Journal of Education and Learning Technology (JELT)
ISSN 2720-7730
Volume 6 Issue 9 2025 pp 729 - 745
Available online at: https://noyam.org/journals/jelt/
DOI: https://doi.org/10.38159/jelt.2025693

An Assessment of the Challenges Associated with Technology Integration in Agricultural Programs in TVET Colleges in South Africa

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ABSTRACT

The lack of effective technology integration is a significant challenge in several Technical and Vocational Education and Training (TVET) colleges in the South African Province of Limpopo. This qualitative study aimed to assess the challenges associated with technology integration in agricultural programs. Using purposive and convenience sampling techniques, three out of seven TVET college campuses offering agricultural programs were identified, and a total of 20 agriculture lecturers were interviewed. Thematic analysis was employed to examine the data and identify patterns and themes. This study was grounded in Kotrlik et al.'s theory of technology integration and Sephokgole's model, highlighting potential solutions for the challenges faced by agriculture lecturers in TVET colleges. The findings revealed that the exploration, experimentation, adoption, and advanced technology integration phases are hindered by ongoing challenges, including a lack of resources, tools, and stakeholder support. Unless the challenges related to insufficient training in technology integration are addressed, agricultural programs in TVET colleges risk falling behind in adopting modern agricultural practices. This study recommends that relevant stakeholders, including TVET colleges and the Department of Higher Education and Training (DHET), provide lecturers with the necessary technological tools, resources, and training. This study serves as a valuable resource for future research, policy development, and practical implementation of technology integration in agricultural education.

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Publication History
Received: 24th March, 2025
Accepted: 5th August, 2025.
Published: 12th September, 2025.

To Cite this Article:
Sephokgole, Ramongwane Daniel. "An Assessment of the Challenges Associated with Technology Integration in Agricultural Programs in TVET Colleges in South Africa." *Journal of Education and Learning Technology* 6, no. 9 (2025): 729 - 745. https://doi.org/10.38159/jelt.2025693.

Keywords: *Agriculture, Challenges, Technology Integration, TVET Colleges.*

INTRODUCTION

The ongoing challenges that the lecturers in agriculture programs face at Technical and Vocational Education and Training (TVET) colleges require urgent solutions. Among the challenges is the institution's lack of technical teaching and learning resources support. The potential solutions should not only resolve the challenges but also raise the bar for technological integration in the TVET colleges. Ultimately, this will enhance efficiency and productivity while promoting technology-integrated adaptive teaching and learning in the TVET colleges.[1] Technological teaching and learning support should include establishing continuous workshops and regularly developing TVET lecturers through training on the use of technological resources. Teaching support and learning resources are educational needs that influence technology integration and must be made available to enhance teaching

[1] Said Elbanna and Loreta Armstrong, "Exploring the Integration of ChatGPT in Education: Adapting for the Future," *Management & Sustainability: An Arab Review* 3, no. 1 (2024): 16–29.

methods, developmental strategies, and a curriculum aligned with technology integration.[2] Every educational institution requires support and strategies to address developmental problems that affect technical skills in integrating technology into educational programs. Other required strategies involve revising curriculum materials, enhancing the lecturers' training and assessing the lecturers' digital competency in TVET programs.[3] To improve technology integration in the TVET colleges, strategies and pedagogical support are required to end the ongoing challenges. A significant challenge facing TVET college lecturers is the scarcity of technology resources tailored to support content-specific teaching and learning.[4]

Therefore, this study sought to investigate the ongoing challenges faced by the agriculture lecturers in the TVET colleges. There is a dearth of empirical research on the ongoing challenges that the agriculture TVET colleges' lecturers have when integrating technology. For instance, Raof et al., focused on the challenges faced by the agriculture lecturers in improving teaching delivery in Malaysia's agriculture vocational colleges.[5] Zirkle and Martin focused on the challenges and opportunities for the TVET colleges in the United States,[6] while Paudel et.al. focused on the challenges of the agriculture education and training system in Nepal.[7] In light of the limited empirical evidence on technology integration in agricultural programs at South African TVET colleges, very few studies have focused on the challenges faced by the agriculture lecturers in the TVET colleges. The majority of existing studies have concentrated largely on examining the general challenges faced by TVET colleges. For instance, Ramongwane, et.al. focused on the challenges of implementing an effective agriculture-based TVET program.[8] Badat researched the challenges of transforming higher education and training institutions,[9] while Minde et al., researched challenges for Agricultural Education and Training (AET) institutions.[10] Considering the scarcity of research on the challenges faced by the agriculture lecturers in the TVET colleges, this study aimed to contribute new knowledge that will enable the TVET colleges and DHET to resolve challenges faced in the agricultural programs. Support with technical resources and the tools used to train modern agriculture is essential. This study holds significance in that it will enable TVET lecturers to gain a deeper understanding of the potential impact of their challenges on the efficacy and outcomes of agricultural programs. Furthermore, the study's findings will have practical implications for TVET colleges offering agricultural programs, informing strategic resource allocation decisions and potentially facilitating the acquisition of necessary resources and technological tools to support modern agricultural training and education.

It is against this background that the researcher argues that there is no proper exploration, experimentation, adoption and advancement of agricultural content without the support of technical resources, equipment and infrastructure from the stakeholders. Effective technology integration in TVET colleges necessitates that lecturers embed the four phases of technology integration into their daily pedagogical practices, while concomitant support in the form of relevant teaching and learning

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[2] Ramongwane Daniel Sephokgole, "Challenges of Integrating Innovative Technological Approach towards Teaching and Learning Agricultural Programmes: A Case of Technical and Vocational Education and Training Colleges in Limpopo Province, " (Tshwane University of Technology , 2023).

[3] Nor Roselidyawaty Mohd Rokeman et al., "Navigating Digital Competence in TVET Education: Overcoming Challenges and Harnessing Opportunities for Industry 4.0," *Jurnal Pendidikan Bitara UPSI* 17 (2024): 200–215.

[4] H. Mhlungu and L. R. Maharajh, "Lecturers' Experiences of the Use of Technology in Mathematics Teaching at a TVET College. of South Africa (AMESA)," in *Reimagining Mathematics in a Digital Space* (Kimberley: Sol Plaatje University, 2024).

[5] Shuhada Abdul Raof, A Hatib, and Haiza Atmareni, "The Challenges Faced by the Agriculture Lectures in Improving Teaching Delivery at Malaysia Agriculture Vocational Colleges: A Competency Study," *Journal of Educational Research & Indigenous Studies* 2, no. 1 (2020): 1–12.

[6] Christopher Zirkle and Lindsey Martin, "Challenges and Opportunities for Technical and Vocational Education and Training (TVET) in the United States," *The Future of Vocational Education and Training in a Changing World*, 2012, 9–23.

[7] Sulav Paudel, Thomas Gill, and Edwin Rajotte, "Agriculture Education and Training (AET) System in Nepal: Present Status, Challenges and Future Priorities," *Innovate: Innovation for Agricultural Education and Training, Virginia Tech/USAID*, 2013.

[8] Ramongwane Daniel Sephokgole, Ramaligela Sylvia Manto, and Makgato Moses, "Exploring Challenges to Implementing an Effective Agriculture-Based TVET Program in South Africa," *Journal of Technical Education and Training* 14, no. 3 (2022): 125–39.

[9] Saleem Badat, "The Challenges of Transformation in Higher Education and Training Institutions in South Africa," *Development Bank of Southern Africa* 8, no. 1 (2010): 1–37.

[10] Isaac Minde et al., "Challenges for Agricultural Education and Training (AET) Institutions in Preparing Growing Student Populations for Productive Careers in the Agri-Food System," *Journal of Agribusiness in Developing and Emerging Economies* 5, no. 2 (2015): 137–69.

resources, as well as technological tools, plays a crucial role in facilitating successful implementation and sustainability of technology-enhanced learning in agricultural programs. Therefore, this study aimed to investigate the ongoing challenges faced by the TVET lecturers when integrating technology. This study proposed a strategic model for TVET agriculture education, centered on supporting lecturers with the requisite technical resources and expertise to navigate the complexities of rapid technological change and integration.

LITERATURE REVIEW

The integration of technology in learning environments is contingent upon a multifaceted approach, wherein the provision of support for learning content is intricately linked with the effective utilization of key factors, including exploration, experimentation, adaptation, and advancement of learning content. This study posits that a direct connection exists between these variables, underscoring the importance of targeted support in facilitating successful technology integration. Indeed, the pivotal role of support in facilitating technology integration is further underscored by the challenges encountered in teaching agricultural subjects in TVET colleges, where the absence of experimentation with technology-based content severely compromised the efficacy of teaching, thereby reinforcing the notion that targeted support is essential for effective integration of technology in agricultural programs. Agriculture is a practical subject, and it cannot be taught without infrastructure, technical resources, as well as equipment.[11] A perennial challenge confronting lecturers in TVET colleges offering agricultural programs is the inadequate provision of support for acquiring requisite technical resources, infrastructure, and specialized agricultural equipment, thereby hindering the effective delivery of high-quality agricultural education. To effectively deliver high-quality agricultural education and produce competent graduates, TVET lecturers require unfettered access to essential infrastructure, specialized equipment, and innovative technical resources that enable them to model and teach best practices in agricultural production and management.

The challenges that persist beyond the technological age are considered persistent problems. The use of old agricultural equipment that does not match modern requirements, frequent disconnections from the network system, and malfunctioning technical instruments are examples of the challenges resulting from a lack of support from the stakeholders. In turn, the challenges, including the lack of resources, as well as equipment and infrastructure, force the lecturers to teach using the traditional method without exploring agricultural content with technology.[12] To stay up to date with modern methods and improve the teaching and learning processes in the 21st century, it is crucial to have technical resources and equipment to explore agricultural content with technology integration.[13] Ongoing support is paramount for agriculture lecturers, as it enables the effective facilitation and implementation of technology integration, thereby fostering a dynamic and adaptive learning environment that keeps pace with the rapidly evolving agricultural sector.

The efficacy of ongoing support for technological integration in TVET colleges appears to be significantly influenced by persistent challenges, notably the inadequacy of infrastructure, equipment, and technical resources, which collectively impede the provision of comprehensive support to lecturers and hinder the successful implementation of technology-enhanced learning. Moreover, across all domains of vocational education, a sophisticated support system for integrating technology into the teaching process is essential.[14] Continuously offering traditional agricultural educational programs, degrades the standard of education that should be provided once all necessary infrastructure, equipment, and resources are in place. However, vocational training in the TVET colleges is still being taught

[11] Sephokgole, "Challenges of Integrating Innovative Technological Approach towards Teaching and Learning Agricultural Programmes: A Case of Technical and Vocational Education and Training Colleges in Limpopo Province."
[12] Abdullah Aljaber, "E-Learning Policy in Saudi Arabia: Challenges and Successes," *Research in Comparative and International Education* 13, no. 1 (2018): 176–94.
[13] Iris Backfisch et al., "Variability of Teachers' Technology Integration in the Classroom: A Matter of Utility!," *Computers & Education* 166 (2021): 104159.
[14] Adedayo Olayinka Theodorio, "Examining the Support Required by Educators for Successful Technology Integration in Teacher Professional Development Program," *Cogent Education* 11, no. 1 (2024): 2298607.

without the continuous and proactive support of integrating technology into the agricultural programs.[15] Most educational institutions are trying to integrate technical tools to carry out educational activities, and agriculture is not exempt. Given the global presence of technology in the lives of current students, it is imperative that agricultural education undergoes a paradigmatic shift to incorporate technology integration, thereby harnessing the potential of modern tools to enhance learning outcomes and equip students with the skills necessary to thrive in a rapidly evolving agricultural sector. According to Hu et al., modern agriculture education must incorporate technology since it is imperative to tackle the current problems.[16] The paradigm shift precipitated by technological integration has rendered traditional agricultural practices obsolete, necessitating a fundamental reorientation towards innovative, technology-driven approaches that transcend mere experimentation and instead, harness the full potential of innovative agricultural activities to drive sustainability, efficiency, and productivity.

The rapid evolution of technological innovations in agriculture presents a compelling opportunity for continuous integration, enabling the sector to harness the potential of emerging technologies and drive transformative changes in productivity, sustainability, and efficiency. Therefore, technology integration in education sector serves to capacitate students with technical skills through practicing agriculture, engaging in sharing and through the delivery of study content, communication, as well as multimedia.[17] Furthermore, it has been discovered that experimenting with technology integration during the training of agricultural programs helps to exercise agricultural activities by employing modern technology.[18] While the use of modern technologies are indeed in the early stages of agricultural experimentation, it can be persuasively argued that their integration into educational settings serves as a valuable pedagogical tool, providing students with hands-on experience and exposure to innovations that will shape the future of agriculture.[19] However, the transformation has also brought about new approaches to the challenges that technology can rapidly respond to. When experimenting with technology in agriculture, technical resources and equipment should be accessible. This concept might assist in resolving an ongoing challenge that has hindered the lecturers' abilities to integrate modern technologies into training.[20] This can go beyond employing an adaptable strategy that enhances the use of technology in the classroom. Though, the researcher passionately argues that overcoming the ongoing challenges confronting TVET colleges offering agricultural programs necessitates a inclusive and clear commitment to supporting technology integration, encompassing not only infrastructure and technical resources but also innovative equipment, lest these institutions remain hindered in outdated pedagogies and unable to produce graduates equipped for the modern agricultural landscape. The stakeholders should provide tangible support for a smooth integration of technology into the educational settings to avoid the ongoing challenges that the agriculture lecturers face.[21] This can include assisting in the training of lecturers to help integrate technology for the efficient practice, training, and implementation of modern farming. It is confirmed that ongoing training and support are essential for the successful integration of new technologies.[22] Considering this, the continuous support for experimentation with technology integration adds value to alleviate the challenges the lecturers face when training agricultural programs.

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[15] Sephokgole, "Challenges of Integrating Innovative Technological Approach towards Teaching and Learning Agricultural Programmes: A Case of Technical and Vocational Education and Training Colleges in Limpopo Province."

[16] Fengjun Hu et al., "Transforming Agriculture with Advanced Robotic Decision Systems via Deep Recurrent Learning," *Expert Systems with Applications* 259 (2025): 125123.

[17] Laila Mohebi, "Theoretical Models of Integration of Interactive Learning Technologies into Teaching: A Systematic Literature Review," *International Journal of Learning, Teaching and Educational Research* 20, no. 12 (2021): 232.

[18] Dimitrios Kalfas et al., "Integration of Technology in Agricultural Practices towards Agricultural Sustainability: A Case Study of Greece," *Sustainability* 16, no. 7 (2024): 2664.

[19] Bruno Basso and John Antle, "Digital Agriculture to Design Sustainable Agricultural Systems," *Nature Sustainability* 3, no. 4 (2020): 254–56.

[20] Alfred Mvunyelwa Msomi, "Lecturers' Experiences in the Integration of Technology in Teaching and Learning in the Context of an ICT-Challenged Environment: The Case of a South African University of Technology," in *Online Teaching and Learning in Higher Education: Issues and Challenges in an African Context* (Springer, 2024), 11–30.

[21] Julia Kroh and Carsten Schultz, "The More the Better? The Role of Stakeholder Information Processing in Complex Urban Innovation Projects for Green Transformation," *International Journal of Project Management* 41, no. 3 (2023): 102466.

[22] G. L. Roberts and A. Turner, " The Role of Continuous Training and Support in Technology Adoption for Animal Health Management," *Veterinary Practice Journal* 12, no. 2 (2015): 101–15.

The effective adoption of technology in agricultural education at TVET colleges is hindered by ongoing challenges, namely, lecturers' limited proficiency in technology integration, inadequate access to resources, and knowledge gaps, which collectively impede the successful implementation of innovative teachings.[23] Technical skills put the lecturers in a good position to know how to identify the appropriate technologies and equipment that may be adopted and utilised in an agricultural program. The acquisition of technical skills requires sufficient time and training to equip the lecturers with the capacity for technology integration.[24] Furthermore, it facilitates a more dynamic and efficacious learning environment, thereby enabling lecturers to impart relevant knowledge and skills to students, and ultimately enhancing the overall quality and relevance of the educational experience. Yet, it is challenging to sustain high quality without integrating technical resources and equipment to support modern training.[25] This study sought to address the need to alleviate the ongoing challenges that the lecturers face in their institutions. Both lecturers and students are consistently unable to integrate technology due to the shortage of technical resources and equipment. Even if the adopted technologies, such as MS Teams, the internet of things, as well as other technical resources and agricultural tools, are adopted for usage, TVET lecturers still lack necessary support to implement technology integration.

The advanced technology integration training for the TVET lecturers lacks intensity and effectiveness because they still cannot practice training in agriculture using technology. The ability to grasp modern technology depends on the individual's knowledge and understanding of the basics.[26] Given the complexity of advanced technology integration, it is woefully inadequate to expect lecturers to grasp its nuances and intricacies through a mere few hours of one-time training, which would likely leave them struggling to effectively implement modern technological tools and methods in their teaching practices. In terms of the function of the technological tools or ways of usage, one-time workshops often have little impact on the understanding of advanced technology operations and other related activities.[27] Therefore, the way training is conducted clearly reflects the kind of challenges the lecturers are facing. Despite the increasing recognition of technology's importance in agricultural education, a significant gap remains in the integration of more complex and innovative technological solutions including the use of robotics, artificial intelligence, and the internet of things, to enhance and solve the problems of the current issues facing agriculture in the context of climate change. Against this backdrop, it can be argued that TVET lecturers continue to have challenges regarding training without technology integration due to a lack of modern technology integration training. Old techniques and resources, which lack the sophistication and nuance required to effectively address modern agricultural challenges, remain prevalent in many educational settings. Furthermore, the dearth of sufficient support for technology integration exacerbates the existing challenges, underscoring the imperative for enhanced resources and infrastructure to facilitate the effective adoption of innovative technologies in agricultural education. Thus, it seemed appropriate for this study to look at the ongoing challenges the TVET lecturers face when integrating technology. In light of this, it is crucial to keep in mind that a lack of support from the stakeholders continues to cause the challenges the lecturers offering agricultural programmes face in the TVET colleges.

[23] N S Musa, J M Githeko, and K El-Siddig, "The Adoption and Use of ICT by Small Scale Farmers in Gezira State, Sudan.," 2014.

[24] Gabriel M. Kennedy, "Challenges of ICT Integration in Teachers' Education: A Case Study of the College of Education, University of Liberia," *International Journal of Social Science and Education Research Studies* 03, no. 05 (May 13, 2023): 860–70, https://doi.org/10.55677/ijssers/V03I5Y2023-15.

[25] Khalid Abdullah Bingimlas, "Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature," *Eurasia Journal of Mathematics, Science and Technology Education* 5, no. 3 (2009): 235–45.

[26] Muhammad Rusli Baharuddin, "3D Printing Basic Knowledge and Skills Training for Teachers of SMAN 2 Palopo," *Jurnal IPMAS* 2, no. 3 (2022): 107–16.

[27] Susan Bickerstaff and Maria S Cormier, "Examining Faculty Questions to Facilitate Instructional Improvement in Higher Education," *Studies in Educational Evaluation* 46 (2015): 74–80.

THEORETICAL FRAMEWORK

This study is grounded on Kotrlik et al.'s theory of technology integration[28] and Sephokgole's model of technology integration in TVET agricultural education.[29] Technology integration has transformed the educational system, and it has resulted in a digital system for teaching content. Timotheou et al., claim that digital technology transforms education as it now heavily relies on technology for practice and problem-solving issues.[30] Furthermore, it has an impact on the students' performance, as well as on other school-related aspects and stakeholders, going deeper into subject training. Therefore, the critique of technology integration recognises the significance of four phases, including exploration, experimentation, adoption, and advanced technology integration, that, to complement one another effectively, the stakeholders must provide tangible support.[31] The focus of these four distinct and independent phases shows that the exploration of technology integration embraces the way the lecturers integrate technologies with or without challenges when training agricultural programs. The experimentation of technology integration embraces the way technology is integrated in practice and solves agricultural problems. The adoption of technology integration embraces the kind of technology that is integrated for training agricultural programs. Lastly, advanced integration embraces the incorporation of modern technologies into agriculture education. The effective functioning of these four phases in the TVET colleges' agricultural program training is severely impeded by the glaring inadequacy of technical resources, equipment, and infrastructure, thereby underscoring the imperative for enhanced support to ensure the successful delivery of these critical programs.

The TVET colleges require support from the stakeholders to integrate technology into the agricultural curriculum.[32] To supplement Kotrlik et al.'s theory of technology integration, Sephokgole's technology integration in the TVET agriculture education model was added to this study. Kotrlik et al.'s theory of technology integration emphesised the concepts of exploring technology integration, experimenting with technology integration, adopting technology integration, and advancing technology integration, lack specificity regarding the hierarchical structure and reporting lines, as well as the procedural guidelines that would facilitate a coherent and effective integration process within the TVET education system. The South African TVET system has different role players, with different college campuses having different office bearers. To support the integration of technical needs in agricultural programs, Sephokgole's theory of technology integration in TVET agricultural education stresses the interconnected and interdependent phases that are thought to be relevant to solving the ongoing challenges faced by the lecturers in the TVET colleges.[33] These phases are (a) Technology integration; (b) Teaching support; (c) Learning support; (d) The teaching and learning needs; (e) Lecturers; (f) Students' technology integration in TVET agricultural education; and (g) Teaching methods and learning objectives. The role of these interconnected phases helps to maintain and support the implementation of technology integration during the training of agricultural programs in the TVET colleges. The model is appropriate for the agriculture lecturers to understand the importance of integrating technology. The model considers the need to involve the stakeholders to support the necessary technical resources and tools used to integrate technology. Therefore, the following research questions probed the challenges faced by the lecturers when integrating technology into agricultural programs:

[28] Joe W Kotrlik, Donna H Redmann, and Bruce B Douglas, "Technology Integration by Agriscience Teachers in the Teaching/Learning Process," *Journal of Agricultural Education* 44, no. 3 (2003): 78–90.
[29] Sephokgole, "Challenges of Integrating Innovative Technological Approach towards Teaching and Learning Agricultural Programmes: A Case of Technical and Vocational Education and Training Colleges in Limpopo Province."
[30] Stella Timotheou et al., "Impacts of Digital Technologies on Education and Factors Influencing Schools' Digital Capacity and Transformation: A Literature Review," *Education and Information Technologies* 28, no. 6 (2023): 6695–6726.
[31] Kotrlik, Redmann, and Douglas, "Technology Integration by Agriscience Teachers in the Teaching/Learning Process."
[32] Sephokgole, "Challenges of Integrating Innovative Technological Approach towards Teaching and Learning Agricultural Programmes: A Case of Technical and Vocational Education and Training Colleges in Limpopo Province."
[33] Sephokgole, "Challenges of Integrating Innovative Technological Approach towards Teaching and Learning Agricultural Programmes: A Case of Technical and Vocational Education and Training Colleges in Limpopo Province."

What are the challenges of integrating innovative agriculture training technology?

- How are the challenges that prevent one from integrating innovative technology into teaching and learning solved?
- What are the challenges that exist during the adoption of technology that can be used for agricultural programs?
- How were you trained to integrate technologies in your agriculture teaching?

The idea was to come up with a possible solution so that the agricultural programs may keep abreast of the technology used to train modern agriculture. The lecturers who have sufficient technical resources and tools can train and produce better candidates who are able to implement modern agriculture than those who are trained without technology integration.

METHODOLOGY

This study employed a qualitative approach to examine the perceptions of the lecturers about the ongoing challenges faced by the agriculture TVET college lecturers when integrating technology. The approach was perfect for the study because the researcher got a deeper understanding of the phenomenon through first-hand experience, truthful reporting, and quotations from actual conversations.[34] The research population included the lecturers offering agricultural programs in the TVET colleges. Purposive and convenience sampling methods were used to select the participants of the study. From the population of seven TVET colleges in the Limpopo Province, three colleges campuses were purposively sampled because they offer agricultural programs. During the data collection period, the participants were conveniently accessed whenever available to share experiences. Data was obtained from 20 available lecturers who were ready to be interviewed in suitable settings. The 20-30-minute interviews aimed to gather in-depth qualitative data by allowing the interviewer to explore the participants' thoughts, feelings, and experiences. The interview data underwent a thematic analysis where the responses were identified and presented with recurring patterns or themes. The findings from the analysis were presented using the variables guided by Kotrlik et al., framework and research questions to obtain responses from the questions related to the themes shown in Table 1.

Table 1: The research statements

Variables	Research questions
Exploration of technology integration	What are the challenges for integrating innovative agriculture training technology?
Experimentation with technology integration	How are the challenges that prevent one from integrating innovative technology into teaching and learning solved?
Adoption of technology integration	What are the challenges that exist during the adoption of technology that can be used for agricultural programs?
Advanced technology integration	How were you trained to integrate technologies in your agriculture teaching?

All the gathered interview data were transcribed, and themes emerged through codes and means. The whole process involved six steps of the qualitative method, namely, organisation, transcription, coding, interpretation and reduction, presentation, as well as the drawing of data, which helped the researcher to verify the conclusion of the study.[35] The four variables of exploration, experimentation, adoption, and advanced technology integration helped to probe the ongoing challenges faced by the agriculture TVET college lecturers when integrating technology. However, Sephokgole's model of technology integration in TVET agriculture education served as a reference for the outcome's discussion. The presentation of the transcribed data was coded and analysed using thematic analysis,

[34] Steven Tenny, Janelle M Brannan, and Grace D Brannan, "Qualitative Study," 2017.
[35] Virginia Braun and Victoria Clarke, "Using Thematic Analysis in Psychology," *Qualitative Research in Psychology* 3, no. 2 (2006): 77–101.

in accordance with Kotrlik et al.'s theory of technology integration. Before the interviews, the participants received a briefing on the research and were given questions to help them prepare and contribute relevant experiences. The participants further signed documents expressing consent to participate in the research process.

PRESENTATION OF FINDINGS AND DISCUSSION

From the data collection and analysis, the presented emerging results are grouped under four variables, with each responding to one research question. Answering research questions can help the TVET colleges and policymakers to be informed about the challenges faced by the lecturers when training agricultural programs. Interviews were conducted with the participants when they were available and in appropriate settings. The researcher was also allowed to record the interviews because it was crucial to record the responses to capture verbatim responses, ensuring accuracy and reducing reliance on memory or note-taking. To gain a better understanding of the findings, all the recordings were transcribed and subjected to a thematic analysis. Coding helped to organise the variables that probed the responses by posing one research question on each variable, each composed of several themes emerging from the responses. The phases are presented in a flexible and iterative manner, with the findings organized and discussed in a logical sequence, starting with the exploration of the technology integration variable, followed by experimentation with technology integration, and adoption of technology integration, and concludes with advanced technology integration.

Exploration of Technology Integration

What are the challenges for integrating innovative agriculture training technology?

The exploration of technology integration refers to the way the lecturers integrate technologies with or without challenges when training agricultural programs. To respond to the exploration of the technology integration theme, the research question sought to assess challenges that the TVET lecturers experienced when integrating technologies into the agricultural programs. The following sub-themes emerged:

- ICT integration;
- Lack of resources;
- Lack of support.

ICT integration in agriculture is a strategy used to explore agricultural content using technologies. This strategy can put the lecturers in a position to involve technologies during practice. The lecturers were asked about the challenges of introducing innovative agriculture training technology. The majority of the lecturers stated that they faced challenges, including the lack of data and poor network coverage. These were the responses from the lecturers:

> *"We had Moodle as our LMS that was provided to us by the college, but the main challenge with our students is that they don't have data"* (**Participant 4**).

> *"We are still having challenges talking about the issue of having data." We're still having issues with the poor network. The issue of load shedding is one of those factors that the students are complaining about, and we are not getting along with online learning"* (**Participant 10**).

> *"The online classes, especially during the lockdowns, there is a program called Moodle that was introduced by the TVET colleges. However, most of the time, you will find that the students are from remote areas with limited network coverage"* (**Participant 11**).

Notwithstanding the challenges encountered by the lecturers, it became apparent that some individuals, despite receiving training in ICT integration, faced significant obstacles due to inadequate support from the TVET colleges, thereby hindering their ability to effectively integrate technology into their teaching practices:

"Some of the machines are getting older. And then the procurement process here takes a long time, which could be because the supply chain doesn't understand the language of farming when you talk about farming" (**Participant 3**).

"There is no clear link between the curriculum and current technology" (**Participant 6**).

The lack of resources is a sign of resource shortages, which are the challenges impeding agricultural programs from being implemented smoothly. The participants stated that a shortage of network coverage and resources was among the challenges of integrating innovative agriculture training technology in the TVET colleges:

"The challenge we are currently facing is a shortage of network coverage and a shortage of resources in terms of data" (**Participant 5**).

"If you want to implement something new and you don't have a lot of resources, then there's a chance that whatever you want to achieve might not take off in a manner that will benefit the people that it is supposed to benefit" (**Participant 19**).

"You'll find that the projector is not working, and you are supposed to teach. So, if you're not giving me resources, I will not stop teaching; instead, let me come up with something to avoid frustrating myself and my students" (**Participant 20**).

The lack of support is the failure or insufficiency of the financial, emotional, or practical support, resources, or encouragement required to accomplish a goal or overcome challenges when implementing agricultural education into practice. Some participants explained how a lack of student support with resources contributed to the challenges they faced:

"Only those who are coming from an advanced family can, but for those who are from unadvanced families, it's still a challenge" (**Participant 16**).

Regarding the challenges for integrating innovative agriculture training technology, it was found that most respondents agreed that the lecturers face challenges, including the lack of ICT integration, the lack of resources used to integrate technologies, and the lack of support from families who are supposed to support the students with learning material, including technological tools.

Experimentation with Technology Integration

How do you solve the challenges that prevent you from integrating innovative technology into teaching and learning?

The experimentation of technology integration refers to the way technology is integrated into practice to solve agricultural problems. The question probed the ways in which the lecturers used technologies to solve the challenges that prevented integrating innovative technology into teaching and learning. The question presented the participants with the opportunity to voice suggestions pertaining to the challenges they faced. In exploring the responses to the question, the following themes emerged:

- Provide technical resources and equipment;
- Involve all stakeholders;
- Use a flexible approach to teaching and learning;
- Have own funds;
- Collaboration;
- Train lecturers.

Providing technical resources and equipment is a strategy that can be used to solve many challenges the lecturers face with technological integration. The majority of the participants indicated

that the strategies, including providing technical resources and equipment, can work to integrate innovative technology into teaching and learning. The participants suggested that technical resources such as smartphones, laptops, tablets, and data should be made available for the lecturers and students:

> *"Students must have smartphones, particularly those who have not yet received the devices. They had to buy their own smartphones"* (**Participant 11**).

> *"The college must provide students with resources such as laptops, tablets, and data* (**Participant 12**).

> *"You can put your textbooks on a smart board. Lecturers don't have to use textbooks in class. They must just open it with their password, and then you can access the whole content"* (**Participant 18**).

Involving all stakeholders is a strategy that can be used to work out any challenges before they hamper the teaching and learning process. The college should not be solely responsible for providing technical resources and equipment, but any party that is close to the involved participants should act accordingly. However, one participant suggested the strategy of involving other stakeholders:

> *"If stakeholders, like those companies, can assist the department or the employer in terms of funding or assist them with funds, that could be better"* (**Participant 1**).

Using a flexible approach to teaching and learning can alleviate the challenges experienced in the TVET colleges. Most of the participants suggested using flexible approaches that could accommodate both face-to-face as well as online teaching and learning:

> *"The only option recently is to try to bring it back to the old ways (face-to-face) until data is provided to students. Until students are provided with laptops, other resources are in place, and you can also allow students with good families to do it online"* (**Participant 5**).

> *"When there is no connectivity with the students, I reschedule the class for a contact lesson instead of using online learning"* **(Participant 6**).

> *"Figure out how to integrate the information students get from the internet"* (**Participant 7)**.

> *"Encourage online learning so they must go online to do research for their assignments* (**Participant 13**).

The sectional heads in the TVET departments are free to buy the required equipment and supplies for teaching agricultural programs since they have access to funds. Some participants suggested that the colleges must have their own accounts that can be used for the lecturers' training. This could allow each department in the colleges to train the lecturers accordingly:

> *"The college must have its own account"* (**Participant 3**).

> *"Whenever budgeting or strategic planning is discussed on campus, this is where we need to emphasize the importance of the training that needs to be budgeted for"* (**Participant 19**).

To overcome the challenges the lecturers face when training agriculture programs, teaching and learning in the TVET sectors should adopts a collaborative approach. This process code investigates alternative strategies for incorporating technology. One participant said:

"I go to someone who is well-equipped and knowledgeable and ask for help" (**Participant 4**).

Providing lecturers with ongoing training is one of the finest ways to incorporate technology into agriculture education. Some participants indicated that training can be beneficial to the lecturers. There was a suggestion that providing the lecturers with in-house training could be an effective way to use technology in the classroom:

> *"Pumping up the in-house training. We need to be fully trained in this modern technology. But, for the time being, I will continue to teach the traditional way, by writing on the chalkboard and reading from textbooks"* (**Participant 8**).

> *"Provide proper training that will be beneficial to lecturers and be an effective way to use technology in the classroom"* (**Participant 16**).

On the issue of how the lecturers solve the challenges that prevent them from integrating innovative technology into teaching and learning, most of the lecturers still experience challenges that prevent them from experimenting with agriculture through technology integration. However, most of them stated that the strategies, including providing technical resources and equipment, can help with the integration of innovative technology into teaching and learning. Though, one lecturer suggested the strategy of involving other stakeholders in the process of solving challenges. Many lecturers suggested using flexible approaches that could accommodate both face-to-face and online learning. Among the flexible approaches, the lecturers suggested that the TVET colleges must have their own accounts that can be used for the lecturers' training and other related matters. Furthermore, some lecturers suggested that a flexible approach can provide in-house training and collaboration that can be an effective way to use technology in the classroom.

Adoption of Technology Integration

What challenges exist during the adoption of technology that can be used for agricultural programs?

The adoption of technology integration refers to the kind of technology that is integrated for training agricultural programs. This theme considered the challenges that exist during the adoption of technology in agricultural programs. It presented the participants' daily challenges. In exploring the responses to the question, the following themes emerged:

- Lack of resources;
- Poor attendance;
- Lack of network connection/ poor network;
- Slow training of lecturers.

The lack of resources is a serious and complex issue that affects organisations and training programs. It also compromises the quality of training in the TVET sectors. Most of the participants indicated that the lack of resources is another factor affecting the adoption of technological integration by providing detailed comments:

> *"Some students do not have a smartphone"* (**Participant 4**).

> *"The other challenge will be the insufficiency of equipment and resources"* (**Participant 5**).

> *"Inadequacy of resources. We are still struggling with other students to get connectivity. Some of the students do not have gadgets, laptops, smartphones, and the connectivity is a problem"* (**Participant 6**).

> *"I can't speak of any challenges because we lack the necessary technology"* (**Participant 17**).

Poor attendance at workshops or training sessions can seriously impair operations and result in the participants losing valuable information. The participants stated that the poor attendance of online classes due to a lack of resources can have an impact on the pass rate:

> *"The main one is attendance, and I believe this will have an impact on the pass rate"* (**Participant 2**).

> *"Students do not attend to content sent via WhatsApp group"* (**Participant 8**).

One major issue interfering with the seamless operation of technology integration during training programs is a lack of network coverage. The majority of the participants explained how the lack of network coverage contributed to the lack of technology adopted:

> *"I think the network coverage will be poor given the power outage because if there is no electricity, there won't be network coverage"* (**Participant 11**).

> *"Lack of network or lack of connection"* (**Participant 12**).

> *"The challenge can be the speed at which the signal is transmitted"* (**Participant 15**).

Slow technology integration training for lecturers is a challenge that causes delays to advanced transformation. The participants also described the slow training of lecturers and students, which was caused by a poor network due to load shedding:

> *"The challenge is that we are slowly being trained, and the poor network due to load shedding"* (**Participant 1**).

During the interviews, the lecturers were given the opportunity to share their perspectives on the challenges that exist in the process of adopting the technology that can be used for agricultural programs. Many lecturers indicated that the lack of resources is another factor affecting the adoption of technology integration. Additionally, inadequate network coverage emerged as a significant factor contributing to poor attendance and hindering the adoption of technology, with many lecturers citing the unreliability of network infrastructure as a major obstacle to effective technology integration. Therefore, lecturers struggled to deal with the poor attendance of students because they were not trained to deal with that aspect. In their response, one lecturer described how the slow training of lecturers and students was caused by a poor network due to load shedding.

Advanced Technology Integration

How were you trained to integrate technologies in your agriculture teaching?

Advanced technology integration refers to how modern technology is integrated into agricultural education. There are numerous ways of training to integrate technologies into teaching and learning programs. However, the participants stated that intensive training is ideal to provide appropriate training. In exploring responses to the question, the following themes emerged:

- Basic training;
- Lack of intensive training.

The participants reported receiving foundational training in technology implementation, which provided an introductory understanding of the operational mechanics, but may not have equipped them with the advanced skills necessary for sustained effective integration:

> *"We were only trained for the basics and possibly for the agricultural sector because of this online teaching, which I managed to cut short, training of which one cannot say it's applicable training, as we were trained for the basics"* (**Participant 6**).

"We were trained in how to record a lesson and how to teach using live videos. I can record the lesson, leave it, and check if students are logging in" (**Participant 9**].

"We were only trained to use technology to teach a lesson about Google Classroom. We were trained online, and then the facilitator was just showing us this is Google Classroom, and how to create groups" (**Participant 18**).

The lack of intensive training for lecturers poses significant challenges, which could result in fewer quality graduates who are capable of practising agriculture with technology. Some participants explained how the training they attended unfolded:

"The trainer came to train us. They only showed or trained us for a few hours on one day, and obviously, there will be some things we don't understand" (**Participant 3**).

"One cannot say we were trained to that extent. Both lecturers and students still need more training so that we can become fully familiar with this technology" **[Participant 10**).

"It's like the training that I was doing online, where we had many tasks and little time. It wasn't as effective as if someone had stood in front of us and shown us how to do it" (**Participant 16**].

Some participants indicated that they had participated in workshops organized by the head office, which served as a key mechanism for professional development and skill enhancement:

"You just go in there once in a classroom, and they show us the steps on how to integrate technology" (**Participant 2**).

"There were workshops in the central venue on a regular basis, and people with skills from different companies came to teach us some things" (**Participant 5**).

"The department has brought us an IT specialist to train us. The problem is that the training is done after a long time" (**Participant 8**).

In the interviews, the lecturers were asked whether they were trained to integrate technologies into agriculture teaching. Some lecturers stated that they were trained in the basics of implementing technology. Some lecturers indicated that they experienced a lack of intensive training, and they therefore need intensive training on the use of advanced technologies. The lecturers stated that they were trained in how to create an online lesson and that they were assigned tasks during training to practise. The next section discusses the results of the study.

DISCUSSION

Based on the results of the data analyses carried out through Kotrlik et al.'s framework, there are ongoing challenges that impede the integration of technology in the TVET colleges offering agricultural programs. The technology integration model will serve as a diagnostic framework to identify and assess the ongoing of challenges in agricultural education within the TVET sector, thereby informing targeted interventions and support strategies. The implementation of four phases, including exploration, experimentation, adoption, integration, and advanced technology integration, influences the ongoing challenges that require support from various stakeholders. However, the results of this research show the existence of the ongoing challenges of integrating technology into agricultural programs.

The results show that the exploration of technology integration is hampered by a lack of resources and support from various stakeholders. Most lecturers stated that they faced challenges, including but not limited to a lack of resources and poor network coverage, which are fuelled by a lack

of support. This finding indicates the need for continuous support with resources that could help the lecturers to integrate technology when training agricultural programs. This finding substantiates the researcher's assertion that embracing contemporary methodologies is essential for enhancing the efficacy of agricultural training programs in the 21st century, thereby ensuring relevance and excellence in vocational education. Therefore, it is crucial to continue supporting the lecturers with technical resources and equipment to realise the exploration of agricultural content with technology integration.[36] As a result, it is important to include the stakeholders in providing infrastructure, equipment, and resources to assist education so that the agricultural programs can completely integrate technology into the teaching and learning process.

The experimentation of the technology integration strategy will enable the smooth practice of agriculture only if there is support with money to purchase the required technical resources and equipment. The majority of the participants indicated that the strategies, including providing technical resources and equipment, can work for integrating innovative technology into agriculture training. A sophisticated support system for integrating technology into agriculture training is essential.[37] Supportive systems should involve the capacity development of continuous training of the lecturers to apply flexible teaching approaches, of experimenting with agriculture using technology. Modern agricultural education must incorporate technology since it has become imperative to tackle the current problems using various approaches.[38] Alternative strategies, including collaboration with well-equipped and knowledgeable counterparts to improve the chance of getting necessary support when there are challenges are getting worse.

The adoption of technology integration becomes challenging because the adopted technical resources lack the support of a network connection. The challenge influenced poor attendance for online classes, which is also caused by a lack of tools used to connect or access the online classes. The training of lecturers to learn how to integrate technology is slow due to poor network coverage. Insufficient resources, lack of knowledge, and the lecturers' lack of technical skills are some of the challenges preventing the adoption of technology integration into agricultural programs.[39] Various challenges to technology integration may exist; however, the support to adopt reliable technology is vital to facilitate the use of suitable technology.

Advanced technology integration requires intensive training to understand how modern technology operates. The training in learning new technologies should always be broadly intensive to acquire enough knowledge and skills to operate modern technology. Hence, the understanding of the function of the technological tools or ways of usage, and one-time workshops often have little impact on the understanding of advanced technology operation and other related activities.[40] This implies that adequate training time is a necessary prerequisite for effective integration of modern technology, enabling educators to develop the requisite skills and confidence to harness its full potential. Therefore, supporting the lecturers with continuous training to understand the broader function of modern technologies is imperative to the lecturers who are to deal with various modern agricultural tools throughout training.

It was crucial to analyse the ongoing challenges faced by the agriculture TVET college lecturers when integrating technology because this research sought to understand various challenges for support. It is still vital to understand that challenges are continuous, so that tangible support should be given to specific challenges that are experienced throughout the training of agricultural programs. Since there are ongoing challenges experienced during the integration of technology, the study concludes in accordance with Sephokgole's model of technology integration in TVET agricultural education that all the stakeholders (DHET& TVET colleges) must participate concurrently to support all the agricultural programs if the desired objectives of technology integration are to be realised. The findings of the TVET colleges and DHET highlight the urgent need for support with technical resources and tools to

[36] Backfisch et al., "Variability of Teachers' Technology Integration in the Classroom: A Matter of Utility!"
[37] Theodorio, "Examining the Support Required by Educators for Successful Technology Integration in Teacher Professional Development Program."
[38] Hu et al., "Transforming Agriculture with Advanced Robotic Decision Systems via Deep Recurrent Learning."
[39] Musa, Githeko, and El-Siddig, "The Adoption and Use of ICT by Small Scale Farmers in Gezira State, Sudan."
[40] Bickerstaff and Cormier, "Examining Faculty Questions to Facilitate Instructional Improvement in Higher Education."

implement swift, modern training in agriculture with technology integration. As such, the teaching and learning of agricultural programs should be complemented with technical resources and tools so that the agricultural candidates fit into the current labour market and engage swiftly in community projects using modern agriculture.

RECOMMENDATIONS

The study recommends that the lecturers should always be supported with technical resources and tools to deal with the ongoing challenges they experience when integrating technology. To enhance the implementation of technology integration, the stakeholders should support the lecturers' required technical resources and equipment to fulfil the integration of technology. Continuous audits of technological resources should be done to ascertain the challenges that the lecturers have when integrating technology into the agriculture training programs. Through the execution of an internal audit, the agriculture department within the TVET college and its lecturers will be able to identify deficiencies, thereby assisting the stakeholders in replenishing and supplying the necessary resources.

CONCLUSION

This study sought to investigate the ongoing challenges faced by the TVET lecturers when integrating technology. The ongoing challenges that the lecturers offering agriculture programs face at TVET colleges require urgent solutions. To understand the various challenges occurring during the integration of technology when training agricultural programs, the findings of this study came up with suggestions that include tangible support from various stakeholders. The findings of this study revealed that the exploration of the technology integration process is hampered by challenges, including but not limited to a lack of resources and support from various stakeholders. The experimentation of technology integration strategies, including supportive systems, should involve the continuous training of lecturers to apply flexible teaching approaches. The adoption of technology integration becomes challenging if the adopted technical resources lack the support of a network connection, which influences the poor attendance of online classes and the slow training of lecturers. Advanced technology integration requires broad, intensive training to acquire enough knowledge and skills to operate modern technology. This study emphasizes the complications involved in integrating technology inside educational environments, stressing the various challenges that impede its efficient adoption. The results underscore the essential requirement for extensive support systems, continuous training, and strong infrastructure to enable effective technological integration. The study indicates that overcoming these challenges necessitates a comprehensive strategy involving stakeholder engagement, capacity building, and infrastructure development to enable educators to fully leverage technology in improving teaching and learning experiences.

BIBLIOGRAPHY

Aljaber, Abdullah. "E-Learning Policy in Saudi Arabia: Challenges and Successes." *Research in Comparative and International Education* 13, no. 1 (2018): 176–94.

Backfisch, Iris, Andreas Lachner, Kathleen Stürmer, and Katharina Scheiter. "Variability of Teachers' Technology Integration in the Classroom: A Matter of Utility!" *Computers & Education* 166 (2021): 104159.

Badat, Saleem. "The Challenges of Transformation in Higher Education and Training Institutions in South Africa." *Development Bank of Southern Africa* 8, no. 1 (2010): 1–37.

Baharuddin, Muhammad Rusli. "3D Printing Basic Knowledge and Skills Training for Teachers of SMAN 2 Palopo." *Jurnal IPMAS* 2, no. 3 (2022): 107–16.

Basso, Bruno, and John Antle. "Digital Agriculture to Design Sustainable Agricultural Systems." *Nature Sustainability* 3, no. 4 (2020): 254–56.

Bickerstaff, Susan, and Maria S Cormier. "Examining Faculty Questions to Facilitate Instructional Improvement in Higher Education." *Studies in Educational Evaluation* 46 (2015): 74–80.

Bingimlas, Khalid Abdullah. "Barriers to the Successful Integration of ICT in Teaching and Learning Environments: A Review of the Literature." *Eurasia Journal of Mathematics, Science and*

Technology Education 5, no. 3 (2009): 235–45.
Braun, Virginia, and Victoria Clarke. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3, no. 2 (2006): 77–101.
Elbanna, Said, and Loreta Armstrong. "Exploring the Integration of ChatGPT in Education: Adapting for the Future." *Management & Sustainability: An Arab Review* 3, no. 1 (2024): 16–29.
Hu, Fengjun, Fan Wu, Hanjie Gu, Ghulam Abbas, Meshari D Alanazi, Salwa Othmen, Jingming Wang, and Tianrong Zhang. "Transforming Agriculture with Advanced Robotic Decision Systems via Deep Recurrent Learning." *Expert Systems with Applications* 259 (2025): 125123.
Kalfas, Dimitrios, Stavros Kalogiannidis, Olympia Papaevangelou, Katerina Melfou, and Fotios Chatzitheodoridis. "Integration of Technology in Agricultural Practices towards Agricultural Sustainability: A Case Study of Greece." *Sustainability* 16, no. 7 (2024): 2664.
Kennedy, Gabriel M. "Challenges of ICT Integration in Teachers' Education: A Case Study of the College of Education, University of Liberia." *International Journal of Social Science and Education Research Studies* 03, no. 05 (May 13, 2023): 860–70. https://doi.org/10.55677/ijssers/V03I5Y2023-15.
Kotrlik, Joe W, Donna H Redmann, and Bruce B Douglas. "Technology Integration by Agriscience Teachers in the Teaching/Learning Process." *Journal of Agricultural Education* 44, no. 3 (2003): 78–90.
Kroh, Julia, and Carsten Schultz. "The More the Better? The Role of Stakeholder Information Processing in Complex Urban Innovation Projects for Green Transformation." *International Journal of Project Management* 41, no. 3 (2023): 102466.
Mhlungu, H., and L. R. Maharajh. "Lecturers' Experiences of the Use of Technology in Mathematics Teaching at a TVET College. of South Africa (AMESA)." In *Reimagining Mathematics in a Digital Space* . Kimberley: Sol Plaatje University, 2024.
Minde, Isaac, Stephanus Terblanche, Bernard Bashaasha, Ignacio Casper Madakadze, Jason Snyder, and Anthony Mugisha. "Challenges for Agricultural Education and Training (AET) Institutions in Preparing Growing Student Populations for Productive Careers in the Agri-Food System." *Journal of Agribusiness in Developing and Emerging Economies* 5, no. 2 (2015): 137–69.
Mohebi, Laila. "Theoretical Models of Integration of Interactive Learning Technologies into Teaching: A Systematic Literature Review." *International Journal of Learning, Teaching and Educational Research* 20, no. 12 (2021): 232.
Msomi, Alfred Mvunyelwa. "Lecturers' Experiences in the Integration of Technology in Teaching and Learning in the Context of an ICT-Challenged Environment: The Case of a South African University of Technology." In *Online Teaching and Learning in Higher Education: Issues and Challenges in an African Context*, 11–30. Springer, 2024.
Musa, N S, J M Githeko, and K El-Siddig. "The Adoption and Use of ICT by Small Scale Farmers in Gezira State, Sudan.," 2014.
Paudel, Sulav, Thomas Gill, and Edwin Rajotte. "Agriculture Education and Training (AET) System in Nepal: Present Status, Challenges and Future Priorities." *Innovate: Innovation for Agricultural Education and Training, Virginia Tech/USAID*, 2013.
Raof, Shuhada Abdul, A Hatib, and Haiza Atmareni. "The Challenges Faced by the Agriculture Lectures in Improving Teaching Delivery at Malaysia Agriculture Vocational Colleges: A Competency Study." *Journal of Educational Research & Indigenous Studies* 2,no.1(2020):1–12.
Roberts, G. L., and A. Turner. " The Role of Continuous Training and Support in Technology Adoption for Animal Health Management."*Veterinary Practice Journal* 12, no.2 (2015):101–15.
Rokeman, Nor Roselidyawaty Mohd, Che Ghani Che Kob, Farah Waheda Othman, Hanzolah Che Sobry, Mohd Lutfi Mohd Raffi, Siti Aisyah Mohd Nong, Mohd Fadzlee Untong, and Mohd Nasir Mohd Yaacob. "Navigating Digital Competence in TVET Education: Overcoming Challenges and Harnessing Opportunies for Industry 4.0." *Jurnal Pendidikan Bitara UPSI* 17 (2024): 200–215.
Sephokgole, Ramongwane Daniel. "Challenges of Integrating Innovative Technological Approach towards Teaching and Learning Agricultural Programmes: A Case of Technical and Vocational

Education and Training Colleges in Limpopo Province." Tshwane University of Technology, 2023.

Sephokgole, Ramongwane Daniel, Ramaligela Sylvia Manto, and Makgato Moses. "Exploring Challenges to Implementing an Effective Agriculture-Based TVET Program in South Africa." *Journal of Technical Education and Training* 14, no. 3 (2022): 125–39.

Tenny, Steven, Janelle M Brannan, and Grace D Brannan. "Qualitative Study," 2017.

Theodorio, Adedayo Olayinka. "Examining the Support Required by Educators for Successful Technology Integration in Teacher Professional Development Program." *Cogent Education* 11, no. 1 (2024): 2298607.

Timotheou, Stella, Ourania Miliou, Yiannis Dimitriadis, Sara Villagrá Sobrino, Nikoleta Giannoutsou, Romina Cachia, Alejandra Martínez Monés, and Andri Ioannou. "Impacts of Digital Technologies on Education and Factors Influencing Schools' Digital Capacity and Transformation: A Literature Review." *Education and Information Technologies* 28, no. 6 (2023): 6695–6726.

Zirkle, Christopher, and Lindsey Martin. "Challenges and Opportunities for Technical and Vocational Education and Training (TVET) in the United States." *The Future of Vocational Education and Training in a Changing World*, 2012, 9–23.

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