Effect of using agricultural teaching resources on the acquisition of agricultural skills by certificate in agriculture trainees in technical institutions in the Western Kenya region

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ABSTRACT

There exists a positive relationship between agricultural productivity and the quality of agricultural education offered in learning institutions of a country. However, increasing agricultural productivity has been limited by access to quality extension services and the failure of farmers to embrace new farming technologies. The purpose of this study was to determine the effects of agricultural teaching resources on the acquisition of agricultural skills by certificate agriculture trainees in technical training institutions in Western Kenya. The methodological behaviorism theory guided the study, assuming that all the resources considered as the source of stimuli were available to the learners. The study employed cross-correlational study designs. A stratified random sample of 269 certificates in agriculture trainees from 12 TVET institutions in western Kenya were proportionally selected from a sampling frame of 890 trainees. A pretested questionnaire and a key informant interview guide were used to collect data. The data were analyzed using both descriptive (percentages, means, modes, and standard deviations) and inferential statistics (regression analysis, ANOVA, chi-square, and t-test) with the aid of the Statistical Package for Social Sciences (IBM SPSS version 26) software. The results show that the level of agricultural skills acquired by certificate in agriculture trainees in TVET institutions was of medium level (M=3.13, SD=.253) on a scale of 0 to 5. The level of acquired agricultural skill by the trainees was positively affected by the use of demonstration farms (β=.527, t=10.12, p <.001), use of agricultural workshops (β=.457, t=22.33, p <.001), use of agricultural laboratories (β=.807, t=22.33, p <.001), and use of agricultural libraries (β=.509, t=22.33, p <.001). The teaching resource that was highly utilized by the TVET institutions was demonstration farms (M=4.02, SD=.43), followed by agricultural workshops (M=2.94, SD=.29). The study concluded that all four teaching resources were useful in skill development. The study recommended that there be a need to equip and improve the quality of the teaching resources and train instructors in TVET institutions to enhance their use of technology and enable them to transfer agricultural skills to the certificate in agriculture trainees.

Keywords: Agricultural Skills, Certificate Agriculture Trainees, Teaching Resources, TIVET Institutions

I. INTRODUCTION

Globally, the focus in the agriculture sector currently is to attain Sustainable Development Goal (SDG) 2 of ensuring sustainable food production systems by implementing resilient agricultural practices that increase agricultural productivity (Hiywotu, 2025). This is possible through trans-formative principles of environmental sustainability and use of modern agricultural practices. Complementing the SDG 2 aspiration, the Food and Agricultural organization (Ghosh & Braun, 2020) has recommended value addition in food systems, protection and enhancing of natural resources to improve livelihoods and foster inclusive economic growth (Ghosh &Braun, 2020). However, increasing agricultural productivity has been limited by access to farming advisory services, limited resources and failure of farmers to embrace new farming technologies (Ghosh &Braun, 2020). This problem is prevalent in the developing countries and particularly in the African countries often blamed on few agriculture extension officers or poorly trained agricultural extension officers.

In Africa, agriculture accounts for two thirds of livelihoods and food accounts for two thirds of the household budgets (Yeboah & Jayne, 2017). The problems of food insecurity compounded by seasonality of food production, has necessitated the development of new agricultural productive techniques. Whereas many Sub- Saharan Africa (SSA) countries including Kenya rely on agricultural exports like coffee, tea, fresh produce and animal products for their Gross Domestic product (GDP), the United Nations Conference on Trade and Development (UNCTAD) report showed that many of these countries are net importers of food, with the region spending an estimated $65 billion on food imports in 2017 (Canton, 2021).The limiting factor in the food production in these countries has been the reliance on subsistence farming which is less efficient in providing adequate food for the high populations in the African countries.

One of the means by which agricultural productivity can move from subsistence to commercial productivity is by adoption of new technologies through provision of modern agricultural education and skills (Yeboah & Jayne, 2017). Many countries in Africa have made agricultural-related subjects and courses mandatory starting from primary schools through secondary (high schools) to higher institutions of learning. This is in efforts to improve agriculture skills to the learners and ultimately the quality and quantity of produce in the agricultural sector (Ghosh and Braun, 2020). In Kenya, one of the main strategies to increase agricultural productivity has been in training of agriculture extension officers and the adoption of technologies by farmers (Williams et al, 2019). This training is carried out in the technical training institutes. The technical institutes are collectively referred to as Technical and Vocational Education and Training (TVET) institutions and are regulated by Technical and Vocational Education and Training Authority (TVETA).

The goal of technical training institutions in Kenya to produce high performing graduates with higher level of skills and expertise who can provide practical skills to farmers. The trainees in technical training institutions who qualify to be awarded certificates in agriculture end up as Agricultural Extension Officers providing practical skills and extension services to farmers. These extension officers need to be competent both in theory and practical skills since they deal directly with farmers (GOK, 2018). In effect, the agricultural training institutions require teaching resources to ensure trainees master practical skills in the agriculture subject before being released to work in the field and industry (Onu, 2013). Some of these teaching resources include the human resources, Crop Samples and Plant Specimens, Livestock Models, Agricultural Laboratories, Demonstration farms, Soil and Water Quality Testing Kits, Farm Machinery and Tools, Horticultural and Aquacultural Demonstrations, Compost and Vermicompost Demonstrations.

This study sought to establish the effect of agricultural teaching resources on the acquisition of agricultural skills by certificate in agriculture trainees from TVETs in Western Kenya. Some of the skills that the certificate trainees should acquire include the following: Land Preparation Skills, Crop husbandry, Harvesting, Crop storage, Animals Management Skills, Aquaculture Pond/tank use and maintenance, Greenhouse use and maintenance skills among others. Western Kenya is made up of four Counties (Kakamega, Bungoma, Busia and Vihiga). Western Kenya has a rich agricultural potential (Suitable soils and rainfall amounts) that can support the Kenya Governments' aspiration of attaining food security for the country. However, the food productivity of the region has not substantially changed over the past 10 years. The four counties have a total of 71 TIVET institutions (both private and public) of which, TVET institutions offering agriculture courses at Certificate and Diploma level are 36, with an estimated population of 1,300 diploma students and 3000 certificate students, with 600 instructors (NCA, 2016). There are an estimated 600 certificate trainees who graduate annually from these institutions.

1.1 Statement of the Problem

The Government of Kenya has heavily invested in the technical education by equipping TVET institutions with required materials and equipment. This is aimed at equipping trainees with required quality skills to improve economic productivity in all sectors including the agricultural sector. The TVET Institutions that train agriculture students acquire and engage wide range of Instructional resources to ensure that trainees acquire agricultural skills by the end of the course. The level of skills acquired by the trainees is usually assessed by the Kenya National Examination Council (KNEC) Examination at the end of the course. The examinations for the agriculture TVET trainees are mainly practical in nature and require the trainees to demonstrate a mastery of agricultural skills. Skill acquisition by the trainees depends much on exposure and use of the Agricultural teaching resources. Despite heavy Government investment of resources in TVET institutions, analysis of KNEC results for the Certificate in Agriculture trainees over the last four years shows downward trend in student performance (KNEC, 2016, 2017, 2018, 2019). Students scoring quality grades (credits) in the examined units reduced with a majority (more than 90%) of the candidates scoring only pass grades in the units taken. The overall mean scores for the certificate in Agriculture shows a high proportion of the students (12%) being either having been referred to retake some failed units or having failed (Score of F)- (KNEC, 2016, 2017, 2018, 2019). These graduates (who have scored poorly in the Agricultural production techniques and skills) end up being employed by the government to provide the most needed extension services to farmers. This likely to be one of the factors limits famers agricultural productivity and hampers the achievement of the government aspirations of vision 2030 and SDG 2 of elimination of hunger by production of adequate food supplies. It is still not clear if the problem is the caliber of students selected for the course, the teaching strategies employed in the TVET institutions or exposure of the trainees to practical skills. This study therefore evaluated the effect of Agricultural teaching resources on the acquisition of agricultural skills by trainees in technical Institutions in Kenya.

1.2 Research Hypothesis

The hypothesis of the study was 'Exposure and use of Agricultural teaching resources in training has no effect on the acquisition of agricultural skills by certificate trainees in technical institutions in Western Kenya.

II. LITERATURE REVIEW

2.1 Theoretical Review

This study was guided by the methodological behaviorism theory. Methodological behaviorism began as a reaction against the introspective psychology that dominated the late 19th and early 20th centuries. Methodological behaviorists such as Watson and Skinner argue that the presence of a stimulus coupled with reinforcement makes learning more effective (Deegan et al, 2016). From a behaviorist perspective, the transmission of information from teacher to learner is essentially the transmission of the response appropriate to a certain stimulus. Thus, the point of education is to present the student with the appropriate repertoire of behavioral responses to specific stimuli and to reinforce those responses through an effective reinforcement schedule.

Behaviorists such as J. B. Watson and B. F. Skinner focused on objectively observable, quantifiable events and behavior. They argued that since it is not possible to observe objectively or to quantify what occurs in the mind, scientific theories should take into account only observable indicators such as stimulus-response sequences. Behaviorists such as Watson and Skinner construe knowledge as a repertoire of behaviors (Hermans *et al,* 2015). Skinner argues that it is not the case that we use knowledge to guide our action; rather, ‗knowledge is action, or at least rules for action'. Behaviorist teaching methods tend to rely on so-called skill and drill 'exercises to provide the consistent repetition necessary for effective reinforcement of response patterns. Other methods include question (stimulus) and answer (response) frameworks in which questions are of gradually increasing difficulty; guided practice; and regular reviews of material (Deegan et al, 2016).

This theory is useful to this study, particularly in the use of learning resources. When the trainee learners in the TVET institutions observe, they are stimulated, and if the responses are reinforced for the behavior and the events leading to a particular behavior, they remember the sequence of events and use this information to guide subsequent behaviors. Observing can also prompt the trainees to engage in behavior they already learned but had no opportunity of practicing. However, this theory assumes that all the resources, which are considered as the source of stimuli are available to the learners, which may not be the case.

2.2 Empirical Review

Skill can be defined as the learned ability to perform an action with determined results with good execution often within a given amount of time, energy, or both (Meciej, 2021). Skill is viewed as the ability to do a particular task well, and a skilled individual is one who has acquired much competency in performing a particular task. Agricultural Skills or expertise can be acquired through training and experience. Training is the process of organization of opportunities for participants to acquire necessary understanding and skill (Lynton & Pareek, 1990).

The linkage between use of teaching resources and imparting skills to learners is varied. Factors that influence the use of these teaching resources and the performance of students taking agriculture course are numerous and are also affected by other intervening factors such as availability of funds, education policy, and instructor motivation to use the resources among others. In the teaching of agriculture, multiple elements contribute both to the process of learning and to the contextual factors that enable this learning (Coudel *et al.,* 2011; Leeuwis, 2004). Medema *et al.* (2014), for example, identified content actors, context factors (external and internal), process factors and individual attributes as key drivers and conditions that facilitate multi-loop social learning; while, from a different perspective, Coudel *et al.*, *(*2011)described the many components that influence the who, what, and why of individual learning.

From the point of view of enabling learners to achieve objectives (skills), there is a need to examine and understand the nature of the different forms of learning. From one perspective learning is fundamentally about achieving individual short-term change, specifically the act or process by which behavioral change, knowledge, skills, and attitudes are acquired (Knowles *et al.*, 1998). In the context of agriculture, this is often achieved by providing information through different formats to help learners and farmers improve management practices and increase productivity and profitability. From other perspectives learning is more about building capacity, putting in place the capacities for learning, this can be at an individual or group level. With respect to individuals this can be in terms of providing triggers for change, improving analytical skills, critical thinking, the ability to make better decisions, and familiarity with practices; while at a group level it can happen by formulating networks and exposing participants to debate and others' ideas (Waddington *et al.*, 2014). At this deeper level, empowerment and enhanced capacity to learn are seen as indicative of improved and more trans-formative learning (Percy, 2005; Duveskog *et al.*, 2011). But all these are affected by the entry behavior of the learners.

Globally, the key knowledge gaps in agricultural skill acquisition by TVET trainees identified include: insufficient practical experience provided to TVET trainees as most programmes are theoretical; limited exposure of trainees to modern farming technologies; lack of training in entrepreneurial skills, such as business planning, marketing, and financial management; and outdated training curriculum, failing to incorporate the latest research findings and best practices (Waddington *et al.*, 2014).

A knowledge gap in agricultural skill acquisition persists as aspiring future farmers and trainees appear to lack access to comprehensive and practical training programs that incorporate modern, sustainable farming techniques and technologies. A World Bank report discussed the economic aspects of agriculture and the importance of equipping farmers with the skills needed for sustainable practices (World Bank. 2018). The existing knowledge gap in agricultural skill acquisition and importance of addressing it for sustainable and prosperous agriculture has been highlighted by FAO (Ghosh and Braun, 2020). The acquisition of agricultural skills is important in enhancing sustainable agriculture and achieving food security. Examined the challenges farmers face in accessing agricultural knowledge and proposed strategies to bridge the knowledge gap. Adekunle et al (2015) evaluated the effectiveness of agricultural extension and highlighted the knowledge gaps, which should be addressed in training of agricultural extension staff.

As with other subjects, Barrera-Pedemonte (2016) argues that the quality of agriculture education is strongly dependent on the quality of teachers, a function of their knowledge, mastery of subject content, appropriate teaching methods and professional values. All of which have been shown to be improved by continuous professional development. Investments in training of agriculture teachers/instructors therefore produces the highest increases in learning outcomes compared to other investments aimed at improving learning. The competencies of teachers have been found to matter more than other factors such as school and class size and available physical facilities (Muchiri & Kiriungi, 2015). Institutions in Kenya have slowly been upgrading their staff to at least Master of Science degree level (Indoshi *et al.,* 2010). However, the backlog of staff scheduled for advanced training is large. Most importantly, the staff now have few opportunities for field tours, seminars and workshops through which to update them due to limited financial resources. This has had a negative impact on teacher morale and effectiveness (Akala et al., 2018).

Another factor that has been investigated in Kenya is the level of motivation of the trainees in learning agricultural skills. Lack of employment opportunities for graduates in the public sector since late 1980s has demoralized students (Indoshi *et al.,* 2010). A few have become farmers, but these few are mostly those whose parents own commercial farming enterprises like horticulture or dairy. Despite the slump in the employment opportunities, no follow-up has so far been made on the fate of the graduates. There is yet no clear policy on the desirable number of students to be admitted into agricultural Institutions each year (Akala et al., 2018). The decline in enrolment had not been anticipated, which makes planning for resource allocation to these programmes difficult.

Although the literature on Training in agricultural Education is extensive, it fails to establish the effect of learning resources on performance of trainees in TVET institutions, and more so the acquisition of the necessary agricultural skills.

III. METHODOLOGY

The study was conducted in Western Kenya (Kakamega, Bungoma, Busia and Vihiga counties). Western Kenya has fertile soils and ample rainfall; the region is suitable for agriculture. Majority of the farmers in Western Kenya are small holder farmers; the major crops are maize, beans, bananas, sorghum, millet, cassava and sweet potatoes. The main cash crops include sugarcane, tea, tobacco and cotton. Farmers in this region also keep livestock including cattle, sheep, goats, pigs and local chicken.

The study adopted a correlation research design with a mixed methods approach. This design and approach were preferred because the nature of data the study required (both quantitative and qualitative data) sources to appropriately answer the research question. Using stratified random sampling, western Kenya was first stratified into Counties; from each county, three TVET institutions were randomly selected. From the selected 12 institutions, 269 trainees were then selected proportionately by systematic random sampling using class lists (Table 1). The selected trainees were approached and interviewed using structured questionnaires. Another 28 tutors were also selected purposefully as Key informants for the study. Tutors are involved in the regular teaching using available teaching resources and regular assessment of the trainees. Data from the tutors was collected using Key informant interview guides. The data collection tools were pretested in the neighbouring Kisumu County and attained a reliability coefficient of 0.782. Quantitative data collected was analysed using descriptive statistics, Chi square tests and Regression analysis with aid of the Statistical Package for Social Sciences (SPSS) computer software program Version 27. The qualitative data collected was analysed thematically using the N-Vivo version 14 computer software. The results of the study are presented in narratives, tables and figures. This research study was approved by the Directorate of Postgraduate studies of Masinde Muliro University of Science and Technology and the researcher also obtained a research permit from the National Commission of Science, Technology and Innovation (NACOSTI Permit No: 939024).

Table 1

Proportional Allocation of the Study Sample to the Different TVET Institutions Offering Certificate in Agriculture in Western Kenya

Institution (Strata)	Number of Agriculture Students	Proportional Allocation	Number of Trainees
Sigalagala NP	120	269 (120/890) = 36.2	36
Shamberere TTI	100	269 (100/890) = 30.2	31
Kaimosi TTI	80	269 (80/890) = 24.1	24
Kongoni TTI	40	269 (40/890) = 12.0	12
Kisiwa TTI	120	269 (120/890) = 36.2	36
Sangallo TTI	160	269 (160/890) = 48.3	48
Webuye West TTI	20	269 (20/890) = 6.0	6
Webuye North TTI	60	269 (60/890) = 18.1	18
Musakasa TTI	30	269 (30/890) = 9.0	10
Bunyala TTI	60	269 (60/890) = 18.1	18
Amakoro TTI	60	269 (60/890) = 18.1	18
Sabatia TTI	40	269 (40/890) = 12.0	12
Total	**890**		**269**

IV. FINDINGS & DISCUSSION

4.1 Sociodemographic Factors of the Trainees

The sociodemographic characteristics of the trainees are summarized in Table 2. It was observed from Table 2 most (55.4 %) of the students were males; the sex distribution was not statistically significant (χ^2 =3.126, *df* =1, *p* > 05)**.** Majority (59.9 %) of the students were aged below 23 years; only 7.8 % were aged above 28 years. The mean age was 24years, (SD±3.358) and ranged between 20 and 46. The age difference among the trainees was statistically significant value (χ^2 =398.47, *df*=13, *p*< .001). A Majority (50.9 %) of the students joining the TVET institutions had a mean grade of D (plain) at KCSE level. The distribution in the KCSE grades of the trainees was highly statistically significant value (χ^2 =250.18, *df*=3, *p*< .001). The majority (90 %) of the TVET students had prior knowledge of agriculture as they had taken it as an examinable subject at O' level.

Table 2

Sociodemographic Characteristics of the Trainees

Variable	Category	Count	Frequency	Chi-Square
Sex of Trainee	Male	149	55.4%	χ^2 =3.126
	Female	120	44.6%	df=1
	Total	**269**	**100%**	P=0.077
Age category	20-25years	224	83.3%	
	26-30 years	34	12.6%	χ^2 =686.40
	31-35 years	8	3.0%	*df*=4
	36-40 years	1	0.4%	
	41-50 years	2	0.7%	P=0.001
	Total	**269**	**100%**	
KCSE Grade attained	D-	1	0.4%	χ^2 =250.18
	D	137	50.9%	
	D+	127	47.2%	*df*=3
	C-	4	1.5%	*p*=.001
	Total	**269**	**100%**	
Knowledge of Agriculture Subject	Yes	242	90.0%	χ^2 =171.84
	No	27	10.0%	df=1
	Total	**269**	**100%**	**P= 0.001**

4.2 Sociodemographic Factors of Tutors

The sociodemographic characteristics of the tutors are summarised in Table 3. It was observed from Table 3 that majority (20) 71.4% of the tutors were male. The age of the tutors ranged from 26 years to 49 years with a mean 36.6 (Median 37, Mode 49, SD ±7.58). The age difference among the tutors was not statistically significant (P>0.05). Their teaching experience ranged from 2 years to 7 years with a Mean 4.3 years (Median 4.5, Mode 5, SD ±1.47). The difference in the experience of the tutors was not statistically significant (P>0.05).

Table 3

Sociodemographic Characteristics of Tutors

Variable	Category	Count	Frequency	Chi-Square
Sex of the Tutor	Male	20	71.4%	χ^2 =5.143
	Female	8	28.6%	*df*=1
	Total	**28**	**100%**	*p*=.023
Age category	20-25 Years	8	28.6%	
	26-30 Years	4	14.3%	χ^2 =3.429
	31-36 Years	8	28.6%	*df*=4
	4o-45 Years	4	14.3%	*p*=.001
	46-50 Years	4	14.3%	
	Total	**28**	**100.0%**	
Experience as a tutor	2 Years	4	14.3%	
	3 Years	4	14.3%	χ^2 =4.571
	4 Years	6	21.4%	*df*=5
	5 Years	8	28.6%	*p* > .05
	6 Years	4	14.3%	
	7 Years	2	7.1%	
	Total	**28**	**100.0%**	
Qualification of the tutor	MSc	6	21.4	χ^2 =3.714
	BSc	14	50.0	*df*=2
	Diploma	8	28.6	*p*> .05
	Total	**28**	**100.0**	

4.3 Level of Skills Acquisition by the Certificate Trainees in TVET in Institutions in Western Kenya

The level of acquisition of agricultural skills by trainees was developed as a multi-indicator index. The indicators identified and selected, reflected the acquisition and proficiency of agricultural skills. The trainees were asked to self-rate their level of skill acquisition by relating it to their practical competence in performing the different techniques or activities contained in this list of indicators. The descriptive statistics for the index are given in Table 4.

Table 4

Certificate in Agriculture Trainees Rating of the Acquired Skills in Agriculture

No	Activity/Component	Student Rating of the Skill (0-5)		
		Total	Mean	SD
1	Land Preparation Skills	990	3.68	.400
2	Crop planting skills	1133	4.21	1.15
3	Weed control	1081	4.01	1.03
4	Crop husbandry	975	3.62	.185
5	Harvesting	1135	4.21	.897
6	Crop storage	931	3.46	.498
7	Perennial Crops	1106	4.11	.467
8	Animals Management Skills	857	3.18	.179
9	Aquaculture pond/tank	1017	3.78	.796
10	Greenhouse	290	1.07	.268
	Index of Acquired Agricultural			
	Skills by Trainees	**843.61**	**3.13**	**.253**

Table 4 shows the indicators of the index categorized into a summarized list of land preparation, crop planting, weed control, crop husbandry, harvesting, storage and perennial crops, animal management skills, aquaculture and greenhouse management. The rating of the extent of skill acquisition was based on a 6-point rating scale (0 to 5 points), where 0 indicated no skill was acquired, 1 very low level of skill acquisition, 2 low level of skill acquisition, 3 moderate level of skill acquisition, 4 high level of skill acquisition and 5 very high level of skill acquisition. The scores for the individual indicators were summed up and averaged to give the index.

Mean 3.13± .01, Median 3.0, Mode 2.95, SD .253, Min 2.72, Max 3.56. The index was grouped into six categories (0=No skill, 0-1=very low, 1.01-2=low, 2.01- 3=medium, 3.01-4 high and 4.01-5 very High) and the chi-square test for the equality of categories of the index was performed and the results are shown in Table 5.

Table 5

Chi-square Test for Equality of Categories for the Index of Skill Acquisition in Agriculture

Category	Description	Observed N	Expected N	Residual	Statistics
2.01-3	Medium	116	134.5	-18.5	χ^2 =5.08
3.01-4	High	153	134.5	18.5	*df*=1
Total		**269**			***p*=.024**

The chi-square test (Table 5) revealed statistically (p=.024) significant differences among the different categories of the index of skill acquisition in agriculture by TVET trainees. The category (3.01-4) of the index was statistically significant (χ^2 =5.08, df=1, p= .024) higher than the other categories, indicating a majority of the trainees' skill acquisition was in the level of high.

4.4 Effect of Use of Teaching resources on Agricultural Skill Acquisition by Certificate in Agriculture Trainees

The effect of use of agricultural workshops on the acquisition of agricultural skills by students taking certificate in agriculture course in TVET institutions in western Kenya was determined by examining the use of the following teaching resources; demonstration farms, agricultural education workshops, agricultural laboratories, and agricultural libraries.

4.4.1 Use of Demonstration Farms in Skills Acquisition

The TVET trainees were asked to rate their extent of use of the demonstration farm on a 6-point (0-5), rating scale, where 0 indicated no use of the farm, 1 very low use of the farm, 2 low use of the farm, 3 moderate use of the farm, 4 high use of the farm and 5 very high use of the demonstration farm. The individual rating for each statement was then summed up and averaged to produce the index of demonstration farm use by students. The descriptive statistics for the index are summarized in Table 6

Table 6

Rating of the Use of Demonstration Farms by Certificate in Agriculture Trainees

No	Activity/Component	Total	Mean	SD
1	Learning of different crops	1254	4.66	.838
2	Crop production skills	1036	3.85	.702
3	Pasture and Fodder production	1022	3.79	.808
4	Animal Management	952	3.54	.702
5	Poultry	1100	4.08	1.10
6	Crop harvest and storage	869	3.23	.403
7	Horticulture (fruit, vegetables, spices)	1342	4.99	.812
8	Soil fertility (fertilizer and compost)	1021	3.79	.752
9	Soil and water conservation	608	2.26	.622
10	Irrigation	174	.646	.904
11	Agroforestry and live fences	537	1.99	.714
12	Aquaculture	347	1.29	.845
13	Greenhouse	347	1.29	.845
	Index of Demonstration Farm Use	**1082**	**4.02**	**.434**

Mean 4.02±.026, Median 3.97, Mode 3.98, SD .434, min 2.87, Max 4.97. The extent of use of demonstration farm by the certificate agricultural trainees was found to be of very high (M=4.02. SD=.434) and ranged between 2.87 to 4.97. The reliability index using Cronbach alpha was found to be (α=.887).Further analysis involved the index being

grouped into six categories (0=No use, .01-1= very low, 1.01-2=low, 2.01-3=medium, 3.01-4 high and 4.01-5 very High) and the chi-square test for the equality of categories of the index performed and the results are shown in Table 7.

Table 7

Chi-square Test for Equality of Categories for the Index of Use of Demonstration Farms by Certificate in Agriculture Trainees

Scores	Scale	Observed N	Expected N	Residual	Statistics
2.01-3	Medium	4	89.7	-85.7	χ^2 =128.12
3.01-4	High	148	89.7	58.3	*df*=2
4.01-5	Very high	117	89.7	27.3	*p*=.001
Total		**269**			

It was observed from Table 7 that the chi-square there was a highly statistically (p=.001) significant differences among the different categories of the index of use of demonstration farm by TVET trainees. The category (3.01-4) of the index was statistically significant (χ^2 =128.12, df=2, p= .001) higher than the other categories, indicating the majority of the trainees' use of demonstration farm was in the level of high. The effect of using demonstration farms on the acquisition of agricultural skills was determined by the use of bivariate linear regression analysis. The level of use of demonstration farms formed the independent variable, while the acquisition of agricultural skills was the dependent variable. The results of the regression model summary are shown in Table 8.

Table 8

Regression Model Summary for Use of Demonstration Farms and Skill Acquisition by Certificate Trainees

		Adjusted	Std. Error of the
R	**R square**	**R Square**	**Estimate**
.527[a]	.277	.275	.21548

4.5 Use of Agricultural Workshops in Skills Acquisition

The TVET trainees were asked to rate their extent of use of Agricultural workshops on a 6-point (0-5), rating scale, where 0 indicated no use of the farm, 1 very low use of the farm, 2 low use of the farm, 3 moderate use of the farm, 4 high use of the farm and 5 very high use of the demonstration farm. The individual rating for each statement was then summed up and averaged to produce the index of demonstration farm use by students. The descriptive statistics for the index are summarized in Table 9

Table 9

Descriptive Statistics of the Ratings for the Use of Agricultural Education Workshops by Certificate in Agriculture Trainees

	Activity/Component	Rating in terms of use		
		Sum	Mean	SD
1	Wall hanging (maps, diagram, charts, picture)	656	2.44	.102
2	Models	810	3.01	.222
3	Weather station	351	1.30	.461
4	Workshop tools	879	3.26	.625
5	Workshop machines	729	2.71	.720
6	Chemicals (herbicides, acaricides)	617	2.29	.456
7	Tractors	1119	4.15	.573
8	Implements (ploughs, Harrow, planters)	941	3.50	.500
9	Farm tools (digging, cutting, maintenance)	500	1.86	.109
10	Harvesting equipment	420	1.56	.497
11	Drying equipment	621	2.31	.560
12	Storage equipment	301	1.11	.773
13	Irrigation (lines, sprinklers)	125	.464	.499
14	Carpentry	551	2.05	.741
15	Welding tools	320	1.19	.749
	Index of use of agricultural workshops	**792.29**	**2.94**	**.293**

Mean 2.94±.017, Median 2.91, Mode 3.38, SD .293, Min 2.21, Max 3.58

From Table 9, it is observed that the extent of use of agricultural workshops by agricultural trainees was found to be of medium level (*M*=2.94. *SD*=.293) on a scale of 0 to 5 (0= No use and 5=Very High use of the agricultural workshops) and ranged between 2.21 to 3.58. The reliability of the index using Cronbach alpha was found to be (α=.777). Further analysis involved grouping the index into six categories (0=No use, .01-1=very low, 1.01-2=low, 2.01-3=medium, 3.01-4 high and 4.01-5 very High) and the chi-square test for the equality of categories of the index was performed and the results are shown in Table 10.

Table 10

Chi-square Test for Equality of Categories for the Index of Agricultural Workshop Use by Certificate in Agriculture Trainees

Score	Level	Observed N	Expected N	Residual	Statistics
2.01-3	Medium	161	134.5	26.5	χ^2 =10.44
3.01-4	High	108	134.5	-26.5	*df*=1
Total		**269**			***p*=.001**

The chi-square test (Table 10) revealed a highly statistically (*p*=.001) significant differences among the different categories of the index of use of agricultural workshops by certificate in agriculture TVET trainees. The category (2.01-3) of the index was statistically significant (χ^2 =10.44, *df*=1, *p*= .001) higher than the other categories, indicating the majority of the trainees 'use of agricultural workshops was in the medium level. The use of agricultural education workshops in TVET institutions in western Kenya was found to be in the medium level. A study undertaken to determine the adequacy of space in TVET workshops by Othoo *et al.* (2022) found a variation among the different institutions and the averaged rating by the participants was in the medium level of workshop space availability and adequate for practical sessions. They also found that the serviceability and adequacy of the workshops was low. The low use of agricultural workshops can be due to the use of old curriculum with minimum agricultural skills to address current agriculture problems (Thwala, 2017).

Table 11

Regression Model Summary for Use of Agricultural Workshops and Skill Acquisition by Certificate in Agriculture Trainees

R	R Square	Adjusted R Square	Std. Error of the Estimate
.457[a]	.209	.206	.22546

The model in Table 11 indicates an adjusted R^2 value of .206, indicating that the use of agricultural workshop explained approximately 20.6 % of the variation in skill acquisition by agricultural trainees. The *F* test for the regression model is shown in the ANOVA Table 12.

Table 12

ANOVA Table for Regression Testing the Fit of the Model of the effect of Use of Agricultural Workshop on Skill Acquisition by Certificate in Agriculture Trainees

	Sum of Squares	*df*	Mean Square	*F*	*p*
Regression	3.583	1	3.583	70.483	.001
Residual	13.572	267	.051		
Total	**17.154**	**268**			

From Table 12, the overall regression model was found to be significant (F (1,267) =70.48, p< .001). The regression coefficients of the model showing the *Beta*, *t*-statistics and the collinearity status are shown in Table 13

Table 13

Regression Coefficients for Use of Agricultural Education Workshops and Skill Acquisition by Certificate in Agriculture Trainees

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	*t*	*p*
(Constant)	1.981	.138		14.323	.001
Workshop	.392	.047	.457	8.395	.001

The regression analysis shows that the use of agricultural workshops in TVET institutions in western Kenya by agricultural trainees had a statistical significant (β=.457, *t*=22.33, *p* <.001) positive effect on the acquisition of agricultural skills. The effect of the use of workshops by TVET trainees in the acquisition of agricultural skills was found to be positive, that the higher the use of the workshops the higher was the level of skill acquisition. The finding of a study by Aleru and Lazarus(2021) in Rivers state Southern Nigeria is in agreement with the finding of this study in which the use of agricultural education workshops enhanced students' hands-on-experience in the use of mechanized technologies, improved student skills in construction and installation of agricultural indigenous mechanized tools, and provided them with the required skills in maintenance of farm equipment and experience in industrial workshop activities. Adequate working space within the facility for effective practical sessions is factor that can affect the TVET programmes. Othoo *et al*. (2022), study on adequacy of workshop space among TVET institutions in Kenya realized a varied score which averaged (*M*=2.65, *SD*=1.34) indicating that in some institutions the space was inadequate, though in others it was adequate. This could have a negative effect on the learning of agriculture.

4.6 Effect of Using Agricultural Laboratory on the Acquisition of Agricultural Skills by Certificate in Agriculture Trainees

The level of use of agricultural laboratories by technical trainee's students in technical Institutions in Western Kenya was rationalized as an index that combined subjective rating of statements on a 6-point rating scale, where 0 indicated no use of the laboratory as a teaching resource by the student and 5 indicated the highest rating. The individual rating for each statement were then summed up together and averaged to produce the index of laboratory use by students. The descriptive statistics for the index are given in Table 14.

4.8 Effect of Using Agricultural Libraries on the Acquisition of Agricultural Skills by Certificate in Agriculture Trainees

The level of use of agricultural libraries was rationalized as an index that combined the subjective rating of 9 statements on a 6- point rating scale, where 0 indicated no use of the laboratory as a teaching resource by the student and 5 indicated the highest rating. The rating by students for each every statement were then summed up and averaged to produce the index of library use by Table students. The descriptive statistics for the index are given in Table 14.

Table 14

Descriptive Statistics of the Students Ratings for the Use of Library by Certificate in Agriculture Trainees

		Rating in terms of use			
No	**Activity/Component**		**Total**	**Mean**	**SD**
1	Information resources: Books, journals,		329	1.22	.834
	Practical manuals and Guides: practical	manuals,			
	guides, handbooks,		583	2.16	.684
2	Research Materials: data bases, findings, publications,	journals,	196	.728	.445
3	Multimedia Materials: CD-ROMS,	videos,			
documentaries, case studies			551	2.04	.783
4	Computer facilities: computer and internet facilities		435	1.61	.609
6	Collaboration and group work rooms: areas for student to collaborate on discussions and group work		1059	3.93	.965
7	Curriculum support. Material and books for				
agricultural curriculum			105	.390	.488
8	Career development resources: resumes, internships, scholarships,	job search,	275	1.02	.616
9	Extension services: collaboration with agencies, NGOs, workshops, seminars	government	158	.587	.493
Index of Library Use			**478.14**	**1.77**	**.479**

Mean 1.77±.02, median 1.88, Mode 1.44, SD .479, Min .890, Max 3.33

Table 14 shows that the use of agricultural libraries was found to be low (*M*=1.77. *SD*=.479) on a scale of 0 to 5 (0= No use and 5=Very High use of the agricultural libraries) and ranged between .890 to 3.33. The reliability index using Cronbach alpha was (*α*=.810). The index was grouped into six categories (0=No use, .01-1=very low, 1.01-2=low, 2.01-3= medium, 3.01-4 high and 4.01-5 very High).

Table 15

Regression Model Summary for Use of Libraries and Skill Acquisition by Certificate in Agriculture Trainees

R	R Square	Adjusted R Square	Std. Error of the Estimate
.509[a]	.259	.256	.21821

The model (Table 21) indicates an adjusted R^2 value of .256, indicating that the use of agricultural libraries explained approximately 25.6 % of the skill acquisition by agricultural trainees. The *F* test for the regression model is shown in the ANOVA Table 16.

Table 16

Descriptive Statistics of the Students Ratings for the Use of Laboratory by Certificate in Agriculture Trainees

	Use of Laboratory as a Teaching Resource	Student Rating in Terms of Laboratory Use		
No		**Total**	**Mean**	**Std. Dev**
1	Experiential learning: hands on learning and			
	experimentation, lab based instruction	395	1.46	.582
2	Research and innovation: conduct research	120	.446	.498
3	Learn by doing in laboratory	400	1.48	.500
4	pH testing Kit	824	3.06	1.07
5	Soil Testing Kit	487	1.81	4.93
6	Reagents	181	.672	.557
7	Nutrients	479	1.78	.736
8	Models	636	2.36	.938
9	Preserved specimens	344	1.28	.535
10	Greenhouse	78	.2900	.454
11	Fertilizers	64	.237	.426
12	Growth chambers	73	.270	.426
13	Microbiology	63	.233	.111
	Laboratory Use Index	**517.39**	**1.92**	**.438**

Mean 1.92±.02, median 2.0, Mode 2.0, SD .438, Min 1.08, Max 2.50

From Table 16, it observed that the use of agricultural laboratories by agricultural trainees was found to be l o w (*M*=1.92. *SD*=.438) on a scale of 0 to 5 (0= No use and 5=Very High use of the agricultural laboratories) and ranged between 1.08 to 2.50. The reliability of the index using Cronbach alpha was found to be (α=.796). Further analysis involved grouping indices into six categories (0=No use, .01-1=very low, 1.01-2=low, 2.01- 3= medium, 3.01-4 high and 4.01-5 very High) and the chi-square test for the equality of categories of the index was performed and the results are shown in Table 17.

Table 17

Chi-square Test for Equality of Categories for the Index of Agricultural Libraries Use by Certificate in Agriculture Trainees

Score	Level	Observed N	Expected N	Residual	
0-1	Very low	15	67.3	-52.2	χ^2 =229.60
1.01-2	Low	152	67.3	84.8	*df*=3
2.01-3	Moderate	101	67.3	33.8	*p*=.001
3.01-4	High	1	67.3	-66.2	
Total		**269**			

The chi-square test (Table 17) revealed statistically (*p*=.001) significant differences among the different categories of the index of use of agricultural libraries by TVET trainees. The category (1.01-2) of the index was statistically significantly (χ^2 =229.6, *df*=1, *p*= .001) higher than the other categories, indicating a majority of the trainees'use of agricultural libraries was in the level of low. The significance of agricultural libraries in skill acquisition is determined by the extent of access and use of the resources (Lucas *et al.*, 2012) and the pattern of library utilization. Wakoli and Kitainge (2019) found that instructional resource transformation increased internal efficiency of public technical training institutions in Bungoma County and recommended the need for the public TTI management to

consider expanding the capacity of libraries through stocking and conducting book donation drives. The effect of use of libraries on the acquisition of agricultural skills was determined by the use of simple linear regression analysis. The results of the regression model summary are shown in Table 18.

Table 18

Chi-square Test for Equality of Categories for the Index of Agricultural Workshop Use by Certificate in Agriculture Trainees

Score	Level	Observed N	Expected N	Residual	Statistics
2.01-3	Medium	116	134.5	-18.5	χ^2 =5.08
3.01-4	High	153	134.5	18.5	*df*=1
Total		**269**			***p*=.024**

The chi-square test (Table 18) revealed statistically significant differences (p=.024) among the different categories of the indices of use of agricultural laboratories by Certificate in Agriculture TVET trainees. The category (3.01-4) of the index was statistically significant χ^2 =5.08, df=1, p= .024) higher than the other categories, indicating a majority of the trainee's use agricultural laboratories in TVET institutions in western Kenya was relatively low.

4.7 Effect of Use of Laboratories on Agricultural Skill Acquisition by Certificate Agriculture Trainees

The effect of use of laboratory on the acquisition of agricultural skills was determined by the use of bivariate linear regression analysis. The results of the regression model summary are shown in Table 19.

Table 19

ANOVA Table for Regression Testing the Fit of the Model of the Use of libraries and Skill Acquisition by Certificate in Agriculture Trainees

	Sum of Squares	*df*	Mean Square	*F*	*p*
Regression	4.441	1	4.441	93.259	.001
Residual	12.714	267	.048		
Total	**17.154**	**268**			

The overall regression model was found to be significant (F (1, 267)=93.25, p< .001). The regression coefficients of the model showing the *Beta*, *t*- statistics and the collinearity status are shown in Table 20.

Table 20

Regression Model Summary for Use of Laboratories and Skill Acquisition by Certificate in Agriculture Trainees

R	R Square	Adjusted R Square	Std. Error of the Estimate
.807	.651	.650	.14968

From Table 16, the model indicates an adjusted R^2 value of .650, indicating that the use of agricultural laboratory explained approximately 65.0 % of the skill acquisition by agricultural trainees. The F test for the regression model is shown in the ANOVA Table 21.

Table 21

ANOVA Table for Regression Testing the Fit of the Model on the Effect of Use of Laboratories on Skill Acquisition by Certificate in Agriculture Trainees

	Sum of Squares	*df*	Mean Square	*F*	*p*
Regression	11.173	1	11.173	498.692	.001
Residual	5.982	267	.022		
Total	**17.154**	**268**			

The overall regression model was found to be significant (F (1, 267) = 498.69, p< .001), and regression coefficients of the model showing the *Beta*, *t*- statistics and the collinearity status are shown in Table 22.

Table 22

Regression Coefficients for Use of Libraries and Acquisition of Skills by Certificate in Agriculture Trainees

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics
	B	**Std. Error**	**Beta**	***t***	***p***	***VIF***
(Constant)	2.659	.051		51.913	.001	
Libraries	.269	.028	.509	9.657	.001	1.000

The regression analysis (Table 22) shows that the use of libraries had a statistically significant (β=.509, *t*=22.33, *p* <.001) effect on the acquisition of agricultural skills. The use of agricultural libraries in TVET institutions in western Kenya was found to be low and to have a statistically significant effect on the acquisition of agricultural skills by certificate in Agriculture trainees. This finding is consistent with the works of Maina and Muathe (2023) who highlighted the significance of libraries in TVET institutions in the acquisition of skills and the availability of the resources in the institutions. In Kenya, libraries have been found to be useful tools in enhancing technical skill acquisition and research in TVET institutions (Kevogo, 2018; Odundo & Wachira, 2019; Oyieke & Ngulube, 2018; Wamukoya & Ongwae, 2019).

Table 23

Regression Coefficients for Use of Laboratories and Skill Acquisition by Certificate in Agriculture Trainees

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics
	B	**Std. Error**	**Beta**	**t**	**p**	**VIF**
(Constant)	2.240	.041		54.455	.001	
Laboratories	.466	.021	.807	22.331	.001	1.000

The regression analysis (Table18) shows that the use of laboratories in TVET trainees had a statistically significant (β=.807, *t*=22.33, *p* <.001) effect on the acquisition of agricultural skills.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusions

The study examined the effect of using agricultural teaching resources on the acquisition of agricultural skills by Certificate in Agriculture trainees in technical training institutions in the Western Kenya region. The findings of the study demonstrate that agricultural teaching resources play a significant role in enhancing trainees' acquisition of practical agricultural skills. The overall level of agricultural skills acquired by trainees was found to be moderate, suggesting that while learning is taking place, there is considerable room for improvement in the effectiveness of training. The study established a positive and statistically significant relationship between the availability and utilization of agricultural teaching resources and trainees' acquisition of agricultural skills. Institutions that had adequate and well-utilized teaching resources—such as farm tools, demonstration plots, laboratories, instructional materials, and ICT-based resources—recorded higher levels of skill acquisition among trainees. This finding confirms that hands-on, resource-supported instruction is critical in agricultural education, which is inherently practical in nature. Furthermore, the study revealed that limitations in teaching resources, including inadequate equipment, insufficient instructional materials, and limited access to modern agricultural technologies, negatively affected the development of practical competencies among trainees. Although instructors demonstrated commitment to teaching, the effectiveness of instruction was constrained by resource-related challenges. These findings underscore the importance of investing in relevant and modern agricultural teaching resources to improve the quality of training outcomes. The study affirmed that effective use of agricultural teaching resources is a key determinant of agricultural skill acquisition among Certificate in Agriculture trainees. Enhancing the availability, accessibility, and utilization of these resources is essential for strengthening agricultural training and supporting the development of a skilled workforce capable of improving agricultural productivity in the region

5.2 Recommendation

Based on the findings and conclusions of the study, the following recommendations are made: The Ministry of Education, TVET authorities, and institutional management should prioritize increased funding for the acquisition and maintenance of agricultural teaching resources. Emphasis should be placed on modern farm tools, equipment, laboratories, demonstration farms, and ICT-based instructional materials to support practical skills training. Technical institutions should develop strategies to ensure optimal utilization of existing agricultural teaching resources. This may

include scheduling regular practical sessions, integrating resource-based learning into the curriculum, and monitoring the use of teaching facilities to maximize trainee engagement and skill development.

Continuous professional development programs should be provided for agricultural instructors to enhance their competence in using modern teaching resources and innovative instructional methods. Training in emerging agricultural technologies and learner-centered approaches will further improve instructional effectiveness. TVET institutions should establish and strengthen partnerships with agricultural industries, research institutions, and farms. Such collaborations can provide trainees with exposure to real-world agricultural practices, modern technologies, and additional learning resources through attachments, demonstrations, and mentorship programs. Policymakers should develop and enforce standards for minimum agricultural teaching resources in TVET institutions. Regular monitoring and evaluation should be conducted to ensure compliance and to assess the impact of resource provision on trainees' skill acquisition. Future studies should explore the long-term impact of agricultural teaching resources on graduates' employability and performance in the agricultural sector. Additional research could also examine the effectiveness of specific types of resources or instructional approaches across different regions and levels of agricultural training

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