Learning Competencies among Students of Agriculture in Secondary Schools in Uasin-Gishu County, Kenya: A Value Chain Approach

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Abstract

Governments in Sub-Saharan Africa are undertaking education reforms to shift from knowledge-based learning to a curriculum that lays emphasis on technical and transferable skills. Despite the fact that over 90% of public secondary schools are taking agriculture in Kenya, food insecurity continues to be a major challenge raising the question of whether learners acquire the requisite competencies in agriculture. The aim of this research was to assess the learners' skills and attitudes necessary to achieve the philosophy of teaching agriculture at the basic level of education in Uasin Gishu County. The specific objectives of this research were: to establish the instructional techniques used in teaching crop production practices and to determine the acquired learner competencies so as to prescribe possible ways of enhancing learner competencies in crop production for food security. A baseline study on the status of teaching and learning of crop production practices among schools in Uasin Gishu was conducted to establish the current status of teaching with a view to determine appropriate interventions that would be used by teachers of agriculture to respond to the needs of the Kenyan society. The study design was descriptive. Fourteen schools were purposively sampled to participate in the study. Questionnaires, interview schedule and observation checklists were used to collect data from the sampled respondents. Data was analyzed and presented using distribution tables and graphs. Findings showed that 46.2% of the teachers commonly used lecture method to teach general concepts in agriculture, 30.8% use student activity while 15.4% use demonstration method. Specifically, demonstration was used by 76.9% of the teachers to teach only planting while 56.3 % of students indicated that teachers explained most practical activities theoretically. In terms of enthusiasm, it was noted that 35.7% of the students' leadership skills were below expectation. There was no significant relationship between the teaching method and the competencies manifested by learners ($P(\chi 2=2.266, df\ 8) =0.972$ at α 0.05). Based on the current teaching approaches, the learners of agriculture did not seem to acquire any competencies that they would transfer in agricultural production in the society. Recommended interventions should include experiential learning targeting high value crops and post-harvest handling.

Keywords: Agricultural education, Learning competencies, Food security, learning interventions

INTRODUCTION

In the world today, education is globally recognized as the most effective development investment a country can make. It is one of the critical pathways to promote social and economic development (World Bank, 2007). It is estimated that by the year 2050, the world's population will have reached 9 billion which is higher by 34% in relation to current population. Nearly all of this increase will occur in developing countries (FAO,

2015; IFPRI, 2015). Given that about 1.8 billion young people worldwide are aged between 10 to 24 years and 90% of them live in less developed countries the focus of attention should increasingly shift to young people as they make the next generation of farmers (United Nations (UN), (2016). The major concern is to provide sustainable livelihoods and employment opportunities in agriculture for young people. According to Okoli (2011), agriculture is the pillar of the nation's welfare, and sound economic development and technological advancement. Agricultural education equips learners with the needed practical skills to be able to undertake basic agricultural practices in order to successfully engage themselves in the agriculture enterprise (Darko *et al.*, 2016).

Agricultural extension history runs back to the Renaissance period when there was a movement to relate education to the needs of human life and to relate science to daily practice. The start of modern science in 16th and 17th Century resulted in a desire to use new knowledge in education. Among the proponents of this idea was Rabelais who required pupils to study nature, as well as books and apply the learned concepts in their daily lives (True, 1929 as cited by Eicher, 2006). Later Pestallozi joined the proponents, as a result of Rousseau's influence. As from 1775 for several years he conducted a school for poor children in whom part of their time was spent in raising farm products, spinning and weaving of cotton. Some of the earliest agricultural schools in Europe were established in Hungary, including one at Zarvas which started in 1779, another at Nagy Michlos in 1786, and the Georgicon Academy at Kezthely, which was founded in 1797 and was for 50 years, the model agricultural college of Europe. In the early 20th Century the British Colonial Government through Phelps Stoke Commission, 1920s was involved in improving agricultural resources in Kenya. This commitment led to the establishment of six schools of agriculture in Kenya namely: Alliance, Chavakali, Bungoma, Kangaru, Kisii and Narok High Schools between 1920 and 1960.

The main objective of opening the schools was to facilitate the training of technical competent extension workers to help Kenya farmers improve their production techniques (Harlin *et al*., 2007). Another objective was to allow youth to be trained about improved farming as an improvement to the traditional apprenticeship system. This awareness led to the introduction of gardening and nature study into primary school curriculum as a way of improving technical agricultural education in Kenya. Competency-based learning lays emphasis on the importance of developing skills and knowledge with a view to applying them to real life situation. It is an approach to helping learners increase mastery of skills, knowledge and developing self-confidence in problem solving situations (Ifeanyieze, 2010). Acquisition of necessary practical skills and attitudes is the most critical component of teaching and learning of agricultural education. Learners' acquisition of competencies especially in crop production practices can be achieved through practical lessons in farm fields. Practical lessons provide concrete hands-on learning experiences for learners whereby they become active participants of the instructional processes.

The purpose of practical agriculture instruction is to educate young learners and prospective farmers for proficiency in farming technologies; to equip learners with knowledge, skills, attitudes and motivation to carry out agricultural practices (Onuekwusi and Okorie, 2008). Practical lessons are known to provide experience and they at the same time expose the students to practical reality of learning (Kabugi, 2013). According to Bruening and Shao (2005) experiential learning offers learners

opportunities for interaction with professionals and develops meaningful relationships among others. Lunetta, Hofstein and Clough (2007) defined practical teaching and learning as process of creating learning experience in which students interact with materials or with secondary sources of data to observe and understand the natural world. During practical lessons, students observe or manipulate real objects or materials for themselves either individually or in small groups or witness teacher's demonstrations. Practical agriculture instruction helps to generate motivation in the subject and make learning more enjoyable (SCORE, 2008; Collins, 2011).

Despite high investment in agricultural education training programs and institutions in sub-Saharan Africa since the 1950s, there is growing dissatisfaction with the contribution of graduates to the livelihoods of smallholder farmers, who still face persistent challenges of hunger and poverty (Suvedi and Kaplowitz, 2017). Food insecurity in Africa and Kenya in particular lies in crop production practices (Kinyua, 2016: GoK, 2017). Governments are increasingly interested in skills training for youth to meet national development goals and to prosper within the global economy. With over 90% of public secondary schools taking agriculture as an examinable subject in Kenya, food insecurity continues to be a major challenge raising the question of whether learners acquire the requisite competencies in agriculture. The focus of this paper is on skills acquired by learners in crop production practices. Competence involves having quality and adequate judgment and strength for a given task and/or in a given field. Agriculture education uses a teaching approach that involves thinking and reasoning as a philosophy (Mwaka, Nabwire and Musamas, 2014). Practical approaches that have proved workable in mathematics and other sciences include discovery (Mondoh, 2005), problem-solving (Aydogdu and Kesan, 2014), individualized instruction and small group discussion (Ifeanyieze, 2010).

Uasin Gishu was selected due to its high agricultural potential and the fact that farming is a source of livelihood for 60% of the population. Uasin Gishu County lies between longitudes 34 ^{0} 50' East and 35 ^{0} 37' West and latitudes 0^{0} 03' South and 0^{0} 55' North. It shares common borders with ElgeyoMarakwet, Baringo, Kericho, Nandi, Kakamega and Trans Nzoia It covers a total area of 3,345.2 Km^{2}.The County is a highland plateau ranging from 1500m – 2700m above sea level and soils range from red brown loam to clay. Rainfall averages 900mm to 1200mm per annum with its peak in May and October, temperatures range from 8.4 ^{0}C to 26.2 ^{0}C (a mean of 18 ^{0}C). It has six sub Counties; Turbo, Soy, Moiben, Ainabkoi, Kasses and Kapsaret, 51 locations and 100 sub-locations. Arable land covers 2,995 km^{2}, 332.78 km^{2} is non-arable (hilly and rocky), 23.4 km^{2} is water mass and 196 km^{2} is urban. According to UasinGishu CIPD 2017-2022, the current population of Uasin Gishu stands at approximately 1.2 million with over 55% being youth aged between 14 years to 49 years (GoK, 2017). The County has a total of 129 secondary schools with a Gross Enrolment Rate (GER) of 65%. The GER does not compare well with the national average standing at 78%. Therefore, enhancing competency in agriculture was a sure way of limiting food insecurity.

The specific objectives of this research were: to establish the instructional techniques used in teaching crop production practices and to determine the acquired learner competencies so as to prescribe possible ways of enhancing learner competencies for food security. Appropriate interventions needed to ensure sustainable food security in the value chain of crop production practices were recommended.

METHODOLOGY

The study adopted a descriptive design. This study was designed and conducted in the six sub-counties in Uasin Gishu namely: Turbo, Soy, Moiben, Ainabkoi, Kesses and Kapsaret. Data was collected in 14 secondary schools targeting head teachers, teachers of agriculture, farm employees and Form three students taking agriculture. Sub-county schools were purposively sampled since they host the bulk of the students that reside in the county and are likely to have greater impact on the practices (Cresswell, 2014). All the sub-counties were represented in the sample with at least two secondary schools. All the 14 head teachers in the selected schools responded to a key informant interview schedule. One teacher of agriculture and one farm employee and thirty form three students taking agriculture per school (totaling to 358 students) were randomly selected to participate in responding to questionnaires. In cases where the students were less than thirty all the students were involved in the study. Data was collected by research assistants who had been inducted for data collection. Descriptive statistics, frequencies were used to analyze data as presented and discussed in the section below. Qualitative data were organized to quick impression summary to thematic areas then analyzed.

RESULTS AND DISCUSSION

The variables that affect the choice of teaching method in agriculture include land size, distribution by wards, cultivated land size; land left fallow, age of teachers, working experience, distribution by gender of teachers, number of students per class and teacher qualification. The average land size was 1.73 hectares against an expected minimum of 1.6 ha (i.e. 0.4 ha for demonstration, 0.4 ha for museum plots, 0.4 ha for projects and 0.4 ha for commercial farming). From this land schools had an average of 0.4 ha left fallow for some proposed development infrastructure. Only Dry's Girls in Ainabkoi rented land for teaching agriculture, implying that the teachers of agriculture were contented with the land sizes available in the respective schools. The crop categories reviewed for study in terms of the area planted, quantity produced and major constraint were legumes, cereals, tubers, fruits and agroforestry. The responses obtained on the same were rather scanty and full of guesswork. It was clear from the observation checklists and responses that no records were kept. Schools could not determine the accurate gross margins of the farming enterprises that they engaged in. For learning to be effective and lasting, the concepts learnt must be put to use in different situations. Achievements of learning have been conceptualized as theory based on academic frameworks often judged by one's ability to recall key points, and sequences of memorized information.

Instructional Techniques Used in Teaching Crop Production

The study sought to establish the instructional techniques used in teaching crop production practices in secondary schools in Uasin Gishu County. Majority of the teachers of agriculture were holders of Bachelor's degree with females forming the majority (1.62). On average the teachers have about 9 years post qualification experience. The average class size is 59 students taking agriculture, above the World Bank recommendation of 40-55 class size (Ndethiu *et al*., 2017). The study determined that 46.2% of the teachers commonly used lecture method to teach general concepts in agriculture, 30.8% used student activity while 15.4% used demonstration method. In regard to specific concepts, it was noted that demonstration method was used by 76.9% of the teachers to teach planting concepts while 23.1% used student activity to teach the same. For weed control majority of the teachers (76.9%) used student activity,

53.8% used demonstration method to teach fertilizer application while 38.5% use demonstration to teach harvesting. Weed control being largely manual may not infuse the competencies and may just be intended to cut costs incurred on labour. It was also observed that most schools used weed control as a form of punishment hence the involvement of learners in manual weed control may also impact negatively on their attitude. The findings are indicated in Figure 1.

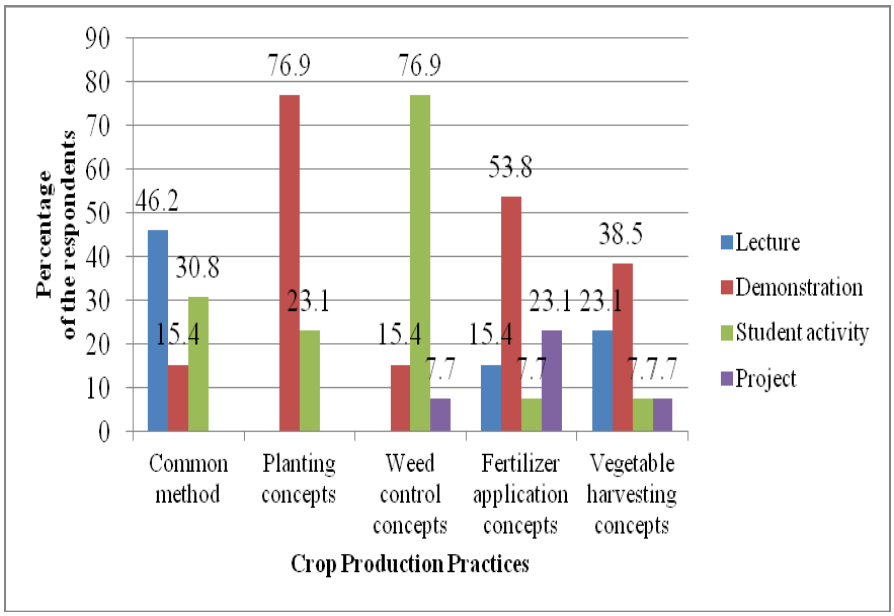

Figure 1: Agriculture Teaching Methods in Uasin Gishu County Public Secondary Schools

Lecture method is a teacher-centered approach whereby the teacher reads out the notes to the learners as he/she explains to them. According to Williams and Dollisso (1998), the most used instructional techniques are lectures, demonstrations, discussion, projects. A study by World Bank (2007) reported that most teaching in agricultural education in Africa is comprised of "chalk and talk" presentations of theory and facts (Hassen, Sokora & Taha, 2016). Demonstration method of instruction involves teachers demonstrating and explaining the step-by-step process of basic agricultural tasks before engaging the class in the same. The teacher may also use one of the learners to demonstrate the activity. This approach of teaching agricultural practical often reduces students to mere passive observers and as such they are unable to master the tasks (Mundi, 2006). Project teaching method according to Gültekin (2007) as cited by Hassen, Sokora and Taha (2016) is "a learning approach based on students working for a period of time in order to intensively investigate the real-world issues or problems in an interdisciplinary approach so as to produce something concrete through individual efforts or group work". It is based on the conviction that learning by doing enables students to learn about and experience their environment and are prepared for competing in the dynamic workplace typical of agricultural farm. Project work is structured around students' questions, lives, experiences, and abilities, and allows students to have control over their own learning process.

Agricultural Competencies Acquired by Students

Agricultural competencies were categorized into knowledge, practical competencies and behavioural competencies. Competencies should comprise of knowledge (understanding), behavioural change (overtly discernable) and a value component (based on beliefs and attitudes). From the teachers' perspective, learners were competent in weed identification and control (71.4%) and farming of different crops (57.1%). The learners were not competent in designing agricultural projects, use of tillage machinery, food processing and conservation and diagnosis of plant diseases. Employees identified the following competencies; farming of different crops (78.6%), weed identification and control (71.4%), identifying major pests (71.4%), fertilizer application (64.3%) and farm management (57.1%). A comparison between the teaching methods used to teach fertilizer application showed that demonstration was the most dominant. The students themselves were also asked to state the knowledge competencies they felt they had acquired. Table 1 shows the opinion of students on acquired knowledge competencies (SA meaning strongly agree, A is agree U is undecided, D is disagree and SD meaning strongly disagree).

Table 3: Opinion of students' knowledge competencies acquired by agriculture students

Competency	Response in Percentage				
	SA	A	U	D	SD
Ability to apply fertilizer	53.2	35.9	2.2	4.9	.8
Ability to farm different crops	50.8	40.0	2.4	2.4	.8
Ability to identify and control weeds	47.0	41.4	4.3	3.5	1.4
Ability to manage irrigation	44.1	33.0	5.1	10.5	4.6
Ability to carry out farm operations	43.2	47.3	3.5	1.9	1.9
Ability to identify major pests	42.4	43.2	5.1	5.7	1.6
Ability to manage farm	40.5	42.2	7.6	4.3	1.6
Ability to do agricultural marketing	38.4	40.3	6.5	5.7	4.9
Ability for horticulture and gardening	30.5	41.4	8.9	10.3	4.3
Ability for food processing	29.7	39.7	8.6	10.5	5.9
Ability for agricultural economics	25.4	43.8	10.3	11.1	3.2
Ability to carry out soil testing	23.8	30.5	13.0	17.3	11.9
Ability to explain plant morphology	23.5	35.4	13.0	15.1	7.8
Ability to diagnose plant diseases	21.1	43.5	12.2	13.8	4.1
Ability to design agricultural projects	21.1	30.0	15.1	19.2	9.2
Ability for sustainable agricultural	18.6	33.8	16.5	15.7	7.0
Ability for machinery tillage	15.1	26.8	12.4	21.9	17.0
Ability to survey and landscape	10.0	28.1	17.0	22.2	17.3

In terms of planting methods, 88.8 % of learners believed they were competent in various planting methods (P (χ2=53.441, df 20) =0.000 at α 0.05). The study established that students were comfortable with and confident in competencies gained in fertilizer application activities (89.1%) (P (χ2=83.687, df 20) =0.000 at α 0.05), farming of different crops (90.8%), carrying out weed identification and control (88.4%) (P (χ2=115.445, df 20) =0.000 at α 0.05). It was however noted that in Moiben sub County only 18% of the students expressed confidence in weed identification and control. Further analysis on the correlation between the teaching method and

competence in weed identification and control was done. The results showed positive correlation (r= 0.033) as shown in Table 2. This means that when more practical methods like demonstration or project method is used the learners gain experience and confidence as they acquire the knowledge hence become more competent. The less usage of such practical methods the lower the competencies acquired.

Table 2: Pearson's Spearman Correlation between teaching method and knowledge competency

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	-.112	.055	-2.139	.033c
Ordinal by Ordinal	Spearman Correlation	-.132	.059	-2.527	.012c
N of Valid Cases		364			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Only 41.9% agreed that they were competent in use of machinery to till land and 38.1% stated they knew how to carry out surveying and landscaping. The major crop grown in the schools was maize. On harvesting of the major crop the most popular method was by hand (88.5% of students. Machine harvesting accounted for only 4.7% and it was more common in Soy and Kesses where land parcels were larger. In Turbo and Moiben where the size of holdings was least there was no respondent who was conversant with machine harvesting. On vegetable farming, manual storage in cool dry place at room temperature was the most common (83.3%). Refrigeration was only recorded in 15.9% in Soy and Ainabkoi sub-counties. Other methods like solar drying and blanching were unheard of in the other sub Counties; a clear indicator of how much wastage is incurred during periods of glut.

The research assistants were trained to observe and asses the observable competencies in learners as they carried out agricultural practices to corroborate the responses given by learners. The acquired agricultural competencies observations were rated as: below expectation (BE), approaching expectation (AE), meeting expectation (ME) and exceptional compliance (EC). From the observation checklists, it was noted that majority of the students (64.3%) were meeting expectation or were exceptional in land preparation and fertilizer application while another 35.7% were not competent. While 14.3% of observed students were below expectation in soil and water conservation, only 42.9% were meeting expectation on this aspect of soil and water conservation. On this particular aspect there was no respondent who displayed exceptional compliance; implying the existence of a gap in terms of teaching and learning competencies. Table 3 shows the percentage ability of agriculture students to carry out crop husbandry practices in the field.

Table 3: Competency rating of practical skills by agriculture students based on observation

Competency	Observation in Percentage			
	EC	ME	AE	BE
Land preparation	14.3	50.0	35.7	
Fertilizer application		64.3	21.4	14.3
Planting	14.3	35.7	42.9	7.1
Weed control	7.1	28.6	57.1	7.1
Soil and water conservation		42.9	42.9	14.3
Pest and diseases	7.1	42.9	42.9	7.1
Harvesting	7.1	50	42.9	
Storage	7.1	28.6	64.3	

According to Okoli (2011), it is the duty of the teacher to make sure that the trainees (students) are fully involved and effectively supervised in their training package for enhanced skills acquisition. Agriculture as a subject involves training of man-power in the area of crop production and learners should be given opportunities to enhance their abilities to competently manipulate agricultural activities in areas such as production, processing, packaging and marketing to become employed in government or private sector or be self-reliant. The study showed that 92.3% teachers thought that they involved learners in preparing land for crop production practical. However, from the students' perspective 56.3 % of students expressed that teachers explained land preparation theoretically (83% in Soy, 25% in Moiben, 77% in Ainabkoi, 53% in Turbo, 46% in Kapseret and 54% in Kesses). Some of the competencies shown by learners may be as a result of previous exposure from home rather than from teachers. Inferential statistics showed that there was no relationship between the teaching method for land preparation and the competencies acquired (P (χ2=2.266, df 8) =0.972 at α 0.05). A measure of opinion of learners showed that 91.9% were comfortably able to use the land preparation tools, 4.7% were not so comfortable while another 3.4% were undecided. The larger group of the undecided and those were not comfortable were from Soy Sub-County. Lecture method was also used by 61.5% of teachers to teach crop storage and 53.9% for pest control. Besides classroom teaching, teachers of agriculture also had clubs which could be used to teach skills and attitudes. From the study, 77% of the teachers noted that students had clubs through which they initiated their own agricultural practices.

Behavioral Competencies Acquired by Students

On behavioral competencies teachers indicated that their learners had acquired personal responsibility, motivation, self-confidence, problem-solving and creativity. Only 14.6% of the teachers indicated that their students had acquired market awareness, self-efficacy and digital literacy. The students themselves were also asked to state the personal competencies they felt they had acquired. The students noted that they had acquired self-confidence, responsibility, decision making, creativity, critical thinking, interaction, work experience, motivation, problem-solving, market awareness, leadership, work ethic, adaptability and enthusiasm The least acquired competencies according to employees were self-confidence and digital literacy. Observation checklists showed that 35.7% of the sampled students' leadership skills were below expectation with the same percent of students approaching expectation. Majority (42.9%) of the students' motivation was approaching expectation with 21.4% meeting

expectation. Half of the sampled students' personal initiative was approaching expectation. The opinion rating of students on behavioral competencies is in Table 4

Table 4: Competency rating of behaviour by agriculture students

Competency	Response in Percentage				
	SA	A	U	D	SD
Self-confidence	47.3	40.0	5.4	2.4	.5
Responsibility	46.5	40.8	4.6	3.0	1.1
Decision making	46.2	41.9	5.1	1.4	1.1
Creativity	45.9	42.2	7.3	.8	.3
Critical thinking	39.2	46.8	5.9	3.8	.8
Interaction	38.1	40.0	7.3	7.0	2.4
Personal work experience	37.3	38.6	9.7	7.6	2.4
Motivation	36.5	38.6	7.3	7.8	4.3
Problem solving	35.7	46.8	7.0	5.4	1.4
Market awareness	31.9	33.8	9.2	9.5	8.4
Leadership	30.3	33.8	13.2	10.0	7.3
Work ethic	29.2	34.1	11.1	12.4	5.9
Adaptability & adjustability	25.1	32.7	16.5	13.5	5.7
Enthusiasm	23.8	34.6	18.1	11.9	5.4

Given the fact that a very large percentage of learners had indicated that they had the competency of fertilizer application, a cross tabulation was done to check the correlation between fertilizer application and crop losses in terms of attitude. The results showed positive correlation (r= 0.006). This means that when more practical methods of like competency in fertilizer application were directly related to reduction in crop losses hence impacting on the attitude of the learners.

CONCLUSION

The major conclusions from teh study were that schools teaching agriculture did not keep proper records of activities, expenses, yields and revenue generated. This was found from the focus groups that were used for providing data for program development and evaluation, planning, and needs assessment in the baseline survey. There was no unique amount of knowledge, skills, and abilities that was recorded to help strengthen experiential learning or learning on the job.

Furthermore, the school students taking agriculture were not engaged in any project work. Instead, the dominant method of instruction was lecture method. While, the teachers believed their approach was fine, it was clear from the results that learners acquired very limited practical skills. The current approaches used by teachers of agriculture were not geared towards competency-based learning. Students lacked soil and water conservation skills, leadership skills, motivation and personal initiative. For schools that practiced irrigation, the learners were not involved hence denying them of the needed competencies.

RECOMMENDATIONS

The study recommended the following interventions:

1. The agriculture teacher, learner and farm worker should keep proper farm records for the management agricultural project activities as well as the execution of the subject.
2. Teachers of agriculture should encourage interactive and collaborative approaches to learning for use in group and project work.
3. Agriculture projects should allow for a variety of crops to be experimented with to provide choice to learners to acquire multiple competencies
4. Agriculture projects in schools should address weather related concerns and provide practical skills needed in the locality.

Acknowledgement

The authors acknowledge University of Eldoret through the Annual Research Grant for the financial support for this study.

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