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"I Mainly Rely on the Textbook:" A Call for Teacher Enhancement in Agricultural Sciences

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ABSTRACT

Universities play a crucial role in teachers' professional development. This study aims to examine the following research question: How can universities enhance the teaching of agricultural sciences in schools? Previous research has focused on the university's collaboration with stakeholders, such as parents, to enhance teaching, but without a specific focus on the teaching of agricultural sciences. In response to this question, a transformative theoretical framework anchors this study. This study employed a participatory action research design involving focus group discussions to determine the need for improving the teaching of agricultural sciences. Eleven participants were involved in this research, and pseudonyms were used to ensure privacy and protect their identities. The study findings from the three schools in the Thabo Mofutsanyana District of the Free State Province, included in the study, revealed that there is an inability to meet curriculum requirements, accompanied by a reluctance to implement continuous professional teacher development. The findings emphasize the need for extended university involvement in the implementation of teacher development policies to address the teachers' needs.

KEYWORDS
Agricultural sciences; participatory action research; continuous professional teacher development; curriculum and policy assessment policy statement.

INTRODUCTION

The school-level curriculum comprises numerous subjects, including agricultural sciences, which centers on the "relationship between soils, plants, and animals in the production and processing of food, fiber, fuel, and other agricultural commodities that hold economic, aesthetic, and cultural value" [RSA DBE, 2011(a)].

Challenges in the teaching of agricultural sciences are caused by the fact that some teachers instructing the subject lack specialization in it (Olajide, et al., 2015) or had no exposure to equipment before commencing instruction. Afolabi et al. (2023) and Ndem (2016) studies have shown that certain rural schools do not have the necessary teaching equipment. Even when available, teachers may require retraining in machinery operation. Additional challenges in teaching agricultural sciences include its direct connection to other subjects such as mathematics, economics, physical sciences and life sciences [RSA DBE, 2011(a)].

Despite governance of teacher development in South African through documents such as the Department of Basic Education (DBE), 2003] and the Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011–2025 (CPTD) [(RSA, 2011(b)] program, authors like Tsotetsi and Mahlomaholo (2013) discovered an unavailability of specific development programs. Bantwini (2009) also highlighted an absence of available teacher professional development programs, along with challenges such as the facilitators merely reading materials to participants.

Bantwini (2009), Hlongwane (2009), and Biputh and McKenna (2010) have similarly reported that teacher development, particularly through peer evaluation, often occurs primarily for compliance, and there is limited (or no) follow-up teacher development after classroom visits, as originally intended.

While the latter may not have specifically pertained to agricultural sciences, the overall absence of relevant CPTD programs has been identified, emphasizing the important role that universities could play.

Challenges necessitating teacher development are confined to South Africa alone. A study conducted in Nigeria by Afolabi et al. (2023) identified difficulties among teachers in teaching certain agricultural science concepts due to the unavailability of resources.

Additional challenges arise from insufficient depth in subject knowledge or having an adequate depth of subject knowledge without the requisite teaching qualifications. Other challenges in teaching agricultural sciences in Nigeria encompass the lack of farm-based work, as the subject is not exclusively theoretical (Ogbuoka & Ajibo, 2023). Practical experience remains essential for developing skilled teachers and students. Teacher incompetence and a shortage of equipment further compound these challenges.

Ogbuoka and Ajibo's (2023) findings reveal that the availability of laboratories and other facilities improves learners' performance in the subject. Moreover, the availability of teaching material enhances learners' comprehension of agricultural sciences process. Universities are ideally situated to play an important role in educational development, and their involvement

remains a vital component for the successful implementation of any professional development program, including those tailored for teachers.

Regarding the professional development of teachers in South Africa through tertiary education, Mohammed et al. (2023) identified several hindrances to teachers upgrading their qualifications. These include the geographical distance of rural areas from university access, unmotivated teachers, teachers who are approaching retirement, insufficient financial support, and inadequate support from their supervisors.

The Department of Basic Education addresses this challenge by emphasizing Mathematics and hard sciences, as well as by supporting teachers who are employed at tertiary institutions but face difficulties in paying their tuition.

As a result, some of these teachers either withdraw from the programs or, if they manage to complete them, fail to obtain a certificate because the institution withholds qualification issuance due to unpaid fees (Mohammed et al., 2023). As mentioned earlier, several studies have explored teacher professional development. However, it's worth noting that none of these studies were conducted in the Thabo Mofutsanyana district of the Free State Province, in South Africa. This paper aims to address this gap. In light of the aforementioned, this study centers on the following research question: How can universities enhance the teaching of agricultural sciences in schools?

The following section will examine Critical theory (CT) as the theoretical framework for exploring the research question. Subsequently, we will delve into an examination of the development policies, present our findings from the participatory action research, and our final concluding thoughts.

Critical theory as the framework of thinking and basis for research design selection

Critical theory (CT) has primarily influenced our thinking, largely owing to its multi-perspective and dialogical character (Chilisa, 2012; Mertens, 2010). CT embraces various viewpoints (realities) in addressing issues.

In the context of this study, the implication is that teacher development initiatives would have to consider perspectives of all stakeholders, such as teacher, other agricultural officials, and the university itself. Furthermore, through dialogues, a sense of unity is fostered between the researcher and researched, in contrast to the utilization of questionnaires, which may lack physical interaction between the researcher and the research participants.

In the realm of education, it is imperative for teachers, government officials, and universities to engage in a dialogue as equal partners. Such dialogue also aligns with the concept of subjectivity, integral to CT, thereby affording the opportunity to contemplate the human element of research process (Mertens, 2010). The relationship can lead to reciprocity, where both the university and the other stakeholders will benefit from their interaction. To align with the CT framework, research employing a participatory action research design was identified as the most suitable choice, given its compatibility with the multi-perspective and dialogical nature inherent in CT.

RESEARCH METHODOLOGY

Research design

The researchers employed a participatory action research (PAR) design in this study. Moseki and Schulze (2019) define PAR as a democratic design that addresses power dynamics between the principal researcher and research participants. Participants are elevated to contribute to knowledge generation, while the researcher assumes a learner's role.

Researchers would be entering the community armed with theoretical knowledge. The learning process within the community unfolds as researchers glean insights from the participants on how they approach specific challenges they encounter. Furthermore, Qhosola (2016) emphasizes the importance of the three non-linear stages in PAR: the initial planning, implementation, and reflection. In the initial planning stage, we had to recruit participants and elucidate all research-related details, including the importance of active participation.

It was a challenging process, particularly since the district-based officials had schedules that didn't align with those of the three schools Given that one of the researchers was also an agricultural sciences teacher, we approached the researcher project not as "foreigners," but as partners.

In the PAR design, this aspect is crucial, as the research environment necessitates trust and the development of a strong connection between the researchers and the researched to gather the optimal data. During the implementation stage, our focus was specifically directed towards examining the challenges related to teaching agricultural science. We subsequently proceeded to identify the activities necessary for addressing these challenges. Regular reflection sessions were essential for monitoring progress. For the purpose of this paper, which draws from one of the researcher's dissertations, we will solely concentrate on the challenges. Prior to commencing the study, ethical clearance was secured from the appropriate institution, namely the University of the Free State (UFS-HSD2016/0424).

Sampling

We collected data from three senior secondary schools located in one district in the northeastern part of the Free State Province in South Africa. Our sample consisted of 11 participants, including six teachers, three departmental heads of agricultural sciences from the three schools, the farm manager, and subject advisor responsible for these three schools. The teachers were purposeful selected because they were actively teaching agricultural sciences. The farm manager and subject advisor were conveniently chosen due to their availability for participation in the study and their employment within the Thabo Mofutsanyana Education district.

Prior to their involvement in the study, the researchers provided a detailed explanation of the research and presented consent forms to the participants for their voluntary participation in research project. While the study encompassed several components, this paper's sole focus will be on the participants' requirements for improving their teaching of agricultural sciences.

Table 1.

Demographics of the Participants

Co-researchers	Designation	Age	Gender	Years of experience
Job	Subject advisor	55	Male	35
Molinga	Departmental head	41	Male	16
Kgoroge	Departmental head	55	Male	32
Sakhile	Departmental head	42	Male	20
Nzoko	Farm manager	55	Male	35
Xhoxo	Educator	44	Male	10
Pahle	Educator	51	Male	18
Sekharume	Educator	42	Female	16

Data collection and data analysis

Our data collection method adhered to the principles of Free Attitude Interviews, which involve asking single to prompt a discussion (Mahlomaholo & Netshandama, 2012). In this study, our guiding question was: How can universities enhance the teaching of agricultural sciences in schools? We conducted discussions with participants at their respective schools. However, in the case of the subject advisor, we visited the district office to engage with him. We recorded these discussions and transcribed them verbatim. To ensure the accuracy of the transcribed information, we provided the transcripts to participants for confirmation. Subsequently, we coded the transcribed data and categorized them into themes.

In the process of data analysis, four distinct themes emerged:

1) Inadequacy in meeting the curriculum requirements and teaching objectives of agricultural sciences

2) Reluctance to implement continuous teacher development programs for agricultural sciences teachers

3) Accessibility of higher education programs in agriculture; and 4) Staffing-related matters.

Trustworthiness

Quality assurance in qualitative research is evaluated through factors such as credibility, dependability, transferability, conformability, and authenticity (Kyngäs, 2020; Alonzo & Teng, 2023). To address credibility, we provided biographical information about the co-researchers (Table 1). To ensure dependability, one of the researchers examined the provided data and information. To address conformability, we cross-referenced responses with those of other co-researchers. In terms of transferability, we provided the research design. We presented a spectrum of perspectives to enhance the authenticity of the data we have provided.

DISCUSSION of EMERGED THEMES

Inability to meet the curriculum requirements and aims of teaching Agricultural Sciences at school.

The subject CAPS [RSA DBE, 2011(a):8-9] document recommends that agricultural sciences should be integrated with other science subjects due to its combination of knowledge and skills. Agricultural sciences is an integrated science, where facilities and laboratories should be made available.

The subject advisor organized a start-up workshop during which he shared the following two extracts from the final 2016 agricultural sciences grade 12 end-of-year papers:

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

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

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

Extract 1 Extract where mathematical literacy is a necessity (NCS Exam 2016)

An analysis of the final results shows that in Q2.5, as shown in the initial extract from the first paper above, candidate responses demonstrated a struggle with calculations that required a foundational understanding of mathematics. Some candidates were unable to convert the provided percentages into the required values in kilograms. Surprisingly, some candidates even used the figures given for sunflower oilcake meal to calculate the maize meal amount (in kg). Due to this error, their incorrectly calculated values led to incorrect answers in the subsequent question (Q2.5.2).

It is important to highlight that the diagnostic report also recommends the inclusion of calculations as an essential component of animal nutrition. Therefore, it is anticipated that teachers would incorporate calculations into assessments, whether they are informal or formal in nature. The report also recommends that teachers should emphasize and ensure that learners use the correct formulas in both informal and formal assessments, as this will help them in making accurate calculations during final assessments. Learners must comprehend that agricultural sciences fall within the category of hard sciences, and, therefore, that they should rely solely on scientific formulas.

Hereunder follows the second extract from the same 2016 exam paper: As emerging broiler and egg farmer wants to create a cash flow budget for a month, commencing with a starting balance of zero. The expenses include workers' wages at R4,000 per week, chicken feed at R7,000 per week, electricity at R2,500 per week, and additional costs totaling R1,500 per week. The farmer's income comprises the following:

- *Eggs sold for cash to local shops amount to R10,000 per week.*
- *Once a month broilers are sold to a slaughterhouse for R50,000.*

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

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

3.4.3 Explain if the net income of this business can be assured on its cash flow. (2)

Extract 2 Extract requiring an accounting background (NCS Exam 2016)

In Extract 2 above, it is recommended that both teachers and learners involved in Agricultural Sciences should possess a stronger foundation in accounting. Accounting is particularly important because it involves the creation of cash flow budgets, a skill that teachers and learners can benefit from in their study of agricultural sciences.

As per the subject advisor's assessment, only a limited number of candidates were able to successfully respond to Q3.4.1 by calculating and illustrating a mini-cash-flow budget to ascertain the net cash at different stages. Additionally, a small number managed to determine the income derived from expenses. However, a majority of candidates could correctly provide the formula to calculate and determine the net cash in Q3.4.2. The challenge mentioned earlier, related to teaching certain accounting concepts in agricultural sciences, highlights the need for collaboration between agricultural sciences teachers and other educators within the commerce stream, such as accounting instructors.

Referring to the two previous extracts, our research team observed that teachers lacking a background in Mathematics or Accounting were essentially left to navigate these challenges independently, facing the possibility of either succeeding or struggling on their own. As members of society, they found themselves in a situation where they had to learn alongside their Grade 12 learners to perform the aforementioned calculations. This situation could potentially involve the university, given its multidisciplinary faculties. Regarding the failure to meet the curriculum expectations and objectives for teaching agricultural sciences at the school level, the subject advisor expressed his feelings as follows:

"Poor mathematical and accounting skills in some questions resulted in poor performance, as indicated in the diagnostic report depicted. Some topics are intentionally skipped or omitted in our teaching practices. deliberately skip or omit to teach. It's a fact that some of us didn't study Mathematics and Accounting during our basic education" (Job).

Based on the above sentiments, it appears that the subject advisor is aware that some teachers under his leadership are skipping sections. However, he does not indicate how he assists them inovercoming these challenges. He recognizes the importance of having knowledge in both Mathematics and Accounting.

In addition to subject advisor, members of the School Management Team (SMT) also faced their own distinct challenges. Molinga added, "I'd like to mention that I've recently been appointed - by the head of the school to serve as the departmental head for agricultural sciences because of a of staff. However, I may not be able to support the subject teacher in meeting the curriculum requirements, as I lack any background in agricultural sciences."

From Molinga's statements, it is apparent that he is merely fulfilling his duties for the sake of compliance. He does not take any responsibility for potential poor performance, as he does not mention any areas of professional development related to the subjects under his leadership as an HOD.

Our observation is that such a stance contributes to the failure to meet the curriculum needs in agricultural science. This provides an opportunity for tertiary institutions to professionally develop teachers and school leaders. The challenges in agricultural sciences were not exclusive to the departmental head; two teachers also expressed the following sentiments:

Phahle: "I need assistance with teaching topics that demand a background in physical sciences, accounting, and mathematics. I lack the qualifications to handle aspects that necessitate prior knowledge in Physics, Accounting or Mathematics."

Sekharume: "I basically have no clue about the layout of the agricultural sciences laboratory. My primary resources for planning, preparing, presenting, and assessing agricultural sciences are the textbook and past exam papers. Some of the apparatus featured in last year's final exam paper do not appear in any of the textbooks and past papers I used for teaching at school."

Phahle's statement, "I need help," indicates his willingness to engage in professional development, such as that which universities may offer. Sekharume's comments highlight the adverse results of the apartheid system in South African education, where the black community had limited exposure to facilities such as laboratories. Teachers who have had exposure to laboratories are better equipped to explain certain activities based on their first-hand experiences.

Her reliance on past exam papers and learner textbooks serves as a clear plea for universities to step in and provide support for teacher development. These findings contrast with those of Olajide et al. (2015), where the necessary equipment for teaching Agricultural Sciences was readily available. However, not all the necessary tools were available. Another discovery by the aforementioned authors is that teachers assigned to teach were not sufficiently qualified. A study by Boakye and Ampiah (2017) yielded similar results.

Some of the recently appointed teachers lacked adequate exposure to certain apparatus that needed to be used. The programs they underwent did not sufficiently prepare them to teach some of the science topics.

As mentioned earlier, one of the three schools had a farmer manager who was willing to assist other schools. His responsibilities included preparing experiments and ensuring safety and health compliance in accordance with Employment Acts. However, his interactions with teachers were not without challenges: "It is my responsibility to prepare practical experiments that will reinforce classroom teaching. However, subject teachers must furnish an annual plan of practical experiments in accordance with the subject assessment guidelines.

In many cases, some of the visiting teachers are unable to furnish me with the annual plan for practical experiments. Consequently, I find myself deciding on the content, but as teacher Sekharume indicated, learners had to respond to questions related to apparatus with which they were unfamiliar" (FM).

We infer from the preceding comments that the reason teachers were unable to furnish the farm manager with their annual teaching plans stemmed from their theoretical confidence but a deficiency in practical proficiency in the subject.

The CAPS document [RSA DBE, 2011(a)] and even some of the practical activity guidelines do not provide any indication of what teachers should do to reinforce the theoretical aspects outlined in agricultural science. Our conclusion, based on empirical data and the existing literature, is that there is a pressing need for the professional development of agricultural science teachers to enhance their creativity in meeting the curriculum requirements in the subject. Universities can play a major role in enhancing the pedagogical and content knowledge of agricultural science teachers.

In our immediate society, formal qualifications for agricultural sciences teachers may not necessarily include mathematics, physical sciences, and accounting. This situation can present a challenge, leading teachers to omit topics that incorporate elements of these subjects. Furthermore, previous literature does not provide any indication of teachers solely relying on textbooks and past exam papers for their teaching.

Reluctance in implementing continuous professional teacher development (CPTD) programs for agricultural sciences teachers

District officials and the school leadership should actively encourage and support teachers in their professional development (Mitchell et al. 2010). The South African Council for Educators (SACE) (RSA, 2013:4) CPTD policy handbook supports this by emphasizing that teaching is a complex field that requires continuously deepened knowledge.

According to Steyn (2011), school leadership is expected, as part of its duties and responsibilities, to assist teachers their professional development. Likewise, they are also expected to undergo professional development themselves. Although the above policy was announced by the Minister of Education in 2007, it is surprising that more than a decade later, there is still uncertainty regarding this matter.

Molinga expressed, "The last time I checked, we only managed to register for CPTD. However, I am still unsure about what steps needs to be taken next," The head of the agricultural sciences department, despite being registered for the CPTD program, remains uncertain about his responsibilities. The authors believe that his ongoing lack of clarity indicates that he is passive back and waiting for assistance. However, we haven't observed any proactive initiative from him in trying to understand what is expected of him. It appears that Molinga registered and then did not take further action. Similar uncertainty regarding CPTD was also expressed by the teachers.

Phahle: "What is a professional development portfolio?"

In the year 2026, training was scheduled to be offered to teachers and SMT members as on how to organize and assemble their portfolios. However, Phahle's question illustrates that this has not occurred, as he is even not even aware of what a portfolio is or what it should contain.

Sekharume: "I'm familiar with the school-based assessment portfolio. If that is what you are asking for, mine is ready for submission; I just need to include this year's assessment tasks written by the learners."

The uncertainties among participants regarding implementation of CPTD programs presents an opportunity for universities to become involved and assist schools effectively implementing these programs, thereby benefiting from them.

Schools' potential reluctance to actively engage in CPTD may be associated with their limited knowledge of the contribution such programs can have, not only on their personal and professional development, but also on the success of their students.

FM stated, "I registered with SACE many years ago and obtained a SACE number. To the best of my knowledge, SACE has not requested a portfolio from me, at least for the past five years. What is the due date for submitting SBA portfolios to SACE?

We did not expect the farm manager to lack awareness of the availability of teacher development programs. Our deduction from this is that some school leaders may be uncertain or perhaps unwilling to facilitate opportunities for their teachers' growth.

According to the prevailing societal norms, teachers often resist changing their practices unless there is external "pressure" or tangible gains involved. We anticipate that their reluctance to implement CPTD could stem from one of the following three reasons.

Firstly, this could be due to their expectation of not seeing immediate benefits from the activity, leading to their reluctance to implement the CPTD policy document. Secondly, as noted by McCrickerd (2012), there are schools where there is insufficient support for the implementation of CPTD Programs. Lastly, Thompson et al. (2016) also highlighted that reluctance to implementation is exacerbated by shortcomings in teacher training, as some universities fail to align their training programs with secondary school curricula.

According to literature, there is an apparent lack of clear and reliable communication pathways between senior management and subject advisers (Thompson et al., 2016). In light of this, it is once again emphasized that the university can play a pivotal role in addressing the mentioned gaps.

Lack of access to higher education agricultural programs

Job: "Bursaries for tertiary-level skills development are exclusively accessible to colleagues who have studied Mathematics and Physical Sciences in addition to agricultural sciences at schools." The subject advisor's implication is that agricultural sciences teachers have limited opportunities for skill development at higher education institutions with financial assistance. This aid is primarily accessible to those who teach other science subjects at the school level.

Molingasaid, “In addition to your point, a teacher of agricultural sciences can only pursue a teaching qualification in the subject up to the advanced certificate in agriculture education.” One can observe that, as noted by Molinga, certain higher learning institutions are unable to contribute to the improvement of teacher development in agricultural sciences due to the absence of teacher development programs beyond the advanced certificate in teaching. The advanced certificate in teaching served as a certification that facilitated progress for groups previously marginalized by the South African government at the time.

Universities need to discover creative ways for teachers with such qualifications to upgrade their qualifications. FM: “The best way to avoid frustration stemming from limited access to registering with higher education institutions, attending short courses offered by private agricultural organizations is the optimal route. However, it's important to note that the resulting informal certificate carries less weight when pursuing promotional positions in teaching.”

The farm manager's comments imply that the sole opportunity for teacher skill development lies in participating in informal teacher training programs. It can also be added that informal teacher development certificates do not hold the same significance as formal qualifications and are less esteemed in terms of promotional teaching positions. This should also be an important consideration for universities when planning and implementing teacher development programs, particularly in the context of agricultural sciences.

Phahle shared, “I applied for admission to the master’s degree program in sustainable agriculture at a South African university. Despite submitting my honors degree in education, I was informed that I could not be admitted to the master’s program because my honors degree doesn't serve as an appropriate foundation for the desired master’s degree in agriculture.”

There is willingness to develop, but access remains limited for teachers whose previous qualifications were not directly related to agricultural sciences. Universities need to consider programs that facilitate articulation, which involves recognizing and utilizing what applicants have already acquired to enable progression into the desired higher qualifications.

In society, there is a tendency to register for what is easily accessible. It is only when individuals with such qualifications realize there is limited progression that they soon look back. They then come to realize that the qualifications they hold do not open doors as they initially believed. The universities need to reconsider how they recognize the qualifications and experiences possessed by prospective postgraduate students.

Referring to Mr. Phahle's case mentioned above, we believed that the Recognition of Prior Learning (RPL) process would benefit teachers. The hope was that teachers' qualifications and experiences would undergo assessment.

The South African government adopted RPL as a means to address past injustices and as a tool for accessing higher education (Dyson & Keating, 2005; RSA, 2008). Given the aforementioned scenario, other teachers believed it was necessary to stand collectively to make their voices heard: Sekharume: “Considering the barriers mentioned by Phahle, it seems nearly

impossible to enhance our teaching skills. This necessitates political intervention from teacher unions and organizations representing agricultural science teachers. Otherwise, agricultural sciences may face a natural death."

Sekharume's sentiments calls for a collaborative approach to enable both teachers and students to excel in the subject of agricultural sciences. Sekharume further suggests that without such collaboration, the subject may naturally decline. The lack of funding for teachers eager to pursue studies in agricultural science is a cause for concern. The government prioritizes funding for students specializing in mathematics education, often at the expense of other subjects such as agricultural sciences.

The subject advisor doesn't inherently exclude specific teachers. The exclusion is embedded in the requirements, where other sciences receive greater recognition. In a sense, this creates a sense of being undervalued for sciences teachers compared to mathematics and other natural sciences subjects. Universities should contemplate providing financial support, such as bursaries, to teachers aiming to enhance their qualifications, particularly in agricultural sciences. This step is crucial in addressing the perceptions of inequality.

The previous dispensation in South Africa left scares of inequalities, especially in access to previously marginalized groups, which continues to be a challenge even in recent times. There is a necessity to reassess funding for teachers in rural areas to address the imbalances of the past. The notion of undervaluing agricultural sciences extends beyond individuals in higher positions. A study conducted by Olajide et al. (2015) also illustrated that school-level learners do not accord the same level of importance to agricultural sciences.

They perceive Mathematics and English as more crucial, considering their influence on job prospects and access to tertiary education. Proponents of agricultural sciences must steadfastly emphasize its importance.

While short courses may appear to be viable alternatives, according to our participants, they carry less weight when seeking promotional positions. Universities are well-positioned to assist the agricultural community in tackling the educational challenges highlighted by the study's participants.

Inadequate Staffing

The DBE is expected to provide adequate subject advisors who can offer immediate support to teachers. Subject advisors play a crucial role as a source of assistance and support for teachers. Job: "In our district, I am the only subject advisor for agricultural sciences. I lack sufficient time to offer the best support to the school's teaching, taking place at school, resulting in a decline in learner performance.'' Accordingly, Job is responsible for servicing multiple schools. According to him, the current situation results in rather low performance.

Molinga: "The same applies to me; agricultural sciences is not the only subject I oversea, and I'm not proficient in teaching it. I mostly depend on the teacher for guidance on what needs to be done. Due to manpower shortages, the subject was added to the list of subjects I need to supervise."

Molinga shares the same sentiments as Job, the subject advisor, by stating that the subject was assigned to him due to staff shortages. Universities can step in to support development of SMT members like Molinga to lead various subjects.

Phahle: "At my school, I am the only teacher for five classes of learners studying agricultural sciences. When I attend subject conferences outside the municipal confines, the learners are left without a teacher for the entire duration of the conferences. Under typical circumstances, there are more learners than I can individually attend to those in need."

Phahle's sentiments suggest that due to staff shortages, he serves as the sole agricultural science teacher. When he is absent from work, learners face difficulties. According to Phahle, the insufficient supply of agricultural sciences teachers is a pressing issue negatively affecting teachers at school.

Learners also suffer due to a default that clearly does not originate from them at school. Universities should consider theoretical and scholarly approaches to assist teachers like Phahle, who teach multiple grade levels. Universities should also offer courses to support SMT members who like Molinga, who oversee multiple subjects. Job, who oversees the entire district, also requires support support from the university.

Sekharume: "In my situation, we have all the resources for conducting practicals, but I lack the skills to perform other practical activities due to the need for appropriate subject practical skills I am learning alongside the learners I must involve in high-quality practical activities."

Nevertheless, one can observe from Sekharume's situation that resources are available; the only issue lies in the skill to effectively use these facilities.

From the above utterances, we notice that Sekharume needs some practical ways to demonstrate or provide experience for her learners. Her inability to conduct experiments deprives her learners of an opportunity to learn through hands-on experience. Instead, her learners rely solely on studying or memorization.

Visual, tactile, and kinesthetic learners face disadvantages. Universities can contribute positively by offering courses to enhance teachers' skills and expertise in conducting experiments.

FM: "Farm management involves a lot of tasks. During busy seasons my primary focus is on farm production and productivity. I also require a teacher to assist in organizing practical sessions for Agricultural Sciences instructors."

Schools allocate teachers based on student numbers; consequently, I struggle to find an assistant farm manager with the necessary teaching skills. Based on the above utterance, the primary challenge for the farm manager is finding a teacher to assist during busy periods in guiding leaners through practical activities. Staff shortages make the farm manager's job difficult.

Universities can play a role in providing workshops to help teachers and education partners address the current situation.

The above sentiments align with the study conducted by Boakye and Ampiah (2017), in which teachers expressed dissatisfaction with teacher preparatory programs for not adequately preparing them for the demands of the workforce They lacked exposure to certain apparatus, which made it challenging for them to confidently teach specific topics.

Study limitations

We collected data from three district schools. Consequently, our results may not b not be generalizable. Nevertheless, readers can compare our presentations within their context. We gathered data from 11 participants, and including more could have enhanced our findings.

Concluding thoughts

The study revolves around the following question: How can universities enhance the teaching of agricultural sciences in schools? The empirical data suggest a need for universities to support teachers in understanding the multidisciplinary aspects of agricultural sciences. The university possesses experts in fields like mathematics and accounting. Schools can seek assistance from the respective faculties for discipline-related concepts.

To deepen the agricultural sciences, schools, and teachers can collaborate with university lecturers to focus on specific thematic concepts instead of relying solely on past exam papers and learners' textbooks, which tend to promote surface-level learning.

Teachers can thus receive assistance from the university lecturers. Conversely, the university should take an approach to offering teacher professional programs tailored for ongoing teacher development. These programs should include exposure to equipment and hands-on usage.

The findings revealed an inability to fulfill the curriculum requirements, reluctance in implementing CPTD programs, and a shortage of high-quality teachers. Our research also highlights that teachers often seem passive in their professional development, lacking proactive efforts to enhance their skills.

Regarding the significance of our findings, this paper could hold importance for senior faculty management when designing teacher development programs. Government officials, based on these findings, may consider further research, perhaps employing quantitative research methodologies, to address the gaps highlighted in this paper.

Policymakers and researchers can extend this research by conducting similar studies in various South African contexts and in other locations for comparative analysis. Additionally, policymakers and academics may explore alternative approaches to this project, moving away from a PAR approach.

Authors' contributions

NSB generated the empirical data and conducted a literature review. CTT updated the literature and composed the article based on NSB's dissertation.

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