional techniques negatively affect learners' academic performance by reducing engagement and motivation. This implies that the efficiency of educational approaches may differ according to socioeconomic circumstances. Furthermore, Akyeampong et al. (2013) discovered that the efficiency of teaching approaches was also affected by teacher training and experience.

Summary of the review

Mabena and Mavuso (2020) contrasted learner-centred education against teacher-centred instruction in South African secondary schools. The study discovered that learner-centred education outperformed teacher-centred instruction in terms of boosting academic achievement in Agricultural Sciences. Similarly, Mlilo and Dube (2017) conducted research in Zimbabwe that compared the two instructional strategies for teaching agricultural science. According to the findings of the study, learner-centred education was more successful than teacher-centred instruction in enhancing the comprehension of Agricultural Sciences subjects. The mode of instruction used in secondary schools in the circuit, province of Limpopo, can have a considerable influence on academic achievement in Agricultural Sciences.

THEORETICAL FRAMEWORK

The study is based on two key theories of learning, which are constructivism and social learning theory. The constructivist theory posits that learners construct knowledge through active engagement with the learning environment. Learners actively construct their understanding of the material, rather than passively receiving information from the teacher. In a learner-centred approach, the teacher acts as a facilitator, creating opportunities for learners to engage in inquiry-based learning, problem-solving, and reflection. The constructivist approach is aligned with the idea of active learning, which is more effective in promoting deep learning and improving learner performance in Agricultural Sciences (Barkley et al., 2014). Learners learn through observing and modelling the behaviour of others, as well as through feedback and reinforcement. In a learner-centred approach, collaboration and group work are emphasized, providing learners with opportunities to interact and learn from one another. Social learning theory is also consistent with the idea of active learning, as learners engage in social interaction and collaboration during the learning process.

The theories relate to this study in the sense that constructivism and social learning theory emphasize the role of social interaction and modelling in the learning process. Learner-centred, i.e., inquiry-based learning methods, involving group work and collaboration, are expected to improve performance for Agricultural Sciences learners. The study's outcome measured learners' ability to construct knowledge through active learning, aligning with constructivist principles. Teachers played a facilitative role in the learner-centred instructional methods. The study's contextual insight can validate or challenge aspects of constructivist and

social learning theories in the context of Agricultural Sciences education for South African secondary learners.

This theoretical framework guided the design and implementation of the study, informing the selection of instructional strategies and the design of the learning experiences provided to the participants. The constructivist and social learning theories informed the choice of outcome measures and the analysis of the data collected. By using this theoretical framework, the study will provide insights into the effectiveness of learner-centred and teacher-centred instructional strategies in promoting active engagement, collaboration, and knowledge construction in Agricultural Sciences. The theoretical framework helped to guide the interpretation of the findings and provide a theoretical basis for any recommendations for future research or practice.

In conclusion, the study investigates the effect of inquiry-based learning on the academic performance of poultry breeds on Grade 10 Agricultural Sciences learners, emphasizing constructivist and social learning theories. It emphasizes active engagement, social interaction, and knowledge construction. The study aims to test the extent to which the two methods are effective in improving the performance of Agricultural Sciences learners. The two methods were implemented, focusing on constructivist and social learning theory principles.

METHODOLOGY

Purpose

To investigate the effects of the learner-centred and teacher-centred instructional method on the performance of Poultry breeds under animal studies in agricultural sciences grade 10 learners.

Research question

i. *How do learner-centred and teacher-centred instructional methods influence grade 10 learners' performance on poultry breeds under animal studies in agricultural sciences?*

Research design

The study used a mixed-methods approach that combined quantitative and qualitative techniques. The study adopted a concurrent research design to address the identified problem under investigation (Creswell et al., 2003). The two approaches allowed the study to explore learners' performance using the score and learners' actual responses on the test scripts. This is because the quantitative component entailed the collection and analysis of numerical data. Furthermore, the quantitative approach used the pre-test and post-test. On the other hand, the qualitative component focused on analysing textual data through document analysis of the assessment scripts. An experimental group and a control group were used. The control group was taught through the traditional lecture method, whereas the experimental group was given instruction using the inquiry-based learning approach, where the teacher was a facilitator of the collaboration, question, and discussion and provided necessary support and guidance to learners at different stages of the inquiry process (Pedaste et al., 2015). An overview of the topic

of poultry breeds was provided, followed by a set of guiding questions on the poultry breeds topic as informed by the learning outcomes outlined in the Agricultural Sciences CAPS **Error! Bookmark not defined.**document to stimulate curiosity and encourage learners to explore the topic further, i.e., What are the different poultry breeds suitable for egg production? What are the characteristics of poultry breeds used for meat production? What is their relevance in the agricultural industry? During the research and Investigation phase, the learners were paired, and each pair was assigned to the specific guiding question on poultry breeds. After conducting their research, the groups analysed the data they collected to promote critical thinking and help learners understand the diversity within the field of poultry breeds. Each group was given time to present their findings and discussions as a class.

In this study, qualitative data were collected through document analysis, specifically focusing on the examination of learners' assessment scripts on poultry breeds within the animal studies chapter. By analysing the scripts of agricultural sciences learners, valuable insights were obtained regarding the effectiveness and impact of inquiry-based learning for both the control and experimental groups.

The inquiry-based teaching strategy has shown effectiveness in generating deeper knowledge and improving academic achievement. The emphasis on active involvement, problem solving, cooperation, and critical thinking distinguishes IBL, making it an effective technique for teaching difficult subjects such as Agricultural Sciences (Gholam 2019; Kadir et al., 2023; Twizeyimana et al., 2024).

Population and sample size

The population of the study was based in Vhembe district, Limpopo province, with the school having one Agricultural Sciences class. A total of 46 grade 10 agricultural science learners participated in the study, where there were two groups of 23 participants each. Before the instruction, the learners took a pre-test assessment to measure the preconceptions and after two weeks after both experimental and control groups received their respective instructions through the traditional lecture method and the inquiry-based, and the learners took a post-test after the intervention.

Data collection

In this study, two teaching methods were compared: the traditional lecture method and inquiry-based learning (IBL). The lecture method involved the teacher delivering organized content using visual aids and spoken explanations, with an emphasis on passive learning where learners primarily listened and took notes. In contrast, IBL positioned the teacher as a facilitator, guiding learners through problem-solving by posing probing questions (Gholam, 2019). The IBL approach was implemented by dividing participants into five small groups, each consisting of five learners.

To assess learning outcomes, a class test consisting of 50 questions on poultry breeds was administered. Validity refers to how accurately an instrument measures what it is intended to measure in a quantitative study (Heale & Twycross, 2015). In this study, content validity was

ensured by aligning test items with learning objectives on poultry breeds, ensuring comprehensive coverage. Face validity was assessed by my supervisor, who reviewed the assessments for clarity, grammar, and structure to confirm their effectiveness in measuring learners' understanding.

Reliability, which refers to the consistency and stability of a measurement instrument over time (Heale & Twycross, 2015), was ensured through piloting the pre-test and post-test assessments with a small group of learners to refine ambiguous questions. Test-retest reliability ensured consistent results under similar conditions, while internal consistency verified that all test items measured the same underlying knowledge of poultry breeds.

The quantitative data collection involved pre-tests and post-tests. The pre-test assessed learners' prior knowledge in both groups: the control group (taught using the lecture method) and the experimental group (taught using IBL). After the instruction, both groups completed a post-test identical to the pre-test to measure learning gains. Additionally, document analysis was conducted by reviewing learners' scripts to gather qualitative data on their comprehension and performance in specific test questions related to poultry breeds.

Data analysis

The quantitative data collected from the control group and experiment group were analysed using descriptive and inferential statistics. Descriptive statistics, such as means and standard deviations, were calculated to summarize the scores of both groups. Inferential statistics i.e., the *paired t-test* was conducted to determine if there were significant differences in academic performance between the two instructional method groups. When $p < 0.05$, statistical significance was declared. Using the Statistical Package for Social Science (SPSS) the quantitative data was analysed.

The data collected from the learners' scripts was evaluated using thematic document analysis. The analysis focused on identifying and examining the themes and trends within the documents, with a focus on which kind of questions on poultry breeds the learners got right and those they got wrong from the learners' scripts from the school records the scripts. The purpose of this analysis was to compare the performance of two different approaches and determine which one is more efficient. By conducting a careful review of the data through document analysis and employing a rigorous analytical methodology, the study aimed to uncover insights that would contribute to a reliable and trustworthy conclusion regarding the relative efficacy of the approaches (Braun & Clarke, 2006).

Ethical consideration

The study was conducted in compliance with the University's Research Ethics Committee's guidelines; hence, a research approval letter/certificate from the University's Research Ethics Committee was required. The key ethical issues observed include the following. Informed consent about the nature of the study, its purpose, procedures, risks and benefits were outlined to the participants, and they provided their informed consent to participate in the study. Participants were free to withdraw from the study at any time without penalty. The participants'

personal information was kept confidential, and their identities were not revealed to ensure their anonymity in any publications or presentations resulting from the study. The researcher took steps to ensure that participant confidentiality was maintained throughout the study.

The study was a voluntary participation wherein participants in this study were not pressured to participate. The researcher considered the potential risks and benefits of the study to participants and took steps to minimise any potential harm. Participants were not exposed to any risks that were greater than those encountered in their normal daily activities. Prior to taking part in the study, the participants were provided with an explanation of the study's objectives and outcomes as well as any implications for their learning.

The researchers ensured that all participants were treated fairly and equitably, regardless of their gender, age, ethnicity, or socioeconomic status. The researcher ensured that the selection of participants was unbiased and that all participants had an equal opportunity to participate in the study. The researcher obtained approval from the Research Ethics Committee before conducting the study. The ethics committee reviewed the study design and procedures to ensure it follow the ethical guidelines and regulations.

Any possible conflicts of interest that might affect the study's conduct or results were declared by the researcher. This covers monetary stakes, interpersonal ties, and other elements that can taint the research's neutrality. Consent for their parents, guardians, or other adults was obtained for underage learners. Participants were treated with respect and dignity throughout the study. Information is only accessible to the researcher, supervisor, and co-supervisor.

RESULTS

The results showed a significant impact of teaching methods, as differences were observed among treatments (Table 1). Initially, pre-test scores for both the lecture and inquiry-based method groups were similar, with no significant difference ($p < 0.05$) between them before the study intervention. However, after teaching, the inquiry-based method group outperformed the lecture method group (Table 2 and Figure 1). All learners in the inquiry-based method group achieved significantly higher mean scores compared to those taught by the traditional lecture method (Table 3). This suggests that, of the 46 participants, 23 demonstrated a better understanding of poultry breeds when the inquiry-based method was employed.

Table 1.

The paired t-test summary of post-test scores

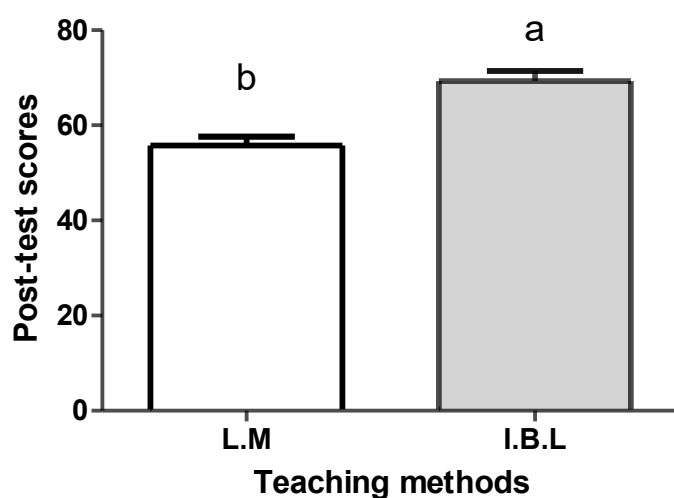
Group	Sd	t	p
Lecture method vs Inquiry-based method	12.954	-0.183	<0.001

Table 2.*Summary of the paired t-test for pre-test*

Treatments	Mean	Sd	t	p
Lecture method	55.39	12.858	-0.183	0.428
Inquiry based learning	56.09	12.954	-.0183	0.428

Table 3.*Summary of the paired t-test for post-test*

Treatments	Mean	Sd	t	p
Lecture method	61.57	12.262	-4.188	<0.001
Inquiry-based learning	77.04	12.797	-4.188	<0.001

Figure 1.*Post-test scores for L.M, lecture method and I.B.L, inquiry-based method.*

Error bars represent standard errors of the means. Letters above error bars indicate significant differences ($p < 0.0001$).

Analysis of the results using Document analysis

The gathered documents were carefully arranged by the researcher to enable a methodical and thorough analysis. The documents were categorized by the researcher based on how the learners performed. This performance-based grouping gave rise to a framework for contrasting and comparing the results of learners with various performance levels. Following the division of the documents into performance groups, the researcher selected particular scenes or passages from the scripts for analysis. These sections were selected because they addressed the themes and research question that were being investigated. The researcher made certain the study concentrated on the most important and instructive sections of the documents by selecting sample. The selected segments were then subjected to the coding procedure. This entailed

giving codes to various textual passages that illustrated particular notions. During the coding process, a coding framework. The data's patterns, similarities, and contrasts were found through the coding process, which made it easier for the emergence of themes.

Table 4 provides a concise and organized overview of the document analysis themes and coding. It consists of several columns representing different aspects of the analysis.

Table 4.

Document Analysis Themes and Coding

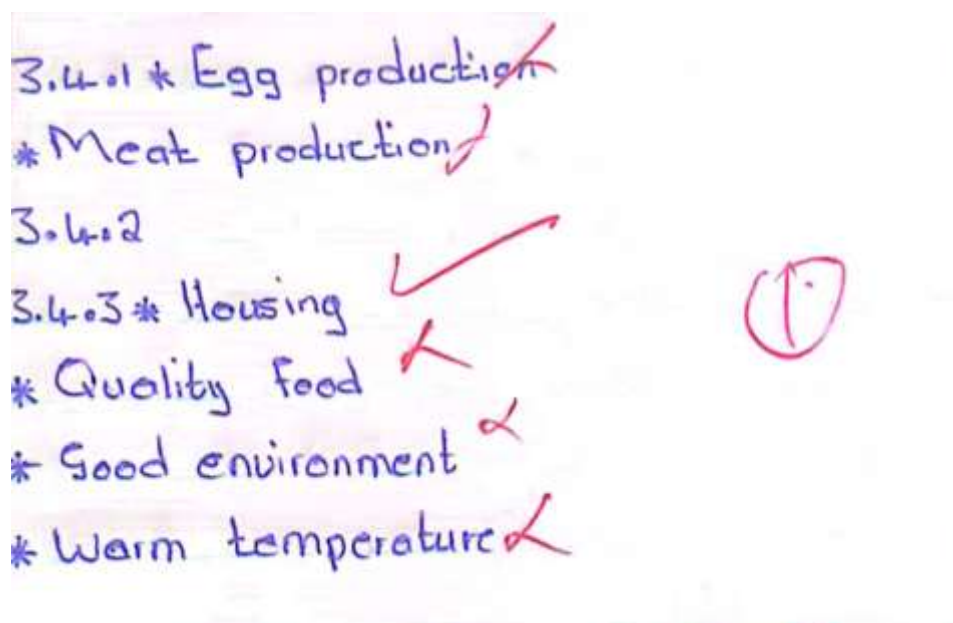
Sample Document ID	Performance Group	Coding	Theme 1: Enhanced Conceptual Understanding	Theme 2: Application of Knowledge to Problems	Theme 3: Development of Higher-Order Thinking
1	Experimental Group (IBL)	B1	X	X	X
2	Control Group (TLM)	A1		X	
3	Experimental Group (IBL)	B2	X	X	X
4	Control Group (TLM)	A2	X	X	
5	Experimental Group (IBL)	B3		X	X
6	Control Group	A3	X		

The document analysis results are succinctly and logically summarized in the accompanying table. It has columns for themes, coding, performance groups, and document identification. While the performance group organizes the documents according to the performance levels of the learners, the document ID refers easily. The exact codes allocated to document segments pertaining to the specified themes are displayed in the coding column. The themes that emerged from the analysis are also shown in the table; each theme has a separate column. When a "X" appears in a cell, it means that the particular code is in line with that theme. This table helps with the analysis and comparison of the results by providing a visual depiction of the links between coded segments, themes, and performance groups.

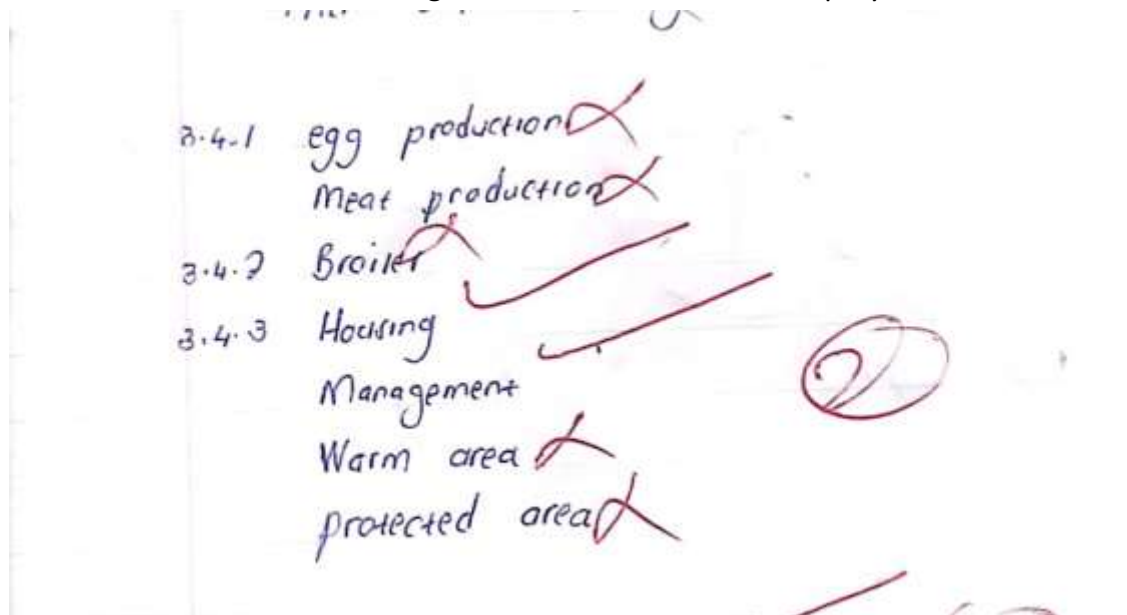
Table 5.*Themes*

Theme	
1. Enhanced conceptual understanding	Both control and experimental groups demonstrated an understanding of basic concepts related to poultry breeds. The experimental group showed a solid grasp of the subject matter.
2. Application of Knowledge to Problems	Learners in the experimental group were able to apply their knowledge of poultry breeds to real-world situations, considering factors such as climate, space, and market demands.
3. Higher-Order Thinking	The experimental group exhibited higher-order thinking skills, such as critical analysis, evaluation, and

Table 5 shows the key themes that were explored on the study. When comparing learner-centred teaching methods against traditional lecture approaches, each theme highlights important research findings. This table offers a concise synopsis of how these topics might be used to comprehend attitudes toward agricultural science, academic achievement, and involvement by learners.

Figure2.*Learner A (Lecture method)*

The images presented in Figures 2 and 3 illustrate the feedback provided by students who received instruction through traditional lectures and inquiry-based methods. These visuals



demonstrate how the learners responded to questions regarding the application of knowledge.

Figure 3.

Learner B (Inquiry based learning)

DISCUSSION

The influence of learner-centred and teacher-centred instruction on learners' performance on poultry breeds

The study focused on the poultry breed topics because this is one of the one significant knowledge which enables learners to practice poultry farming. On this topic, learners are expected to understand the classification of the main types of poultry. There are further expected to differentiate the main chicken/ fowl breeds according to the broiler production and egg production, and also basic production requirements such as nutrition, housing, management and breeding. This topic requires that learners should be exposed to teaching methods that would enable achievement of these curricular objectives. The lecture method can introduce learners to abstract concept; however, the method does not encourage the development of skills. On the hand the inquiry-based learning can allow learners to be both hands-on and head-on, which allow learners to develop critical thinking skills and problem-solving skills, which are critical farm enterprise. The study results indicate that inquiry-based learning significantly enhances learners' academic performance compared to traditional, teacher-centred methods. This improvement is attributed to active learner engagement, which promotes critical thinking and problem-solving skills. The findings support our hypothesis that inquiry-based learning boosts the academic performance of Grade 10 Agricultural Sciences learners in understanding poultry breeds more effectively than traditional lecture-based

instruction. This aligns with Andrini (2016), who noted that inquiry-based learning allows learners to connect new knowledge with their existing cognitive structures, leading to meaningful learning. Similarly, Khubayi et al. (2024) found that using YouTube videos improves learners' academic performance.

Learners actively build their understanding by applying prior knowledge to solve problems. Unlike traditional lecture methods, where teachers are the primary source of information and learners often passively recall and reproduce content, inquiry-based learning engages learners in tasks that go beyond merely receiving information (Plessis, 2020). This aligns with constructivist theory, which holds that learners actively interpret experiences rather than passively absorbing knowledge. Inquiry-based learning encourages deeper understanding as learners apply solutions to specific problems, fostering critical thinking and problem-solving. Teaching methods significantly impact the depth of learners' understanding, with deep learning strategies involving high motivation and active engagement (Ncisana et al., 2023). Furthermore, educators are expected to support learners at every step of the design process, cultivating creative thinking skills essential to problem-solving (Nkosi & Mtshali, 2024). This study's findings are consistent with Abdi (2014), who found that learners engaged in active, inquiry-based learning achieved better outcomes compared to those who received traditional instruction.

Learners taught using inquiry-based learning achieved better scores (Af'idayani et al., 2018). This method allows learners to explore and discover concepts independently, potentially enhancing learning outcomes. Witt and Ulmer (2010) found that inquiry-based strategies improved academic performance. However, Chung (2004) noted no significant differences between inquiry-based and traditional teaching methods, aligning with Thoron et al. (2011) and Harris and Rooks (2010), who reported that learners often face confusion when first exposed to inquiry-based education. In contrast, learners in learner-centered groups performed significantly better ($p < 0.05$) than those in teacher-centered groups (Khubayi et al., 2024; Ncisana et al., 2023).

In contrast to these findings, Karamustafaoğlu & Havuz (2016) found no appreciable differences in the pre-test statistical analyses relating to inquiry-based learning in science education between the control and experimental groups in a study of a similar design. This outcome is consistent with the data that was collected. Öztürk et al. (2022) discovered that learners had similar levels of knowledge prior to the use of inquiry-based learning in science education. The findings of this study and the literature evaluation suggest that inquiry-based learning significantly improves learners' academic performance. Inquiry-based learning encourages fruitful learning opportunities by actively immersing learners, fostering critical thinking, and advancing problem-solving abilities. However, it's critical to recognize the study's limitations and acknowledge the contrasting results.

The document analysis indicated that inquiry-based learning significantly improved learners' understanding of fundamental concepts and their ability to apply knowledge regarding poultry breeds. It also fostered critical thinking, problem-solving, analytical, and higher-order

thinking skills, as reflected in their written work. These findings align with Kızılaslan et al. (2012), who noted that inquiry-based learning (IBL) enhances learners' critical thinking skills and prepares them to function as scientists by employing the scientific method. Additionally, Wong et al. (2010) supported the effectiveness of inquiry-based learning as an instructional method, emphasizing its role in engaging learners through active and meaningful activities. The results further demonstrated that learners in the experimental group could accurately answer and articulate key concepts (Khubayi et al., 2024; Maphakane et al., 2025). However, Kapur (2020) argued that lecture-based instruction is still the best way to teach many learners, especially when introducing new subjects and transferring conceptual knowledge.

CONCLUSION

The study's findings indicate that learner-centred inquiry-based learning positively influences the performance of Grade 10 learners in agricultural science, particularly in the context of poultry breeds within animal studies. Compared to traditional lecture-based teaching, inquiry-based learning enhances academic achievement. Learners find inquiry-based learning more engaging, inspiring, and interactive, which fosters their critical thinking, problem-solving, communication, and teamwork skills. Additionally, teachers observe that inquiry-based learning facilitates a better understanding and application of knowledge among learners than traditional methods (Adbi, 2014; Mabena & Mavuso, 2020; Ncisana et al., 2023).

Vocational subject teachers should adopt a flexible instructional framework. Based on this study's findings, we recommend implementing learner-centred approaches in the teaching and learning of science subjects, as well as for policymakers. Since this study focused on poultry breeds and Grade 10 learners, further research should explore other learner-centred methods and topics with larger population sizes. Additionally, future studies could investigate the factors influencing the effective implementation of inquiry-based learning in various educational contexts. Overall, the inquiry-based instructional method proves to be more effective than teacher-centred approaches.

Limitations of the study

The study was carried out at a single secondary school in the Limpopo province of South Africa, which may limit the generalizability of the findings to other contexts. Consequently, caution should be exercised when applying these results to different locations or populations. Additionally, the sample size was relatively small, comprising only 46 learners. A larger sample would yield more robust and representative findings. Furthermore, the study focused on comparing inquiry-based learning to the traditional lecture method without exploring other instructional approaches or factors that might influence learners' performance.

Acknowledgements

The authors acknowledge the teachers and learners who were involved in data collection

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