The Evolution of Agricultural Programs Towards Learning: A Look into Gender Disproportions in TVET Colleges

Abstract

The current training needs in agricultural program learning should contribute to the evolution of training in South African Technical and Vocational Education and Training (TVET) colleges. It is ironic that while other countries have advanced into a new era of educational innovation, the South African TVET colleges lag behind in technological development. The survey research approach allows for data measurements and statistical analysis. The study sought to determine whether the agricultural training in TVET colleges is evolving and progressing to integrate technology into the learning process. The three TVET college campuses with 482 participants were purposefully and conveniently sampled due to their experience in agricultural programmes. The findings were presented using the AVOVA analysis that is based on theory of technology integration. According to the study's findings, TVET colleges have evolved in how they train students in agricultural programmes. The study revealed that agriculture lecturers could use technological tools frequently when training the students. However, the results revealed that lack of learning resources affects the use of technology during agriculture training. The evolution would have been better if there had been an inclusion of phases such as technology integration exploration, experimentation with technology integration, technology integration adoption, and advanced technology integration. The study suggests that the gender factor should be considered as a barrier during the technological integration phases to accommodate all the students.

Keywords: Technical and Vocational Education and Training (TVET) colleges; agricultural programmes; evolution; learning

INTRODUCTION

The South African TVET colleges, like those in many other developing countries, have shifted from the traditional teaching methods to the technology-integrated approaches. This evolution of agricultural training in the TVET colleges could not have come at a worse time, as the world transitions from the third to the fourth industrial revolution. This shift has suggested that technology must be integrated into most learning programs including the agriculture lessons. The current period has seen a dramatic shift in global demand for the use of modern technologies in education. The shift to the use of modern technologies is a way of responding to the demand for and the implementation of the Fourth Industrial Revolution (4IR) phase in the digitisation of the learning process. This reflects the end of learning without the use of technology. In high-level learning institutions, including in the TVET colleges, technology integration is now the new teaching and learning approach. The South African TVET colleges that offer agricultural programmes should not be left behind considering the global shifts, hence this study. The researcher hypothesised that the current training needs lack a modern approach to learning agricultural programmes using technology integration. As a result, this study emphasises that the phases including the experimentation with technology, adopting technology, and advancing agriculture with technology (Kotrlik-Redmann, 2003) contribute to the evolution of training for agricultural programmes. This means that the learning processes should be done through technology integration.

Based on the fact that the agricultural studies were considered inferior when they were compared to other fields of specialisation, a few studies have been conducted to understand the current training needs in the learning of agricultural programmes and to recognise the evolution of training in South African TVET colleges. Although there are studies that were done in various countries about the evolution of training, most

were done in community colleges and not specifically in TVET colleges. For instance, Jurgens (2010) conducted a study on the evolution of community colleges, while Valeau and Raby (2018) conducted a study on community colleges and their global counterparts as evolving forms. Antony (2012) explored the genesis and the evolution of community colleges. Surprisingly, a limited number of studies were conducted in South Africa to understand the current training needs in the learning of agricultural programmes. Raisch and Reimann (2019) analysed the training needs of TVET teachers in South Africa. In light of the limited literature about the current training needs in learning, this study sought to add new knowledge when investigating the evolution of training for agricultural program learning in the TVET colleges. The following question guided this research work: How have the TVET colleges that offer agricultural programmes evolved in terms of learning? To answer the research question, the study adapted Kotrlik-Redmann's (2003) theory of technology integration which is highlighted in the next discussion.

To understand the evolution of agricultural programs towards learning, this study adopted Kotrlik-Redmann's (2003) theory of technology integration. This theory is relevant because it provides an understanding and meaning to the extent to which agriculture lecturers incorporate technology into the learning process. The theory is based on four distinct and independent phases that were deemed appropriate for understanding technology integration into agricultural programs and responding to modern agriculture training in TVET colleges. We are of the view that the evolution of agricultural training programs centered around the integration of technologies. In a study by Singh, Peshin and Saini (2010), looking at the evaluation of agricultural vocational training programs, The study found that the evolution of vocational training programs has achieved the desired outcomes and impacts. In support, Freer (2015) states that the modernizing agricultural education and training systems help to produce the recent and needed workforce. Furthermore, Pitikoe-Chiloane, de Jager and White (2022) profound that incorporating technology into the learning process requires technology training to ensure that TVET lecturers stay abreast of the rapid changes in technology. It is obvious that more support is needed to advance the modern learning programs at TVET colleges. If TVET lecturers teaching agricultural programs are provided with resources, equipment, and infrastructure support, then lecturers could utilize all phases, such as technology integration exploration, experimentation with technology integration, technology integration adoption, and advanced technology integration, to improve teaching and learning. The findings of this study may influence educational practices, including TVET colleges, about potential barriers hampering the evolution of agriculture training programs. To achieve the above, searches for extensive literature would be used to understand the current training needs in agricultural program learning, focusing on the four distinct and independent phases of the exploration of technology integration, experimentation with technology integration, adoption of technology integration, and advanced technology integration.

The exploration of technology integration

The exploration of technology integration helps in the evolution of agricultural training programmes. The use of technology integration should begin with an exploration of frequently developed technologies (Chang, Baudier, Zhang, Xu, Zhang & Arami, 2020). In this study, the exploration of technology integration is regarded as

a means for the lecturers to consider using technology in the teaching and learning of agriculture programmes. However, the lack of the exploration of technologies could delay the evolution of training with appropriate resources, which could potentially harm the use of modern technologies in learning institutions (Kwon, Ottenbreit-Leftwich, Sari, Khlaif, Zhu, Nadir & Gok, 2019). This evidence lacks the awareness towards the importance of integrating technologies in the modern days. Before the use of new technology, the first phase is the exploration of the technology to get used to how it is used for particular learning activities.

There are numerous new technologies that are being developed on a regular basis that are not being used due to a lack of exploration (Chirumalla, 2021). Robotics, Artificial Intelligence (AI), sensors, the internet of things, drones, and other new technological tools are among the aspects that are expected to revolutionise training (Ray, 2017). These technologies are appropriate for the participants of any gender who may oversee agricultural programmes. According to Henderson, Selwyn, and Aston (2017), technology-enabled learning can develop a better understanding for all the students, regardless of gender. Similarly, Strong, Ho, Odom and Irby (2013) discovered that the female students accepted technology more than the male students when it came to learning programs. This point of view sheds light on the purpose of this study, which is to investigate the evolution of agricultural programs in learning. Although previous research has highlighted the significance of agricultural-related experiences with gender, Bradford (2017); as well as Herren (2005) echoed that the gender factors play a key role in how the students choose careers in agriculture. The agriculture students, on the other hand, should better understand what the individual needs are, and gender should not be a factor in the students' career choices.

This means that technology has the potential to support any required educational changes but it goes unnoticed. According to Alam (2022), exploring technologies for the intended use of specific activities can help to improve the understanding of what is taught. That could also help to improve innovation within a particular learning subject. However, the challenges, including a lack of skills, knowledge, and training, hinder the exploration of these during learning (Qurotul Aini, Mukti Budiarto, POH Putra & Untung Rahardja, 2020). The modern technologies that can be utilised to evolve the training of programmes including agriculture are well known, but the lack of knowledge on how to explore the technologies is something to be noticed. These factors affect not only the evolution of training programmes but also the integration of innovative technologies in the learning of agriculture (Taimalu & Luik, 2019). The evolution of training using technology promotes innovation in learning programmes (Li, Yamaguchi, Sukhbaatar & Takada, 2019), therefore, this article intends to trace the factors and the phases that could impact the exploration of technology integration, and which could hamper the evolution of agricultural training programmes. The evolution of training programmes in the Limpopo TVET colleges is taking time because agriculture is still practiced without technology integration. The traditional way of practicing agriculture and learning through textbooks is still the norm and the standard of learning.

The experimentation with technology integration

The experimentation of agriculture with technology integration has become a norm for a series of activities including food production, and the method should also be

utilised during agricultural training. This means that the agriculture lecturers should master the training or the teaching that may be used using advanced technological tools to produce competent graduates from the TVET colleges. Currently, the evolution of training programs has seen agriculture experiment with technology that can be used for a variety of purposes. According to Tian, Wang, Liu, Qiao and Li (2020), technology has been widely used in the field of agricultural automation and it has played a key role in its development to achieve the advantages of high production. Furthermore, the widespread use of digital technologies sets the task for learning institutions to train the students in the integration of modern technologies (Trukhachev, Bobrishev, Khokhlova, Ivashova & Fedisko, 2019). This is clear evidence that the training using technology integration can improve the production of highly skilled graduates to embark on agricultural activities, including food production. This view was also echoed by García-Morales, Garrido-Moreno and Martín-Rojas (2021), who said that learning using innovative technology tools can improve or change the learning process which may be significant to the agricultural activities.

The innovative technologies should be used during training to achieve more changes in the agricultural programmes. With the integration of technology, the changes play a vital role in the learning of new knowledge and skills that could be used to practice agriculture. Innovative technology is essential for experimenting and training new skills that are related to the way the agricultural activities are used with the integration of technology (Meijer, Catacutan, Ajayi, Sileshi & Nieuwenhuis, 2015). The suitable technique is to introduce more technologies into agricultural practice. This can go a long way towards stimulating the students' interest in agriculture through the modern methods of integrating technologies into learning (Goh & Sigala, 2020). Furthermore, learning with the support of resources and equipment makes learning more interesting. The interest in learning a particular program is a factor that partly influences the experimentation in agriculture with technology (Kpolovie, Joe & Okoto, 2014).

The students of any gender should be enabled to use advanced technology in all the learning programmes including agriculture. Generally, the male students are more likely to choose agricultural programmes, while the female students dominate in other fields such as humanities, healthcare, and in the public sector courses (McLaughlin, 2018). This should go beyond simply better understanding the barriers to the women's agricultural transitions and have some important implications for research on gender issues in agriculture education in larger international contexts (Almukhambetova & Kuzhabekova, 2020). In view of the above, the only reason for the sudden interest could be due to the technology inspiration within the training of various programs, including agriculture (Downes & Bishop, 2012). This is a clear indication that using technology in Agriculture may result in but not be limited to the changes of interest and other changes revolving around the evolution of training. Furthermore, the changes could also spike the students' interest in excitedly practicing agriculture with technology. The sudden rise of interest is due to the girls' increased interest in the careers in health fields and applied sciences, including in agriculture (Dlamini, Ngwenya & Dlamini, 2004). More changes may occur because of the increased adoption of technology that can be used to experiment with agriculture and attract people of all genders to agricultural programmes. The Limpopo TVET colleges are unable to experiment with agriculture using technologies due to the lack of the

technical resources that could be integrated during the implementation of agricultural learning. The situation has forced learning to be done in the traditional ways of studying agriculture using their textbooks. The advanced experimentation in agriculture with technologies is learned through reading pictures in the learning material.

The adoption of technology integration

The exploration and experimentation with technology has led to the adoption of technology integration into the learning programmes. This means that the TVET lecturers must identify the suitable technology that may be used to train any program. The rapid spread of innovative technological tools for agricultural training, such as robotics, artificial intelligence, sensors, the internet of things, and drones, provides a unique opportunity to facilitate technological adoption in training programmes (Aker, 2011; Ray, 2017). The adoption of these innovative technologies helps in the evolution of training for the agricultural programmes. Furthermore, the adoption of technological resources is used to support the learning process (Buabeng-Andoh, 2012). Another valuable aspect about the innovative technologies is that they help to acquire the required knowledge and the skills in the agriculture sector (Pierpaoli, Carli, Pignatti & Canavari, 2013). This is a clear indication that the adoption of technologies has value in the training of programmes as it improves the students' understanding and abilities to practice agriculture. Although the graduates rely on their abilities and expertise to practice agriculture, either for employability or self-employment, this reality of knowledge and skills acquisition calls for the adoption of technology integration in the training of agricultural programmes. The knowledge and skills acquisition necessitates a greater adoption of technology integration in agricultural training programmes. Therefore, the lecturers need to upgrade their technical skills to keep abreast of the technological developments (Volery, 2000).

The adoption of technology integration in the TVET colleges offers enormous possibilities for the evolution of agricultural training programmes. The most important process in this regard is to make appropriate technologies available for adoption to provide revolutionary training (Moloi & Salawu, 2022). Currently, the use of technology in different programmes is recognised as a way to keep up with the times. Therefore, technologies are integrated not only in agriculture but in educational environments, including in TVET colleges (Coley, Warner, Stair, Flowers & Croom, 2015). However, there are other TVET colleges that still experience challenges when integrating technologies in their training programmes. For example, Aina and Ogegbo (2022) discovered that among the challenges impeding the adoption of technologies in the TVET colleges are the lack of support for the integration of technology into their practice, the access to connectivity, and the provision of little or no training on the pedagogical practices. These challenges also result in training being delivered in a traditional way, which can delay the evolution of training agricultural programmes in the TVET colleges. As a result, it is critical to conduct research to determine the current training needs in the agricultural program learning in the TVET colleges. The goal is to investigate the adoption phase of the technologies that are used to train in the agricultural programmes. Currently, the Limpopo TVET colleges are unable to implement the agricultural learning technologies due to the delays in procuring technical resources. The students are aware of the delay and the technologies that could have been integrated into their learning process.

The advanced technology integration

The use of advanced technology integration during learning can help to evolve the training programmes. The introduction of the advanced technology is evidence that progress is needed, especially when striving to adapt to the fourth industrial revolution. The use of advanced technology does not only help to evolve training but also to improve the understanding of how agriculture should be done (Jung, Maeda, Chang, Bhandari, Ashapure & Landivar-Bowles, 2021). The strive to understand how agriculture is currently being practiced with the integration of advanced technologies helps to embrace the changes in life and in education at large. For education to be relevant and to respond to current training with the integration of advanced technologies, the learning institutions, including the TVET colleges, should respond to the call. It is also imperative to advance to the new technologies because more advanced skills are acquired when the recent technologies are used (Balsmeier & Woerter, 2019). Therefore, the TVET colleges that are offering agricultural programmes should not be caught lagging behind in advanced training with technology integration. According to Mtshali and Msimango (2023) practical skill development training for TVET lecturers is crucial to close the gaps and upgrade skills. This could keep every lecturer remain competent and ready to provided modernized training required in TVET colleges.

The other pressure is the shift towards making these advanced technologies available. According to Dakhi, JAMA and IRFAN (2020), learning become easier if the advanced technologies are integrated to create a dynamic learning environment. Therefore, the use of advanced technologies should be encouraged, and support should be given to the lecturers and to the students when the need to adopt, explore, and experiment with these advanced technologies arises. This can help the students to gain experience in addressing any technological problems that are associated with agricultural production (Sokhulu, 2021). Furthermore, the lecturers could also gain the current training competency to excel when integrating technology during training because excelling in using the advanced technologies helps to prepare the lecturers to acquire the knowledge and the skills of integrating technology (De Vera, Andrada, Bello & De Vera, 2021). With these views, it seemed fitting for the researcher to investigate the use of advanced technology integration as a current training need to be implemented in the learning of programmes including in agriculture. The Limpopo TVET colleges are lacking the advanced technologies due to the lack of funds to purchase the modern resources, equipment and infrastructure that could help to implement the integration of agricultural learning technologies. Due to a lack of training and skills to apply advanced technology, the situation may also have an effect on the lecturers' ability to impart new knowledge and skills.

METHOD

This quantitative study is based on the positivist research paradigm. The positivist framework and techniques were used in this quantitative research to collect numerical data so that the evidence can be presented quantitatively (Neuman, 2003; Sarantakos, 2005). The positivism paradigm studies are frequently associated with quantitative approaches, in which the empirically based findings are drawn from large sample sizes. The positivist paradigm's ontology and empiricist epistemology require objective research methodology because the focus is on measuring the variables and testing the hypotheses that are related to the general explanations of cause and effect

(Sarantakos, 2005; Marczyk, DeMatteo & Festinger, 2005). The positivists, therefore, emphasise the use of quantitative data to remain detached from the research process and to uncover the social trends and the correlations that are generalisable to society.

Participants

The Limpopo province has seven public TVET colleges, of which three offer agricultural programmes. This study purposively and conveniently sampled three of these TVET college campuses because the researcher believed that the participants were information-rich (Green & Thorogood, 2018). The chosen campuses offer several agricultural programmes and they were thought to be an invaluable source of information for this study. It should be noted that there was not a large number of responses from the agriculture students, despite the fact that the respondents were expected to range between 400 and 500 students on average. The participants who completed the survey were students who enrolled in the National Certificate Vocational [(NC(V)] program under primary agriculture, and the National Accredited Technical Education Diploma (NATED) program courses in farm management.

The survey of the agriculture students was drawn from a PhD study on the challenges of integrating innovative technological approaches in the learning of agricultural programmes in the TVET colleges. This study was descriptive in nature and it used the quantitative analysis to answer the research question which was designed from the framework: How have the TVET colleges that offer agricultural programmes evolved in terms of learning? This article reports on a Limpopo Province case study as guided by Kotrlik-Redmann's (2003) theory of integrating technology. All the participants were informed prior to the data collection process that participation in this study was voluntary and that they would not be forced or threatened if they did not participate (Vanclay, Baines & Taylor, 2013). The survey's purpose was stated, and the potential participants were assured that their data would be treated confidentially and anonymously in accordance with the ethics' approval.

Data collection

The participants were invited to answer closed-ended questions during class or after the class presentation, which was also part of the research instruments for the PhD study. Although this article used a case design because it used survey instruments to collect data from agriculture students, the students were given survey questionnaires for each of the classes that were visited for lesson observation, and the process was made possible with the assistance of their lecturers. A closed-ended question was designed for the students to only accept one possible response as an answer. According to Zhang, Huang, Yang, Yu and Zhuang (2022), closed-ended questions elicit specific facts and an answer of "yes" or "no" from the respondents. The closed-ended questions were designed in such a way that the participants would mark the relevant boxes with an 'X'. Following the ethics approval, the survey was distributed to the students after the researcher visited their TVET colleges. The questionnaire was adapted from Kotrlik-Redmann's (2003) theoretical framework, which included four distinct and independent phases: the exploration of technology integration; the experimentation with technology integration; the adoption of technology integration; and advanced technology integration. According to Büyüköztürk, Kılıç Çakmak,

Akgün, Karadeniz and Demirel (2015), member checking should be done for reliability, and more than one peer reviewers, reviewed this research data to strengthen the validity of this quantitative research. In view of this, two researchers examined the data to ensure the reliability of the study.

Data analysis

The students' responses were imported into a statistical software for Excel called ANOVA. The system analysed data according to the four distinct and independent phases about the current training needs in the learning of agricultural programmes in the TVET colleges. Prior to the data analysis, the researcher entered the questionnaire data into the system by entering the data into a spreadsheet and by coding the participants' responses into numeric form using the Likert scale of 1–3. In this study, the ANOVA system calculated the analysis of variance for many different queries. Generally, ANOVA is used to statistically determine if the sample means are significantly different sources of variation (Mouritsen, Davis & Jones, 2016). Tables were used to present and discuss the survey results in the next section.

RESULTS AND DISCUSSION

The results from the survey instrument were brought together to answer a research question probing the evolution of agricultural programmes towards learning in the TVET colleges. The first section presents the students' biographical data in Section A of the questionnaire and their associations with the variables. The second presentation is about Section B, where the participants answered the questions according to a theoretical framework that included four distinct and independent phases: an exploration of technology integration; experimentation with technology integration; adoption of technology integration; and advanced technology integration.

Students' biographical data

Table 1 shows that there were 284 (59%) females and 198 (41) male respondents. A total of 29 (6%) of the respondent's ages ranged between 16 and 19, 441 (91%) respondent's ages ranged between 20 and 30 years, 11 (2%) participants belonged to another age, and 1 (0,2%) participant had an unknown age, as shown in Table 1. About 481 (99,79%) of the respondents were Africans by race, with 1(0,21%) being of another race; 169 (35%) participated in the NATED, and 313 (64%) participated in the NC(V) program. Table 1 shows the students demographic statistics.

Table 1. The students' biographical data.

Variable	Description	Frequency	Percentage
GENDER	Females	284	59%
	Males	198	41%
	Total	**482**	**100%**
AGE	16-19	29	6%
	20-30	441	91%
	Other	11	2%

	Unknown	1	0,2%
	Total	**482**	**100%**
RACE	African	481	99,79%
	Other	1	0,21%
	Total	**482**	**100%**
PROGRAM	NATED	169	35%
	NC(V)	313	65%
	Total	**482**	**100%**

The biographical data of the students is important in this study because it reveals a specific variable that is associated with either gender or the program. The following section presents the association of gender or the program with the variables including the exploration of technology integration, the experimentation with technology integration, the adoption of technology integration, and advanced technology integration. To determine the association, the results were guided by the scenario that if the p-value is less than 0.05, there is a significant association between a particular variable. The significant associations with the variables are presented in Tables 2 and 3. The groups of females and males were treated differently when presenting and discussing the exploration of technology integration by gender association. The numbering of the items continues on the other presentation and discussion of the theoretical data. Therefore, the first paragraph dwells on the females looking at item 1.1 then it is followed by the males on the same item. The continuity of the data presentation and the discussion would deal with the other variables using the same pattern. The variables to be associated with gender are the exploration of technology integration and experimentation with technology integration as shown in Tables 2 and 3 below:

Table 2. The exploration of technology integration by gender association

Exploration of technology integration			**GENDER**				
			Females	**Males**	**Total**	**Pearson Chi-Square**	**p-value**
1.1 We experience challenges when technology is used during the learning process.	Agree	Count	181	114	295	8.525a	**0,014085**
		% within GENDER	64%	58%	62%		
	Not sure	Count	15	25	40		
		% within GENDER	5%	13%	8%		
	Disagree	Count	87	56	143		
		% within GENDER	31%	29%	30%		
	Total	**Count**	**283**	**195**	**478**		
			GENDER		**Total**		

			Female	Male		Pearson Chi-Square	p-value
1.2 Lack of learning resources has potential harm on the use of technology.	Agree	Count	198	161	359	11.225a	**0,003651**
		% within GENDER	71%	84%	76%		
	Not sure	Count	47	22	69		
		% within GENDER	17%	11%	15%		
	Disagree	Count	33	9	42		
		% within GENDER	12%	5%	9%		
	Total	**Count**	**278**	**192**	**470**		

Table 3. The experimentation with technology integration by gender association

Experimentation with technology integration			**GENDER**				
			Females	**Males**	**Total**	**Pearson Chi-Square**	**p-value**
2.1 Technologies are currently being used to practice agriculture successfully.	Agree	Count	183	126	309	6.024a	**0,049189**
		% within GENDER	67%	66%	66%		
	Not sure	Count	49	23	72		
		% within GENDER	18%	12%	15%		
	Disagree	Count	41	43	84		
		% within GENDER	15%	22%	18%		
	Total	**Count**	**273**	**192**	**465**		

Table 2, item 1.1, indicated that most of the female respondents 181 (64%) agreed that they experience challenges when technology is used during the learning process. However, 15 (5%) of the female respondents indicated that they are not sure whether they experience challenges when technology is used during the learning process, while 87 (31%) disagreed with the statement. Interestingly, when it comes to the group of female respondents (283), the results show that a high percentage face difficulties in exploring the technology that is used during the learning of agricultural programmes.

According to Table 2, item 1.1, many of the male respondents 114 (58%) agreed that using technology in learning presents challenges. The other results indicated that 25 (13%) of the male respondents were not sure whether they experienced challenges when technology was used during the learning process, while 56 (29%) disagreed with the statement. When it comes to the group of male respondents (195), the results show that a high percentage face difficulties in exploring the technology that is used during the agricultural program learning process. Comparing the female and the male groups, it is shocking to discover that the female groups experience challenges when technology is used during the learning process.

This finding is in contrast with Strong, Ho, Odom, and Irby (2013) that the female students accepted the technologies more than the males. However, this could be because the participants were based in a rural area of the Limpopo province. The remaining factor is that this study discovered that even within the groups of females, the exposure to technology remains a challenge for them.

Table 2, item 1.2, indicated that most female respondents 198 (71%) lacked the learning resources that could harm their use of technology. The other results indicated that 47 (17%) of the female respondents were not sure whether they lacked the learning resources that could harm their use of technology, while 33 (12%) disagreed. From the total number of female respondents (278), the results show that a high percentage of female respondents lack the learning resources that could harm their use of technology.

Table 2, item 1.2, indicated that many of the male respondents 164 (84%) lacked the learning resources that could harm their use of technology. The other results indicated that 43 (22%) of the male respondents were not sure whether they lacked the learning resources that could harm their use of technology, while 42 (9%) disagreed. The results show that a high percentage of the male respondents lack the learning resources that could harm their use of technology. The findings show a significant association between gender and the exploration of technology integration among the total number of the male respondents (192). When the male and the female groups are compared, it is surprising to learn that the female groups recognise a lack of learning resources, which could harm their use of technology. This finding is consistent with Almukhambetova and Kuzhabekova's (2020) conclusion that understanding the barriers to women's agricultural transitions is critical because they have important implications for research on gender issues in agriculture education in larger international contexts. However, this study has discovered that the female groups perceive a lack of learning resources as a barrier to the use of technology in the TVET colleges.

Table 3, item 2.1, shows that most of the female respondents 183 (67%) indicated that the technologies are currently being used to successfully practice agriculture. The other results indicated that 49(18%) female respondents were not sure that the

technologies were currently being used to successfully practice agriculture, while 41 (15%) disagreed. From the total number of female respondents (273), the results show that a high percentage of female respondents are familiar with the technologies that are currently being used to successfully practice agriculture.

Table 3, item 2.1, shows that many of the male respondents 126 (66%) indicated that technologies are currently being used to successfully practice agriculture. The other results indicated that 23 (12%) are not sure that technologies were currently being used to successfully practice agriculture, while 49 (18%) disagreed. From the total number of male respondents (192), the results show a significant association between gender and the experimentation with technology integration. When experimenting with technology during the training of agricultural programmes, the female students are more impressed when they realise the technologies that are being used to practice agriculture. Comparing the female and the male groups, it is unusual and interesting that the females can notice the successful technologies and the operations during the agriculture practice. This finding is consistent with Dlamini, Ngwenya, and Dlamini (2004), who claim that the girls have increased aspirations for careers in health and applied sciences, including agriculture, and are therefore more impressed with the kinds of technologies that are used lately. However, this study has discovered that the females are inspired by how the technologies are currently being used to successfully practice agriculture.

The second presentation is about Section B, in which the participants responded to the questions using a theoretical framework. In this section, the authors present the main results of the survey analysis of each of the four distinct and independent phases, and this is followed by a discussion. The study organises each phase into tables, with discussions beginning with Tables 4–7. Table 4 discusses technology integration exploration; Table 5 discusses technology integration experimentation; Table 6 discusses technology integration adoption; and Table 7 discusses advanced technology integration.

The participants in the survey were asked to respond to the questions about the exploration of the technology that is integrated during the evolution of agricultural training programmes. Table 4 displays some percentage of the responses, as well as a summary of the respondents (n = 482) who took the survey. The validity of the students' responses to each variable is determined by the p-value of the Chi-square test which is less than 0.05.

Table 4: Exploration of technology integration

Exploration of technology integration	Agree	Not sure	Disagree	Total

1.3 I am aware of technologies that can be used to teach agricultural education.	65%	24%	11%	100%
1.4 Innovative agricultural technologies are used in teaching and learning.	45%	24%	31%	100%
1.5 There are challenges to incorporating innovative technologies in the teaching and learning of agriculture.	57%	29%	14%	100%
1.6 The use of innovative technologies improves our understanding of what we learn.	81%	11%	8%	100%
Average	**61%**	**20%**	**19%**	**100%**

Anova: Single Factor				
SUMMARY				
Groups	***Count***	***Sum***	***Average***	***Variance***
Agree	6	3,866616	64%	0,016973
Not sure	6	1,102948	18%	0,006688
Disagree	6	1,030436	17%	0,011096

After analysing the students' responses in Table 4, the results in item 1.3 indicated that the students are aware of the technologies to be used for training agricultural programmes. The results indicated that many of the respondents agreed (65%) that they are aware of the technologies that can be used to teach agricultural education compared to those who disagree (11%). A learning program with enough technological resources is likely to bring about the evolution of training agricultural programmes because it is well equipped with resources. Item 1.4's results show that most of the respondents agreed (45%) that innovative agricultural technologies are used in the learning process compared to those that disagreed (31%). Item 1.5's results show that most of the respondents agreed (57%) that there are challenges of incorporating innovative technologies in the teaching and learning of agriculture compared to those that disagreed (14%). Item 1.6's results show that many of the respondents agreed (81%) that the use of innovative technologies improves the understanding of what they learn compared to those that disagreed (11%). The results indicated that a high percentage (64%) of the exploration of technology integration is one of the current training needs in the learning of agricultural programmes.

However, an innovation is more likely to succeed if the technological challenges are addressed to make those technologies available to bring the innovation and evolution of agricultural training programmes to the next level. These findings are consistent with Qurotul, Mukti, Putra, and Untung (2010) assertion that the challenges, such as the lack of skills, knowledge, and training, impede the exploration of technology integration in learning and they may have an impact on the evolution of agricultural training programmes in the TVET colleges.

Table 5: Experimentation with technology integration

Experimentation of technology integration	**Agree**	**Not sure**	**Disagree**	**Total**
2.2 The modern ways of integrating technologies into learning can stimulate the interest of practicing agriculture.	84%	10%	6%	100%
2.3 Learning with innovative technology tools can improve or change the learning process.	92%	6%	2%	100%
Average	**67%**	**14%**	**18%**	**100%**
Anova: Single Factor				
SUMMARY				
Groups	**Count**	**Sum**	**Average**	**Variance**
Agree	5	3,365965	67%	0,04327
Not sure	5	0,71305	14%	0,006846
Disagree	5	0,920985	18%	0,024416

The results in Table 5 shows that experimenting agriculture with technology plays a major role in the evolution of agricultural training programmes in the TVET colleges. A modern way of training with the integration of technology is likely to stimulate the students' interest in engaging and expecting to learn more about the subject. This was also indicated in item 2.2 that 84% of the responses agreed that the modern ways of integrating technologies into learning can stimulate an interest in practicing agriculture compared to those who disagreed (6%). Item 2.3's results show that most respondents agreed (92%) that learning using innovative technology tools can improve or change the learning process compared to those who disagreed (2%). This means that experimenting agriculture with technology is likely to bring the evolution of training agricultural programmes. Therefore, the overall results indicated that a

high percentage (67%) of the experimentation with technology integration contributed to the current training needs in the learning of agricultural programmes. These findings are consistent with those of Meijer, Catacutan, Ajayi, Sileshi and Nieuwenhuis (2015), who argue that innovative technology is essential for experimenting with and for training new skills that are related to agricultural activities.

Table 6: Adoption of technology integration

Adoption of technology integration	**Agree**	**Not sure**	**Disagree**	**Total**
3.1 The available technological resources are used to support the learning process.	73%	12%	14%	100%
3.2 Innovative technologies are applied in agriculture teaching and learning.	45%	33%	22%	100%
3.3 Agriculture training is being provided here without the use of technology.	57%	18%	26%	100%
3.4 Training is still a traditional way without integrating technologies.	57%	25%	18%	100%
3.5 Training programmes require technical upgrades to assist the lecturers to train more effectively.	56%	22%	22%	100%
Average	56%	22%	22%	100%
Anova: Single Factor				
SUMMARY				
Groups	***Count***	***Sum***	***Average***	***Variance***
Agree	8	4,486248	56%	0,02865
Not sure	8	1,772327	22%	0,013583
Disagree	8	1,741425	22%	0,012476

The results in Table 6 show that the adoption of technology integration plays a major role in the evolution of agricultural training programmes in the TVET colleges. Item 3.1 shows that many respondents (73%) agreed that the available technological resources are used to support the learning process, compared to those that disagreed (14%). Item 3.2 means that the adopted technologies must be used to train agriculture, as the results show that most respondents (45%) agreed that innovative technologies are applied in agriculture teaching and learning, compared to those who disagreed

(22%). An Agriculture lecturer who adopts a suitable technological tool is likely to integrate that tool during training. That was also revealed by item 3.3's results, which show that many respondents (57%) agreed that agriculture training is being provided without the use of technology, when compared to those that disagreed (26%). An agriculture lecturer who cannot adopt any technological tool is unlikely to change the current method of training. Item 3.4's results show that many respondents (57%) agreed that training is still done in a traditional way without integrating technologies, when compared to those that disagreed (18%). Item 3.5's results show that most respondents (56%) agreed that the training programmes require technical upgrades to help the lecturers to train more effectively, when compared to those who disagreed (22%). Adopting technology for training is likely to shift the method of learning to a new method that incorporates technology. The results indicated that a high percentage (56%) of the adoption technology integration contributed to the current training needs in the learning of agricultural programmes. These findings are consistent with Moloi and Salawu (2022) who highlight that the most important process of meeting the current training needs in the learning of agricultural programmes, is to make appropriate technologies available for adoption to provide revolutionary training.

Table 7: Advanced technology integration

Advanced technology integration	**Agree**	**Not sure**	**Disagree**	**Total**
4.1 The understanding of agricultural programmes is improved when integrating advanced technologies into lessons.	74%	18%	7%	100%
4.2 I become more skilled when there is the advanced integration of technologies in teaching and learning.	78%	13%	9%	100%
4.3 Learning becomes easy if I learn through the integrated advance technologies.	75%	15%	9%	100%
4.4 I am gaining experience in addressing the real technological problems that are associated with agricultural production.	70%	18%	13%	100%
4.5 The technical changes increase performance in training programs.	74%	18%	8%	100%
Average	**74%**	**17%**	**9%**	**100%**
Anova: Single Factor				
SUMMARY				
Groups	*Count*	*Sum*	*Average*	*Variance*
Agree	5	3,713694	74%	0,000897

Not sure	5	0,825729	17%	0,000488
Disagree	5	0,460577	9%	0,000436

The results in Table 7 show that advanced technology integration plays a major role in the evolution of agricultural training programmes in the TVET colleges. Item 4.1 means that the use of advanced technology improves training, as many respondents (74%) agreed that the understanding of agricultural programmes is improved when integrating the advanced technologies into the lessons compared to those that disagreed (7%). When the students are trained with advanced technology, their knowledge and skills are more likely to improve than when they are trained without technology integration. Item 4.2's results show that the majority of respondents (78%) agreed that they become more skilled when there is the advanced integration of technologies in the learning process compared to those that disagreed (9%). Item 4.3's results indicated that the majority of respondents (75%) agreed that learning becomes easier if they learn through integrating advanced technologies, compared to those that disagreed (9%). The training that incorporates advanced technology is likely to impart current knowledge and skills. Item 4.4's results show that many respondents (70%) agreed that they gain experience in addressing real technological problems that are associated with agricultural production compared to those that disagreed (13%). Item 4.5's results show that the majority of the respondents (74%) agreed that the technical changes increase the performance in the training programmes compared to those that disagreed (8%). The overall results indicated that a high percentage (74%) of the advanced technology integration contributed to the current training needs in the learning of agricultural programmes. These findings are in accordance with those of Jung, Maeda, Chang, Bhandari, Ashapure, and Landivar-Bowles (2021) that the use of advanced technology not only helps to evolve training, but it also improves the understanding of how agriculture should be practiced now.

The issue of conducting an analysis on each group was critical because the researcher wanted to closely examine the associated variable with gender and reach a conclusion. Even though the female groups are entering the agricultural programmes, within their groups, they still need to find a way to accelerate their interest in the technologies that are integrated into agriculture. When it comes to the males, they should participate in agriculture as well because they are dominant, but they should be aware of any challenges occurring in the so-called "man's dominant field," which is agriculture. In general, both groups (females and males) have more females in other programs, and this could be improved if females are given a chance to accelerate their interest in agriculture. Furthermore, because the males outnumber the females in agriculture, the males are more likely to dominate. Now that we know the challenges at hand, the study concludes in line with the framework below.

CONCLUSION

The study looked into the current training needs in agricultural program learning in TVET colleges. The findings of this study revealed that the evolution of training for agricultural programmes should include phases such as the exploration of technology integration, the experimentation with technology integration, the adoption of technology integration, and advanced technology integration. Firstly, the study found that the phase of exploration of technology integration as the current training needs in agricultural program learning is hampered by challenges such as the lack of skills, knowledge, and training to integrate technology. The survey revealed that a lack of learning resources affects the use of technology during agriculture training. For example, the students indicated that they experience challenges when technology is used during teaching and learning. Secondly, the study found that the phase of experimentation with technology integration has been successfully implemented because technologies are currently being used to practice agriculture. The survey revealed that the agriculture lecturers use technological tools frequently when training the students. For example, the students indicated that learning using innovative technology tools improved or changed the learning process and it stimulated their interest in practicing agriculture. Thirdly, the study found that the phase of the adoption of technology integration was used to support the learning process. The survey revealed that no suitable integration of technologies is used in the practice of agriculture. For example, the students indicated that training is still done in a traditional way without integrating the technologies in some learning activities. Lastly, the study found that the phase of advanced technology integration is being faced in the agricultural program to improve skills, experience, and performance. For example, the students indicated that learning becomes easier through the integration of advanced technologies.

RECOMMENDATION

The study recommends that the challenges such as the lack of skills, knowledge, and training to integrate technology should be addressed to embrace the evolution of agricultural training programs. This will allow the TVET lecturers to use the advanced training technologies in agricultural programmes. This study adds new knowledge to the understanding of the association between the variables, including the exploration of technology integration and experimentation with technology integration by gender. Future research should look into the association between programs during the integration of agricultural technologies.

ACKNOWLEDGMENT

The authors would like to thank the agricultural lecturers at all TVET colleges in the Limpopo Province who took part in this PhD study. The authors also express their appreciation to all the volunteers who were willing to contribute for the findings in this study to be attained.

Declaration of interests

The researchers declare no conflict of interests.

REFERENCES

Aina, A. Y., & Ogegbo, A. A. (2022). Investigating TVET college educators' experiences while transitioning from the traditional classroom to the virtual classroom during the

COVID-19 pandemic. *Perspectives in Education*, *40*(1), 129-142. DOI: 10.1109/ICSTSN53084.2022.9761354

Aker, J. C. (2011). Dial "A" for agriculture: a review of information and communication technologies for agricultural extension in developing countries. *Agricultural economics*, *42*(6), 631-647. https://doi.org/10.1111/j.1574-0862.2011.00545.x

Alam, A. (2022, March). Educational robotics and computer programming in early childhood education: A conceptual framework for assessing elementary school students' computational thinking for designing powerful educational scenarios. In *2022 International Conference on Smart Technologies and Systems for Next Generation Computing (ICSTSN)* (pp. 1-7). IEEE. DOI: 10.1109/ICSTSN53084.2022.9761354

Almukhambetova, A., & Kuzhabekova, A. (2020). Factors affecting the decision of female students to enrol in undergraduate science, technology, engineering and mathematics majors in Kazakhstan. *International Journal of Science Education*, *42*(6), 934-954. https://doi.org/10.1080/09500693.2020.1742948

Antony Jacob, M. J. (2012). The genesis and evolution of Community Colleges in Papua New Guinea. DOI:10.1108/S1479-3679(2012)0000017017

Balsmeier, B., & Woerter, M. (2019). Is this time different? How digitalization influences job creation and destruction. *Research policy*, *48*(8), 103765. https://doi.org/10.1016/j.respol.2019.03.010

Bradford, J. S. (2017). College choice: Perceptions of first-year students in the College of Agricultural Sciences and Natural Resources at Oklahoma State University (Master's thesis). Stillwater, OK: Oklahoma State University. https://hdl.handle.net/11244/49049

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using ICT*, *8*(1).

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş. & Demirel, F. (2015). Bilimsel araştırma yöntemleri [Scientific research methods]. Ankara: Pegem Akademi [Pegem Academy].

Chang, V., Baudier, P., Zhang, H., Xu, Q., Zhang, J., & Arami, M. (2020). How Blockchain can impact financial services–The overview, challenges and recommendations from expert interviewees. *Technological forecasting and social change*, *158*, 120166.

Chirumalla, K. (2021). Building digitally-enabled process innovation in the process industries: A dynamic capabilities approach. *Technovation*, *105*, 102256. DOI: 10.1016/j.techfore.2020.120166

Coley, M. D., Warner, W. J., Stair, K. S., Flowers, J. L., & Croom, D. B. (2015). Technology usage of Tennessee agriculture teachers. *Journal of Agricultural Education*, *56*(3), 35-51. doi: 10.5032/jae.2015.03035

Dakhi, O., Jama, J., & Irfan, D. (2020). Blended learning: a 21st century learning model at college. *International Journal Of Multi Science*, *1*(08), 50-65.

De Vera, J. L., Andrada, M. D., Bello, A., & De Vera, M. G. (2021). Teachers' competencies in educational technology integration on instructional methodologies in the new normal. *Lukad: An Online Journal of Pedagogy*, *1*(1), 61-80.

Dlamini, M. P., Ngwenya, S. S., & Dlamini, B. M. (2004). Reasons girls choose agriculture or other science and technology programs in Swaziland. DOI:10.5191/jiaee.2004.11308

Downes, J. M., & Bishop, P. (2012). Educators engage digital natives and learn from their experiences with technology: Integrating technology engages students in their learning. *Middle School Journal*, *43*(5), 6-15.

Freer, T. J. (2015). Modernizing the agricultural education and training curriculum. *Pp1-25. Place Published*.

García-Morales, V. J., Garrido-Moreno, A., & Martín-Rojas, R. (2021). The transformation of higher education after the COVID disruption: Emerging challenges in an online learning scenario. *Frontiers in psychology*, *12*, 616059. https://doi.org/10.3389/fpsyg.2021.616059

Goh, E., & Sigala, M. (2020). Integrating Information & Communication Technologies (ICT) into classroom instruction: teaching tips for hospitality educators from a diffusion of innovation approach. *Journal of Teaching in Travel & Tourism*, *20*(2), 156-165. DOI:10.1080/15313220.2020.1740636

Green, J. & Thorogood, N. (2018). Qualitative methods for health research. London Sage.

Henderson, M., Selwyn, N., & Aston, R. (2017). What works and why? Student perceptions of 'useful'digital technology in university teaching and learning. *Studies in higher education*, *42*(8), 1567-1579. https://doi.org/10.1080/03075079.2015.1007946

Herren, C. D. (2005). Perceptions of influences on college choice by students enrolled in the College of Agricultural Sciences and Natural Resources at Oklahoma State University (Masters thesis). Stillwater, OK: Oklahoma State University.

Jung, J., Maeda, M., Chang, A., Bhandari, M., Ashapure, A., & Landivar-Bowles, J. (2021). The potential of remote sensing and artificial intelligence as tools to improve the resilience of agriculture production systems. *Current Opinion in Biotechnology*, *70*, 15-22. https://doi.org/10.1016/j.copbio.2020.09.003

Jurgens, J. C. (2010). The evolution of community colleges. *College Student Affairs Journal*, *28*(2).

Kotrlik, J. W., Redmann, D. H., & Douglas, B. B. (2003). Technology integration by agriscience teachers in the teaching/learning process. *Journal of Agricultural Education*, 44(3), 78– 90. doi:10.5032/jae.2003.03078

Kpolovie, P. J., Joe, A. I., & Okoto, T. (2014). Academic achievement prediction: Role of interest in learning and attitude towards school. *International Journal of Humanities Social Sciences and Education (IJHSSE)*, *1*(11), 73-100.

Kwon, K., Ottenbreit-Leftwich, A. T., Sari, A. R., Khlaif, Z., Zhu, M., Nadir, H., & Gok, F. (2019). Teachers' self-efficacy matters: Exploring the integration of mobile computing device in middle schools. *TechTrends*, *63*, 682-692. https://doi.org/10.1007/s11528-019-00402-5

Li, S., Yamaguchi, S., Sukhbaatar, J., & Tamada, J. I. (2019). The influence of teachers' professional development activities on the factors promoting ICT integration in primary schools in Mongolia. *Education Sciences*, *9*(2), 78. https://doi.org/10.3390/educsci9020078

Marczyk, G., DeMatteo, D. & Festinger, D. (2005), "Essentials of Research Design and Methodology". New Jersey. John Wiley and Sons, Inc

McLaughlin, K. (2018). Kazakhstan Country Gender Assessment. Asian Development Bank; Gender and Youth Employment in the Commonwealth of Independent States: Trends and Key Challenges. The Decent Work Technical Support Team and the ILO Office for Eastern Europe and Central Asia. https://doi.org/10.3390/educsci9020078

Meijer, S. S., Catacutan, D., Ajayi, O. C., Sileshi, G. W., & Nieuwenhuis, M. (2015). The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa. *International journal of agricultural sustainability*, *13*(1), 40-54. DOI:10.1080/14735903.2014.912493

Moloi, T., & Salawu, M. (2022). Institutionalizing Technologies in South African Universities towards the Fourth Industrial Revolution. *International Journal of Emerging Technologies in Learning (iJET)*, *17*(3), 204-227. DOI: https://doi.org/10.3991/ijet.v17i03.25631

Mouritsen, M. L., Davis, J. T., & Jones, S. C. (2016). ANOVA Analysis of Student Daily Test Scores in Multi-Day Test Periods. *Journal of Learning in Higher Education*, *12*(2), 73-82.

Mtshali, T. I., & Msimango, S. M. (2023). Factors Influencing Construction Technology Teachers' Ability to Conduct Simulations Effectively. *Jurnal Penelitian dan Pengkajian Ilmu Pendidikan: e-Saintika*, *7*(1), 88-102. https://doi.org/10.36312/esaintika.v7i1.1079

Neuman, W.L. (2003), "Social Research Methods: Qualitative and Quantitative Approaches" (5th ed.). Boston: Allyn and Bacon.

Pierpaoli, E., Carli, G., Pignatti, E., & Canavari, M. (2013). Drivers of precision agriculture technologies adoption: a literature review. *Procedia Technology*, *8*, 61-69. DOI:10.1016/j.protcy.2013.11.010

Pitikoe-Chiloane, G. M., de Jager, T., & White, C. (2022). The Application of Technology-Assisted Teaching Methods by Engineering TVET College Lecturers to Promote Academic Success. *The International Journal of Learning in Higher Education*, *29*(2), 55. DOI: https://doi.org/10.18848/2327-7955/CGP/v29i02/55-70

Qurotul Aini, Q. A., Mukti Budiarto, M. B., POH Putra, P. O. H., & Untung Rahardja, U. R. (2020). Exploring e-learning challenges during the global COVID-19 pandemic: A review. *Jurnal Sistem Informasi (Journal of Information System)*, *16*(2), 47-65.

Ray, P. P. (2017). Internet of things for smart agriculture: Technologies, practises and future direction. *Journal of Ambient Intelligence and Smart Environments*, *9*(4), 395-420.

Sarantakos, S. (2005), "Social Research". (3rd ed.). Melbourne: Macmillan Education. https://doi.org/10.2466/17.CP.4.1

Singh, K., Peshin, R., & Saini, S. K. (2010). Evaluation of the agricultural vocational training programmes conducted by the Krishi Vigyan Kendras (Farm Science Centres) in Indian Punjab. *Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS)*, *111*(2), 65-77. http://nbn-resolving.de/urn:nbn:de:hebis:34-2010091334536

Sokhulu, L. H. (2021). Students' experiences of using digital technologies to address their personal research needs during the COVID-19 lockdown. *African Identities*, *19*(4), 436-452. DOI:10.1080/14725843.2020.1801384

Strong, R., Ho, S. P., Odom, S. F., & Irby, T. L. (2013). A course focused on the critical issues in agriculture: Students' acceptance and use of mobile learning. *NACTA Journal*, *57*(4), 57-64.

Taimalu, M., & Luik, P. (2019). The impact of beliefs and knowledge on the integration of technology among teacher educators: A path analysis. *Teaching and teacher Education*, *79*, 101-110.

Tian, H., Wang, T., Liu, Y., Qiao, X., & Li, Y. (2020). Computer vision technology in agricultural automation—A review. *Information Processing in Agriculture*, *7*(1), 1-19. https://doi.org/10.1016/j.inpa.2019.09.006

Trukhachev, V., Bobrishev, A., Khokhlova, E., Ivashova, V., & Fedisko, O. (2019). Personnel training for the agricultural sector in terms of digital transformation of the economy: Trends, prospects and limitations. *International Journal of Civil Engineering and Technology*, *10*(1), 2145-2155.

Valeau, E. J., & Raby, R. L. (2018). Community colleges and global counterparts as evolving forms. Handbook of comparative studies on community colleges and global counterparts, 1-13. DOI:10.1007/978-3-319-50911-2

Vanclay, F., Baines, J. T. & Taylor, C. N. (2013). Principles for ethical research involving humans: ethical professional practice in impact assessment Part I. *Impact Assessment and Project Appraisal*, 31(4), 243-253. https://doi.org/10.1080/14615517.2013.850307.

Volery, T. (2000). Critical success factors in online education [Electronic version]. *The International Journal of Educational Management*, 14 (5), 216-223. https://doi.org/10.1108/09513540010344731

Zhang, L., Huang, Y., Yang, X., Yu, S., & Zhuang, F. (2022). An automatic short-answer grading model for semi-open-ended questions. *Interactive learning environments*, *30*(1), 177-190. DOI:10.1080/10494820.2019.1648300

Zinn, B., Raisch, K., & Reimann, J. (2019). Analysing training needs of TVET teachers in South Africa: An empirical study. *International journal for research in vocational education and training*, *6*(2), 174-197. DOI: 10.13152/IJRVET.6.2.4

The Evolution of Agricultural Programs Towards Learning: A Look into Gender Disproportions in TVET Colleges

ORIGINALITY REPORT

5%	2%	4%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Ramongwane Daniel Sephokgole, Moses Makgato, Sylvia Manto Ramaligela. "The Impact of Contextual Factors on Learning of Agricultural Programmes in Technical and Vocational Education Training Colleges, South Africa", International Journal of Learning, Teaching and Educational Research, 2021 Publication	3%
2	Submitted to Tshwane University of Technology Student Paper	1%
3	aaaeonline.org Internet Source	1%
4	www.researchgate.net Internet Source	1%
5	journals.ufs.ac.za Internet Source	1%

Exclude quotes	Off	Exclude matches	< 1%
Exclude bibliography	On		