

Agricultural science preservice teachers implementation of practical activities through video-based observations

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ABSTRACT

Practical activities are essential for promoting experiential learning and preparing future teachers to effectively convey complex concepts, particularly in agricultural science education. Teacher training institutions strive to equip prospective teachers with the requisite knowledge and skills necessary to successfully implement the curriculum in their future teaching endeavors. This study aimed to evaluate preservice agricultural science teachers in their ability to integrate practical activities into their classrooms using easily accessible and locally available resources to teach agricultural science content that requires hands-on engagement from learners. This qualitative study involved six preservice agricultural science teachers in their third year of the Bachelor of Education in secondary education honors program at the International University of Management in Namibia. Preservice teachers were asked to record a 10-15-minute videos of them enacting agricultural science during their four weeks school-based studies (also known as teaching practicum). Video observations revealed that teachers effectively utilized readily available materials to explain concepts in agricultural science in the topic of soil in which they were primarily asked to concentrate on in any grade of their choice. Additionally, the teachers engaged with syllabus-based content appropriately, demonstrated enthusiasm in presenting the material, and exhibited a strong command of the language used as the medium of instruction.

Keywords: agricultural science, video-based observations, preservice teachers, practical activities, experiential learning

INTRODUCTION

Practical activities are vital for encouraging experiential learning and preparing future teachers to effectively present complex ideas (Bradberry & De Maio, 2019; Munna & Kalam, 2021), particularly in the field of agricultural science education. Teacher training institutions aim to equip prospective teachers with necessary knowledge and skills to be able to implement the curriculum successfully in their future teaching (Asrial et al., 2019). The use of practical activities, particularly when teaching the concepts related to hands-on practical activities does not only improves learners understanding, but also fosters their excitement for learning more about the dynamic relationship between different agricultural science concepts (Banerjee & van der Heijden, 2023).

One of the aims of agricultural science as a subject within the natural science key area as advocated for by the national curriculum for basic education (Ministry of Education, Arts and Culture [MoEAC], 2018) is that it “encourage the teaching, in a practical manner, of basic principles and skills in agricultural science” (p. 2). As the focus of this video-based observation (VBO) centered around the teaching of the concepts in the topic of soil, the concept of soil is a cornerstone among the core topics in agricultural science because it lays the foundation for knowledge of plant growth, nutrient cycles, and sustainable agricultural methods (Banerjee & van der Heijden, 2023). Although the importance of practical experiences has been emphasized frequently in teacher preparation programs (Darling-Hammond, 2017; Korthagen, 2016), assessing the effectiveness and efficiency of these activities is still a crucial part of ensuring that preservice agricultural science teachers in Namibia are competently prepared to implement practical activities in their future teaching. As these aspiring teachers begin their careers as teachers, it is critical to evaluate their capacity to use real-world activities and modify their instructional approaches to meet the requirements of various learner populations.

The extent and depth of knowledge about a preservice teacher’s instructional practices are typically constrained by traditional methods of teacher evaluation, which frequently rely on observations made by mentors or supervisors (Temel, 2014). Particularly within the Namibian contexts, students’ teachers are usually evaluated by their mentor teachers and/or by the university lecturers to assess how students effectively implement and utilize the content and pedagogical knowledge during teaching practices.

Recent developments in educational research have, however, led to the incorporation of technology into the field of teacher evaluation (Admiraal et al., 2017). VBOs have thus become a powerful tool for capturing the intricacies of classroom interactions and providing a singular view for examining the enactment and implementation of practical activities in real-world contexts (Bhatt & de Roock, 2013; Gold & Windscheid, 2021).

The advantages of using VBOs over the traditional methods of mentor teachers and lectures observations is attributed to the fact that videos are less intrusive and reduces the tendency of students to modify their behaviors with regards to what is believed to be desirable when they are conscious of being observed and this is regarded as the 'Hawthorne's effect' (Borg, 2021). Moreover, using VBOs students' behaviors can be observed remotely. Borg (2021) further alluded that VBOs offers analysts more flexibility in terms of the observed behaviors as opposed to the in-person observation and it is often not time-consuming and costly as students will only be required to video record their teaching practices, cutting down on the travel expenses usually encountered by university lecturers (Dagnaes-Hansen et al., 2018; Diefenbacher et al., 2020). To this end, VBOs are regarded to generate permanent records that can be reviewed several times and in a focused manner such that less relevant extracts can be fast forwarded and studied more than once if necessary leading to an increased conceptualization of a student's teaching experience and practices and leading to improving reliability (Dagnaes-Hansen et al., 2018; Mesman, 2021).

By examining how VBOs might be used as a substitute of conventional and/or traditional evaluation methods by mentors to assess the effectiveness of preservice agricultural science teachers in teaching practical topics through hands-on activities, this study intends to close the gap between theory and practice.

The introduction should provide an overview of the topic and clarify the reasons for investigating this topic. This part also needs to draw the literature about the topic and indicate the study's originality. While providing an adequate background, please avoid giving a detailed literature survey or a summary of the results. Note that use et al. for all citations of all sources with three or more authors in the paper's body.

THEORETICAL PERSPECTIVES

As a theoretical underpinning of this study, pedagogical content knowledge (PCK) is described as the amalgam of the teacher's knowledge of the content as well as his/her knowledge of the pedagogy (Shulman, 1986). According to Shulman (1986), PCK is the knowledge that goes beyond the subject matter of its own accord and reaches the dimension of subject matter knowledge for teaching. In addition, Shulman (1986) further described PCK as a technique of representing and articulating the topic content to make it more intelligible to others. PCK is distinct from general pedagogical knowledge for teaching, which involves understanding of the basic theories and techniques of instruction as well as generic principles of organization and management in the classroom (Mavhunga & Rollnick, 2013).

A teacher's comprehension of the subject matter is referred to as their content knowledge, whereas their understanding of instructional methodologies, assessment methods, and classroom management is referred to as their pedagogical knowledge (Mavhunga & Rollnick, 2013; Shulman, 1986). PCK is thus a special combination of these two forms of knowledge and is necessary for efficient instruction. While PCK has been the subject of research in several scientific fields, its use in agricultural science education is relatively new (Rice & Kitchel, 2015). Therefore, this study used PCK as a lens to view how agricultural science teachers' knowledge of the subjects as well as that of the teaching pedagogy facilitated learners' acquisition of important concepts pertaining to the teaching of the topic of soil in agricultural science.

METHOD

The qualitative approach was used to capture preservice agricultural science teachers' pedagogical orientations in enacting practical activities when teaching agricultural science practical activities and most particularly, in the topic of soil during their school based studies (SBS). The study sampled six preservice agricultural science teachers during their video recorded teaching practicum. The sample comprises of three male and three female preservice agricultural science teachers. A purposive sampling technique was employed zooming into teachers who mostly used locally available and easily accessible materials when presenting the topic of soil to their learners. Purposive sampling technique is described by Campbell et al. (2020) as a technique used to choose participants who are most likely to provide accurate and meaningful information. Additionally, purposive sampling technique is used for identifying and selecting situations that will make the most use of the limited research resources at hand (Palinkas et al., 2015). Preservice agricultural science teachers' classroom practices were collected by means of VBO of teachers teaching the concepts of soil.

In fulfilment of their academic requirements within the tertiary education program, student teachers enrolled in their third year of the Bachelor of Education in secondary education honors program at the International University of Management in Namibia were tasked with documenting their teaching practices through video recordings, with a particular emphasis on their pedagogical approaches when teaching the topic of soil during their SBS. This instruction emanated from the first author, who concurrently acts and fulfil the roles of lecturer for agriculture education III and evaluator/assessor for SBS activities at the institution. The instruction involved the design and implementation of lesson plans relating to teaching the topic of soil, employing easily accessible and readily available teaching materials in teaching the topic of soil. While typical classroom sessions lasted between 40 to 45 minutes, students were specifically directed to capture only 10 to 15 minutes of their teaching practices on video. Additionally, the first author required that these lessons on soil could be tailored for any grade within the agricultural

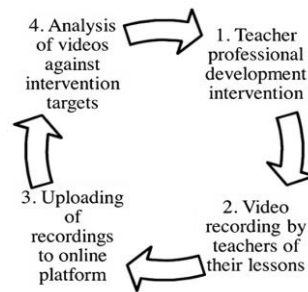


Figure 1. The model of VBO in M&E (Borg, 2021, p. 2)

science subject spectrum (ranging from grades 8 to advanced subsidiary [AS]). Subsequently, students were instructed to upload their recorded videos onto their designated class's YouTube channel during the data collection phase. Utilizing his position as a science educator at the institution, the first author was able to readily engage with this cohort of selected students, rendering them a convenient sample for the study's purposes.

Data Analysis

According to Dyer et al. (2018), VBO was also used as a data analysis tool during the evaluation of a training program designed to improve the use of evidence-based practices by mentee nurses in India. For this reason, VBO was used in this study as a process of developing and implementing a video-based monitoring & evaluation (M&E) system rather than using the traditional observation method used by mentors and lecturers. A coding system was developed for the analysis of the videos by the authors. The use of ongoing video analyses to assessing student teachers during the teaching practicum would be preferred over the conventional mentors and lecturers' observations as it saves time.

The first step in the data analysis process was to transcribe all the video data verbatim. The information taken from the video recordings was then subjected to a theme analysis, where it was methodically grouped under appropriate topic categories. During our analysis of the students' SBS video recordings, we identified recurrent themes from the instructional methods of agricultural science preservice teachers that we observed. By using an iterative process, the analysis improved theme categories over time, resulting in the final thematic domains being defined. The authors carried out this thorough procedure in a sequential manner, guaranteeing the correctness and dependability of the results. After this complex process was finished, six overarching themes became apparent, which were explained by means of a thorough analysis and synthesis of the data extracted from the videos.

The model of VBO in M&E envisioned by the British Council and shown in **Figure 1** serves as some pointers for the analysis of the videos in this paper, which evaluated six agricultural science teachers' videos teaching the topic of soil (Borg et al., 2020).

As it can be seen in **Figure 1**, there were various steps that needed to be taken to apply the VBOs model of M&E framework. First, a teacher professional intervention was conducted to guide and coach preservice agricultural science teachers in appropriate teaching practices for teaching the subject of soil. This was done during class in the subject called 'teaching methods of agriculture', which forms as a prerequisite for SBS III. Subsequently, the involved year III preservice agricultural science teachers were assigned with the responsibility of filming their teaching methods during their teaching practicum focused on the topic soil and the use of readily available resources. These recordings provided insightful information for later study by capturing the instructional strategies used, learner involvement levels, content taught relevance, grade-appropriate content, teacher's use of instructional language, and the general classroom dynamics.

The recorded videos were posted to the class's YouTube channel, making it simple for the teachers and the assessors to view them. This stage advanced the data analysis process and guaranteed data centralization. Ultimately, the video records underwent a methodical analysis considering the interventions that had been offered during the teacher professional development stage. The purpose of this analysis was to determine how well the agricultural science preservice teachers' chosen instructional strategies worked in connection to the intended interventions. Evaluators determined the extent to which prescribed interventions were adopted and their effect on educational outcomes by contrasting the practices that were seen with the techniques that were advised.

RESULTS AND DISCUSSION

The findings showed that many preservice teachers had a solid understanding of ideas linked to the topic of soil and successfully involved learners in hands-on activities, which is also corroborated by the findings of other scholars (Asheela, 2017; Asheela et al., 2020; Shivolo, 2018; Shivolo & Ramnarain, 2020). After the videos were transcribed and analyzed, the following five themes were generated:

1. The use of readily available teaching aids to explain the concepts in the topic of soil.
2. The appropriateness and relevance of contents taught to the grade and syllabus with varied instructions.
3. The constant interactions between the teachers and the learners and the contents taught.
4. The enthusiasm of the preservice teachers exhibited during lesson presentations.
5. The preservice teacher's usage of the instructional language of command.



Figure 2. Making a compost from garden refuse and other available organic substances in grade 11 (Source: Field study)

The Use of Readily Available Teaching Aids to Explain the Concepts in the Topic of Soil

The analysis of the VBOs revealed a varied utilization of readily available teaching aids by preservice agricultural science teachers during their teaching practicums in explaining the concepts in the topic of soil to their learners. Additionally, majority of the preservice teachers demonstrated a proactive approach by integrating a differentiated range of visual aids such as diagrams, posters, and models to elucidate the concepts related to soil. These aids were strategically employed to enhance learner understanding and engagement, fostering a more interactive and immersive learning experience. Equally, a subset of teachers exhibited limited use or reliance solely on traditional instructional methods, overlooking the potential benefits of incorporating additional teaching aids. This disparity in the utilization of teaching aids underscores the need for targeted support and professional development initiatives to equip preservice teachers with the necessary skills and resources for effective pedagogical practice (Asregid et al., 2023; Ho et al., 2023).

The extent to which readily available teaching aids were employed significantly influenced the clarity and depth of conceptual understanding among students regarding the topic of soil. Instances where teachers proficiently integrated visual aids resulted in heightened conception and retention of key concepts regarding the topic of soil among learners (Strawn et al., 2020). The use of tangible representations facilitated the visualization of abstract ideas, enabling students to grasp complex soil related phenomena more effectively (Alzahrani, 2020; Urrutia et al., 2019). Equally, classrooms characterized by minimal or inadequate utilization of teaching aids often exhibited lower levels of learner engagement and comprehension (Manan, 2019). This suggests a direct correlation between the thoughtful use of teaching aids and enhanced learning outcomes in agricultural science education. These findings emphasize the importance of fostering a pedagogical environment that encourages innovative instructional practices and resource utilization to optimize learner learning experiences.

The findings highlight the critical role of readily available teaching aids in facilitating effective instruction and conceptual clarity in the context of agricultural science education (Asheela, 2017; Asheela et al., 2020). While the use of teaching aids varied among preservice teachers, those who employed a diverse array of visual aids demonstrated greater effectiveness in communicating complex soil related concepts to learners. This underlines the significance of integrating multimedia resources into instructional practices to cater to diverse learning styles and foster deeper conceptual understanding.

Furthermore, the observed disparity in the utilization of teaching aids highlights the need for targeted interventions and professional development initiatives to enhance pedagogical competencies among preservice agricultural science teachers at teacher training institutions. Providing preservice teachers with comprehensive training on the selection, adaptation, and integration of teaching aids, particularly those that can be drawn from within their local vicinity can empower them to create dynamic and engaging learning environments conducive to optimal learner learning outcomes.

To this end, educational stakeholders must prioritize the provision of adequate resources and support mechanisms to enable preservice teachers to effectively harness the potential of teaching aids in their instructional practices. Additionally, ongoing research and evaluation efforts should continue to explore innovative approaches and best practices for integrating teaching aids into agricultural science education, ultimately enhancing the quality and efficacy of teaching, and learning experiences in this domain.

Figure 2, Figure 3, and Figure 4 depict how the use of readily available materials were used by teachers during their teaching practicums as they were captured on videos during VBOs.

The Appropriateness of Contents Taught to the Learners with Varied Instructions

The VBOs showed that only two out of six teachers taught contents that were grade appropriate, with most teachers not aligning their subject content matter to the grade in which such can be taught. The analysis thus indicated a notable discrepancy between the appropriateness of the content taught and the utilization of varied instructional strategies. While the selected topics were generally deemed suitable for the chosen grade levels, ranging from grades 8 to AS, the teaching strategies lacked adaptability to cater to diverse learning styles and abilities of learners within the classroom.

For example, one teacher was observed testing the 'infiltration capacity of water in different soil types' to grade 8 learners and this topic was found to be grade inappropriate. Despite the varied nature of teaching materials available, including visual aids and practical demonstrations, a significant portion of teachers predominantly relied on traditional lecture style teaching methods.



Figure 3. Testing for water infiltration capacity of different types of soils in grade (Source: Field study)



Figure 4. Experimentation of soil size particles and water holding capacity in grade 9 (Source: Field study)

This lack of instructional diversity potentially limited the effectiveness of content delivery and failed to sufficiently engage all learners in the learning process.

Further analysis of the VBOs emphasized the critical role of instructional adaptability in fostering learner engagement and enhancing learning outcomes which concurs with the articulations of Halverson and Graham (2019). Instances where preservice teachers demonstrated flexibility in their instructional approaches, such as incorporating group activities, hands-on experiments, and multimedia resources, were associated with higher levels of learner participation and comprehension. On the contrary, classrooms characterized by inflexible teaching methods exhibited signs of disengagement among certain learner cohorts, potentially hindering their academic progress. These findings suggest that while the content taught may align with curriculum standards, the effectiveness of instruction hinges on the teachers' ability to tailor their methods to accommodate diverse learning needs and preferences.

To this end, the observed misalignment between content appropriateness and teaching strategies signifies the importance of holistic pedagogical training for preservice agricultural science teachers. While the selection of relevant topics is a crucial aspect of effective curriculum planning, it is equally imperative for teachers to possess the pedagogical skills necessary to deliver this content in a manner that maximizes learner engagement and understanding. Addressing this gap requires targeted professional development initiatives that emphasize the integration of diverse instructional approaches customized to the needs of specific learner populations.

Moreover, the identified correlation between instructional adaptability and learner engagement highlights the need for ongoing support and mentorship for preservice teachers as they navigate their teaching practicums. Encouraging reflective practice and providing opportunities for peer collaboration can facilitate the exploration and implementation of innovative teaching methods. Additionally, the integration of technology enhanced learning tools and differentiated instruction strategies can further enhance the inclusivity and effectiveness of classroom instruction. By prioritizing instructional adaptability alongside content mastery, preservice agricultural science teachers can cultivate dynamic learning environments that promote learner success and academic achievement.

The Constant Interactions Between Teachers and Learners and the Contents Taught

Under this thematic area, the analysis of VBOs of preservice agricultural science teachers during their teaching practicums revealed a consistent pattern of interactions between the teachers and their students. These interactions encompassed various forms, including verbal exchanges, questioning techniques, and non-verbal cues and prompts. Throughout the instructional sessions, teachers actively engaged with their learners, fostering an active learning environment characterized by dialogue and collaboration. Furthermore, the VBOs highlighted instances of responsive teaching, wherein teachers adapted their instructional strategies in real-time to address the evolving needs and queries of their learners, this is to say, most teachers were able to respond to questions posted to them by their learners and they also encouraged learners to pose questions to them. This finding stresses the importance of effective communication and rapport-building in facilitating meaningful learning experiences within the classroom context.

In terms of the contents taught, the analysis revealed a comprehensive approach to the distribution of agricultural science concepts, with particular emphasis on the topic of soil. Teachers employed diverse instructional resources and methodologies to convey key principles and practical applications related to soil science. Moreover, the VBOs depicted a refined understanding of

the subject matter among preservice teachers, as evidenced by their ability to articulate complex concepts and facilitate hands-on learning experiences. Additionally, the findings indicated a strong alignment between the prescribed curriculum and the content delivery strategies employed by the teachers. This alignment highlights the importance of curriculum reliability in ensuring the attainment of educational objectives and the cultivation of subject mastery among learners.

The consistent interactions observed between preservice agricultural science teachers and their learners during teaching practicums underscore the pivotal role of teacher-learner engagement in facilitating effective learning outcomes. By actively soliciting learner input, clarifying doubts, and fostering a participatory classroom environment, teachers can cultivate a sense of ownership and enthusiasm for learning among their learners. Moreover, responsive teaching practices enable teachers to tailor their instruction to the diverse needs and learning styles of individual learners, thereby promoting inclusive and equitable educational experiences.

To this end, the comprehensive coverage of agricultural science content, particularly the topic of soil, reflects the pedagogical competence and subject expertise demonstrated by preservice teachers during their practicum experiences. By making the most of a variety of instructional strategies and resources, teachers can enhance the accessibility and relevance of subject matter, thereby fostering deeper conceptual understanding and practical skills development among students. Moreover, the alignment between curriculum standards and instructional practices underlines the importance of curriculum coherence in promoting instructional quality and ensuring the attainment of educational goals. Overall, the findings highlight the potential of VBOs as a valuable tool for assessing and enhancing teacher effectiveness in the context of preservice teacher education and professional development initiatives.

The Enthusiasm of the Preservice Teachers Exhibited During Lesson Presentations

One notable finding from this study is the level of enthusiasm exhibited by the preservice teachers during their lesson presentations. Analysis of the video recordings revealed a consistent demonstration of enthusiasm and passion among the preservice teachers when delivering instructional content related to the topic of soil. This enthusiasm was evident through various non-verbal cues such as engaging body language, lively vocal inflections, confidence in presenting their lessons, and animated gestures employed by the teachers throughout their lessons (Dewaele & Li, 2021; Frenzel et al., 2019; Hackett et al., 2021; Lazarides et al., 2019). The observed high level of enthusiasm among preservice agricultural science teachers during their lesson presentations holds significant implications for both teacher training programs and classroom instruction. Firstly, the enthusiastic behaviors displayed by preservice teachers reflects a genuine interest and commitment to their profession, which is essential for fostering a positive learning environment and learner engagement (Amerstorfer & von Münster-Kistner, 2021; Fathi et al., 2023). Research has consistently shown that teacher enthusiasm positively influences learner motivation, academic achievement, and overall classroom climate (Dewaele & Li, 2021; Jungert et al., 2020; Lazarides et al., 2019).

Furthermore, the enthusiastic delivery of instructional content by preservice teachers during their teaching practicums indicates a successful integration of pedagogical strategies and content knowledge acquired through their teacher education programs. This suggests that the teacher training curriculum effectively cultivates not only the necessary subject matter expertise but also the instructional skills and confidence needed to deliver engaging and effective lessons. Additionally, the enthusiasm exhibited by preservice teachers may serve as a model for their future colleagues, inspiring a culture of passion and dedication within the teaching profession.

In conclusion, the findings regarding the enthusiasm of preservice agricultural science teachers during their lesson presentations underline the importance of cultivating passion and commitment among teachers. Moving forward, teacher education programs should continue to emphasize the development of effective instructional practices alongside subject matter expertise to ensure that preservice teachers are well-prepared to meet the demands of the classroom environment. Moreover, ongoing support and mentorship for novice teachers can further nurture and sustain their enthusiasm throughout their careers, ultimately benefiting both teachers and students alike.

The Preservice Teacher's Usage of the Instructional Language of Command

The findings revealed that all six preservice teachers frequently employed a good command of the English language used as a medium of instruction between the teacher and the learner. The instructional language usage of all six teachers was characterized by authoritative commands during their teaching practicums. The prevalent usage of this instructional language of command by preservice teachers observed in this study suggests a tendency towards a more traditional, directive approach to classroom management and instruction. This is in line with the study by Rizzo (2023), who also revealed a strong relationship between a preservice teachers' language usage and teacher-learner communication in the classroom. This finding aligns with previous research indicating that novice teachers often resort to authoritative language as a means of establishing control and maintaining order within the classroom (Huang et al., 2019; Mercer & Dörnyei, 2020). However, while such language may be effective in managing behaviors in the short term, it can also hinder learner engagement and autonomy, as it diminishes opportunities for dialogue and collaboration in the learning process (Alam & Mohanty, 2022; Mercer & Dörnyei, 2020).

Moreover, the reliance on instructional language of command may reflect a lack of pedagogical repertoire and confidence in classroom management among preservice teachers. Without adequate training and support in alternative instructional strategies, novice teachers may default to familiar, teacher-centered approaches that prioritize compliance over active participation and critical thinking (Biggs et al., 2022; Tshishonga, 2023). Therefore, addressing the overreliance on instructional language of command should be a key focus of teacher preparation programs, with an emphasis on promoting more student-centered and inquiry-based instructional practices (Al Hasani, 2022; Attard Borg, 2023; Nghia et al., 2020).

In conclusion, while the usage of the English instructional language of command by preservice agricultural science teachers in Namibian schools may serve as an immediate strategy for maintaining order, it also highlights the need for ongoing professional development and mentorship to promote a more diverse and inclusive instructional selection that fosters learner engagement and agency in the learning process. By empowering preservice teachers with the necessary skills and strategies to create dynamic and interactive learning environments, universities can better prepare them to meet the diverse needs of learners and promote meaningful learning outcomes in the agricultural science classroom.

To this end, all these five themes, exhibited that most preservice teachers had a solid understanding of ideas linked to soil and successfully involved learners in hands-on activities, which is also corroborated by the findings of other scholars such as (Asheela et al., 2020; Shivolo, 2018; Shivolo & Ramnarain, 2020). The findings of the study highlight the significance of including hands-on activities in agricultural science instruction and emphasize the relevance of utilizing locally accessible resources to make it more sustainable and adaptable to various educational contexts (Asheela et al., 2020; Shivolo & Ramnarain, 2020). These results can be a useful resource for curricula development and review, teacher training programs, and pedagogical progresses in agricultural science education.

CONCLUSION

The findings from our study shed light on several key aspects of agricultural science preservice teachers' enactment of practical activities, particularly in the context of teaching the topic of soil. Firstly, the utilization of readily available teaching aids emerged as a prevalent theme throughout the observed lessons. Our analysis revealed that preservice teachers demonstrated a commendable effort in incorporating diverse instructional materials ranging from easily accessible and locally available materials, charts, diagrams to any other possible resources that promote hands-on experiments to elucidate complex concepts in teaching the topic of soil. This emphasis on the use of tangible resources not only enhanced the clarity of instruction but also catered to diverse learning styles, thereby fostering a more inclusive and effective learning environment.

Furthermore, our study highlighted the importance of aligning instructional content with the grade level and syllabus requirements while employing varied instructional strategies. We found that preservice teachers exhibited a detailed understanding of curriculum expectations and adeptly tailored their lesson plans to meet the needs of their learners. By incorporating differentiated instruction and scaffolding techniques, teachers were able to cater to the diverse learning needs and abilities within their classrooms, thereby promoting more equitable learning outcomes across the board.

Moreover, our analysis revealed the dynamic and interactive nature of classroom interactions between preservice teachers and their students. Throughout the observed lessons, teachers consistently engaged learners in meaningful discussions, elicited responses, and provided constructive feedback, thereby fostering a collaborative and learner-centered learning environment. Additionally, the enthusiasm exhibited by preservice teachers during lesson presentations was palpable, contributing to a positive and conducive learning atmosphere. However, it is noteworthy that our study also identified a tendency among preservice teachers to rely on English as an instructional language of command, highlighting an area for potential growth and development in fostering more learner-centered instructional practices. Overall, these findings heighten the importance of continuous professional development and mentorship to support the growth and efficacy of preservice teachers as they embark on their teaching careers in agricultural science.

Lastly, with regards to the use of VBOs as a method of assessing preservice teachers during their SBS, the evidence garnered from our study strongly advocates for the use of VBOs as a modern and effective alternative to traditional observational methods employed by mentor teachers and university lecturers in assessing and evaluating preservice teachers. Unlike conventional approaches, which often rely on subjective interpretations and limited snapshots of classroom interactions, VBOs offer a comprehensive and detailed view of preservice teachers' instructional practices. By capturing authentic teaching moments in real-time, VBOs provide evaluators with a more holistic understanding of teachers' pedagogical orientations and skills, classroom management strategies, and learner engagement levels. This depth of insight enables more informed and objective assessments, leading to more targeted feedback and tailored professional development opportunities for preservice teachers.

Moreover, the advocacy for using VBOs as a contemporary method of evaluating and assessing preservice teachers during SBS is emphasized by their inherent flexibility and accessibility. VBOs afford preservice teachers the opportunity to document their teaching practices in diverse settings and contexts, transcending the constraints of traditional observation schedules and logistical challenges. Furthermore, the use of digital platforms such as YouTube channels facilitates continuous sharing and collaboration among stakeholders, including mentor teachers, university lecturers, and preservice teachers themselves. This democratization of the evaluation process promotes transparency, accountability, and continuous improvement within teacher preparation programs, ultimately enhancing the quality of education and professional development for aspiring teachers.

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Declaration of interest: No conflict of interest is declared by the authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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