UGANDA LOWER SECONDARY SCHOOL AGRICLUTURE COURSE TEACHERS GUIDE 1

What can I do to produce more food?

Introduction

Welcome to the first edition of your Lower Secondary School 1 Agriculture course.

This book covers the first year, Senior 1 of the Uganda Lower Secondary School curriculum. At the end of the year, you agriculture teacher may ask you to take a test or examination. This book will help you to learn how to be a good agriculturalist and to do well in the assessment.

The main areas of senior 1 Agriculture course

The book is divided into three main terms, each one dealing with one or two main areas of agriculture. These are:

- Introduction to Agriculture- the intentional planting of crops and raising of domesticated animals
- Farm tools, equipment and machinery
- Soil science
- Crop science

Learning to be an agriculturalist

During your studies so far, you have learnt a lot of facts and information. You have also been learning to be a modern farmer. You have learnt how to grow crops and rear animals using modern technology. You have been carrying out activities to improve production of your crops and animals. You have learnt how to maintain the soil fertile for better yields. You have learnt how to operate safely some tools, equipment and machines so that activities are faster and more efficient. You have learnt how to record your activities and the different careers for people.

Without application, principles and ideals have no bearing —John Dewey

The idea of linking hands-on learning with academics is not a new one. John Dewey advocated education through experience at the turn of the last century. Unfortunately, relatively few schools took it up to offer this integrated approach, typically limiting instruction to textbooks lectures and examinations. Yet, the evidence suggests that learners, who engage in experiences that connect school learning to the real world, are more likely to stay in school to acquire the skills that useful to their communities. Furthermore, such experiences increase the chances that learners will be both further education at college and career ready for world of work.

This book will help you the teacher to deliver in such a way that learners continue to develop these critical skills and abilities.

CONTENT

COMPETENCY FOCUSES ON SKILLS

How might a focus on skills instead of content change the way we design assessments? The promise of competency-based learning is a learning environment that better reflects the world our learners are preparing to enter. Designing competency-based teaching and assessments is about creating

opportunities for demonstration of important skills in authentic contexts. The purpose of these training and assessments is to focus less on collecting data for the teacher but more on empowering learners to demonstrate what they have learnt, reflect on how they are doing it, and planning what they will do or learn next.

What does this look like?
The best way to recognize a competency-based learning experience is to look at the work learners produce and the learning environment in which they produce it.

A core principle of competency-based learning: Learner ownership and learner centred. It's important to recognize that at every stage of the process, you have to involve the learners as co-designers, co-teachers, co-leaders, co-facilitators and co-knowledge/skill/ attitude/value providers. What steps do you take?

Step One: Articulate Competencies
As a teacher/facilitator you come out to say what do you want learners to know and be able to do? These are the essential skills learners need to succeed in the world beyond school or your classroom and many years to come. These should be transferable, observable, transdisciplinary, and accessible to your learners. As Chris Sturgis of CompetencyWorks writes, a well-articulated competency "will be valuable ten years from now even if the content knowledge has changed."

How to engage learners in this work: Ask them what success in learning agriculture looks like. Ask them to share their goals and visions for their futures. Collaborate with them to translate their answers into competencies they can develop in school while learning different Agriculture topics.

Step Two: Develop Evidence of Competencies
Evidence of skill development — what are called "learning outcomes" in the teaching syllabus of Agriculture— are the criteria teachers and learners use to assess learners work and engagement. These outcomes must focus on learning *targets*, not tasks. A competency-based training, teaching, learning and assessment does not aim to measure how quickly/completely a learner can finish tasks or comply with instructions; rather, it aims to articulate clearly what the learner should be able to do as a result of completing the learning and assessment.

For this reason, learning outcomes are often framed by learners as **"I can..."** statements to reinforce the idea that the target is met only when the knowledge is successfully applied in a demonstrable way.

How to engage learners in this work: During conversation with learners have them select a competency, competencies or learning outcomes and ask them, "What does success look like in this area? How will I know you have mastered this learning outcome and skill?"

Step 3: Build Learner-Friendly Rubrics

In competency-based learning, a rubric is used for far more than scoring. Rubrics built on clearly articulated competencies and learning outcomes can be used to establish clarity with learners about what they are learning and why they are learning it. They are also essential tools for teachers to calibrate understanding of quality performance: collaborative teacher review of learners work using rubrics is a regular element of competency-based learning. Finally, they are tools for assessment: learners and teachers can use the rubric to measure their performance, what they can do, reflect on learning, and plan next steps.

Because competency-based learning is not a time-based system, learners frequently have the opportunity to revisit learning activities, given support to master the how to do it and be reassessed, supported by formative feedback and routine metacognitive reflection. Formats like the single-point rubric below allow a rubric to anchor an ongoing conversation about learning between student and teacher rather than merely deliver points.

COMPETENCY; Communicate and empathizes with other people who have perspective different from your own on biotechnology		
CONCERNS areas that need work	**LEARNING OUTCOMES OR SUCCESS CRITERA**	**Areas exceeding expectations**
	Audience awareness; learners work reflect an understanding of the needs and perspectives of the target audience	
	Communication; learners their own perspective and identify the influences on that perspective	
	Context; learners communicate how cultural , historical, technological, social, economic and local factors have an impact on the situations, events, issues or phenomena	
	Empathy; learners explains or describes how perspectives influence human interactions and understanding of biotechnology	

How to engage learners in this work: Have them build personalized rubrics using competencies and outcomes you (or you and them) have articulated. Let them choose the learning outcomes that matter the most to the work they want to do.

Step 4: Create the Learning Experience(s)

Only after the intentional process of articulating competencies and outcomes should we think about how learners will demonstrate these skills via learning experiences. There are many ways to demonstrate these skills, so the products of the teaching, learning and assessment — the learners' work — should be varied and interesting.

It is helpful to think about the apprenticeship model, where learners, with the support of a mentor, learn the field through authentic practice (a blacksmith's apprentice makes a shoe or a carpenter's apprentice makes a stool, chair, nursery seedbed box, rabbit hutch and birdhouse). When it comes to more academic work, think about what Jal Mehta and Sarah Fine call "cognitive apprenticeships," where the essential question is not "What is the content I need to cover?" but instead **"What does it mean to think in the domain? Or what product or service will society get out of my interaction with the learners"** This shift allows teachers to organize learning around purpose and meaning, culminating in learning exhibitions of learning that might contribute to the domain.

Figure1.1 Agriculture in action

CHAPTER 1

INTRODUCTION TO AGRICULTURE

COMPETENCY: Learners should be able to have a good understanding of the sector and of the opportunities in agriculture for a living in Uganda

Key words

- ✔ Agriculture
- ✔ Nomadic
- ✔ Production
- ✔ Subsistence
- ✔ Commercial
- ✔ Activities

By the end of this chapter , you should be able to

i. Understand the historical background of agriculture in terms of animal herding, the nomadic way of life, food gathering and hunting
ii. Understand the value of agriculture to society and human being
iii. Understand the value of the farm as a production unit
iv. Understand the value of various farming systems and their socioeconomic impact in Uganda
v. Understand the importance of keeping records in agriculture
vi. Understand the requirements of a career in agriculture and key principles of the labour act on the living conditions of the farm workers

WEEK1

Teacher Preparation

1. *Check out location and appropriateness of assigned room where to teach agriculture*
2. *Arrange well in advance any audiovisual, multimedia, or experimental equipment required preferably two day before the first lesson*
3. *Order and verify arrival of textbooks at bookstore/reference materials in library; make arrangements for any other reading, photocopying if required*
4. *Meet with laboratory assistants and departmental members you are likely to teach with during the term or year, if applicable; three days before the lesson*
5. *Prepare a syllabus outline for the learners, including all or most of the following:*

a. *Your name, office location, office hours, phone number, socio- media contact/platform and email address*

b. *The subject as part of the curriculum of the school which includes the* ***teaching syllabus, learners book, teachers guide, assessment guide lines, community engagement guideline, co-curricular guideline and curriculum framework***

c. *Subject competency and society problem being addressed in the term*

d. *Weekly topics and activities as planned*

e. *Readings, references, action research issues and their location*

f. *Agriculture subject requirements/prerequisites*

g. *Scheduling of activities of integration, classroom based assessment which emphasize observation, conversation/listening to each other or product including presentations, examination papers, or other assignments*

h. *Grading policy, including any penalties for late or missed work*

i. *Discussion of academic honesty/dishonesty and such issues as what constitutes plagiarism or taking advantage of other people's work*

6. *Sources of assistance with course material including consultation and collaboration in group work and as a class*

Teacher instruction

1. *Introduce yourself/have the learners introduce themselves or each other as well as talking about their goal and what they like most*
2. *Discuss syllabus and/or subject goals of helping them to identify opportunities in agriculture as a way of livelihood in Uganda*
3. *Explain choice of textbook/readings, relationship of readings to lessons and/or review of what they experience daily in their communities*
4. *Ask the learners questions using the help of the 6Ws (of What, Why, How , Where, When and Who), get them to ask questions—establish a give-and-take atmosphere for the class*
5. *Introduce material like the learner's book, newspapers, magazines or ICTs /websites and others that give the flavor of the class and connect it with agriculture or experiences that learners have already had.*

Teach it to ensure understanding

Share point by point what you have been instructed to do starting with number 1 all the way to 5. Start by introducing yourself. Tell them how motivated you enjoy by having them in your class as new partners. Inform them that you are going to work and build a big team of champions of agriculture as a way of life and livelihood in Uganda

Possible answers is a warm and welcoming atmosphere to build rapport

WEEK2

Teacher Preparation

1. MAKE A REQUISTION TO THE SCHOOL ADMINISTRATION FOR ALL MATERAILS REQUIRED IN THIS CHAPTER ***TWO WEEKS BEFORE THE START OF TERM 1. DISCUSS THE MATTERS INVOLVED WITH AUTHORITIES CONCERNED****.*

2. Read and understand the introduction FOUR days before the lesson

3. Write down on a flip chart or print the reflection question one day before the lesson of what is the most common commodity people buy or sell in a market on a daily basis in your community? Have you ever imagined a day without food?

4. Visit the community to observe, identify and record agricultural products produced in your community and suggest their uses then prepare the list two days before the lesson

5. Secure a number of local products widely produced by agriculture around the school and those found in the local market one day before the lesson

6. Research on the comparison between agriculture and nomadism so that it is put in a table for learners to complete one day before the lesson

Teacher instruction

1. *Presented to the learners a variety of local product widely produced and used in that community*
2. *Ask them to identify the local products and suggest their uses*
3. *Ask learners to respond to the reflection questions of: Have you ever imagined a day without food? What is agriculture? What is nomadism? What is subsistence farming? What is commercial farming? What do you say about the agricultural activities and products in your community*
4. *Present a table 1.1 for learners to write in their exercise book and complete*
5. *Give learners instructions on their short visit to a local market where they will spend only 30 minutes and the task will be to observe, identify and record agricultural products produced in your community and suggest their uses*
6. *Ask learner to be in pairs during this short visit*
7. *Arrange for 5 groups to present and the rest to put their flip sheet in a learning station in the class.*

DISCOVERY, EXPLORATION, LITERACY, APPLICATION and ANALYSIS

Activate Prior Knowledge

Present to the learner a number of local agriculture products and ask them to identify them and suggest their uses (10minutes)

Ask the learner to answer the reflective questions: Have you ever imagined a day without food? What is agriculture? What is nomadism? What do you say about the agricultural activities and products in your community? (10minutes)

Ask learners to read text below in learner's book and note down words they consider important (5 minutes)

Introduction

In this Chapter you are going to find out the opportunities and benefits of engaging in agricultural production activities. This will enable you to identify possible careers that will enable you produce enough food and have enough income to live a comfortable life. Developing an interest in agriculture can lead to a fulfilling career. Think about the different activities in agriculture and select those that appeal to you. Engaging in any of these will lead you to discover the opportunities in Agriculture. What is the most common commodity people buy or sell in a market on a daily basis in your community? Have you ever imagined a day without food?

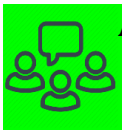
Ensure understanding

Teach it

Historical background to agriculture in Uganda

People must have food to live and there are different ways of getting food. In Uganda, many years ago people used to get food through hunting and gathering. It became more and more difficult to get food which forced the people to domesticate crops and animals for a more reliable supply of food. Before 1900, shifting cultivation and nomadic paternalism were the main forms of agricultural production. They have long been replaced by commercial farming on large scale production using fertilizers, machination, and agrochemicals and selling to the market beyond the local community.

Guide learners on how they will behave during a short visit to the local community (5minutes)
Go to the local community market (30minutes)
Instruct them to be in pair to observe, record and suggest the uses of the agriculture products
Gather in one place at the community for a debrief so that 5 pairs present to the class and ask others to point out what else could be added (10 minutes)
Ask learners to copy and complete table 1.1 when you are back in class(10 minutes)



Activity 1.1Exploring agricultural activities in your community

You will need: note book, pen and observation list

In pairs

1. Develop an observation list of agricultural activities and products in the community
2. Make a plan of your movement in the community
3. Carry out the visit, observe, identify and record agricultural products produced in your community and suggest their uses. Present your findings in class.
4. What do you say about the agricultural activities and products in your community?
5. Compare agriculture and nomadism by completing the table below

Table 1.1 Comparison of agriculture and nomadism

	What you know about it	Examples to show it	Definition
Agriculture			
Nomadism			

6. Extended work in groups "Identify the value of agriculture and the prospects for the future of agriculture in Uganda, regionally and globally
7. Extended work in groups "Investigate the evolution and progress in development of agriculture activities in their community and other regions in Uganda

Possible answers
Responses given by the learners will depend on a given community where the school is found
Have you ever imagined a day without food? ***Definitely No***
What is agriculture? ***This is art and science of growing crops and rearing of animals by ma****n*
What is nomadism?
What do you say about the agricultural activities and products in your community? Response will be according to the community where the school is found.

WEEK 3

Teacher Preparation
1. Read and understand the next page two days before the lesson
2.Identify a typical family in your community with two adults (male and female) two school going age children and one housekeeper or one worker for this family
3. Write down the names of the family members and what they do daily as their main work or job on flip chart or using ICT print a big font size A4 pages containing this information
4. Using a coloured printer make copies of figure 1.2 or by help of coloured pencils/paint get support of a fine art teacher to ask some learners to draw pictures in figure 1.2 list <u>five days</u> before the lesson
5. Secure a number of old local newspapers or magazines containing picture of products from or activity in agriculture for learners to use make a collage
6. Prepare a manila cards or ICT aided quiz containing words for learners to unscramble in activity 1.2 two days before the lesson
7. Use Google apps/Whatsapps to share a picture of a collage on value of agriculture

Teacher instruction
1. *Ask learners to identify the names of five family members in the community and what they do as their main work*
2. *Presented to the learners a variety of local product widely produced and used in that community*
3. *Ask learners to read Activity 1.2 in the learners book and answer question b*
4. *Ask learners to respond Activity 1.2 question c and d*
5. *Guide learners to make a gallery walk on the responses for question c on the posters mad*
6. *Ask learners to submit their exercises books or those having ICT facilities to submit saved files of unscrambled work and send it by email or Google/ whatsapp*
7. *Ask learners to use Google apps/whatsapps to share a picture of a collage on value of agriculture*

DISCOVERY, EXPLORATION, LITERACY, *APPLICATION* ***and ANALYSIS)***

Activate Prior Knowledge

Start by asking 4 learners to volunteer and tell them to share information about the different members of their family and what they do as work beginning with their parents or guardians
Categorize the information on the chalkboard or using ICT white board /projector screen
Ask learners to do activity 1.2below

Ensure understanding

The value of agriculture to the community

Agriculture is the way of life for most people in Uganda. About 70% of the population is engaged in agriculture. It contributes about 25% to the national gross domestic product (GDP). Local agricultural production contributes 85% of the food consumed in Uganda

Activity 1.2 Importance of agriculture to society

You will need: notebook and pen

a) Individually, write down the names and occupations of about five family members within their local area, indicating what they do for their income and livelihood.

a)

b)

c)

Figure1.2 Products from agriculture

Teach it

Government is committed to transforming agriculture from subsistence farming which is characterized with low-productivity and low incomes to commercial farming so as to take the country to a middle income status

Emphasize that a large population in Uganda directly or indirectly earn income and livelihood in agriculture activities

b) Answer the following questions in your exercise book.

1. Study the photographs above and mention what you see
2. What role does agriculture play in relation to what is found in the photos
3. Why is agriculture a main way of life for about 70 percent of the people in Uganda?
4. List five benefits Ugandan get from Agriculture

c) In groups, collect pictures / labels /samples and make posters showing the food and other products people get from crops and animals

You will demand a report on the group work in the next lesson

d) In pairs, can you unscramble these letters to find these animals and crops that you might find on farms in your community? Write your answer next to the box. There are other animals and crops you can find in the Uganda. How many others can you think of? Write their names and what it does for us as human beings?

Possible answers

- *Answers given by the learners will include their fathers/mother/sister/aunt/brother/ family worker/housemaid*
- *Answers given by the learners will depend on their interpretation of the photos in figure 1.2 such as provision of food, employment , raw materials and income*
- *You can use this method to record achievement on a scale of 1-5 on sharing a picture of a collage made on the value of agriculture to society:*

A: "achieved the learning outcome"
C: "achieved making the collage and sharing with other people did not occur:
E: "requires more support to achieve the learning outcome" (Please describe the support needed by each individual)

- *Answers given by the learners will include (animals) cows, horses, chickens, fish, goose, donkey, pigs, sheep, rabbit, goats and (crops)tea, cotton, banana, mango, coffee, lettuce, chili, rice, cabbage, pawpaw*

WEEK 4

Teacher Preparation

1. Read and understand the next page two days before the lesson
2. Identify the things in text that are used as inputs, process and outputs in agriculture activities as stated in the text
3. Design a format and write on flip chart or using ICT for capturing inputs, process and outputs in agriculture activities as stated in the text
4. Research in the library or internet about the different farming systems in Uganda
5. Study the pictures on the different farming systems in Uganda
6. Review the questions in activity 1.3

Teacher instruction

1. *Ask learners to recall and tell their class how they prepared for the first day of classes? Ask four volunteer to give this account. Then ask another four to tell what happened in the class on that day? What did they do and what did the teacher do? Finally ask another four to tell what new things happened on that day? Record the response in three column as inputs(preparing for the first day), process(things that happened in the class), and output(new things that happened on that day)*
2. *Ask learners to read the text on next page from the learners book in pairs and identify things that can be taken to be inputs, process and output following the designed format*

3. *Relate the input, process and output model to what happens in different farming communities where you have people, climate, land, vegetation, animals or crops that determine the activities carried out and what is produced. Ask learners to do activity 1.3 below*
4. *Illustrate to the learner the local farming system of the area using input, process and output model and then ask them to go to library or internet to search for six other farming systems in Uganda*
5. *Ask the learners to draw a MAP of Uganda showing the different farming systems*

DISCOVERY, EXPLORATION, LITERACY, APPLICATION *(30 minutes)*
Start by introducing the lesson using the content of the first lesson on crops and animals in the learner's community. Ask learners to tell you the main crops and animals in their district
Ask learners in pairs to read the text below and answer questions by identify things that can be taken to be used to produce (inputs), the activities that occurs (process) and what is the outcome from the activities (output. Ask learners to copy the following table on farming system approach and complete it with 4 processes (20 minutes)
Table of a farming system approach

Inputs	**Processes**	**Outputs**
Pastures, dairy cows, water	Feeding or rearing	Milk

You will ask learners to read the text below and do activity 1.3 individually or in groups to identify the activities carried out, the inputs used and suggest farming system
Understanding farming systems in Uganda

Agriculture can be looked at as a production system where inputs are changed into products through a production process. The most important inputs are include natural sources like water, sunshine and soil and manmade sources like seeds, animals, fertilizers, agro chemicals, labour and machinery. Some operations that are involved include ploughing, digging, sowing, irrigation, weeding, crop care or protection and harvesting. While the outputs from the systems include crops, wool, dairy, meat, hides, manure and poultry production. Therefore a farm is a system with inputs, processes and outputs. A farming system is everything that the farmer does in farming under the existing climatic, socio and economic conditions of an area.
A farming system is a way of organizing a farming enterprise. Systems vary widely depending on several factors.

Activity 1.3 The value of farming systems and their socioeconomic impact on Ugandans

You will need: note book and pen

a)

b)

c)

d)

e)

f)

g)

Figure1.3 Different farming activities in Uganda

Learners will answer the questions below (30 minutes)

a) In groups answer the following questions in your exercise book.

1. Study the photographs above and mention what you see
2. What farming system is shown in each of the photography above
3. Of what value is each of the farming system above and benefits to the people shown in the pictures

Individually learners will discover some animals. They will get to know what each animal eats; where they live and which product they give.

Cow Fish Sheep

Pictures of these animals

Goat Pig Donkey

Pictures of these animals

Rabbit Chicken Turkey

Pictures of these animals

b) In groups, research on four different farming systems in Uganda including one of your community, noting and reporting to the class on the:

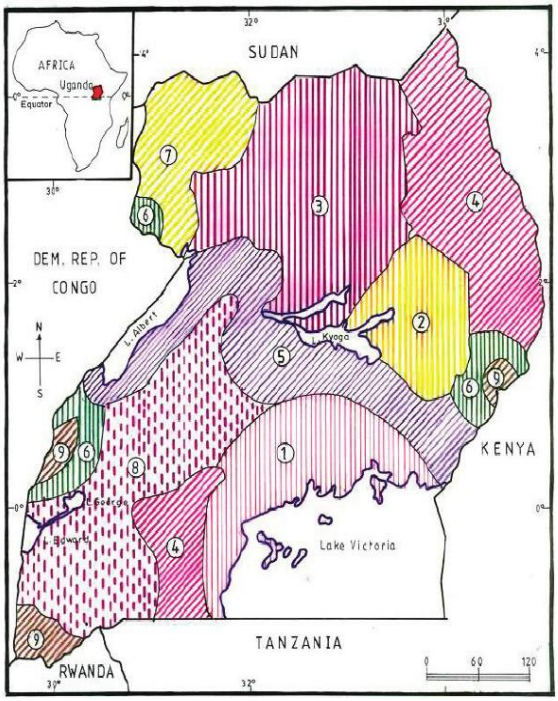
i. reasons for different systems in different regions

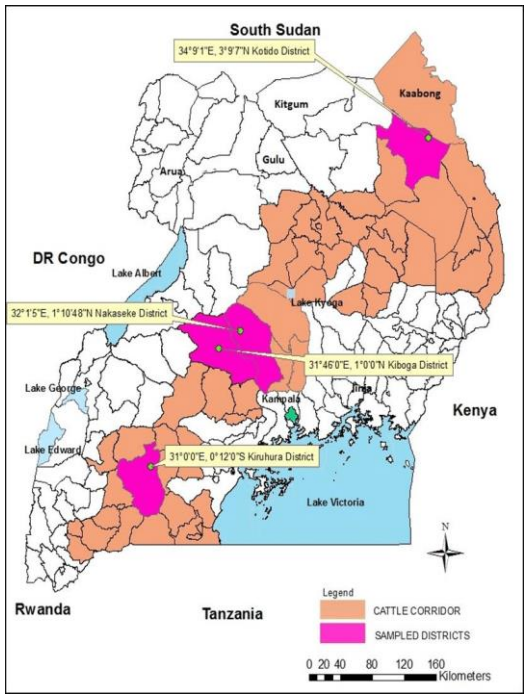
ii. The value of farming systems and the benefits to Ugandans

c.)In pairs or groups, draw a map of Uganda, research and indicate the areas of crop and animal production.

Possible answers

Learners will provide names of the crops and animal found in their area where the school is found





1. Banana, Coffee
2. Teso
3. Cotton, Sorghum, Rice
4. Pastoralism
5. Cotton, Cattle, Millet
6. Cassava
7. Sorghum, Tobacco
8. Cattle
9.Montane

Note that Nomadism is a reality in Karamoja and Ssembabule or Cattle Corridors of Uganda which nobody can refute It is what most teachers would fail to bring out

WEEK 5

Teacher Preparation

1. Prepare a case study on keeping record shown below

Case study of Porena and Minu

Porena and Minu operated a small scale business which dealt in selling fruits of all varieties, such as pineapples, oranges, passion fruit, bananas, watermelons, grapes and many others. They received their supplies directly from the farmers. To ensure good operation of the business they tried very hard to keep good records. They maintained a supplies book where he recorded all the supplies from each supplier. In the supplier book they recorded the quantities supplied and the amount of money the supplies were worth. They also maintained a cash book where they recorded the cash sales. They also recorded any credit given to their customers on small pieces of paper. They also recorded all the business expenses in a hard cover book.

Porena and Minu was very happy with the record keeping but one day the pieces of paper on which they recorded the creditors disappeared and subsequently, they were not able to tell how much they owed their creditors. This had taken two seasons. Yet each season many people carried out business with them. Porena and Minu found it difficult to recall the exact person who gave them credit and the total amount to pay from their head or memory. So they kept on wondering who to pay and how much to pay.

In 2018, the Uganda Revenue Authority (URA) staff visited Minu and Porena's vegetable and fruit business and demanded to see their records. They had no clean book to presents. The data was difficult to understand as on some pages you could find phone numbers with names in the column of total amount. Minu and Porena were surprised to hear that vegetable and fruit sellers were required to maintain records for inspection by the Uganda Revenue Authority staff. The URA staff gave them one month to prepare the records. They did not know where to begin

2. Prepare the questions below for reflection on a flip chart or using ICT on power point for projection on the screen

- *How effective in your opinion are Minu and Porena at record keeping?*
- *Identify the records that Minu and Porena should maintain to meet the requirements of the URA.*
- *If you were Minu and Porena, what methods could you employ to improve the system they have?*
- *Organize learners in groups to perform a role play*

Teacher instruction

1. *Anchor the lesson by telling the learners to read the case study and answer the questions prepared*
2. *Ask learners to read the learners book on importance of keeping records*
3. *Follow the guidance on the different types of records kept and reasons for keeping records*

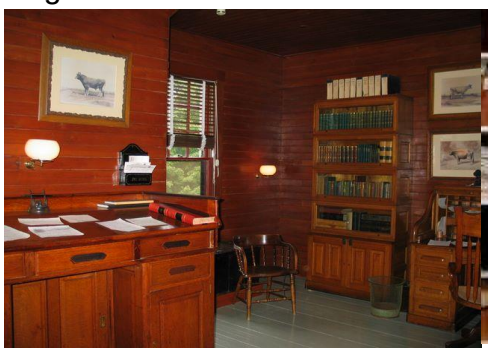
DISCOVERY, EXPLORATION, LITERACY, APPLICATION

Ask the learners to read the case study above on photocopies in pairs/groups or ask a volunteers to read aloud to the class. Instruct learners to respond to the questions prepared (35 minutes)

Teach it and ensure understanding

Importance of record keeping in agriculture

Record keeping is the act of writing down or documenting the activities you are involved in. In the past people used to keep all their information in the head. Today this has changed because the quantity of information that needs to be kept is big. So there are special record books or computer programmes that may be used. Keeping records helps n effective running of farm activities. The activities include planning, budgeting, implementing and evaluation of farm activities.



Record keeping is an important aspect in all human activities. We all keep records of some kind as you do activities. This is because all of us need to keep track of what happened. Farm records are essential to good farm management. Planning decisions rely on information concerning expenditure, use of stock and productivity. Without records the farmers has to make decisions based on guesses. This makes farming activities to be risky. The exact records kept depend on the farming enterprise or activity.

Teach it and emphasize (35 minutes)

Record keeping is important in a business for it is the only way to inform the farmer how the business of agriculture is doing. In order to analyze the 'health' of your agriculture business you need data! Therefore, a systematic process of gathering data and recording it should be set up.

Ask learners to suggest the records kept on the farm

This should be followed by learners to suggesting the reasons for keeping records

Summarize the topic by teaching that

In order to fulfill the needs identified above you will need different sets of records. A farmer should maintain records to meet his or her agriculture business requirements. The following are examples of records that can be maintained:

- *Credit records*
- *Debtors records*
- *Production records (labour, yield, inputs, diary,)*
- *Cash book (petty cash book,)*
- *Purchases records*
- *Stock records*
- *Assets records (inventory, asset register, investment register)*

Ensure understanding

Records are a legal requirement. Records help an entrepreneur keep track of business transactions, aid in the filing of taxes, compile final accounts and act as a future reference. Record types include: Credit records, Debtors records, Production records, Cash book, Purchases records, Stock records and Assets records. As the business becomes more sophisticated it will be necessary to hire a knowledgeable farm auditor, book keeper or farm accountant.

Possible answers

The main idea of the case study is to show that records are a legal requirement and help to run farm business better. As the business becomes more sophisticated it will be necessary to hire a knowledgeable farm auditor, book keeper or farm accountant

The following documents should be kept:

- *Production records;*
- *Operation records such as labour, farm inputs, tools and equipment costs;*
- *Cash transactions*

It is important to keep records for the following reasons:

- *Future reference;*
- *Keeping track of business transactions;*
- *Filing of taxes;*
- *Compiling final accounts*

WEEK 6

Teacher Preparation

1*. Gather real challenges farmers face with keeping record*

2. Think about a conversation between farmers written down on a flip chart/canvas or on power point for projection. Or have an argument between two groups where one is in favour of records and another group is against for learners to role play.

3. Make photocopies this conversation to give to the class

Conversation of animal farmers

Farmer 1: *Hullo, our animal doctors do not really know anything about what we do. They do not write down what they do.*

Farmer 2: *But 90 percent are always on motorcycle as they come to treat our animals. Every time you call them; they just pull out an overall coat, gumboots, syringe, a pack of medicine and gloves.*

Farmer 3: *You are lucky. What did you give them? The animal doctors come so rarely that they really know much about our animals. I really doubt if they know what we are doing?*

Farmer 1: *My elders these people are highly educated. They went to our good universities. But they do not take things seriously. They do not know that our animals are our life.*

Farmer 2: *No! No! No! I do not feel that I can have a serious talk with our animal doctors. No wonder this one who comes to our village studied in the same school as the human doctor in our dispensary. This person's attitude to animal farmers has not changed over the years.*

Farmer 3: *No, these doctors pay no respect to the animal's legislation and welfare ethics. To my surprise when you visit their office; there are heaps of books on the working table!*

<u>Questions</u>

- *What is this conversation about?*
- *What issues are the farmers talking about*
- *What do the farmers expect from the animal doctors*
- *If you are one of the farmers what could you do in this situation*

4. *Write these reflection questions for the role play*

- *What have you learnt from the role play*
- *Who were more forceful in their argument and why*
- *Which side modified its position in any way as the argument went on and how*
- *Which side was more successful in arguing and why*
- *Which side was more effective, confrontational or negotiating*

Teacher instruction

1. *Divide the learners into 5 groups that is two for the role play and three for the conversation*
2. *Ask the groups to prepare, discuss and present the role play and conversation*
3. *Organize for the presentation with the goal of aiding you in effectively conveying information in a way that allows learners (or the audience) to remember what is said or done*

4. *Emphasize that presentations are a great way to have learners practice all language systems areas (vocabulary, grammar, discourse and phonology) and skills (speaking, reading, writing and listening). It allows learners to build confidence, and presenting is a skill that most people will need in the world of work. You find that learners who are good presenters are better communicators all round, since they are able to structure and express their ideas clearly. Presentation skills are extremely useful both in and outside the classroom. After completing a project, a presentation is a channel for learners to share with others what they have learned. It is also a chance to challenge and expand on their understanding of the topic by having others ask questions. And in the world of work, a confident presenter is able to inform and persuade colleagues effectively*

5. *Takes notes for feedback later particularly on how learners supported each other before, during and after the presentation*

6. *Ask learners to do activity 1.4 by both role play and conversation above*

EXPLORATION, ANALYSIS, CREATIVITY, COLLABORATION, CRITICAL THINKING

TEACH It

Start with dividing the learners in groups (10minutes)

Inform the learners that some two groups will be doing a role play and the other three groups will be making a conversation.

Give the role play as one group is in favour of records and another group is against and ask each group to choose 4 members to present.

Give the other three groups the copy of conversation of farmers where each group is farmer participating and each group to have one member to represent them. Allow them to practice

Ask the groups to present their work to the class. (20 minutes)

Arrange for classroom presentation (25minutes- setting the stage 5 minutes, role play 10 minutes and conversation 10minutes)

Ask learners to answer the reflection questions above and complete activity 1.4 questions 1b and 2 (20 minutes)

Summarize the main points (5minutes)

Activity1.4 Understanding the importance of record keeping in agriculture

You will need: note book, pen

a) In groups, prepare and present a role play of a conversation between two groups, one who recognizes the importance of keeping records and one who does not. Whole class discussion then considers which is likely to be more productive and why.

b) In pairs,

1. Identify and write the kind of information found in each of the types of record above

Type of record	**Information shown**
Production records	
Financial records	
Health records	
Breeding records	
Performance records	

2. Mention the importance of keeping each kind of information in the records above

Possible answers

- *Conversation about record keeping and record making*
- *Animal doctors who do not make records but give treatment taking farmers to be ignorant*
- *Role play illustrate how communication, listening, decision making, critical thinking and negotiation is done*

Types of records

Production records	*Is a written statement of activities and transactions in producing specific crop or livestock*
Financial records	*Written lists of expenses and incomes*
Health records	*Is a written statement of activities and transactions of pests and diseases management crop or livestock*
Breeding records	*Is a written statement of activities and transactions of breeding specific crop or livestock*
Performance records	*Are written accounts of the experiences or achievement/output*
Cash records	*Written financial transactions, receipts and payments*
Inventory record	*Is a written list of everything you own including money*
Farm record	*Is a document (in most cases a book) that is used to keep account of **different** activities, events, materials or things regarding the **farm** operations/work*.

It is important to keep records for the following reasons:

- *a requirement for support by lender, financial service providers who would like to good records of farm incomes and expenditure*
- *helps the farmer to plan and do a realistic forecasting*
- *as a future reference;*
- *as way of keeping track of business transactions; income and expenditure*
- *for filing of taxes and compiling final accounts*
- *for better prediction of rainfall and season which helps one to decide when to plant and when to carry out other activities*

WEEK 7

Teacher Preparation

1. Read the MOES (2017) National Guidelines for Post-Primary Institutions: Guidance and Counseling Programe; Kampala Uganda

2. Extract the topics for senior one and make a chart for display

	Topic	*Activities*	*Resources*
1	*Orientation and induction*	*Focusing learners on why they came to school and in agriculture*	*Film show* *https://youtu.be/h1wVXmRZvQA* *http://blogs.worldbank.org/youthink/five-reasons-why-youth-should-choose-agriculture*
2	*Self understanding* *Self exploration*	*Relate specific subjects; strength and weakness to careers* *Identify personal interest, abilities, dreams and talents to enhance decision*	*Johari window* *Role play*
3	*Career vocational exploration* *Formation of career clubs* *Career planning and development*	*Focus on a career path* *Awareness of different careers*	*Guest speakers* *Gallery walk*

3. Contact the school career coordinator to identify guest speakers who are authorities in agriculture sector and career pathways or those who take agriculture as their general direction of life for an effective and sustainable livelihood. Include guest speakers with a good career profile (agriculture teacher/educator; plant breeder; dairy operator; small animal veterinarian; pesticide applicator; feed mill operator; nursery operator; agro processor; poultry farmer; fish farmer; goat farmer; biotechnologist; poultry inspector; agro input dealer; grain grader; meat/fish/rabbit/vegetable/fruit processor

4. Contact the two guest speaker and confirm their coming plus their facilitation one week early who will give practical knowledge and real-life and world examples

Teacher instruction

1. Prepare a chart of the topic and display it in the class

2. Contact the two guest speaker and confirm their coming plus facilitation two days before the lesson. They will use 20 minutes each (10minutes for presentation and 10minutes for questions)

3. Guide learners to work in group to develop questions they will ask the guest speaker including doing a mock two days before. You can share ideas like these.
"I see that in our village and the farm people who are like you; they do work for very many hours and all the time. So I would like to know what guided them to decide to choose this career in farming.
Can you tell us more about the most important factors you considered and why"?
"In your presentation you have discussed at length what motivated you and why you are still in that life as……. What was your reasoning at my age to make that choice and what has helped to stay with your decision and career path?"

prepare questions that are due two-three days before the speaker's visit.

EXPLORATION, ANALYSIS, APPLICATION AND DISCOVERY
Start by making a brief introductory remark to the class and request the guest speakers to introduce themselves to the class the n deliver their presentation (10 minutes)
Give the guest speaker the opportunity to tell the learners their personal information and talk about their career profile and experience since they joined that path (20 minutes)
Allow the learners to ask questions and receive feedback. Encourage others to write down their questions and forward them to guest speakers (20 minutes)
Ask the career coordinator to send off the guest speaker (5minutes)
Ask learners to read in pair the content on careers in agriculture and identify 3 important things to remember (25 minutes)
Teach it

Careers in agriculture

Most young people wonder about their future. They want to be successful in something they enjoy doing. They want to have enough income to live a comfortable life. To achieve this **it requires good planning and preparation**.
A career is an occupation undertaken for a significant period of a person's life and with opportunities for progress. It is the general direction of a person's life in terms of employment. A **Career** may be the sequence of jobs that a person holds to make a living. This may lead a person to have a good income and a better standard of living Careers in agriculture are grouped into pathways. **A pathway** is a group of careers with similar education, training and interests. There are several career pathways in

agriculture including animal, crop, nutrition, agribusiness, conservation and technical systems.
Since you will probably spend the greater part of your adult life working, you will need to familiarize yourself with all kinds of career possibilities in agriculture for you to realize where your interests lie so as to identify a career for better life.

Possible answers
A career requires good planning and preparation; a general direction of a person's life and are grouped in pathways.

WEEK 8

Teacher Preparation

1.Make copies of Rabia story below

<u>Rabia at the road round about</u>

One evening, people found Rabia sitting on the road searching for something. She was an old woman, her eyes were weak, and it was difficult for her to see. So the neighbors came to help her.
They asked, 'What are you searching for?' ***Rabia said, 'That question is irrelevant, I am searching. If you can help me, just help.'***
They laughed and said, 'Rabia, have you gone mad? You say our question is irrelevant, but if we don't know what you are searching for, how can we help?'
Rabia said, 'Okay. Just to satisfy you, I am searching for my needle, I have lost my needle.'
They started helping her — but immediately they became aware of the fact that the road was very big and a needle was a very tiny thing*.*
So they asked Rabia, 'Please tell us where you lost it — the exact, precise place. Otherwise it is difficult. The road is big and we can go on searching and searching forever. Where did you lose it?' Rabia said, 'Again you ask an irrelevant question. How is it concerned with my search?' They stopped. They said, 'You have certainly gone crazy!' Rabia said, 'Okay. Just to satisfy you, I have lost it in my house.' They asked, 'Then why are you searching here?'
Rabia is reported to have replied saying, ' because here there is light and there is no light inside.' So if you had brought light things could have been easy.

2. Write the questions to be posed to the learners

- *What have you learnt from the Rabia story*
- *What does the story tell us about the people around us*
- *What does the story tell us to do or ask from the people around us as learners*

Teacher instruction

1. *Review the guest speaker presentation using a KWL chart below*

What do you KNOW about career 1 career 2	***What do you WHAT to know about career 1 career 2***	***What have you LEARNT about career 1 career 2***

2. *Summarize what the learners need to start doing to prepare for their career*
3. *Ask learners to read the story of Rabia and answer the questions that follow in pairs*
4. *Ask learners to present their work for a discussion*

DISCOVERY, EXPLORATION, LITERACY, APPLICATION and ANALYSIS)

Activate Prior Knowledge

Ask learners to read the story of Rabia

Possible answers

Use this to explain that the parents, teachers and other adults are only holding the torch and learners have to see light and move in the right direction to search for their needle like Rabia. This is exactly the story of career seekers – their inside them is darkness, un-illuminated potential. They have no idea of their potentials, their dreams, and their talents.

The market place, however, is bright and lighted. Every job seeker knows what's on and what's not with their prospective employers. Most important every one of us knows what and how best they want to contribute to better life for their communities.

They know which industry, which company or activity will pay a hefty starting salary and may be evening alluring perks. Their parents and other adults speculate unknowingly what kind of a job or life for their children that will fetch a handsome dowry. But none of these people or nobody knows, and does or do not even care to know, what the aspirant or child is wired for. What's that one dream he/she is born to fulfill and make his/her destiny. What is it that makes him/her unique, awesome and admirable? Just because the inside is dark and there aren't many willing to lend a lamp to see what's hidden out there, there entire career eco-system seems to have given up hope of a career being crafted inside out – based on individuals' talents and potentials.

They behave like a horticulturist or fruit seller who is in a hurry to get their apples sold, they somehow manage to get a polish on them, hoping to fool the buyer, and they send cart loads of them to the market.

Then ask them to start planning and collecting as much information about what they what to be.

WEEK 9

Teacher Preparation

1. *Develop a chart or tree chart the six steps in a career action plan below:*

- ***I Discover****: young people discover their strengths and talents;*
- ***I Explore****: young people explore the world of work and their place in it;*
- ***I Focus****: young people focus on their values and interests;*
- ***I Plan****: young people use decision-making skills to plan their learning and career programs;*
- ***I Decide****: young people decide on their best options and opportunities; and*
- ***I Apply****: young people apply their skills and knowledge to their learning and career planning*

2. *Type or write using a marker on manila sheets the career action plan step on an individual with clear and readable words*
3. *Get masking tape or glue and stick on walls/ trees in the compound or space in the play ground these action steps*
4. *Prepare work sheet for follow up activities*
5. *Design a table 1.7 with two column namely action step and learners response to it*

Action step	***Learners response***
I discover my strength and talents	
I explore the world of work I am interested in and where it is found	
I focus on my values, interest and what is expected in the career	
I decide on what school activities that can help me move into my career	

I identify the opportunities and best options in my career	
I apply the skills and knowledge to demonstrate my interest in the career	

Teacher instruction

1. Divide learners into groups of three. Tell them to work as follows that one becomes their secretary and the other two are runners to six stations to read, understand and come to inform the secretary what to write. This activity will take them only 10 minutes

2. Start them off to do a running dictation and ask them to rank them indicating which one is first and last.

3. Ask the groups to hand over their final wok to the immediate next group

4. Guide line to create the correct order of the steps in a career action plan as you conclude the discussion

5. Ask the learners to do the last table1.7 and 1.8 in their exercise book or word document

DISCOVERY, EXPLORATION, APPLICATION and ANALYSIS

Activate Prior Knowledge

Teach it

Career action plan helps you to focus on your goals and plans for the future. It helps you to work out how you are going to achieve what you want relating to school, work and life. A Career Action Plan lets you decide what you are going to do and how you will do it.

Ask learners to set goals or what they want to do in a table 1.8 below

What is my goal?	How will I do it?	Why is it important?	When will I do it?

Possible answers

Learners copy out the table and complete it as work in progress they will share

WEEK 10

Teacher Preparation

1. *Prepare resource list where learners can get information about different career which will include library, internet web pages, agriculture magazines and newspaper*
2. *Print out many copies of the following careers action plan*
3. *Prepare an agricultural career of teaching that appeal to you*

CAREER ACTION PLAN SHEET

- Tick the words that describe you. You can add to the list.

☐Loyal	☐Committed	☐Enthusiastic	☐Follow rules
☐Reliable	☐Adaptable	☐Sense of humour	☐Believe in yourself
☐Honest	☐Motivated	☐Well-dressed	☐Work well under pressure

- List the 3 things you most enjoy in life, such as looking at animals/plants, travelling, being quiet, computer games, dancing, art or wood work.

☐
☐
☐

- Tick the boxes that match your current skills and abilities, and whether you can do them on your own or with help from others. Then tick the box that describes how well you can do each skill. You can add to the list.

			How well I can do it		
On my own	with help		okay	good	really good
☐	☐	Communicate with people	☐	☐	☐

☐	☐	Work in a team with other people	☐	☐	☐
☐	☐	Solve problems	☐	☐	☐
☐	☐	Come up with my own ideas	☐	☐	☐
☐	☐	Plan and organize things	☐	☐	☐
☐	☐	Manage my own time	☐	☐	☐
☐	☐	Learn new things	☐	☐	☐
☐	☐	Use technology	☐	☐	☐
☐	☐		☐	☐	☐
☐	☐		☐	☐	☐
☐	☐		☐	☐	☐

- Tick the boxes that match your preferred type of work.

☐ Scientific
☐ Creative
☐ Helping
☐ Hands-on
☐ Outdoors
☐ Office
☐ Retail

- Write the type of task you undertake when you are in your community for the good of all people.

Teacher instruction

1. *Distribute the careers list below provided on a chart*

CAREER AREAS IN AGRICULTURE

There are several agriculture careers in:
a) sales; (b) services; (c) marketing; (d) production; (e) education; (f) agro processing; (g) journalism; (h) engineering; (i) administration; (j) management; (k) quality control; (l) food inspection; (m) certification (n) advocacy (o) leadership and politics

List of some careers opportunity in agriculture

Agricultural Economist Agronomist Agricultural Engineer Animal Nutritionist ***Politician*** *Animal Physiologist Agriculture Educator Biochemist Biometrician Biosystems Engineer Biosafety Scientist Botanist (Plant Biologist) Climatologist Entomologist* ***Farmer*** *Ecologist Remote Engineer Environmental Scientist Fisheries Scientist Food Scientist Florist Food Process* ***Educator*** *Food Inspector Food Safety Specialist Forester Forage Agronomist Geneticist Horticulturist Hydrologist Logging Engineer Agronomist Marine Scientist Molecular Biologist Animal Surgeon Naturalist Nutritionist/Dietician Aquaculturist Plant Pathologist Plant Physiologist* ***Agriculture Teacher*** *Postharvest Technologist Range Manager Sensing Specialist Soil Scientist Toxicologist Turf Scientist Veterinarian Viticulturist Agriculture Writer Weed Scientist Wildlife Scientist Biologist Wood Scientist Plant Breeder*

Pesticide Applicator *Dairy Operator* *Dairy Scientist* *Feed Mill Operator* *Poultry Scientist* *Molecular Biotechnologist* *Meteorologist* *Soil Physicist* *Soil Chemist* ***Sociologist*** *Grain Grader* *Poultry Inspector* *Beekeeper* *Agricultural Chemical Dealer* ***Agricultural Journalist*** *Agricultural Photographer* *Agritourist Manager* *Animal Pathologist* *Beef Producer* *Biological Engineer* *Environmental Engineer* *Ecologist* *Epidemiologist* *Farm Appraiser* *Farm Manager* *Fish Hatchery Manager* *Floral Designer* *Forest Ranger* *Poultry Hatchery Manager* *Nematologist* *Green House Manager* *Irrigation Specialist* ***Agriculture Loan Officer*** *Meat Scientist* *Nursery Manager* *Parasitologist* *Swine Producer* *Agricultural Machine Welder* *Surveyor* *Waste Management Specialist* *Water Specialist* *Timber Dealer* *Crop produce Dealer* *Soil Conservationist* *Agricultural Tax Consultant* *Plant Clinical Doctor* *Vegetable Farmer* *Organic Farmer* *Zoologist* ***Agricultural Curriculum Specialist***

Watch the YouTube https://www.edutopia.org/article/competency-based-learning-developing-mastery-skills-and-content

2. *Guide learners to complete the career action plan sheet provided*
3. *File all career action plan sheets for future discussions*
4. *Ask learners to activity 1.5 below*
5. *Make an agriculture career example of teaching that appeal to you*

DISCOVERY, EXPLORATION, APPLICATION and ANALYSIS
Activate Prior Knowledge
Teach it
Start with completing the career action plan and the goal table
Guide learners to work individually as they complete the career action plan and goal sheet
Allow the learners to do activity 1.5

Activity 1.5 Available career opportunities in agriculture
You will need: note book, pen,
a) In groups, investigate and prepare a presentation on the:
i. different agricultural careers and the appeal of each
ii. Working conditions of farm workers in relation to the provision of basic necessities Provided within the agricultural sector
b) Individually recall or go out in your community and identify;
i. One individual doing a career in agriculture
ii. Find out how he/she made it, the opportunities and challenges faced in doing that career.
iii. Are there any other careers in agriculture? if so list them down
iv. Present your findings in class

Possible answers

Complete your own career action plan as a teacher of agriculture. Display it in the class
Receive feedback from the learners about your career action plan then inform them that this is what everyone needs to succeed in their career.

WEEK11

Teacher preparation

Write the activity of integration
Think of questions that will help learners develop the criteria of knowing that a person has responded to the task
Read about the principles of the response being ***Relevant****-correct or suitable for a particular purpose or data which is being used in the situation or problem at hand can help or contribute to the solution, Accurate-, Coherent and Excellent (RACE)*

Teacher instruction

Ask learners to read individually the context and task
Guide learners to suggest the criteria they would follow in responding to the task
Ask learners which materials or pictures and information would be useful in guiding learners to respond to the task
Summarize the activity by drawing the criteria table and guide learners on the 2/3 or ¾ marking guide
Display the criteria in the classroom learning station or display board

ACTIVITY OF INTERGRATION

Context

Most young people wonder about their future. They want to be successful in something they enjoy doing like the great celeb you know in Uganda. They want to have enough income to live a comfortable life. They must have interest in those things that appeal to them. They look at opportunities and develop plans to achieve their desires. Agriculture has many such areas.

Task

Identify something in agriculture you want to be successful in and write down the opportunities and challenges involved.

Criteria for the situation of integration on a selected career

1. Personal strength
2. Personal goals
3. Building expertise
4. Extrinsic and intrinsic motivation
5. Building of network to support you

Evaluation grid

A chosen career by the learners to show the opportunities and challenges

Criteria	Relevance	Accuracy	Coherence	Excellence
Personal strength	How a learners has done self assessment of their strength	How the strength match the characteristics observed in the person	How the actions are balanced with the persons personal, social, and professional life in the selected career	Persons weakness to be changed to get the opportunities in the career
Personal goals	What are values of the person choosing a given career	What the person stands for and how it matches the values expected in the career	Role modelling and exhibiting the values expected in the career selected	Definition of success in the career selected as per the values required
Building expertise	Which:	Which levels	Which persons	Which auxillary

	Knowledge, Skills, Mentoring, Certificate, Trainings is needed	must be attained to perform in that career	and the institutions are providing the expertise for the selected career	and soft skills a person will acquire to enhance performance in the career
Network to support you	Knowing who does what	Suggesting the right people and bodies that support or provide services the career	Listing network examples or stakeholder mapping using most important to least	Knowing the government policies that influence the career ecosystem
Extrinsic and intrinsic motivation	Passion, expected benefits Reward levels currently	Current rewards and benefits	Matching the rewards and benefits to the work involved	Looking for leverages and additional benefits or rewards

Learners should provide information for each square in the grid.

Example of opportunities and challenges as a grain grader

A grain grader evaluates and assigns grades to grains like maize, millet or rice. Good at observing the grain structure, cleanliness, size and shape. Sample of grains are always presented and are compared to standards sets for a given grain. A grain graders is careful and takes time to sort out the different seed sizes, cracked seeds, mis-coloured seeds, insect damage, moisture content and other factors as need may deem it. In some seasons grain production is very low, the seeds are of very small size and there is little work is available for a grain grader.

Grain graders work and get employed at silos; seed companies like Victoria Seeds; with export companies; government agencies like East African Grain Company; grain buyers; milling companies such as Maganjo Millers and other dealers where grain needs to be graded. In Uganda grading of grains is becoming a big sector as more is produced and the export market expanded. This is because Uganda is the food basket of the Great Lakes Region

Grain graders earn a salary in the UGX 24,000,000 per year by 2018; with annual training in digital literacy, communication, and customer care and negotiation skills. Grain graders need considerable knowledge of the grain being handled. They need practical experience as well as complete training in grading and a performance test certificate as a grain grader. At best one needs a Bachelors degree in agriculture or agronomy. However this not enough if it is not supported by annual continuous professional training in grading.

WEEK12

Situation of integration

Context

Farmers receive many people at their farm. Some of these come to experience the life of the farmer. They also get engaged in the activities at the farm. Unusually some do challenge the farmers on work they have a wide experience. This bothers them because the farmers they feel; you have to look from their point of view. They see the people coming to them failing to understand what farmers go through to do what they do.

Support

a)

b)

Task

As a person interested in taking farming as a career; make a 300 words speech or report to the class of what would you expect the people coming to the farmers to have so as to make the interaction change how farming is done?

Evaluation grid

	Relevance	**Accuracy**	**Coherence**	**Excellence**
Purpose or report	One occupation in farming as a career	Is an occupation in agriculture	Is one of the occupations in the area	
Introduction				
Description			Paragraphs with topical sentences	
Focus				
Conclusion				


Writing An Information Report
Purpose
To classify and/or describe.
Classification
Introduce your topic.
Description
Organise your information in paragraphs using topic sentences.
Conclusion
TeachStarter.com

CHAPTER 2: FARM TOOLS, EQUIPMENT AND IMPLEMENTS

COMPETENCY: You should be able to use measurement tools; crop and animal tools, equipment, machines and implements properly and safely in agriculture activities to ensure safety on farm.

Key words	By the end of this chapter, you should be able to
✔ Tools ✔ Equipment ✔ Implement ✔ SI UNITS ✔ Safety standards ✔ Hazard ✔ Health standards ✔ First Aid	✔ Identify tools used on the farm including garden tools, woodworking tools, metal tools, and the basic tools used for fencing, mechanics and farming activities ✔ Demonstrate skills of using farm tools and implements for better production ✔ Show skill in using common measurement tools for length, volume, time, and mass/weight ✔ Demonstrate basic occupational safety and health standards in agriculture ✔ Show skills in applying the steps in giving First Aid on the farm and during agricultural activities

WEEK1

Teacher Preparation

1. *Check out from the laboratory **two weeks** before the term starts for the measurement tools (metre ruler, stop clock, measuring cylinders, spring balance/electrical balance); workshop tools (hammer, hand saw, screw drivers, tape measure, try square); garden tools(hoe/jembe, rake, axe, spade, slasher, panga, secateur), livestock equipment(milking pail, rope, burddizzo, milk can, thermometer)*
2. ***Request and negotiate with** administration to purchase the tools and equipments two weeks before the term starts*
3. *Arrange with the school workshop attendant or nearby farm owners **one week** before the lesson that a group of learners will be coming to identity common tools and equipment*
4. *Make a copy of figure 2.1 according to number of learners expected **two days** before the lesson*

Teacher instruction

1. *Read the introduction below and activity 2.1*
2. *Make arrangement of how you are going to display the tools and equipment so that learners can have access during the lesson*
3. *Ensure that you have at least two tools or equipment for each category (the garden; the workshop; animal husbandry; crop husbandry and building)*
4. *Divide learners into groups*
5. *Carry your selected tools and equipment to the venue 30minutes before the lesson*
6. *Allow 5minutes for each group to present how one tool or equipment of their choice is used by farmer*

DISCOVERY, EXPLORATION, LITERACY, APPLICATION

Ask learners to make a pair with their immediate neighbour and move towards the displayed tool or equipment set in front of them.

Allow learners to find out more about each tool or equipment provided and make notes of how it is used

Ask learners to categorise the tool or equipment according to what they know about them

Ask learners to read the introduction in the groups you formed to do activity 2.1

Introduction

In this Chapter you are going to find out about the farm tools, implements and machines used in taking measurements and carrying out the routine husbandry practices in crops and animals.

Once you have chosen a suitable site for your selected crop to grow or livestock to rear, you need right tools to make work easy. There is need to prepare your planting site, restrain your animal, administer drugs, move materials from one site to another and many more

practices. To do all this, you need to know the right tools, implements and equipment to use.

Figure 2.1 Common tools on the farm

Identifying tools used on the farm

What is the name of the picture in figure 2.1a and b? Where is it used in your community? Did you know the names of its parts? Now look at figure 2.1c, d, e, f and g. What does it do for us? You realize that tools can be grouped into categories based on the type of work they can be used for; these tools will include garden tools, woodworking tools, metal tools, and the basic tools used for fencing, mechanics and animal handling. A wrong tool for the wrong job does not only waste time but causes irreparable damage both to the tool and work being done.

Activity 2.1: Tools used on the farm

You will need a pen, Small note book, tablet, Drawing pad.

a) In pairs,

i. Categorize different farm and measurement tools provided according to their uses in: the garden; the workshop; animal husbandry; crop husbandry and building.
ii. Discuss how each tool is used and prepare a report to present

b) In groups, pay a visit to the school workshop or nearby farm;

i. to identify common tool used
ii. list the functions of each tool

c. Extended work in groups

i) Investigate the reasons for using different tools, equipment and machines in agricultural activities.

ii) Identify career opportunities in manipulating these equipment and machines in agriculture

Possible answers

CATEGORY	**TOOL OR EQUIPMENT**	**USE/FUNCTION**
Garden/crop	Hand hoe	Digging up land
Workshop	Hand saw	Cutting timber to required length
Livestock	.....	
Building	.....	

WEEK 2

Teacher Preparation

1. *Get two sets of cards to match. One set is of pictures of common 5 tools, 5 equipment and 5 machines used in agriculture. You can source them from the net, draw them on a manila sheet of size 7cm by 5cm as cards or ask another person to draw them for you.*
2. *Write the use of each tool, equipment and machines in agriculture on an manila sheet of size 7cm by 5cm as cards like this below or prepare your own example*

Broom	*Sweeping paths and working areas*
Brush	*Washing muddy tools and trays*
Dibber	*Making holes for planting, or sowing large seeds*
Fork	*Digging, especially stony and clay soils; Harvesting; lifting bulky organic materials, eg compost*
Garden line	*Sowing or planting in straight rows*
Garden rake	*Levelling soil and creating fine tilth*
Hoe	*Digging soil; Removing weeds*
Kneeling pad	*Protecting knees when working*
Pencil and labels	*Keeping track of plant names and sowing dates*
Rake (spring-tine)	*Collecting leaves, roots and levelling paths, with gravel or soil*
Secateurs	*Cutting small plant stems; herbs; small branches, pruning vegetables*
Shears	*Cutting hedges and bushes, pruning big branches*
Spade	*Digging, especially sandy and loam soils*
Trowel	*Harvesting and moving small amounts of loose material Planting and removing small weeds*
Watering can	*Watering plants and seedlings*
Wheelbarrow	*Carrying, removing materials and farm harvests*

3. *Multiply the two set of cards (at least 10 of each)made into the number of groups you expect in your class two days before the lesson*
4. *Draw a picture of the school garden map on a large manila sheet showing the boundary and path or roads only*
5. *Get masking tape or stick glue(at least 10 unit of each)two days before the lesson*

Teacher instruction

1. *Divide learners into groups. Tell them each group will be required to do the activity.*

2. *Guide learners to work in groups to match the cards with pictures and those with words*
3. *Provide each group with the two sets of cards and tell them to match the cards correctly*
4. *Select a few groups to present what they have matched*
5. *Using glue stick the pictures of tools on you chart according to what learners tell you is the location where they are used.*
6. *Ask learners individually to draw a picture of the school garden or school compound and label where each tool, equipment and machine could be used.*
7. *Work with the ICT teachers to design a digital game and quiz on farm tools, equipment and implements/machines*

DISCOVERY, EXPLORATION, LITERACY, APPLICATION (50 minutes)
Say that today you are further looking at tools, equipment and machines used in agriculture. Tell them they are going to match each tool, equipment and machine provided as pictures on cards with the use, discussing the special features they have to do the work
Ask a few selected groups to present their work to the class
Ask the learner to display

DISCUSSION (30 minutes)
Allow class discussion on the special features they have to do the work
Possible answers
CHART AND CARDS

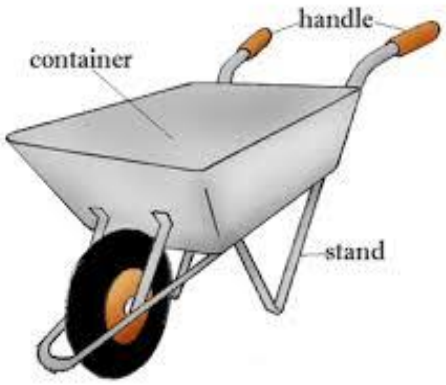
HAND HOE

Adigging tool consisting of a blade set at right angles to a long handle

RAKE

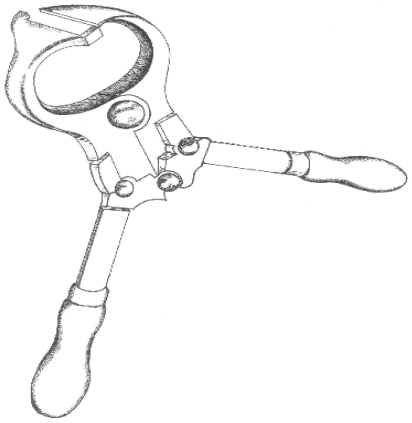
Atoothed bar fixed transversely to a handle, or tines fixed to a handle, and used to collect leaves, hay, grass, big soil clods; level soils

Figure 2.1.1 Charts of common tools



WHEEL BURROW

a popular instrument that is used for carrying loads and this helps us to lighten the weight of loads upon us



BURDIZZO

To castrate male animals or to crush the spermatic cord of male animals causing testicle drying and testicular necrosis

Figure 2.1.2 Chart of common tools

WEEK 3

Teacher Preparation

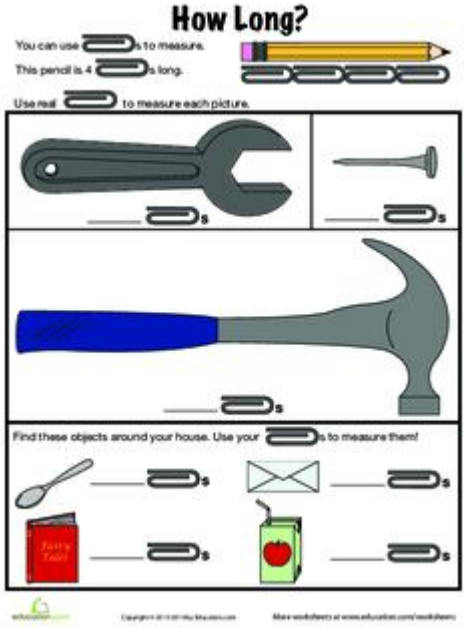


Figure 2.1.3 Using a paper clip to measure

1. Get a box of paper clip which is 3cm length (enough for your class); a packet of sewing needles, drawing pins; a packet of new pencils; stick of blackboard chalk, set of spanners; a set of hammers; plastic syringes; plastic spoons/spatula; a packet of paper envelopes; water bottle

3. Measure the length of your hand (for emphasis mine is 20cm); the length of longest finger (for emphasis mine is 85mm) or the third finger on your hand(millimetres) and the length of your arm (for emphasis mine is 0.72m)or from the shoulder to tip of longest finger(metres)to know what learners will be doing

4. Find out how many longest finger or hands are equal to the length of your arm

5. Measure the height of the blackboard/whiteboard/projector screen, a chair, door, window and cupboard so that you know what the learners will be doing

6. Familiarize yourself with conversion problems like say you know something that is weighing 3 kilogrammes and you want to know how many grams this is. You can check that there are 1,000 grammes in 1 kilogramme, but now what?

To help, you have your learners who you will ask this question: will they be ending up with a unit that is bigger or smaller? In the case of the 3 kilogrammes, you are ending up with grammes, which are smaller than the kilogrammes you started with. Since you are "breaking apart" the big kilogrammes into smaller grammes, we multiply 3 x 1000 to get 3,000 grams. Multiplying gives us more, and we have more in the end if our unit gets smaller.

And this also works in reverse. Say you start with 3,000 grammes and need to know how many kilogrammes there is. Remember that1,000 grammes still equal 1 kilogramme, but this time

you are "trading in or converting to" our smaller grammes for larger kilogramme at the end. So this tells us to divide 3,000 by 1,000 to get 3 kilogrammes. Dividing gives us less, and we have less in the end if our unit gets bigger. This is true for all other conversions you will meet.

Teacher instruction

1. Divide learners into groups and provide each learner with a paper clip

2. Provide each group with a new pencil, spanner, drawing pin, hammer, plastic spoon, plastic syringe, plastic mineral water bottle and a copy of senior one Agriculture Learners book in different locations in the class or big working space

3. Ask learners to make predictions before measuring the actual size before allow them to use paperclip to find out how many paper clips can cover the length of each of the items given to their group

4. Organize learners into pairs. Tell them each pair will be required to do the activity with help of their mathematical set.

5.Guide learners to measure and record the length of their hands; the length of the longest finger or the third finger on their hand(millimetres) and the length of their arm or from the shoulder to tip of their longest fingers on the left hand to the nearest millimetres

DISCOVERY, EXPLORATION, LITERACY, APPLICATION, ANALYSIS

Start when each learner has a paper clip and some of the tools or objects

Ask the learners to join their groups where the items of a sewing needles, a drawing pin; a new pencil; a stick of blackboard chalk , a spanners; a set of hammers; plastic syringes; plastic spoons/spatula; an envelope; a plastic mineral water bottle and Learners book have been placed in the class (20 minutes)

Tell the learners in summary that using one or more of the tips we can make converting measurement units a little easier for learners and the parents who are supporting them in their studies. As unlikely as it might sound, converting measurement units can even provide some quality time as a family. (10 minutes)

Ask learners to tell you how many millimetres are there in one centimetre; in one metre, what about how many grammes are there in one kilogramme and to complete the table below (30minutes)

Unit	***Millimetres/grammes***
1 kilometre	
1 metre	
1 centimetre	
1 kilogramme	
1metric tonne	
1 pound	

So ask the learners to pull out that metric ruler, see who has the longest third finger in millimetres in their groups, and everyone might just end up with a smile. Continue this

measuring and recording the length of their hands (in centimetres); the length of the longest finger or the third finger on their hand (in millimetres) and the length of their arm (in metres) or from the shoulder to tip of their longest fingers on the left hand

Teach it for understanding *(5minutes)*

Conversion of units in agriculture

All of us use measurement in some form on a daily basis. Some activities and professions depend on having competent measurement skills. The builders, farmers, landscape gardeners, veterinarians, plant doctors, crop breeders, processors and retailers of agricultural products all need to calculate mass, length, time, area, volume and dilutions efficiently. A nursery bed operator, for example, may need to calculate the length of wood required to make a seedbed box, the volume of soil to fill it and the amount needed to water seedlings there in. Our ability to accurately measure the length of wood will save money and energy of carrying timber you are not going to use. However the timber dealers use their own measurement and nursery bed operator applies a different unit.
With all of the different measuring systems in the world, converting units can come in handy. When you have two units, they must measure the same thing. For example, you when you have "convert 2 metres into centimetres," both metres and centimetres measure length. If your units measure two different things (like length and weight like 2 grammes and 2 metres), you cannot convert them. While those measuring the same things can be converted. For example if a bicycle is moving 10 Kilometres per hour, how many metres does it travel in one minute? Now you can practice conversion of units. Remember, you can only convert between two units that measure the same thing. In our example, we have units that measure length (kilometres and metres), and units that measure time (hours and minutes). Start with one pair and find the conversion between them. For example 1 kilometre =1000metres and I hour is 60 minutes. This is to say that the metric system, also called the decimal system, is designed for easy conversion. To convert from one metric unit to another, you only have to work with round numbers: 10, 100, 1000, and so on.

Tell the learners that ***measurement is a method of determining the number of units in something***

Ask learners to do activity 2.2 a below *(15minutes)*

Activity 2.2: Conversion of units on farm tools and equipment

You will need a calculator or computer and conversion table

a) In pairs, converting different measurements in agriculture as required

i. 6290 mm into cm, ii. 780cm to m iii. 53,000m into dm
iv. 40,000 dm into km v. 360 seconds into minutes vi. 180minutes to hours
vii. 2.3 km to m viii. 59 cm to m ix. 1hour and 10 minute to seconds

Possible answers

- *a sewing needles-2 paper clips, a drawing pin-1 paper clip; a new pencil-6 paper clips; a stick of blackboard chalk-3 paper clips , a spanners-4 paper clips; a set of hammers-12 paper clips; plastic syringes-3 paper clips; plastic spoons/spatula-5 paper clips; an envelope-8 paper clips, a plastic mineral water bottle-7paper clips and Learners book- 9 paper clips*

Tell the learners that measurement using a clip is a method of determining the number of paper clips in all those things given to their groups.

- *Completing the table*

Unit	***Millimetres/grammes***
1 kilometre	*1,000,000 millimetres*
1 metre	*1000 millimetres*
1 centimetre	*10millimetres*
1 kilogramme	*1000gramme*
1metric tonne	*1,000,000 gramme*
1 pound	*2.2 gramme*

- *the length of your hand is between 10cm -25m*
- *the length longest finger is between 40mm – 120 mm*
- *the length of your arm is between 0.5m- 2.1m*

- Have learners show how they converted the figures

i. 6290 mm into 62.9 cm,
ii. 780cm to 7.8 m
iii. 53,000m into5,300 dm
iv. 40,000 dm into 400km
v. 360 seconds into 6 minutes
vi. 180minutes to 3 hours
vii. 2.3 km to 2300 m
viii. 59 cm to 0.59 m
ix. 1hour and 10 minute to 4200 seconds

WEEK 4

Teacher Preparation

1. *Prepare a chart the conversion charts for length, mass, and volume*
2. *Prepare a chart with Standard Units (SI units)*
3. *Prepare a good example of making temperature conversion*
4. *Identify struggling learners and time takers with conversions of units and pair them*

Teacher instruction

1. Display a chart the conversion charts for length, mass, and volume

2. Display a chart with Standard Units (SI units)

3. Display a good example of making temperature conversion below

Converting Fahrenheit (F) to Celsius (C)

- *Formula: C= 5/9(F- 32)*
- *Step:-1.determine the F temperature*
  -2.subtract 32 from the F temperature
  -3.multiply the difference found in step 2 by 5
  -4.divide the amount found in step 3 by 9

The result is the equivalent temperature in degrees Celsius

- *Example: if the temperature in poultry house is 68^0F. What is the temperature in Celsius?*
- *Solution:*
  68-32=36
  36x5 =180
  180/9 =20

Answer: The poultry house temperature will be 20^0C

Converting Celsius (C) to Fahrenheit (F)

- *Formula : F=9/5C+32*
- *Step:- 1.determine the C temperature*
  -2. Multiply the Celsius (C) temperature 9
  -3. Divide the amount found in step 2 by 5
  -4. Add 32 to the amount found in step 3

The result is the equivalent temperature in degrees Fahrenheit (F)

- *Example: if the tractor engine temperature after working in the field is 150^0C. What is the Fahrenheit temperature*
- *Solution:*
  150x9=1350
  1350/5=270

270+32=302

Answer: The tractor engine temperature after working in the field is 302^{0}F

4. Divide learners into groups. Tell them each group will be required to do the activity.

5 .Guide struggling learners and time takers with conversions of units

6.Select a few groups to present the procedure they followed in carrying out the task

DISCOVERY, EXPLORATION, LITERACY, APPLICATION, ANALYSIS

Start by telling learners that they have experienced measurement of length, volume and weight then ask learners the following questions (20 minutes)

-how many centimetres are there in one metre

-how my milliliters are there in one litre

-how many grammes are there in one kilogrammes

-how many seconds are there in one minute

Remind the learners that measurement is a method of determining the number of units in something. Emphasize to the learners that the following are the ***Standard Units (SI units)*** *of the following measurements.*

Ask learners to do activity 2.2 b individually (10 minutes)

Activity 2.2: Conversion of units on farm tools and equipment

You will need a calculator or computer and conversion table

a) In pairs, converting different measurements in agriculture as required

i. 6290 mm into cm, ii. 780cm to m iii. 53,000m into dm

iv. 40,000 dm into km v. 360 seconds into minutes vi. 180minutes to hours

vii. 2.3 km to m viii. 59 cm to m ix. 1hour and 10 minute to seconds

b) Individually practice converting different measurements in agriculture into the Standard Units (SI units)

i. A vegetable garden of 226cm by 64cm

ii. A path to the farm with 25tiles each 40cm wide

iii. A tractors ploughs an acre of land in 1 hour 20 minutes

v.Milking a cow in 4 minutes

vi.600cm^3 of milk in a bottle of drinking water to litres

Ask learner to do activity 2.2 c in groups 20 minutes

c) In groups

i.select a tool of your own choice to carry out the tasks assigned to you by the teacher from the following: -size of the flower bed; length of the science laboratory; weighing a bucket of beans; the amount of water in a watering can; the hole dug for planting a banana sucker or mango tree; period required to fill a 500ml bottle with water from a water source

ii.Describe the procedure you follow in carrying out the task to the class

iii. What did you learn from the task and presentations

Provide time for a few selected groups to present the procedure they followed in carrying out the task assigned to them *30 minutes*

Possible answers

Length

Units	***Equivalent***	***Conversion scale***	***Factor by which it is multiplied***
10 Hectometre	*1 Kilometre*	*1,000,000*	*1000*
10 Dekametre	*1 Hectometre*	*100,000*	*100*
10 metres	*1 Dekametres*	*10,000*	*10*
10 decimetres	***1 METRE(1 m)***	***1,000***	***1***
10 centimetres	*1 decimetre*	*100*	*0.1*
10 millimetres	*1 centimetre*	*10*	*0.01*
1 millimetres		*1*	*0.001*

Volume

Units	***Equivalent***	***Conversion scale***	***Factor by which it is multiplied***
10 Hectolitre	*1 Kilolitre*	*1,000,000*	*1000*
10 Dekalitre	*1 Hectolitre*	*100,000*	*100*
10 Litres	*1 Dekalitres*	*10,000*	*10*
10 decilitres	***1 LITRE(1 l)***	***1,000***	***1***
10 centilitres	*1 decilitre*	*100*	*0.1*
10 millilitres	*1 centilitre*	*10*	*0.01*
1 millilitres		*1*	*0.001*

Mass

Units	***Equivalent***	***Conversion scale***	***Factor by which it is multiplied***
10 Hectogramme	*1 Kilogramme*	*1,000,000*	*1000*
10 Dekalitre	*1 Hectogramme*	*100,000*	*100*
10 Gramme	*1 Dekagramme*	*10,000*	*10*
10 decigramme	***1 GRAMME (1 g)***	***1,000***	***1***
10 centigramme	*1 decigramme*	*100*	*0.1*
10 milligramme	*1 centigramme*	*10*	*0.01*

1 milligramme		*1*	*0.001*

- *100 centimetres are there in one metre*

1000 millilitre are there in one litre
1000 grammes are there in one kilogrammes
60 seconds are there in one minute

- *Standard Unit (SI) CHART*

MEASUREMENT	***UNIT***	***SYMBOL***
LENGTH	*Metre*	*m*
VOLUME	*Litre*	*l*
MASS	*Gramme*	*g*
TIME	*Second*	*s*
TEMPERATURE	*Kelvin*	*K*

- A vegetable garden of 226cm by 64cm **becomes 2.26 m by 0.64m**
  A path to the farm with 25tiles each 40cm wide **becomes 0.4m x25 =10m length**
  A tractors ploughs an acre of land in 1 hour 20 minutes **becomes**
  1 hour is 60 minutes
  Total minutes is 60+20=80minutes
  1 minute is 60seconds
  Total time is 80x60 =4800seconds

Milking a cow in 4 minutes **becomes**
1 minute is 60seconds
Total time is 4x60=240seconds

600cm^3 of milk in a bottle of drinking water to litres
1000cm^3 is 1 litre
1cm^3 is 0.001 litres
600cm^3 becomes 600x0.001 =0.6litres

- *Tools to be used may include the following*

	Measurement	***Tools***
1	*Length*	*Metric ruler; tape measure*
2	*Mass*	*Weighing scale; electronic scale; spring balance*

3	*Time*	*Stop clock; digital watch; cellophone timer*
4	*Volume*	*Measuring cylinder;*
5	*Temperature*	*Thermometer*

WEEK 5

Teacher Preparation

1. *You are going to do more practice on Standard Units in measurement so read the* ***Standard International (SI) Units below.*** *As an alternative look at the website below to get more information about measurement lessons* **https://www.education.com/lesson-plan/measurement-madness/**
2. *Organize two weeks before the lesson the Standard International (SI) Units chart on manila sheet or power point to be projected where applicable*
3. *Bring to the class lesson a chart you have drawn and some empty containers of items sold in the market in your community using Standard International (SI) Units (milk; fuel-paraffin, petrol and diesel; pesticides; water; soft drinks; common salt; sugar; cooking oil; agriculture produce-beans, fertilizers; building materials like paint)*

Teacher instruction

1. Display the Standard International (SI) Units chart for learners in the classroom

2. You need a chart with the title: items measured and sold to learners following the Standard International (SI) Units

3. Ask learners to suggest items sold in their community that follow Standard International (SI) Units

4. Guide learners to complete the chart by brainstorming

Measurement	***Common item sold***	***Other examples***
Metres	*Cloth*	*Tiles*
Litres	*Milk*	
Grammes	*Common salt*	

5. You will ask learners to read on **Standard International Measurements** *in pairs*

NUMERACY, DISCOVERY, EXPLORATION, LITERACY, APPLICATION, ANALYSIS
Start by asking the learner that as a reminder to what are the Standard International (SI) Units for length, time, mass/weight, volume? (10 minutes)
Ask learners to identify items in their community measured and sold to them following the Standard International (SI) Units (40 minutes)
Drawing the attention of the learners to the Standard International (SI) Units chart you prepared.

Teach it by asking learners to read aloud one sentence at time until you complete all sentences below. (10 minutes)
Pose a question on the following
-what is (SI) Units
-in which year did it start
- when was the mole added to the (SI) Units (20 minutes)

Standard International Measurements

Many things in real life occur as quantities**.** Quantity is a property of materials that is measured [such as mass, length, time, volume, pressure]. The measurement is in units. A unit is a standard quantity against which a another quantity is measured [such as gram, metre, litre, second; and these are units of the above quantities]
These are the Standard International (SI) Units. It was started in 1954; the 9th General Conference on Weights and Measures (**CGPM**) created the first version of the International System of Units. The base units that they used were the metre, kilogram, second, ampere and Kelvin. The seventh base unit, the mole, was added in 1971

Unit	**Symbol**	**Quantity**
metre	m	length
gram	g	mass
litre	l	volume
second	s	time
ampere	A	electric current
kelvin	K	temperature

Possible answers

Measurement	***Common item sold***	***Other examples***
Metres	*Cloth piece*	*Tiles; iron sheets,*

Litres	*Milk of Jessa, GBK, Dairy*	*Fuel-paraffin, petrol, diesel; Water- Rwenzori, Wavah, Highland; Soft drinks-coke, pepsi, riham, Cooking oil; Paint-Global, Sadolin*
Grammes	*Packet of Common salt*	*Sugar; fertilizers;*

- -***SI Units*** *means* Standard International Units
- *The year it start* ***1954***
- *The mole was added to the (SI) Units in* ***1971*** *and is used in Chemistry calculations*

WEEK 6

Teacher Preparation

1. *Get two sets of cards to match. One set is of pictures of common 5 tools, 5 equipment and 5 machines used in agriculture. You can source them from internet or draw them on a manila sheet of size 7cm by 5cm as cards or ask another person to draw them for you. As well you can change the tools, equipment and machines each year as you may wish*
2. *Write how each tool, equipment and machines is maintained by people in agriculture so that it serves for a long time on an manila sheet of size 7cm by 5cm as cards like this below or prepare your own example*

Teacher instruction

1. Divide learners into groups. Tell them each group will be required to do the activity.
2. Guide learners to work in groups to complete a chart on how each tool, equipment and machines is maintained by people in agriculture so that it serves for a long time by placing the cards in the right places

Tool, equipment and machine	***How it is maintained***
 Slasher	
 Panga	

 Forked hoe	
 Tape measure	
 Watering can	
 Spade	
 Tractor	
 Strip cup	

 Jack plane	
Rasp  file	
 Drenching gun	
 Spirit level	

 Calculator	

3. *Hold a class discussion on how tools, equipment and machines before asking learners to read text*

DISCOVERY, EXPLORATION, LITERACY, APPLICATION, ANALYSIS

Start by providing to each group a two pack of cards one with pictures of tools, equipment and machines and the second one where learners are going to write how each of them is maintained.

Ask the learners in groups to do the activity of writing how the tools, equipment and machines are maintained. (40minutes)

Ask learners to tell what they know about how tools, equipment and machines are maintained. (20 minutes)

Teach it for understanding (20 minutes)

Proper use of farm tools and equipment in carrying out farm practices

Farm tools are the equipment that are used in the processes of land preparation. For example the hand hoe, rake, slasher, axe and panga. While *farm equipment* is any kind of machinery used on a farm to help *with* farming. The best- known *example* is a tractor. There are also many other *farm implements. How do you use these farm tools and equipment? Tools and equipment are designed to perform a particular task on the farm. For instance a hoe is used to dig soil and a bucket or pail is used for milking cows. Therefore when choosing a tool* make sure you use the right tool for the right job. Accompany this by keeping them rust free, free of slippery oils, have a budget for replacing broken and worn out tools.

Also when using your tools, equipment and machines:

• Have them organized in a pouch or store, tray, or other system, with each tool going in its own place. This way, you can easily see at a glance which one you might need for task you want to carry out.

• Wipe each tool clean after use

Further when storing tools, equipment and machines:

• Never throw tools or equipment into a tool box. Carefully place each tool or equipment into its proper place in the store or tray.

• Never leave tools or equipment lying about, especially on the floor.

- Record each tool when getting it from the store and on returning it. Report damaged, broken and lost tools as you returning from doing the task.

• Always put tools or equipment away at the end of the activity, even if you are working in a closed room. They must be maintained and kept safely.

Possible answers

- *Use the tool for the right job*
- *Remove dirt, soil and unwanted material*
- *Clean the tools, equipment and machines after use*
- *Store the tools, equipment and machines in a safe and clean place*
- *Record the name of the tools, equipment and machines when going to use and on return*
- *Lubricate by oiling, greasing or painting parts as it is deemed necessary*
- *Replace or repair worn out parts, broken/damaged parts and old parts*

WEEK 7

Teacher Preparation

1. *Organize with school administration **two weeks** before the lesson to bring in a guest speaker or visit the school farm manager to discuss workplace health and safety*
2. *Read about basic occupational safety, health standards and first aid with reference to what is common in Uganda.*

Paid employment is an important feature of adolescent life. Too often, it has negative health consequences, including more than 200,000 workplace injuries to workers particularly the 14 to 17 year olds every year. Training young people about occupational safety is part of an overall strategy to address this problem. Activities addressing hazards in workplaces, prevention strategies, child labour laws, and how to communicate effectively about workplace concerns will be important in this session. Common hazards exist in all workplaces. It is important to learn about these hazards and how they can be controlled so that people at work are not exposed to risk.

3. *Understand the meaning of and design a manila sheet with the following terms:*

***Occupational Health and Safety (OHS)** – all matters related to workplace or farm health and safety (such as hazards, risks, and communication issues).*

***Duty of Care** – the onus is upon both employer or farm owner and employees or workers to be responsible for themselves and for others in the workplace, and to ensure that no person is placed at risk through any of their actions (or as a result of their failing to act when they should).*

***S.A.M. Principles –Spot** the Hazard, **Assess** the Risk, **and Make** the Changes.*

***Principles of Duty of Care** – the "ground rules" stands as enabling employer or farm owner and employees or workers to meet their responsibilities to secure a safe workplace or farm: these include accountability, co-operation and consultation*

Display them in the class

Teacher instruction

1. Divide learners into groups. Tell them each group that they will be required to do the activity.
2. Ask learners in each group to make a list of potential workplace or the farm situations and conditions, including at school garden, from their work experience, travelling to and from farm where they may confront being injured or get a health and safety issues.
3. Pose the same questions on health and safety to the class like:

- *Who has more responsibility for workplace or farm safety: the employer/farm owner or employees/ farm workers?*
- *What is a hazard?*
- *What does it mean to "assess risk"*?
- *How do you take action to remedy a risk or eliminate a hazard?*
- *What is SAM Principles*

4. As a class discuss and develop a list of potential strategies learners may use to reduce the risks of hazards in the home, farm as a workplace or at school
5. Ask learners to read the text below on basic occupational safety, health standards

DISCOVERY, EXPLORATION, LITERACY, APPLICATION, ANALYSIS
Activate previous knowledge
Start the lesson by investigating the reasons why people get injured when working on the farm or during farm work (10 minutes)
Invite a guest speaker to address learners on the importance of health and safety on the farm. Alternatively carry out a running dictation on good practices on the farm to ensure health and safety. Ask learners as a class to answer the questions that you pose (40 minutes)
Divide the learner into groups and ask them to make a list of potential workplace or the farm situations and conditions, including at school garden, from their work experience, travelling to and from farm where they may confront being injured or get a health and safety issues (10 minutes)
Ask learners to read the text below. Teach it for understanding (20 minutes)

Basic occupational safety, health standards and first aid during agricultural activities

Safety is the condition of being free of harm and danger. However on the farm you are using tools, equipment and machines. Some of these have cutting blades, sharp edges or piercing ends. These may cause harm or danger to the users. Therefore it is important to handle them carefully. You can do this by preventing accidents and having a productive working environment which are part of safety precautions on the farm.
When using tools, equipment and machines there are many possible hazards. Therefore a farmer must take precautions. In addition manufacturers provide information on safe use of tools and equipment. You must read, understand and practice safe use of tools and equipment. This does not prevent injuries can occur. Why do you think this happens?

As farmers we need to practice safety during agriculture activities. Routinely you need to follow good safety practices in the farm, laboratory, and daily activities. This will prepare you to practice safety during agricultural tasks and on the job as a good practicing farmer. This may require you to do some of the following:
-Under all circumstance wear protective gear.
-Ensure that you use tools and equipment when you are physically and emotionally sound.
-All your gears should be worn securely to avoid entanglements with tools and equipment you are using.
-cover sharp edges and piercing ends to avoid causing harm to yourself and others
-the right person should use the right tool, equipment and machine for the right job for example you can be a **Farm Equipment Mechanics and Farm Equipment Service Technicians**

FARM EQUIPMENT MECHANIC AND FARM EQUIPMENT SERVICE TECHNICIAN AS A CAREER FOR YOU

a) Record details of repairs made and parts used.
b) Reassemble machines and equipment following repair, testing operation and making adjustments as necessary.
c) Maintain, repair, and overhaul farm machinery and vehicles, such as tractors, harvesters, and irrigation systems
d) Dismantle defective machines for repair, using hand tools.
e) Repair or replace defective parts, using hand tools, milling and woodworking machines, lathes, welding equipment, grinders, or saws
f) Using relevant information and individual judgment to determine whether events or processes comply with laws, regulations, or standards.
g)Install and repair agricultural irrigation, plumbing, and sprinkler systems
h) Calculate bills according to record of repairs made, labour time used, and parts used
i) Clean and lubricate parts
j) Fabricate new metal parts, using drill presses, engine lathes, and other machine tool

Possible answers

- *Health and Safety at work or farm is everyone's responsibility, but the greater responsibility (or duty of care) is the employer's or the farm owner. This is because the employer or the farm owner has ultimate control over the way the workplace/farm and its hazards are managed.*
- *A hazard is anything at a workplace with potential to cause harm – injury or, illness to people, damage to property or harm to the environment*
- *Assessing the risk" means working out how likely it is that a hazard will harm someone, and how serious that harm could be.*
- *By reporting the problem to someone who can arrange for it to be fixed. The best way to remedy a hazard is to get rid of it altogether. It is your employer's responsibility to do this where practicable.*
- ***S.A.M. Principles –Spot** the Hazard, **Assess** the Risk, **and Make** the Changes.*
- *Potential strategies learners may use to reduce*

- Under all circumstance wear protective gear during work(gumboots, overall coats).
-Ensure that you use tools and equipment when you are physically and emotionally sound. - All your gears should be worn securely to avoid entanglements with tools and equipment you are using.
-Cover sharp edges and piercing ends to avoid causing harm to yourself and others
-Removing simple hazards (such as picking up litter or cleaning up a spill to prevent trips and slips) is something the learners may be able to do without risk to themselves or others.
-Displaying safety guidelines
-Training on health standards and basic occupational safety on the farm

WEEK 8

Teacher Preparation

1. *Understand how a running dictation and card matching game on farm tools, equipment and machines can be designed a way you can organize for safety and health the farm*
2. *Arrange with a computer expert to design cards with the 6 titles in "organizing for safety and health on the farm" Get the 30 cards or 30 manila cards of size 18cm x10cm written on(Communication, Organizing, Competence, Committee, Cooperation, Emergency, Control, Spot the Hazard, Assess the Risk, Make the Changes); and some statements that best describes what is in each paragraphs below*
3. *Mix or shuffle these cards*

Teacher instruction

1. Divide learners into groups. Tell them each group will be required to do the activity.
2. Ask learners to work in groups to match the cards with those with words that appropriately give the explanation of the other.
3. Provide each group with the cards and tell them to match the cards correctly
4. Ask each group to have its work put on the wall present what they have matched and receive comments from the class in a gallery walk
5. Summarize the case study on safety standards on the farm

LITERACY, DISCOVERY, EXPLORATION

Start by informing the learners that they are going to read and match cards under the title organizing for safety and healthy on the farm (30 minutes)

Teach it for understanding

<u>"Organizing for safety and health on the farm"</u>

Organising is a continuous process. In organising safety and health, it is necessary to involve farm staff, casual labourer and learners to promote a positive safety culture for the purpose of managing risks, and to meet the objectives of the safety and health policy. There should be an established structure of functional roles among farm staff, casual labourer and learners to be accountable on safety and health, but the ultimate responsibility rests with the management.

1. ***Communication***

Effective safety communication creates a positive safety culture and promotes general safety awareness. Regular discussion on safety as a standing agenda item

The safety message drafted and displayed in farm to arouse safety awareness, and to enrich safety information. Safety tours by school management to observe the practice and behaviour of employees at work provide the opportunities of face-to-face discussion with them on safety and health matters.

2. ***Co-operation***

The one who carries out the work knows best the risk involved in the work. The involvement of people in the hazard identification and the establishment of suitable control measures are essential for the success of safety management. Very often, they are the ones who carry out the control measures. Their co-operation is crucial to the success of the safety and health policy. All levels of workers should be encouraged to report hazardous situations and to propose methods in eliminating the risk.

3. ***Control***

Effective control can be secured by:

a) Allocating clear safety responsibilities among workers and learners to ensure that they recognize their roles on safety and health;

b) Defining safety performance standards by specifying who is responsible and what is to be done and explaining how and when the work is to be carried out, and with what expected result;

c) Providing adequate supervision, instruction and guidance. The degree of supervision depends on the nature of risk involved and the competence of the employees who carry out the work. Sometimes, supervision on fully competent individuals may still be required to ensure that safety standards are being consistently met; and

d) Motivating workers and learners to maintain the momentum in improving the standards of safety and health.

4. ***Competence***

All workers and learners must have adequate safety and health knowledge to do their job. Safety and health training equips the workers and learners with adequate skill and ability to

finish the job in safe and healthy condition. Some examples of training aspects include manual handling operations, use of personal protective equipment and workloads distribution.

5. ***Safety and health committee***

Successful safety performers usually demonstrate the importance of an in-house safety and health committee. The main functions of the farm safety and health committee include:

(a) Monitoring the safety policy;

(b) Assistance in the development of safe work procedures and safe system of work;

(c) on-going evaluation of hazards and arrangements to implement safety measures;

(d) Study of accident/incident statistics and trends together with recommendations for corrective actions;

(e) A watch on the adequacy and effectiveness of employee safety training;

(f) A watch on the adequacy of safety and health communication on the farm; and

(g) The organization of safety promotion activities such as safety competitions, exhibitions, film shows, safety incentive schemes and safety suggestions.

6. ***Emergency Preparedness***

Though a very good safety and health programme is in place, emergency situations may still arise. In order to keep losses to a minimum, proper procedures should be developed before an emergency occurs. For a farm environment, emergency plans include fire evacuation, strong winds and rainstorm procedures, and the handling of agro chemical spillage, epidemics and quarantine

Ask learners to present their matched cards by sticking them on the wall and allow others to have a gallery walk (15minutes)

Provide learners with the case study below to read and summarize (35 minutes)

CASE STUDY ON SAFETY STANDARDS ON THE FARM

By Mulumba Mutema Agriculture Specialist NCDC

Despite detailed safety standards and regulations, surveys show that 7 out of 10 farm workers regularly ignore safe practices because of ease, comfort, complacency and sometimes due to perceived efficiency. Some of these people get hurt as a result. However, I wonder how comfortable they are in their hospital beds... with broken limbs either at home or at worst in their coffins.

Ignoring safety rules caused 16 worker deaths in one of the big plantations in this country last year. I am here to make sure that you or immediate neighbours/relatives are not part of next year's statistic.

However bad farm safety habits form over time. They are passed on from worker to worker until the culture accepts looser farm/house safety standards.

Safer work/farm places are more productive, even in the short term – so workers are not more efficient when they do not take the time to follow safety rules. When workers are responsible and accountable for one another, safety compliance increases. Everyone needs to be responsible and accountable for everyone else's safety

Continuing with the status quo (keep doing things the same way), and someone then is seriously injured. Who is to blame? Nevertheless, moving to another step imagine yourself at a colleague's funeral. You were right beside him/her when he/she decided not to wear his/her safety harness. How do you face his relatives, kids or mother/wife/husband when you know you were right there and did not say anything? On the other hand, imagine seeing your co-worker receive an award for 25 years of service. How would you feel?

Therefore, get and feel the pride when you teach safety standards to new workers. Share the joy of your team's rewards for an outstanding safety record on the farm. Consequently, you will have saved many lives/souls for many years to come.

Possible answers

- *Farm workers regularly ignore safe practices because of ease, comfort, complacency and sometimes due to perceived efficiency*
- *Ignoring safety rules caused 16 worker deaths do not be part of the next statistics*
- *Everyone needs to be responsible and accountable for everyone else's safety*
- *Continuing with the status quo (keep doing things the same way), and someone then is seriously injured. Who is to blame?*
- *Therefore, get and feel the pride when you teach safety standards to new workers.*

WEEK 9

Teacher Preparation

1. *Get sets of cards to be used to complete a puzzle. These cards are for people involved in an accident. You can source them from internet or draw them on a manila sheet of size 7cm by 5cm as cards or ask another person to draw them for you. You have to cut them into pieces that have to be joined to form one picture. As well you can change accident situations each year as you may wish*
2. *Pack three cut pieces in one envelope*
3. *Have one manila or canvas on which the complete pictures as shown below*

4. *Understand the text below on accidents in our life*

Teacher instruction

1. Divide learners into groups. Tell them each group will be required to do the activity.
2. Ask learners to work in groups to get pieces of the cards that match to form one pictures.
3. Provide each group with a packet of cut of cards in an envelope and tell them to work out this puzzle correctly
4. Select a few groups to present what they have got out of their puzzle
5. Ask learners to read the text on accidents in our life and write down what one has to do in case of an accident

DISCOVERY, EXPLORATION, LITERACY, APPLICATION, ANALYSIS
Start by giving instructions of working out the puzzle.
Provide the groups with their packets and allow them to sort the cut pieces into a picture with meaning
Allow a few groups to present by sticking their formed pictures on the blackboard
Teach it for understanding

Accidents in our life

Accidents are caused by being careless. Accident can hurt you or cause injuries to us. Different accidents can lead to scratches, scrapes, damages, cuts and bruises. While fatal accidents can result in broken limbs or loss of life. Injuries take time to heal or to get better and cost huge amounts of money. You need to avoid all this.
Accidents may happen anywhere and at any time. You should therefore be careful so as to avoid accidents happening. You can do this by being cautious and thinking critically before you do something. For that reason there are many safety rules and regulations that help farmers to prevent accidents. One of them is giving first aid.

First aid is the assistance given to any person who gets an accident and is suffering a sudden injury or illness with care to save life or promote recovery. First aid refers to the emergency or immediate care you should provide when a person is injured or ill until full medical treatment is available. The first step in any emergency is the recognition of the problem and providing help. Whether you are at home, work, or school, knows where the first aid kit is kept. After determining the problem, the next step in providing help is to determine the unresponsiveness of the injured or ill person. The best way to determine this is to tap the person and talk loudly to them: "Are you okay?" After determining unresponsiveness, yell for help. Then you pick the first aid box to get out what you can use to provide immediate care

Possible answer

- ***Spot*** *the problem or accident,*
- ***Assess*** *the danger or risk,*
- ***Make*** *the changes by providing help or stopping more damage*

WEEK 10

Teacher Preparation

1. *Arrange a digital or hardcopy quiz for each and every learner to take using the five questions below in the computer laboratory/tablet; photocopies or write them on manila sheets and blackboard*

a) *You're having lunch with a friend and he/she begins to choke on some food. He/she can't speak, breathe or cough it up. How can you help?*

- *Put your fingers down his/her throat to try to dislodge the obstruction*
- *Do some manoeuvre on him/her*
- *Give up to five back blows between his/her shoulder blades*

b) *Your colleague is complaining of breathlessness and a tight pain in the chest. You suspect a heart attack. What should you do?*

- *Get him to lay down flat*
- *Encourage him to stand up and move around slowly*
- *Sit him in a comfortable position*

c) *One of your friends has cut his arm and is bleeding severely. How do you treat his injury?*

- *Put the injured limb in some cold water*
- *Apply direct pressure over the wound*
- *Give him an aspirin*

d) *You're walking home and you see a man lying on the ground. You ask him if he's all right but he doesn't respond. What should you do next?*

- *Leave him to wake up by himself*
- *Begin CPR (cardio-pulmonary resuscitation)*
- *Check his airway is clear*

e) *You need to perform CPR (cardio-pulmonary resuscitation) on your neighbour after she collapsed and stopped breathing. How many chest compressions to rescue breaths should you do?*

- *30 compressions to two breaths*
- *20 compressions to five breaths*
- *15 compressions to three breaths*

2. *Get the right answers to the quiz*

3. Prepare instructions of how to do a role play namely
i. Step 1: Identify the Situation. In this case it and accident on one learner who was using farm tools and needs first aid to be provided. Start the process by gather together as a group, introduce the problem or agree on the accident your friend has got, and encourage an open discussion to uncover all of the relevant issues. ...
ii. Step 2: Add as much details to each action you want others to see. ...
iii. Step 3: Assign ***Roles of who will do what or who is best at what in the play****. ...*

iv. Step 4: Act Out the Scenario in your groups; modify where you can so that it delivers the message. ... Wait for the opportunity
v. Step 5: Discuss what they have learnt from the play, the roles they have acted, and what they could do differently next time.

Teacher instruction

1. *Divide learners into groups. Tell them each group will be required to do the activity.*
2. *Ask the learners to do the simple quiz above*
3. *Make the learners to exchange their exercise books with people in the fourth column of the sitting arrangement.*
4. *Guide learners to work in groups to prepare a short role play on what they should do when one of them has been injured by a farm tool*
5. *Selected 4 groups to present their role play which are exclusive and unique*
6. *Make charts of DRSABCD; AMPLE and BASIC CONTENT OF FIRST AID KIT then display them in the class during this week of the lesson*
7. *Work with the ICT teachers to design a digital quiz and app called **"Go farm tools, equipment and implements/machines"** The app can be set to be downloaded on mobile phones with steps like:* Subscribe to 1 tip daily; About ***farm tools, equipment and implements/machines";*** Where and when do you use ***farm tools, equipment and implements/machines"; how do you maintain farm tools, equipment and implements/machines";*** *what are the basic occupational health and safety standards when using **farm tools, equipment and implements/machines"** Applying **DRSABCD or AMPLE;** Farm basic **First Aid and S.A.M***

DISCOVERY, EXPLORATION, LITERACY, APPLICATION, ANALYSIS

Start with the quiz. Do the corrections with all learners (10 minutes)
Give instructions on the first 4 steps used in preparing a role play (10minutes)
Have learners join their groups and prepare a short role play as provided for in activity 2.3(a) below 15 minutes
Create space for 4 groups to present their role play 20 minutes
Ask learners to go to listen to a guest speaker or research in the library or internet to research about First Aid and the basic occupational safety and health standards in agriculture and prepare a message about what all agriculture workers should know and be able to do with respect to paying attention to health and safety plus carrying out First Aid. (25 minutes)

Activity 2.3 Administering first aid

a) In groups imagine a learner in your class has got an accident while using farm tools.
i. Design a role play and act out how you can provide first aid to the injured.
ii. Make presentation to be displayed in your school to ensure safety on the farm
b) In groups, research on First Aid and the basic occupational safety and health standards in agriculture by listening to an invited speaker or using the internet or other

resources. Present the group's messages about what all agriculture workers should know and be able to do with respect to paying attention to health and safety plus carrying out First Aid.

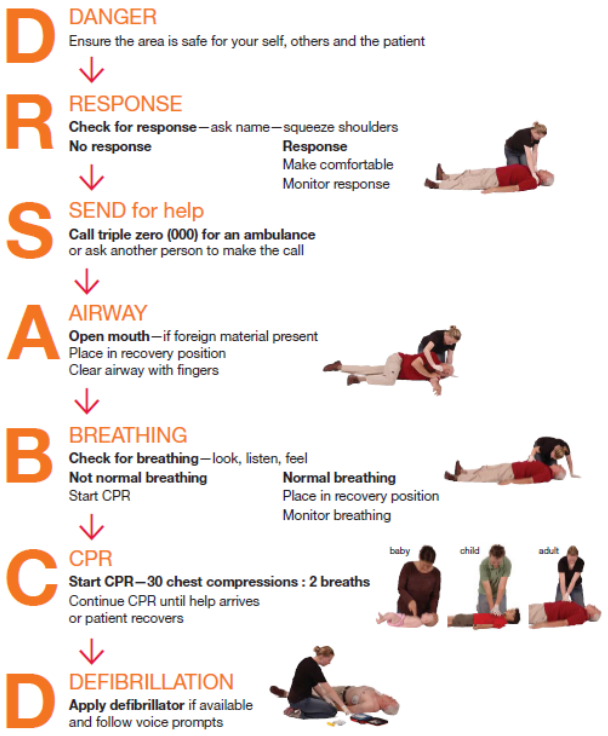
Possible answers

- *Quiz*

a) Give up to five back blows between his/her shoulder blades
b) Sit him in a comfortable position
c) Apply direct pressure over the wound
d) Check his airway is clear
e) 30 compressions to two breaths

- *Role play on having a cut and bleeding badly; escaping a fire from burning dry grass; a fracture of one's leg or arm;*
- *What all agriculture workers should know and be able to do with respect to paying attention to health and safety plus carrying out First Aid*

*- **Spot** the problem or accident,*
***-Assess** the danger or risk,*
***-Make** the changes by providing help or stopping more damage*



BASIC CONTENTS OF FIRST AID KIT

Below are the basic contents of a first aid kit, with explanations of what to use and when.

i) ***Sterile dressings and plasters:***

• ***Plasters:*** *Use plasters for small cuts and grazes.*
• ***Sterile pad:*** *For more cushioning you can use a sterile pad and hold it in place with sticky tape. You could also use any clean, non-fluffy material, like a cloth scarf.*
• ***Sterile wound dressing:*** *A sterile wound dressing is a sterile pad attached to a bandage. These are for larger wounds to apply pressure to help stop bleeding and are quick and easy to put on in an emergency.*

ii) ***Bandages:***

• ***Roller bandages:*** *Roller bandages are long thin bandages rolled up. Use a roller bandage to support joint injuries, hold dressings in place, put pressure on wounds to stop bleeding, and to reduce swelling*
• ***Triangular bandages:*** *Triangular bandages are large triangular shaped pieces of cloth. You can fold a triangular bandage to use as either a bandage or sling, or, if sterile, as a dressing for large wounds and burns.*

iii) ***Protective items:***

• ***Disposable gloves:*** *Using disposable gloves reduces the risk of infection between you and someone you're helping. If they're available, always wear gloves whenever you dress wounds or deal with any body fluids or waste*
• ***Face shields or pocket masks:*** *These are designed to prevent infection when you give rescue breaths.*

iv) ***Other items:***

• ***Cleansing wipes, alcohol free wipes:*** *To clean the skin around the wound*
• ***Gauze pads as dressings:*** *To use as padding, or as swabs to clean around wounds*
• ***Sticky tape (adhesive tape):*** *To hold dressings in place or to hold the loose end of bandages*
• ***Pins and clips:*** *To fasten the loose end of bandages*
• ***Scissors, shears and tweezers:*** *To cut sterile pads, bandages or sticky tape to the right length. You can also use them if you need to cut someone's clothing, so that you can get to a wound, for example.*

v) ***Useful extras:***

• ***Use kitchen film or clean plastic bags:*** *To dress burns and scalds*
• ***Use alcohol gel:*** *To clean your hands if you can't find any water to use*

For outdoors:

• ***Use a blanket:*** *To keep someone warm and protect them from the cold*
• ***Use survival bags:*** *To keep someone warm and dry in an emergency*
• ***Use a torch:*** *To help you see when it gets dark and to attract attention or make others aware that you're there*
• ***Use a whistle:*** *To help attract attention and get help*

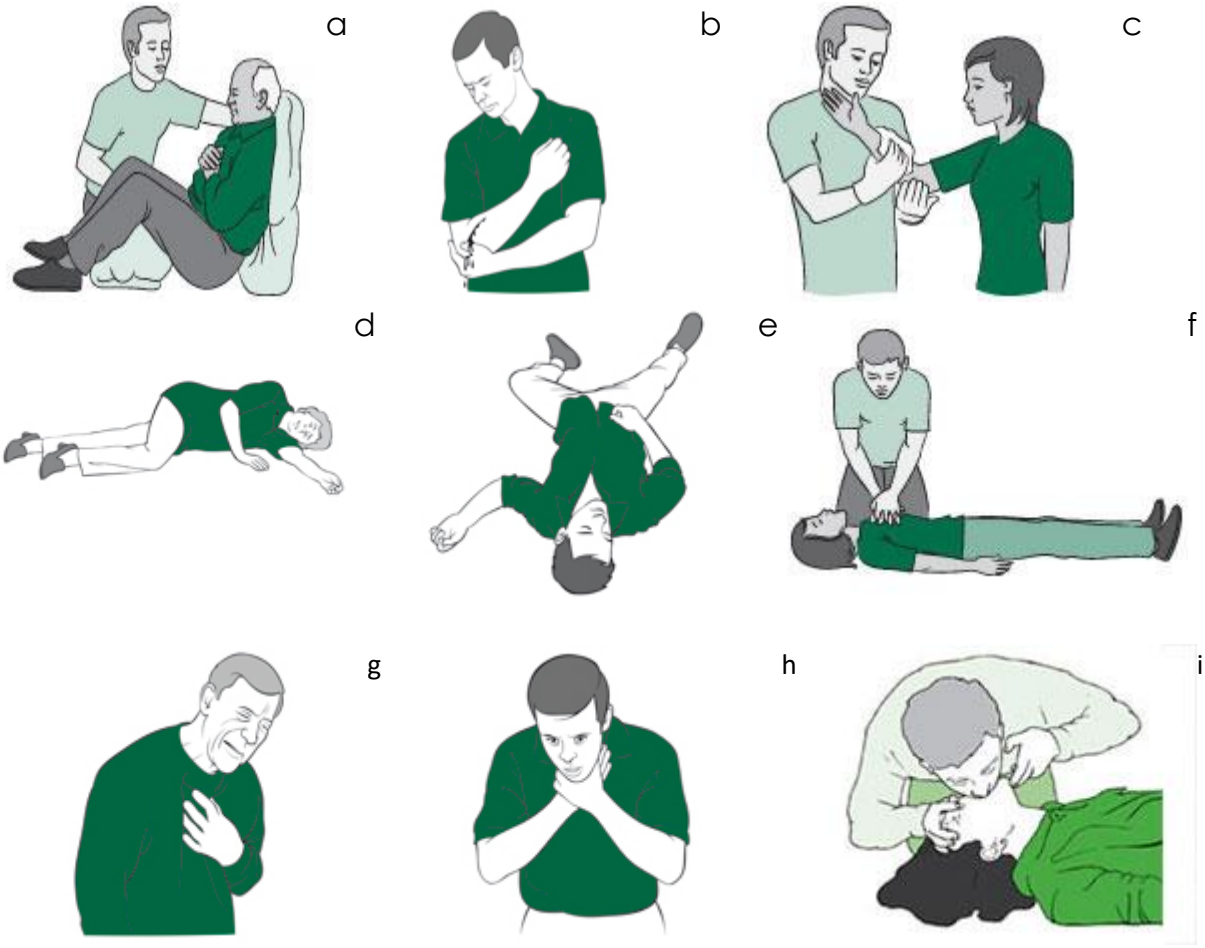
vi) ***For the car, in case of road accidents:***

• ***Warning triangle:*** *Put this on the road to warn other drivers to slow down*
• ***Wear a high visibility jacket:*** *To make sure drivers can see you and reduce the risk of you getting hurt as well.*

WEEK 11

Teacher Preparation

1. Arrange and get 20 sets of cards(a-i) below from internet or photocopy them make as coloured pictures



2. *Cut each picture (a-i) and pack them in one envelope*
3. *Acquire bandage, plaster, razor blade and piece of cotton cloth*
4. *Prepare a presentation on how to put a plaster on a wound*

Teacher instruction

1. Divide learners into groups. Tell them each group will be required to do the activity.

2. Guide learners to work in groups to match the cards with pictures and the accident they providing first aid to

3. Ask each group to display its matched picture by sticking it on the wall and do a gallery walk around the class

4. Select some volunteer compose a song on, roll play and mime First Aid operations

5. Demonstrate how to put a plaster on a wound

DEMONSTRATION OF FIRST AID

How to put on a plaster:

• First remember to clean and dry the skin around the cut. Unwrap the plaster and hold it by the protective strips on the back, with the pad facing downwards
• Peel back the strips enough so the pad is showing and place the pad on the wound
• Carefully pull away the strips and then press down the edges of the plaster.

How to put a sterile wound dressing on a limb:

• First, take the bandage out of the wrapper and unwind it until you get to the dressing pad – but be careful not to touch the part of it that touches the wound
• Then hold the bandage on each side of the dressing pad and place the pad directly on the wound
• Start by winding the short end of the bandage once around the limb to hold the dressing in place
• Then wind the other longer end of the bandage around the limb until it covers the whole pad – leave the short end of the bandage hanging free so you can use it to tie a knot
• To hold the bandage in place, tie the two ends together directly over the pad to keep firm pressure over the wound – any knot will do, but use a reef knot if you know how to
• Once you've tied the bandage, you'll need to check the circulation in the hand or foot beyond where you've tied it – press the fingernail or skin beyond the bandage until it goes pale and then let go. If the colour doesn't come back within two seconds, the bandage is too tight so you'll need to loosen it and retie it.

ACTIVITY OF INTERGRATION

a)Context

If you go out to the community, what do you see? You will see farmers, fields and farms. Oh! the list continues, and trees, hedges, birds, insects……It's a long list! Farms rear animals like goats, poultry, sheep, cattle and pigs and can grow things such as maize, millet, banana, coffee, sorghum, tea, tobacco, cotton, sugarcanes, fruit and vegetables. They use tools, equipment and machines. The people wear things like gumboots, caps, gloves and overall coat

Farms are wonderful places to visit. You may have been to a farm on a school visit in your primary school or on a trip with your parents. Some of you may even live on a farm. It is important to remember that farms are work places and so they might be dangerous objects and you need to take care.

b) Supports

picture

showing a farm with people wearing gum boots, a farm workshop for tools, garden tools, a tractor, farm house, crops and animals

c) Task

The senior 1 you have been asked to establish a small garden for growing vegetable, using the information in this chapter make a presentation and write about what you should do. It should include your preparation, making a nursery bed, transplanting, field bed and care you will carry out.

c) **Evaluation grid as you make a transition from existing assessment approach**

Criteria 1	**the learner A**	**the learner C**	**the learner E**
Visual presentation	Who creates a presentation that accurately and clearly represents facts or ideas on how to establish a small garden for growing vegetable	Who creates a presentation that accurately tells how to establish a small garden for growing vegetable It lacks clarity or facts on three or less areas	Who creates a presentation that does not relate or has a small relation with how to establish a small garden for growing vegetable and is so limited in facts
Criteria 2			
Oral presentation	Who is well prepared to speak about how to establish a small garden for growing vegetable, Is able to share their information using proper grammar and vocabulary in their explanation. If any questions are asked of the audience; is able to provide an accurate information on one selected vegetable	Who has made effort to prepare to speak about how to establish a small garden for growing vegetable Is able to construct sentences using grammar and vocabulary with slight errors on vegetables. Is able to answer any questions that are asked.	Who has mixed ideas of many crops including vegetables The grammar, sentence or paragraph construction and vocabulary have numerous errors and information from different crops. Has limited ability to handle audience questions

d) ***PEDAGOGY OF INTEGRATION EVALUATION GRID***

How to establish a small garden and grow a selected vegetable

Criteria **Outputs**	**Relevance**	**Accuracy**	**Coherence**	**Excellence**
Preparation for crop growing	The activities of preparing to establish **are closely connected to vegetables** Like carrying a market survey on vegetable, identifying the site to put the garden, selecting a vegetable to grow, preparing tools and equipment for use, Observe safe work practices	It **conforms to the correct activities or standards** in preparing for establishing a garden of vegetables such as wearing gumboots, overall, gloves as way of ensuring safety; which resources to use and how to acquire them	**It brings together in a logical way the preparation activities as a whole** like in the market survey could be questions answered starting with: what vegetables are there in the community; where do they come from; how easily can one get them, what do people think about these different vegetables; how much do they pay for them; which of them do they like most and why	**The presentation shows extra things and generic skill**s including – Planning daily work routines for this growing of a selected vegetable -Communicating during the activities of establishing and growing a selected vegetable -Meeting held to discuss about vegetable growing; health and safety requirements adhered to -Using hazardous substances safely -Cooperating and interacting with others in establishment and growing; -Acting in an emergency or accident in during establishment and vegetable growing
Nursery bed making	Provides the principles and methods of nursery bed making	Identifies the different types of nursery and vegetables grown that way	Support the selected type of nursery bed with reasons like preparing a soil media for seedbed box or potted nursery bed	
Transplanting	Follows the correct steps/ procedures of transplanting seedlings	Identifies the steps in transplanting seedlings of vegetables	Ensures that the steps followed result in health looking seedlings after transplanting	
Field bed and care	States the different activities in establishing a small garden of vegetables	Identifies the activities like site selection, land preparation , optimum spacing, planting depth, planting, mulching,	Ensures that seedlings in the field garden are health and growing successfully	

		pruning , fertilizer use		

Figure 3.1 Weathering of rocks

COMPETENCY: You should be able to understand how soil is formed from rocks through the process of weathering.

Key words

- **Soil**
- **Rocks**
- **Weathering**
- **Nutrients**
- **Soil fertility**
- **Soil pH**
- **Fertilizer**
- **Soil**

By the end of this chapter, you should be able to

1. Show skills in analyzing soil and identifying the different components
2. Understand the different types of weathering processes and factors influencing soil formation
3. Show skills in distinguishing between the different soil particles, soil textures, soil structure, soil profile horizons and types of soils as used for agricultural purposes
4. Show skills in
5. Understand the importance of plant nutrients and soil pH

WEEK1

Teacher Preparation

1. Read and study the introduction to soil science, what is soil and components of soil
2. Read the chart on project based learning in figure 3.2
3. Identify an area or garden you are going to use for the project based learning in this unit
4. Get a good amount of dry soil, three different types of rocks
5.Get from internet and print a picture of or real igneous rock, metamorphic rock and sedimentary rock from the community
6. Request from and negotiate with the school administration to provide you with a tray of eggs, onions, tomatoes , cooking oil for making an omelette; a cake of different layers and colour and ice cubes/blocks

Teacher instruction

1. *Ask your learners what they know about soil from a garden and rocks. Make the KWL chart and first list their responses of what they know on chart paper.*
2. *Now ask your learners what they want to know about soil and rocks and list their responses on chart paper.*
3. *Ask the learners to read the text below on what is soil and its components*

DISCOVERY, LITERACY, ANALYSIS, EXPLORATION

Start with giving out a sample of soil and the three different types rocks to each group of learner. Draw their attention to the sample soil and pose the question so that you can list what they know and what they want to know in the KWL CHART.
Ask the learner now to read the text below. Find out what they have learnt that could be added to the KWL chart

Introduction

In this chapter you will know more about soil. Soil is the upper layer of earth in which plants grow. This is the uppermost layer of the earth crust. It is a black or dark brown material typically consisting of a mixture of organic remains, clay, and rock particles. It is portion of the earth crust consisting of disintegrated rock and humus. Thus soil consists of a mixture of inorganic and organic particles in various proportions.

What is soil?

Soil is that material which nourishes and supports growing plants. These include rocks, water, organic matter and air

Because plants get support, nutrients and water from soil making an important area in agriculture. This material do provided human beings the ability to produce food through agriculture. It is also where man and other animals are held to carry out several activities that support life.

Components of soil

The four major ingredients of soil are minerals, organic matter, air and water. Mineral and organic matter is the solid particles in soil. While water and air fill up the spaces between the particles. In the soil you also find living organisms; some are very tinny to be seen with our naked eyes. While other organisms are big like moles, millipedes and centipedes.

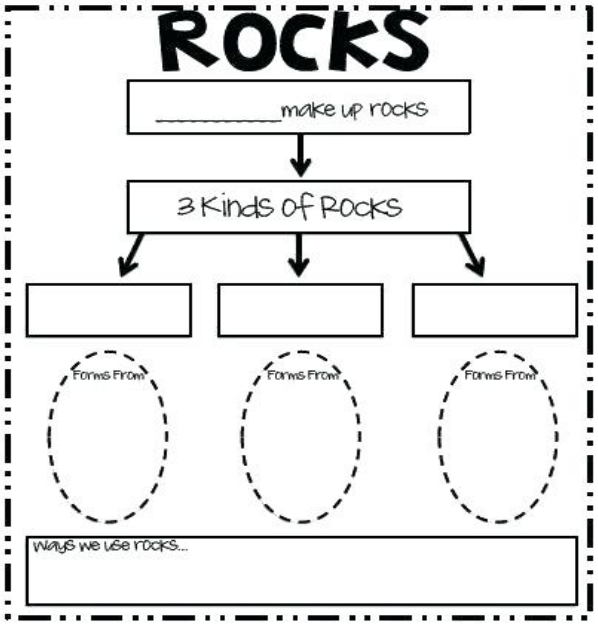
Figure3. 1: Composition of Average Soil

Air 25%
Water 25%
Mineral Matter 45%
Organic Matter 5%

Draw circle showing those percentage composition of soil
Teach it
Tell your learners that soil is made of 4 main components air, water, organic matter and mineral matter. Mineral matter is the largest component of a soil particle. Rocks provide soil with mineral matter.
Tell you learners that there are three different kinds of rocks. The first type is called ***igneous****. Igneous rocks are composed of melted rock that hardens and cools. A few examples include obsidian and pumice. Show your learners a picture of each example.*
Explain that the second type of rock is called ***sedimentary****, and they are formed from material that is settled into layers. The layers are squeezed until they harden into rock. A few examples include limestone and sandstone. Show your learners a picture of each example.*
Tell your learners that the third type of rock is called ***metamorphic****. These rocks are changed by heat and pressure. A few examples include slate and marble. Show your learners a picture of each example.*
To ensure understanding demonstrate each type of rock using the examples below. If the hands-on materials arenot available, simply use each scenario as an analogy to help your learners better understand the differences between the three kinds of rocks.

- *Get an ice tray. Fill it with water and put it in the freezer. After an hour, show your learners that an igneous rock is like a cube of ice. It is originally melted, and then hardens after being put in the freezer. It is cool when you take it out.*
- *Give your learners the example of an omelet for metamorphic rocks. Tell your learners that the egg is mixed with various ingredients, and then cooked. The egg experiences heat and pressure from the flames of the stove, which enables it to turn into an omelet.*
- *Display a layered cake to your class, and tell your learners that this is similar to how sedimentary rock is formed. Tell them the various layers of the cake come together after baking in the oven.*

Conclude by asking your learners to make a graphic poster about either igneous, sedimentary, or metamorphic rocks. On the poster, they should use pictures and words to share how the rocks are formed. You can also them to go the carpentry workshop and get materials that model the three rocks to make a learning station of how these rocks are formed.
Tell the learners to complete this chart on rocks



Finally ask them to do activity 3.1a and 3.1b

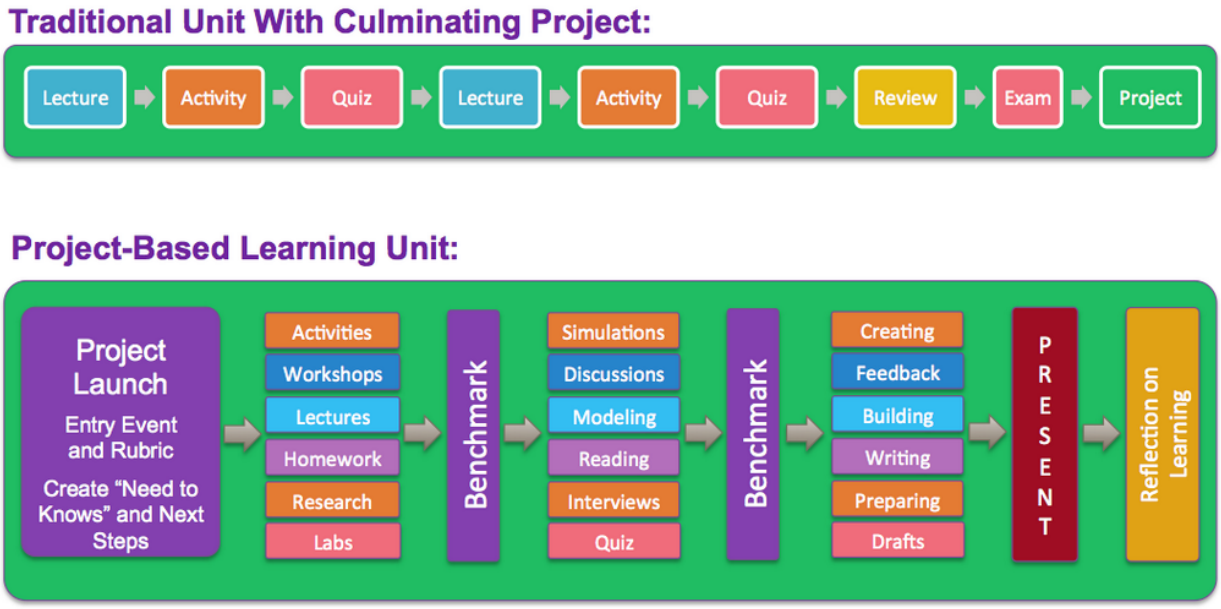


Figure 3.2 Comparison of project based learning with the traditional approach

3.1 a) Activity: Examining the composition of soil

In your group get three different sample of soil from various places in your community (garden, near a kraal, from a swamp, from a forest/tree plantation, school compound, lake shore/river bank/dam/pond)
Place a given amount in a jar/measuring cylinder with a lid
Add some water so that the jar/measuring cylinder is three quarter full
Put the lid/palm firmly and shake the jar/measuring cylinder
Leave the jar/measuring cylinder and its content to settle for two day
Repeat for all you samples collected
Make your observation on how the particles settle
Describe what you see in the jar/measuring cylinder

3.1 b) Activity: Investigating the main components of soil

In small groups carry out the following experiment

- Get two dry sample of soil from two areas (on top of a hill-A and in the valley-B) in or around the college. Label the soil samples A and B
- Get three dry 250ml conical flasks or 100ml measuring cylinders and label any two A and B respectively
- Stick on the side conical flask/measuring cylinder a strip of graph paper
- Put 70ml of dry soil sample A into the respective conical flask/measuring cylinder
- Put 70ml of dry soil sample B into the respective conical flask/measuring cylinder

- Measure 100ml of water and pour it into each conical flask/measuring cylinder containing the soil samples A and B
- Cover with your hand or cover and shake thoroughly for 2minutes. Repeat this for the other conical flask/measuring cylinder
- Allow the conical flask/measuring cylinder to stand for 10minutes.

1. Examine the results of your experiment after settling
2. Estimate the percentage of each type of soil particle using the formula

$$\text{Percentage of soil component} = \frac{\text{Height of the component}}{\text{total height of all solid matter + height of organic}}$$

NOTES: During the experiments at first you will be able to see bubbles come up in the cylinder as you pour the water. This means that soil contains air. The things that float on top of water in the cylinder are pieces of dead plants, dead insects, old rotten roots or leaves and small soil particles. While the heavy soil particles will sink by size. The bigger soil particles will sink to the bottom. The colour of the water in the cylinder will start as brown then clear after 7days. Humus makes the soil look dark brown.

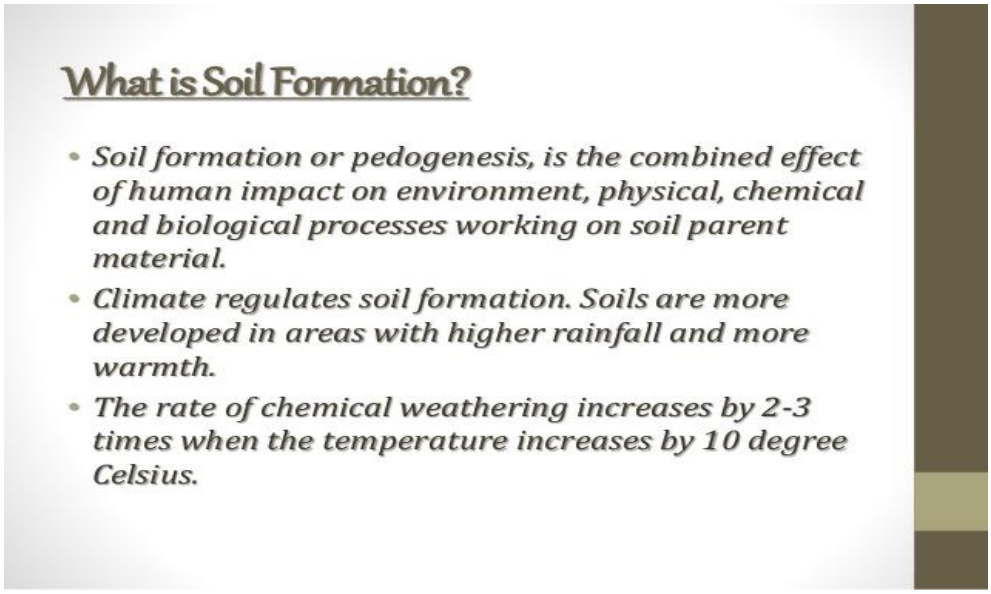
Possible answers

Learners will state what soil is made of as air, water, mineral matter/stones/rocks, organic matter, plant roots, and micro organisms
Rocks that are one solid, mixed coloured rocks and slates like rocks that easily break up
The amount of each component will depend on the area

WEEK 2

Teacher Preparation

1.Write this on charts or type and print out many copies of this information
2.Read the text about soil formation



Teacher instruction

1. Start by asking the learners the three different types of rocks and how they are formed. Then ask the m to read this text before giving the charts or prints to read to find the similarities

2. Divide the learners into groups and give them the three types of rocks to do activity 3.2

3. Ask learners to read the text on weathering and factors influencing soil formation then do activity 3.3

Soil formation

Soil is formed from a mixture of mineral particles, air, water, decaying plant and animal materials. The mineral particles come from rocks. The rocks are the solid material forming the earth crust. Thus the crust of the earth is made of solid rock. But deep inside the earth is very hot. When the rock inside is very hot it melts to form a liquid. The molten rock is called magma. Magma is a mixture of different minerals. When magma cools it forms new rocks. Thus the rocks are classified by the way they are formed. These rocks differ in their chemical composition and the way they were formed. These rocks are of three types: igneous, sedimentary and metamorphic rocks.

Activity 3. 2 Investigating the properties of rocks

In your group look at three different rocks (metamorphic, igneous and sedimentary) given to you

- Write down a list of questions you will need to ask about these rocks (texture, colour, roughness, crystal, size, porous, hard by scratching)
- Use a hand lens to examine the rocks

- Describe what you see
- State four properties of these rocks.

Weathering

Rocks do not stay the same forever. They get changed slowly and with time. **Weathering** is the breaking or splitting down of or rocks. It is the process by which rocks break down to form soil particle.

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Types of weathering

Two important classifications of weathering processes exist – physical and chemical weathering; each sometimes involves a biological component.

a) Physical weathering

This involves the splitting of rocks into small particles without any change in chemical composition. The agents of physical weathering are:

i) Force of running water

When water is fast flowing in a river or stream, it carries along with it any small rocks, stones, boulder and other particles. As these materials move they knock each other and keep breaking. The small particles that break off, form part of soil.

ii) Glaciation

Rocks are split by the movement of huge blocks of ice ending up knocking each other and splitting into small particles

iii) Freezing of water

When rain water collects in cracks in rocks. When it becomes very cold, this water freezes and expands. This is due the anomalous behaviour of water. This forces the crack to widen, making the rock to break.

iv) Wind

When strong wind blows small particles they knock each other and split further into small particles.

v) Temperature

When temperatures are high the rocks expand and when it becomes cold they contract. The expansion and contraction of rocks is caused by heat from the sun rays and cooling in the evening cause rocks crack and split. These changes in temperature weaken the structure of rocks leading them to split into small particles

b) Chemical weathering

This involves a change in the chemical composition of the original rock. The processes involved are:

i) Solution

When water dissolves any soluble minerals found in rocks, this weakens the structure and changes the form of the resulting rock. Thus the rock will easily crumble.

ii) Hydrolysis
When weak acids react with minerals found in rocks they form new substances that dissolve out and this weaken the structure of rocks. Examples of weak acids are Sulphur dioxide and nitric acid.
iii) Oxidation
When oxygen from air reacts with minerals like Iron-and Aluminium-containing rocks new compounds are formed. These weaken the structure of rocks
iv) Carbonation
When carbon dioxide reacts with metals found in rocks to form carbonates, it weakens the structure of rocks.

c) Biological weathering
i) When heavy animals move over rocks will set up vibrations that weaken the structure of rocks.
ii) The activities of human beings like stone quarrying, construction, dynamiting and mineral extraction lead to rocks being broken into small particles
iii) When plants and animals die they decompose/decay into organic matter and humus. These are components of soil and contain plant nutrients.
iv) The activities of burrowing animals like moles and squirrel mix rock particles with organic matter
v) The activities of animals with sharp hooves on rock surfaces will cause crumbling of rocks.
vi) When the roots of plants or mosses will create humid condition to speed up chemical weathering. Also if the grow in cracks will expand in size and widen them leading to splitting of rocks.

Factors influencing soil formation

Weathering is the process whereby rocks are split into smaller and smaller particles. This is the kick start of soil formation.
1. Parent material

This the material from which soil develops. These materials include rocks, stones, in some places peat, and specific minerals. Peat is the decaying plant matter found in a very wet place.

2. Climate

The action of wind, temperature and rainfall of an area affects the weathering process and the movement of rock particle.

Strong winds can move large quantities of particles from one area to another

Heavy rainfall around streams and rivers fill up or swells up then carry particles to far away distance.

Activity 3.3 Micro organism decomposing of plant remains

- Gather fresh plant material and cow dung
- Dig a trench or hole
- Put the fresh material and cover it with cow dung in the hole
- Check on the material after 7days
- Find out what is happening on the materials
- Find out whether there are any living organisms feeding on the materials
- Describe what happened to the material?

3. Living organisms

First the dead plants and animal remains are acted on by microorganisms. They decompose the materials. Decomposition or decay is the process by which plant and animal materials are broken down to form part of soil. The part of soil formed from these materials is known as organic matter or humus. These bacteria and other living organisms in the soil break all organic materials into smaller particles as they feed.

4. Topography

Topography is the nature of the land surface. The slope of the land clearly affects the distribution of soil. Land that slopes will have faster water runoff and dry out more quickly. Water running down the hills picks up soil particles and carries them off. So you find that the hill tops have little amount of soil. While the low laying and valleys receive most of the soil particles carried by erosion. Thus have huge amounts of soil and nutrients.

5. Time

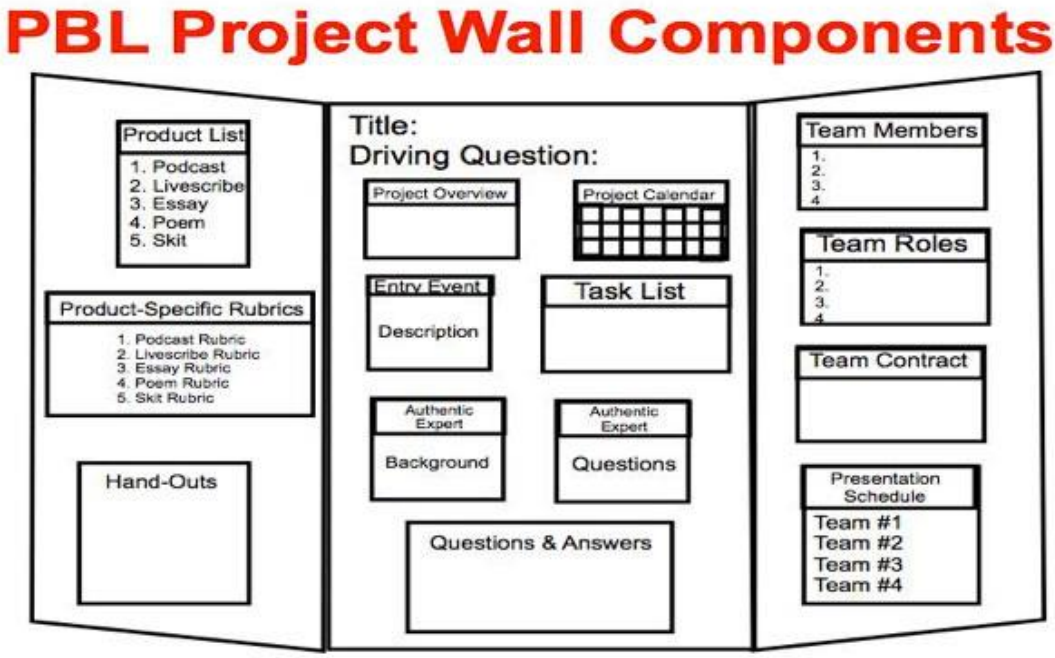
The weathering process is only the beginning of the long journey to form soil. Soil is known to takes many years to mature. It involves distribution of particles, movement of the rock particles, the addition of organic matter and the continuing action of soil organisms, rainfall, winds and plant roots gradually form the soil we see after many years. So the age of a soil or how long it has been forming, determines the nature of the soil in an area.

Possible answers

The three different types of rocks are: igneous, sedimentary and metamorphic rocks. With different characteristic.

There are five factors influencing soil formation of climate, parent rock, living organisms, topography and time
There three types of weathering namely : physical weathering, chemical weathering and biological weathering

WEEK 3
Teacher Preparation
1. *Design a project based learning wall component like this by taking the titles of title, driving question, project over view, project calendar, task list, entry event/ starting task description, background information, questions, question and answers, team or group members, team roles, team contract, presentation schedule, product list, product specific rubric, and hand outs*



2. *Prepare the project titles like : determining the soil profile of our community, investigating the materials that make up the soil in our community soil profile, carrying out soil sampling in different gardens in our community and determining the physical and chemical properties of soil in our community*
3. *Get the material for this projects to enable learners carry out their pieces successfully*
4. *Negotiate with and inform administration that learners will be carrying out a project on soil made of several components*
5. *Design role cards for each group using computer or draw them using manila and markers*

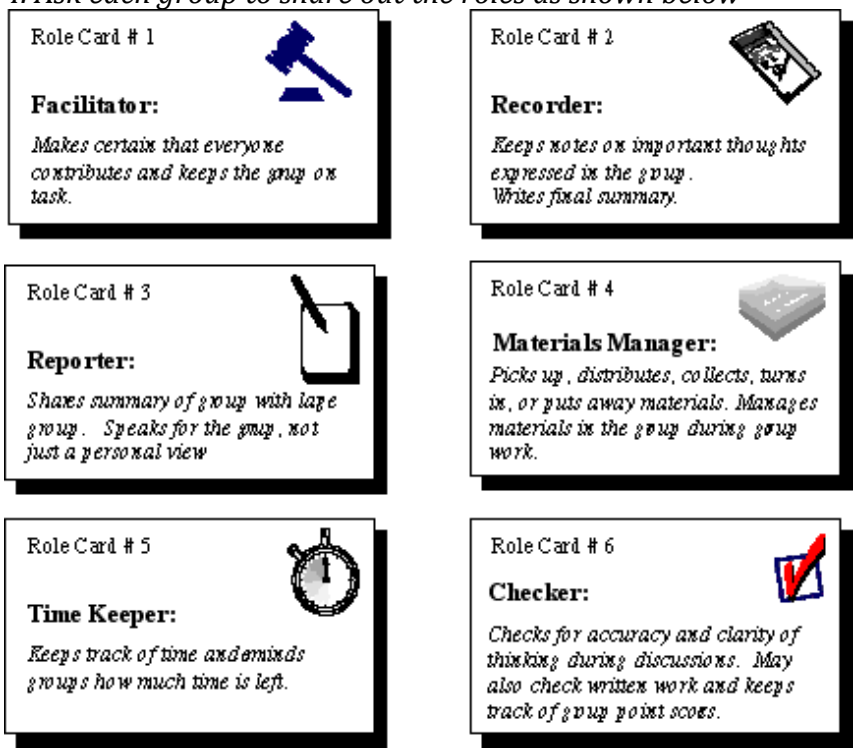
Teacher instruction

1. Divide the learners into groups

2. Inform the learners that they will be doing the project activity after 2.30 pm on each day

3. Explain to the learners the project based learning wall components

4. Ask each group to share out the roles as shown below



5. List down the responses of the learner about the goat that was found in the pit

Teach it and ensure understanding

DISCOVERY, LITERACY, EXPLORATION, APPLICATION and ANALYSIS

Start by introducing telling a short story of when you found a small goat in a pit which is two metres deep. One leg of the goat was hurt and broken. This animal was being reared so that later on it could be sold and you get school fees.

Ask the learners what they could do to get it out of the pit and the subsequent days until healing of the leg.

Tell the learners that getting the goat out of pit and taking care of it until it could heal is a project and many lessons can be learnt from this experience. ***Therefore Project based learning is method in which learners gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging, and complex question, problem, or challenge like the one they are going to do.*** *Tell the learners that they going to be given a project title as group which will take time to complete using the text below among others. Tell them to read and understand it.*

Soil profile

The soil profile is defined as a vertical section of the soil from the ground surface downwards to where the soil meets the underlying rock. The soil profile can be as little as 10 cm thick in immature soils and as deep as several metres in tropical areas where the climate is conducive to rapid alteration of the underlying rock to form soil. In temperate areas, the soil profile is often around a metre deep and in arid areas somewhat shallower than this.

This is the vertical cross-section through the soil showing different horizontal layers soil. The horizontal layers are called horizons. Each horizon differ in colour, depth, texture and structure

Activity 3.4 Determining soil profile

- Observe the different layers of a soil profile
- Select an area in the compound
- Dig up a pit of about 2metres deep or visit a dug pit latrine site
- Was the person paid for digging it? Find out how much was paid for each metre deep?
- How many layers are seen?
- Dig up a pit of about 2metres deep
- Observe the layers or colour of soil as you dig deeper
- Draw the layers you see
- Study and mention the characteristics of the layers
- Compare your drawing with the sketch below. What differences do you see?

At the top in a soil profile you find the most useful part of soil and three other horizons.

Horizon A

This is also called the Top soil. It is covered by a layer of rotting organic matter. Its soils are friable and have a good crumb structure. Air and water can move freely which enable many soil organisms and plant roots to live. Most of the plant nutrients occur in this layer.

Horizon B

This layer known as sub soil has the soil particles closely packed together and there is less movement of air and water. It is red brown in colour. This is an indication of the accumulation of iron. However you also find there silica and calcium often present in large quantities.

Horizon C

This a layer made up rocks slowly disintegrating or weathering. It has coarse rocks, stones and with no or few plant root. It is also called the stony or weathering region.

Horizon D

This is the soil rock at the bottom of the soil profile. It is also called the Bed rock. It may collect underground water forming ponds on top of this rock. It is likely to undergo weathering and in very dry areas some plant roots may penetrate all the other layers to search for water here.

Activity 3.5 Investigating the things that makes up soil

In pairs you will need measuring cylinder, dry soil different layers of dug pit, water, and stop clock

- Get a transparent 250ml measuring cylinder
- Get dry soil from your compound gardens
- Pour 100ml of dry soil into the measuring cylinder
- Add 100ml of water to the cylinder with dry soil
- Record what you see when you have poured all water
- Cover the mouth of the cylinder and shake. Allow the water mix up with water
- Allow the contents of the cylinder to settle for 15minutes. What do you see?
- Are there materials that sink or float?
- What is the colour of the water?
- Draw the final result and label the components in the cylinder of the activity after 7days.

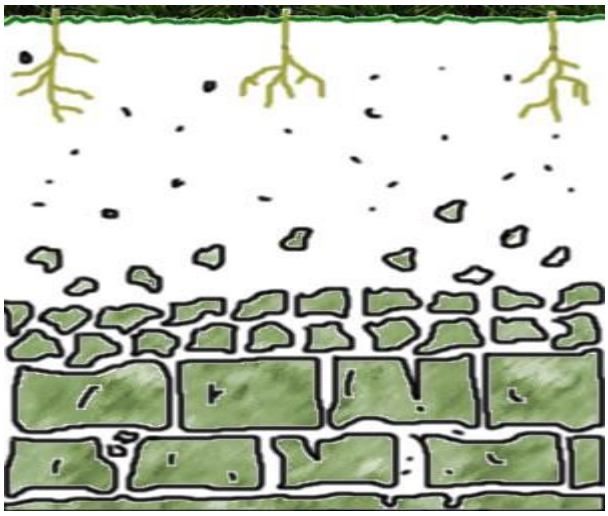


Figure 3.2 **Sketch of *the locations of soil horizons***

Importance of the soil profile

A soil with a thick top soil is more fertile and its productivity is good. Yet an area with a thin top soil layer will not have much fertility and will not produce large crops. Therefore farmers need to use practices that keep the top soil from being lost.

A soil profile will determine which crops or vegetation to grow normally in area. Crops with long roots will need deep soil with a sizeable thickness of top soil. This is because deep soils have more nutrients and water to support plant life or thick and vigorous healthy looking vegetation.

While young soils or heavily eroded areas will have thin layers of each of the first three horizons and will be less fertile soils. This renders such places to naturally support few plants or little pale vegetation.

Soil sampling

Soil sampling is the practice of collecting samples of soil from a given area for detailed study in the soil laboratory. Soil samples are used to determine whether soils are acidic or alkaline; have enough and balanced plant nutrient levels. This information is then be used to make and suggest recommendations on fertiliser, lime or phosphate applications for optimal plant production.

Procedure of soil sampling

1. The first step in taking a soil sample is to remove the top surface (1 to 3 cm) of the area to be sampled as this part usually contains and a relatively high content of plant and animal residues (debris) in different stages of decomposition. These do not form part of soil and will most likely introduce error.
2. The second step involves taking what is known as top soil. Top soil is that part of soil that is up to 30cm deep from the top surface. A tool widely used for soil sampling is an auger (see pictures), which works in an analogous manner to a cork screw. It is inserted into the soil by applying a downward force while rotating it, and fills as it goes deeper into the soil. Once filled at the correct depth, the auger is then removed and the top soil placed into a clean, dry container marked “top soil”. If no auger is available, a simple spade will do just as well.
3. The third part of soil sampling involves taking a sub soil, which is a further 30cm deeper into the soil. In other words, a depth of up to 60cm of soil is taken from the same sampling spot. The sub soil is then placed into another container marked “sub soil”.
4. The fourth and final step is to ensure that both the top and sub soils are representative of the whole area that is being sampled by repeating the three steps above several times at other randomly chosen spots (the more replicate samples collected the higher the likelihood that the area will be well represented). The top soils should then be well mixed together to form a composite top soil. The same must be done for the sub soils. The two composite samples must never be mixed together to form a unit sample, but, from each composite, a laboratory sample weighing about 1,5kg must be obtained. The two laboratory samples (labelled “top soil” and “sub soil” in their respective clean, dry containers) are then sent in for analyses.

Figure 3.3 **Soil auger for soil sampling**

A good sample is obtained by:

(a) first removing the top surface of soil (1 – 3cm)
(b) taking the top soil, which is located up to 30cm into the soil from the top surface using a soil auger or spade
(c) taking the sub soil, which is a further 30cm deeper into the soil,
(d) repeating the three steps above at other randomly chosen spots to ensure that the samples will be representative of the whole area,
(e) mixing all the top soils together to form a composite top soil, and doing the same for the sub soils, then packing it a well labelled container
(f) and finally obtaining a laboratory sample of about 1,5kilogrammes of each composite sample.

There two main methods of soil sampling employed are: Transverse and Zig zag. After soil sampling then you can study more about soil to determine the physical and chemical properties.

Physical properties of soil

Farmers need to know the physical properties of soil. These include size, colour and shape. These soil characteristics of depend on the parent material, amount of organic matter available and weathering process that were in action. Thus the type of soil particles determines the physical nature and characteristics of the soil in a given area.

Activity 3.6: Mechanical analysis of soil particles

Either Part 1: Using a sieve mesh

- Get a set of sieves of different diameter sizes of their holes
- Get a dry amount of garden soil from your area
- Place sieve of the smallest diameter in the holder
- Place a collecting tray below the sieve holder and Place 200gms of dried soil in the sieve
- Collect the soil particles that fall through the first sieve to obtain the first fraction
- Repeat the process above with a new sieve of a bigger diameter until all sieves are done

The soil that is collected one by one in order of increasing diameter size will be helping you to separate the soil particles into fractions of the similar size.
The percentage of the whole soil sample (200gm) that each fraction will be representing will be calculated by weight/mass or volume.

Or Part 2: Using a measuring cylinder

- Get a three 250 ml measuring cylinder which are clean and dry
- Measure about 50gm of dried soil
- Place the measured dried soil in the measuring cylinder
- Using another cylinder get 100ml of water
- Pour the measured volume of water into the cylinder with soil
- With one hand in gloves put over the mouth of the cylinder shake it vigorously for 3-5 minutes
- Allow the cylinder to stand for 20 minutes, 60 minutes, 120 minutes, 240 minutes and 7days.
- Record what you see each of the times above
- Draw what you see in the measuring cylinder after shaking up with the dry soil and allowing to stand for 120 minutes and for 7 days.
- Do you notice any difference?
- What does tell you about soil.

NOTE: Mechanical analysis is a process of separating soil particles according to their size. In the case of a measuring cylinder the particle will settle in order of their size, the heaviest first.. Thus big stones or coarse particles will be found at the bottom of the cylinder. Organic matter or plant and animal remains will float on top. The volume of each fraction can be read off the scale of the cylinder. Sometimes it is called soil sedimentation.

Possible answers

Learners will be subject to the following project based learning criteria

Project members:……;……;……;……;……;…… ***Project title----------*** ***----------*** ***Project location……project start date ……***					
Rating	*1*	*2*	*3*	*4*	
1. ***When starting the project as a group: the task group members***					
Held a meeting					
Shared out the roles					
Brainstormed on a plan					
Begun promptly					
Have materials needed					
Were solving a problem					
Recorded their responsibilities					
When conducting research the group members					
Use primary sources					
Take notes or record notes					
Evaluate information					
Stay on truck of the task					
When discussing project work the group members					
Ask questions					
Take turns					
Make decisions					
Record agreed positions					
Stay on the topic					
When working on the project work group members					
Ask questions					
Take turns					
Make decisions					
Record agreed positions					
Stay on the topic					
When presenting work of the project					
Take turns or share roles					

Support key presenter					
Record questions posed					
Respond satisfactorily					
Wraps the presentation					

Learners carrry our a self assessment on collaboration using the tool below using a rating of not at all, some times, most of the time and always

Collaboration skills self assessment sheet ***Name of the learner*** ***Name of the project***				
	Not at all	*Sometimes*	*Most of the time*	*Always*
I listen to the ideas of others				
I negotiate with others				
I help reach an agreement on what is said or should be done and by whom				
I help put our ideas as a group together into one product or final resolution				
I complete all tasks assigned to me while doing my best work and effort				
I solve conflict reasonably				
I solve problems with peers without being rude				
I pay attention to how others are feeling				
Iam treated well by my peers and other people around				

WEEK 5

Teacher Preparation

1. *Collect soil samples from 5 different gardens in the community including dry fine sand, coarse sand and clay soil particles include the use of the sample of the group that did soil sampling project.*
2. *Examine the soil sample characteristics*
3. *Write in power points, word or on manila the following questions: What is soil? Can you identify different components of the soil? What does it look, smell and feel like? Do all of our samples look identical? How are they the same? How are they different?*
4. *Read the text about soil texture, soil structure and importance of soil texture and soil structure*
5. *Carry out activity 3.7a and activity 3.7b to get the results*

Teacher instruction

1. *Ask learners to bring in soil samples from home or collect samples from your schoolyard. Give them a chance to investigate the soil with a plastic spoon and a hand lens.*
2. *Divide learners into groups and give them time to join their groups at the start of the lesson*
3. *Ask learners: What is soil? Can you identify different components of the soil? What does it look, smell and feel like? Do all of our samples look identical? How are they the same? How are they different?*
4. *Tell learners to read the text about soil texture, soil structure, importance of soil texture and soil structure; the soil types and their characteristics*
5. *Tell learners to do activity 3.7a and activity 3.7b*

DISCOVERY, LITERACY, EXPLORATION, APPLICATION and ANALYSIS

Start by informing learners that although many factors contribute to a thriving garden, any seasoned farmer or gardener will stress the importance of good soil. In addition to anchoring roots, soil provides life-sustaining water and nutrients. Plants in poor soils will struggle to grow, even if optimal water and light are available. In contrast, plants in good soils will grow to their fullest potential and experience fewer problems with weeds, insects and disease.
Soil is composed of minerals and organic matter. Sand, silt, and clay are the mineral particles derived from rock broken down over thousands of years by climatic and environmental conditions (rain, glaciers, wind, rivers, and animals)

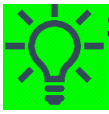
Ask learners to look at the sample of soil given to their group and answer the question you have written in power point or manila. The questions are:

- *What is soil?*
- *Can you identify different components of the soil?*
- *What does it look, smell and feel like?*
- *Do all of our samples look identical?*
- *How are they the same? How are they different?*

Ask learners to read the text about soil texture, soil structure, importance of soil texture and soil structure; the soil types and their characteristics

Ask learners to do activity 3.7a and activity 3.7b

Teach it for understanding



Soil texture

Soil texture is the size distribution of different particle that make up soil. It is the proportion of clay, silt and sand in a given sample. Soil texture determines the size of the spaces between the particles. These spaces between the particles are occupied by air or water you find in the soil. In turn this will influence the living organisms that can be found and the movement of water through the soil particles.

For instance the large particles of sand do not fit closely together. Thus they have large air spaces between them and water easily passes through these sand particles. Consequently sand soils cannot hold water for a long time.

While clay particles are very small and this allows them to stick together very closely. Hence these particles have no or little air spaces between them and water does not easily pass through. Consequently clay soil particles hold water for long and are known to be poorly drained.

Soil structure

Soil structure is the way soil particles are arranged together to form an aggregate or lump. It is the way the soil particles stick together and hold our plants.

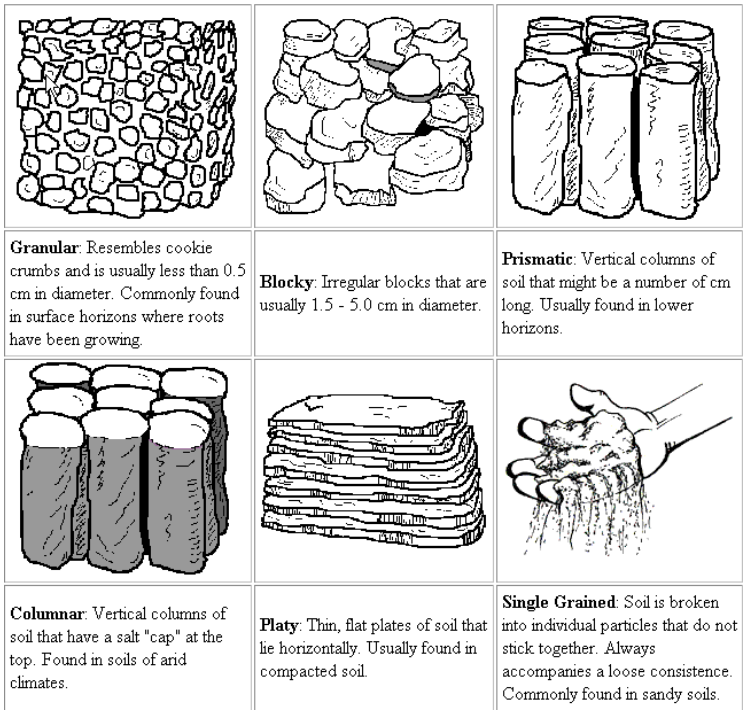


Figure3.4 Examples of soil structures

In summary there are five types of soil structure namely:

- Crumb or granular : is the porous granules with high amounts of organic matter, subject to wide and rapid changes
- Platy/plate-like: arranged as horizontal plates and found in virgin lands
- Blocky: are irregularly six faced cubes or rectangles found in the sub soil
- Prismatic: are pillar like aggregates with a prism shape found in the subsoil
- Columnar : are round pillar like aggregates found in the subsoil

Importance of soil texture and structure

For plants to grow successfully they require air and water. Soil texture and soil structure play a role in determining how much space is available for air and water to occupy. The best soil for crop production is loam soil which has a balanced amount of sand, silt and clay particles. These loam soils have a good soil texture and soil structure. This gives loam soils the following advantages for plant growth:

1. Loam soil is porous. It has enough space between the particles to allow water pass through easily and at the same time holding sufficient amounts for plant use. Yet clay soils with only very fine and small particles gets waterlogged during a rainy season as the space between clay particles get filled with water. Clay soils are not porous. There is no air because the particles get closely packed together. While sandy soils are very porous, this

allows water and nutrients to be washed away easily. Sandy soils also dry out quickly on exposure to drought or heat.
2. A good soil texture and soil structure allows good circulation of air in and around the soil particles. This is essential in plant growth and existence soil organism. They will be supplied with oxygen to carry out their life processes.
3. It allows plant roots to grow and extend to greater heights in the soil profile without much obstruction or barriers
4. The soil temperature will be controlled as warm air will carry away heat from the soil particle
5. Good soil texture and soil structure provides soils that are easy to cultivate or plough using a tractor. They easily break up.

Activity3.7a Experiment to show the relative porosity of soils

You will need 6 measuring cylinders (50 or 100 ml), 4 funnels, beakers or conical flasks, pestle, mortar, filter papers/cotton wool, water, retort stand, weighing balance, a graph paper and a stop clock

-In pairs get dry samples of clay, silt, sand and loam soils then grind it into powder
-Set up four measuring cylinders with a funnel and a filter paper as shown below

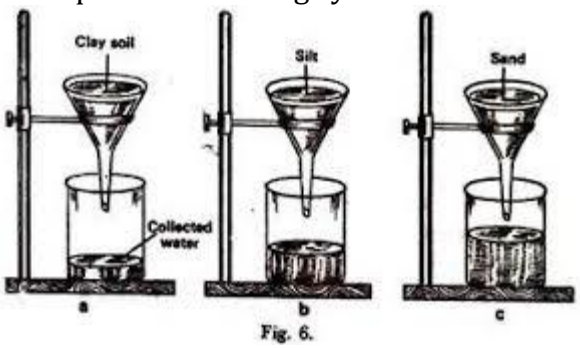


Fig. 6.

Figure3.5 Relative porosity experimental set up

- Weigh 50 gm of dry soil particle from each sample
- Put the 4 soil samples in the funnels of equal size. The end of the funnel is blocked with cotton wool or a filter paper.
- Measure 50 mls of water; four times each in its own beaker/conical flask
- Start the stop clock as you pour the volume of water on the funnel filled with the first sample. Record the time the first drop of water comes out and the volume collected

after 10 seconds, 20 seconds, 30 seconds, 60 seconds, 90 seconds, 120 seconds, 180 seconds, 240 seconds and 360 seconds. Repeat the above task for the remaining funnels

- Plot a graph of volume collected against time
- Display the graph in a learning station or classroom notice board/wall
- Describe what you learn from this experiment

Activity3.7b investigating the water-holding capacity of different soils

You will need dry samples of clay soil and sandy soil, two funnels, three measuring cylinders of 100 mls each, a beaker of 250mls to hold water, stop clock and filter paper or cotton wool.

Set up two measuring cylinders with a funnel and filter paper or cotton wool inside the funnel.

- Place 25 gm of dry soil into funnel with filter paper or cotton wool. Label the first one A (with sandy soil) and B (with clay soil)
- Pour 100ml of water over each sample as you start the stop clock
- Record the time when the first drop appear
- Record the volume of water collected every after 5minutes until all water has drained through. Calculate how much water has been retained by the soil
- Work out how much water would be retained by 100gm of soil. This is the water holding capacity of that soil.
- Draw the experimental setup on a large sheet of paper. Display your work in one corner of the class

Soil types

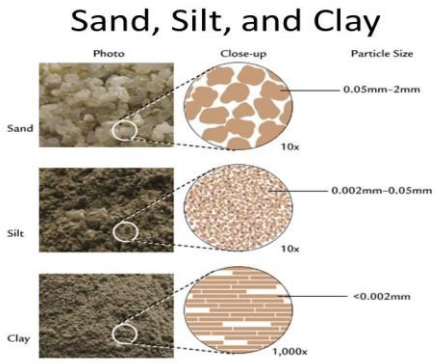


Figure3.6 The different soil particle sizes

At the start of this chapter you came to learn that soil is made up of mineral matter, organic matter, living organisms, water and air. Also you were given the different soil particles sizes and how the particles arrange themselves into soil aggregates or lumps. This means that the soil one finds in one area cannot be exactly the same.

There are three basic types of soil: sand, silt and clay. But, most soils are composed of a combination of the different types. How they mix will determine the texture of the soil, or, in other words, how the soil looks and feels

You can identify the different soil types using colour. For instance soils containing much iron will appear red/ brown or yellow. While fertile loam soils are dark in colour because of the amount of humus content they carry. There are other ways you can use to determine the soil type. These are examination of the soil profile, chemical analysis, mechanical analysis/soil sedimentation and estimation of humus content.

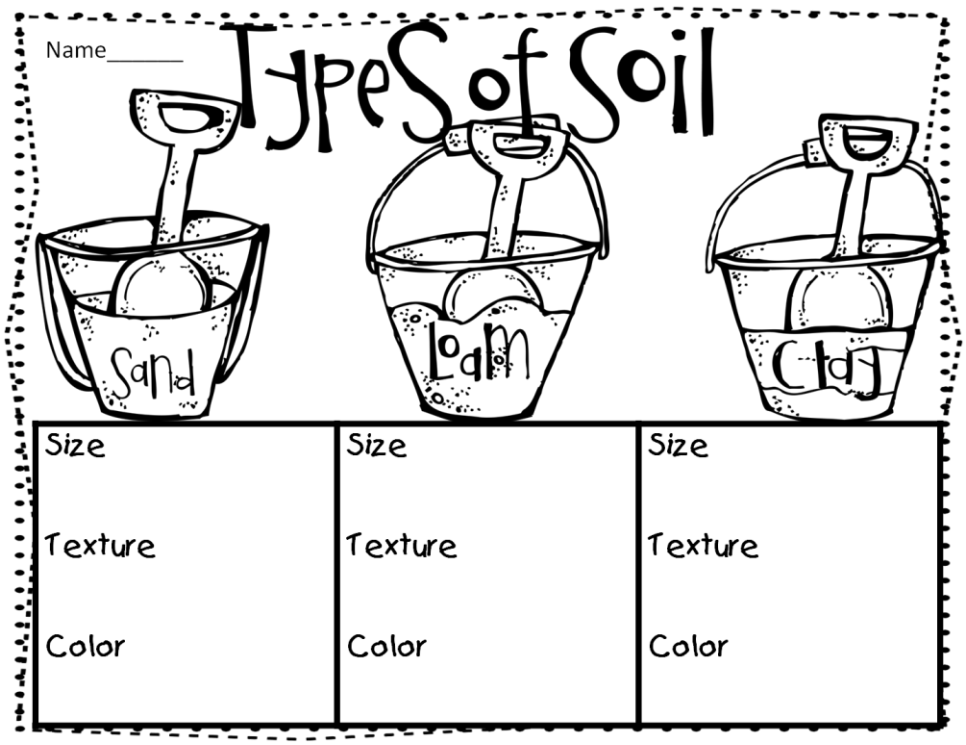
Soil type	Properties	Challenges
Loam soil	Well drained; friable; fertile; has a good proportion of sand, clay and silt; easy to work; forms crumb structure	
Silty soil	Has fine particles large than clay, fairly draining	
Clay soil	Has very tiny particles of soil, compacted, little air space and holds water for long time thus poorly drained; becomes hard like a stone in dry season	Can be water logged, difficult to cultivate, require lime to flocculate
Sandy soil	Has big and coarse particles, well drained and cannot hold water	Has less ability to hold water for crops,

Table 3.1 Soil type

Possible answers

*The largest, coarsest mineral particles are **sand.** These particles are 2.00-0.05 mm in diameter and feel gritty in your fingers. **Silt** particles are 0.05-0.002 mm and feel similar to flour. **Clay** particles are extremely fine -- smaller than 0.002 mm -- feel sticky in your fingers when wet, and clump to the point that you can't see an individual particle without a microscope. The proportions of these three minerals in a soil determine its texture or they way it feels. Organic matter is the decayed remains of once-living plants and animals. Good plant growth and development depends on the mineral and nutrient content of soil, as well as its structure.*

A chart for learners complete on soil types size, texture, colour, water holding capacity, sticking characteristics and smoothness



Pore space -- the arrangement of soil particles in relationship to each other -- is an important component of soil structure. In an optimal situation about 50 percent of the volume of the soil would be pore space, with half of that filled with water and half filled with air. The other 50 percent would be sand, silt, clay, and organic matter. Roots need air as much as they need water; plants can actually suffocate or drown if they are completely submerged in water for extended periods of time.

The proportion of these different-sized particles affects the amount of air, water, and nutrients available to plants, and how the soil "behaves." The smaller the soil particles, the more they stick together when wet. Thus clay soils can be sticky and difficult to work. With fewer air spaces, they drain poorly, and roots may suffer from a lack of oxygen.

However, clay soils can be rich in minerals. In contrast, sandy soils can drain water too quickly and be low in nutrients, but they are easier to work. Adding organic material can offset many of the problems associated with either extreme.

While there's no such thing as a perfect soil, particular plants grow best in particular soils. In general, common garden plants prefer ***loam*** *-- soils with a balance of different-sized mineral particles (approximately 40 percent sand, 40 percent silt, and 20 percent clay) and ample organic matter and pore space, but some common plants grow better in sandy conditions, while others are well adapted to clay soils*

- *Learners will share information about the components of soil and how the amount of sand, silt and clay present effects growing conditions for plants.*
- *Learners will use the ribbon test to estimate the amount of each component in your soil samples. First, take a small clump of soil and add water until it makes a moist ball.*

- *Learners will rub the soil together between their fingers. If the soil makes a nice, long ribbon, then it has a lot of clay in it (thus sticks together well). If it crumbles in your hand, then it has a lot of sand. If it is somewhere in between, then you probably have a good mix (a soil with a good mix of all 3 components is called a loam).*
- *You will ask students to estimate what percentage of each component they think is present. Explain that the ribbon test may not be exact, but scientist may use it in the field to create a general description of a soil since it is very easy to implement (all you need is a little water).*

Follow up with a more concise texture test. Explore soil components by creating "mudshakes" and watching components settle out. To create a "mudshake:"

1. *For each soil sample, have students fill a clear container about two-thirds full of water; then add enough soil to nearly fill the jar. You can also add a pinch of laundry detergent to help the soil components separate well. Shake the jar vigorously; then observe the jar over the next couple of days as the particles settle into layers. The larger particles, sand, are heaviest and will settle at the bottom, followed by silt, with the last full layer being clay. The clay may stay suspended and cloud the water for a long time. Organic matter will float on or just below the water surface.*
2. *Once the jar has settled, compare the results to your ribbon test. Measure the height of each layer and then translate that into percentages for each component (height of each component divided by height of the sample). How accurate were your estimations from the ribbon test?*

WEEK 6

Teacher Preparation

1. *Scout around the community to find a garden in September/October with good supply of nutrient and that with short supply of nutrients to crops/plants*
2. *Organize the questions you will pose as a checklist during the visit to the gardens including: What are the characteristics of the plants visited? What makes the plants to look like that? Where do the nutrients come from? How do plants use the nutrients? Which nutrient is needed most by plants?*

3. ***Again you are going to engage learners in PROJECT BASED LEARNING so review the work on project based learning***

4. Read the text below from plant nutrients, soil pH, fertilizers and safety and health standards when using fertilizers.

5. Bring to class the project titles including:

-determining soil pH of soil in our community from the top of a hill to the bottom valley and make a presentation in the class

-preparing compost manure from locally available materials and make a presentation in the class

-preparing of biological tea from locally available materials and make a presentation in the class

-design messages for farmers in the community about the safety and health standards observed when using fertilizers and make a presentation in the class

-carry out a market survey on organic and inorganic fertilizers in your community and make a presentation in the class

6. ***Two weeks before ask school administration to communicate with local authorities***

7. *Read understand the criteria for oral communication below*

"While oral communication will form part of everyday learning and teaching across the Years, the preparation for and communication by learners of their Classroom-Based Assessment must be completed over a period of three to five school weeks.

Preparation might include some original investigative work by the learner such as interview, survey, library research, internet research, guest speaker presentation, emailing, letter writing, and so on. Where sources are used, the use of more than one source will give learners scope to cross-reference. This is particularly important where learners use internet-based sources, where they should be encouraged to search effectively and ethically, and to evaluate and synthesize material. As the purpose of this assessment is to encourage ***confidence and proficiency in oral communication****, learners should be encouraged to experiment with their oral communication or presentation by practicing short pieces on and with other learners where possible or with a recording device like a tablet or mobile phone.*

In preparation for the assessment each learner must complete the learner's declaration of the part that he or she has played in the activity. The note is submitted to the teacher.

Although this phase of the task is monitored by the teacher, the preparation is the learner's own work, carried out individually or in active, meaningful collaboration as part of a group.

Presentation or communication by a learner should last about three to 10 minutes, including time set aside for engagement with other the listener/audience. Teacher support for the learner's communication, in the form of questions or interventions, may be part of skills building

Inclusive assessment

Where a school has accommodations and supports (Sign Language or hearing devices, support is provided by a Special Needs Assistant to learners who need them, or the support of

assistive technologies) in place to support the learner's learning throughout the school year, these supports should also be in place for the Classroom-Based Assessments. In these cases, the school will have decided that the learner has a specific physical or learning difficulty and will use reasonable accommodations to remove as far as possible the impact of the difficulty on the learner's performance in assessments, so that he or she can demonstrate his or her level of achievement. The accommodations are not designed to compensate for a possible lack of achievement arising from a disability. The preparation for this assessment will be monitored and supported by your teacher.

As part of your preparation for Oral Presentation or Communication you must complete a written Learner Reflection Note. This will include:

- *A title*
- *An account of the part you played and the materials or sources you accessed during your preparation* ***(The part I played in presentation or communication and preparation, including material used/accessed ; One important thing I learned from doing the task and Things I would change or try to improve on)***
- *A short personal reflection on your Oral presentation and communication.*

Learners or group have freedom by random selection to choose the topic from the options outlined, bearing in mind the following:

- *Even at the start of your preparation remember that this is an oral presentation or communication task, so think about how you will communicate with your listener/audience.*
- *The topic should be interesting for you but remember you need to complete your preparation and practice within the time allowed.*
- *Ask yourself one or more key questions about the topic or issue to help you focus and organise your preparation and communication.*
- *With the agreement of your teacher you may collaborate with classmates in the following ways:*
- *Choosing a topic by random selection from those put in front of you*
- *Planning and preparation*
- *Practising and finalising the communication or presentation*
- *Participating in the communication as part of a group in which each member has a part to play.*

Even if you collaborate with classmates on the Oral presentation or communication, you must complete your own Learner Reflection Note.

Completing Oral presentation or communication

In completing the Oral Communication Classroom-Based Assessment learners may use ***any one*** *of the following formats and opportunities that occur in the course of teaching and learning:*

Opportunity	***Description of focus and permissions allowed***
1. Performance	*The learner may participate in a scripted or improvised performance, including drama, alone or with others*
2. Presentation	*The learner may speak with or without notes, and a reading of a prepared script is allowable*
3. Interview	*The learner may respond to questions asked by the teacher and/or other learners; the learner may assume the role of interviewer as well as respondent in a dialogue setting* *The learner may interview using a prepared questionnaire or checklist of not more than five areas then making a note of a summary of findings*
4. Response to stimulus material	*Stimulus material—visuals, written text, aural text, and so on—may be used by the teacher and/or learner/s to promote, prompt or guide oral presentation and communication*
5. Response to unexpected /unknown stimulus material	*Stimulus material –is a question from any topic on subjects taught at that level and national/global issues of concern –may be used to promote ,prompt or guide oral communication of the learner (extraponeous speaking)*

Oral presentation and communication can be completed by the learner as ***an individual*** *or as* ***a member of a group****. The number of learners in a group should be such that it to allow each group member to make a meaningful contribution.*

Choosing the topic

Each learner or group of learners will identify or be asked to pick at random ***one topic.*** *In general, topics may range from school-based or course-related topics —like use of organic and inorganic fertilizer in our community to increase productivity or an exploration of or a response to a text being studied like the safety and health standards when using fertilizers— to surveys regarding matters of interest to learners, to investigations of issues outside school.*

What are the Features of Quality?

Key Features of Quality in support of learner and teacher judgment for Oral presentation and communication are described here. The Features of Quality are the criteria that will be used to assess the learner work as best fitting one of the following Descriptors:

Exceptional *describes a piece of work that reflects the Features of Quality for the Classroom-Based Assessment to a very high standard. While not necessarily perfect, the strengths of the work far outstrip its flaws, which are minor. Suggestions for improvement are easily addressable by the learner.*

Above expectations *describes a piece of work that reflects the Features of Quality for the Classroom-Based Assessment very well. The learner shows a clear appreciation of purpose and register, and the work is praised for its consistency. Feedback from the teacher might point to the necessity to address some aspect of the work in need of further attention or polishing, but, on the whole the work is of a high standard.*

In line with expectations *describes a piece of work that reflects most of the Features of Quality for the Classroom-Based Assessment well. It shows a good understanding of the task at hand and is free from significant error. Feedback might point to areas needing further attention or correction, but the work is generally competent and accurate.*

Yet to meet expectations *describes a piece of work that falls someway short of the demands of the Classroom-Based Assessment and its associated Features of Quality. Perhaps the learner has made a good attempt, but the task has not been grasped clearly or is marred by significant lapses. Feedback will draw attention to fundamental errors that need to be addressed*

Features of Quality for Oral Presentation and Communication

Grade	*Descriptors*
Exceptional (A)	*The learner's communication is remarkable for its fluency and its control of material used.* *The communication is imaginatively shaped to a very clear purpose.* *The learner's engagement with the audience/listener is compelling and sustained*
Above expectations (B)	*The learner's communication is clear and convincing, and material has been very well chosen.* *Communication is fully shaped to its intended purpose.* *Engagement with the audience/listener is highly effective*
In line with expectations (D)	*Communication is clear and convincing for the most part, showing knowledge of the subject of the communication.* *Communication is shaped to a purpose.* *Engagement with the audience/listener is reasonably well sustained*
Yet to meet expectations (O)	*Communication is unconvincing although some knowledge of the subject of the communication is shown.* *The purpose of the communication is often unclear.* *Engagement with the audience/listener is haphazard or poorly sustained*

Teacher instruction

1. Organize the visit to the garden and remind the learners the procedures for field visit learner in term 1

2. *Divide the learners into groups and ask them to respond to the question like: What are the characteristics of the plants visited? What makes the plants to look like that? Where do the nutrients come from? How do plants use the nutrients? Which nutrient is needed most by plants?*

3. Do share with learners the classroom based assessment information which is going to be employed

DISCOVERY, LITERACY, NUMERACY, EXPLORATION, ANALYSIS and APPLICATION

Start by telling learners that today they will be learning about the macro and micronutrients needed by plants. Ask learners questions like: Where do the nutrients come from? How do plants use the nutrients? Tell them that they will be testing the nutrient content of our soil samples through a do-it-yourself soil test kit. Tell learners that although many factors contribute to a thriving garden, any seasoned farmers will stress the importance of good soil with plant nutrients. In addition to anchoring roots, soil provides life-sustaining water and plant nutrients. Plants in poor soils will struggle to grow, even if optimal water and light are available. This will be demonstrated by the visit to the gardens with good supply of nutrient and that with short supply of nutrients to crops/plants

Tell the learners that again they are going to engage in PROJECT BASED LEARNING

Do tell learners to listen and read the text on oral presentation, plant nutrients, soil pH, fertilizers, safety and health standards when using fertilizers

Plant nutrients These are the chemical elements that are necessary for plant growth. These chemical elements are divided into two major categories. These are the: macro nutrients and micro elements

1. Macro Nutrients: are the chemical elements that are needed in large quantities by plants and are necessary for plant growth. Table below lists the major nutrients needed by plants

Element	**Uses**	**Symptoms of deficiency**
Carbon (C)		No growth
Hydrogen (H)		No growth
Oxygen (O)		No growth
Nitrogen (N)	Chlorophyll formation, vegetative growth, protein formation	Stunted growth(short but aged), yellowing of leaves
Phosphorous (P)	Root formation and development, quick maturity	Poor root system, no tubers, leaves are grey or purple
Potassium (K)	Formation of proteins and carbohydrates	Browning of leaf edges
Calcium (Ca)		Young leaves die-back at the tips and margins
Magnesium (Mg)		Leaves curl upwards

Sulphur (S)		Delay in flowering and fruiting

Table 3.2 Example of Macro nutrients and their deficiency symptoms

2. Micro nutrients

These are the chemical element or substance required in small or trace amounts for the normal growth and development of plants. There are about seven nutrients essential to plant growth and health that are only needed in very small quantities. Though these are present in only small quantities, they are all necessary:

- Boron is involved in carbohydrate transport in plants
- Chlorine plays a role in photosynthesis.
- Copper is a component of some enzymes.
- Iron is essential for chlorophyll synthesis.
- Manganese activates some important enzymes involved in chlorophyll formation.
- Molybdenum is essential to plant health. Molybdenum is used by plants to reduce nitrates into usable forms.
- Zinc participates in chlorophyll formation, and also activates many enzymes.

Element	**Symptoms of deficiency**
Iron (Fe)	Yellowing of leaves
Manganese (Mn)	Leaves have spots
Zinc (Zn)	Leaves are mottled or thickened, low starch formation and seed formation
Copper (Cu)	Leaves are pale green, low nitrogen fixation
Boron (B)	Growing points of shoot and root die off, poor cell division
Chlorine (Cl)	
Cobalt (Co)	
Molybdenum (Mo)	Leaf curling

Table 3.3 Example of Micro nutrients and their deficiency symptoms

Soil acidity or alkalinity and soil pH

Soil pH is a way of expressing the acidity and alkalinity of soil. This measure of the acidity or alkalinity of soil solution or soil water employs the use of a pH scale. This scale measures the number of ions in a solution. Hydrogen exists in the soil or solutions as an electrically charged particle called hydrogen ions (H^+). The positive sign shows that the ion is positively charged. Therefore soil pH is the measure of the concentration of hydrogen ions in the soil.

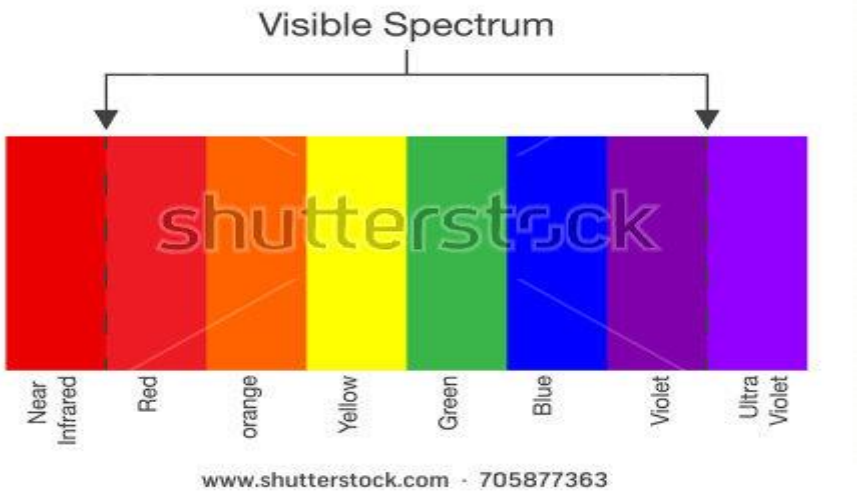
When there are many hydrogen ions in then the soil is acidic. If the soil is too acidic, some nutrients such as phosphorus will not be available. This is very common in poorly drained soils. Therefore only a few crops like tea may be supported. While too alkaline soils will not have iron and potassium available to plants. Soil alkalinity or salinity is a condition that results from the accumulation of soluble salts in soil. the most extensive occurrences are in arid regions, where they usually are found in low-lying areas where evaporation

concentrates the salts received from more elevated locations in surface water, ground water, or irrigation water. Since low-lying areas are most easily cultivated and irrigated, they have the greatest agricultural value. The degree of alkalinity of a soil is conveniently expressed in terms of pH values.
The pH scale is divided into 14 divisions or pH units numbered from 1 to 14. Soils with a pH of 7 are neutral. Soils with pH values below 7 are acid or "sour" and soils with pH values above 7 are alkaline or "sweet". A pH of 9 is ten times more alkaline than a pH of 8 and a pH of 10 is ten times more alkaline than a pH of 9. Thus, a soil with a pH of 10 is 100 times more alkaline than a soil with a pH of 8. The pH value of most soils falls in the range between 4 and 8. Most crop plants grow and produce best on slightly acid or neutral soils. There are exceptions, however, such as some berries which do best on strongly acid soils. Saline conditions are caused by high concentrations of the following ions: sodium, calcium, magnesium, chloride and carbonates. Alkali conditions are caused primarily by a high concentration of sodium carbonate. This reduces uptake of calcium, breakdown the soil structure and makes soil particles to hold strongly plant nutrients.

Activity3.8 Determining soil pH

You will need dry samples of soil from different locations (garden of crop, anthill, freshly burnt bush area, along the road), universal indicator, litmus paper, Munsel chart, soil test kit, water, test tubes, measuring cylinder(25 mls or 50mls), pipette or dropper

- In pairs or individually collect the dry soil sample and label it
- Put about 5 mls of the dry soil particles into a test tube
- Add about 10mls of water to each test tube containing the soil samples
- Shake the mixture while covering completely the mouth of the test tube for 5 minutes and allow it to stand for 5 minutes or 10 minutes
- Add 3 drops of universal indicator to the solution in the test tube; above the settled soil particles. Observe the colour and compare it with the standard range of colours, matched to the pH values. What do you say about each soil sample?



pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Colour	RED		ORANGE		YELLOW		GREEN			BLUE		PURPLE-VIOLET		
strength	Strong ACIDS				Weak		Neu-tral	Weak		ALKALIS			Strong	

Figure3.7 Munsell colour chart

Fertilizer

Fertilizers are any substance used to provide plant nutrients. This is because crops use nutrients to grow and bear fruits. Good crop yield will require adequate supply of nutrients.

Fertilizers may occur as dry or liquid form. The dry fertilizers are packed in bags or containers as pellets or granules. While liquid fertilizers are normally materials that have been dissolved in water at certain concentration. However there are two major forms of fertilizers namely organic (manure) and inorganic fertlizers

Organic fertilizers

These are plant and animal residues which the farmer can use to maintain soil fertility. There are four forms of organic fertilizers. These are four major types of organic fertilizers :compost manure, farm yard manure, green manure and mulch.

1. **Compost manure**

This is the crop residues, weeds, kitchen or household wastes and animal remains that has been rotted and decomposed as material to supply plant nutrients. This type of manure is normally got from decaying household waste like food peelings, slashed grass, leaves of

trees, kitchen plant or animal remains, ash from cooking stove and rubbish from compound. All these are put in compost pits or piles to rot.
After 14 days, you have to turn the heap. After another 14 days, turn the heap again for 2 more rounds and then it is ready for use.

Figure3.8 Procedure for making compost manure

Picture of compost pit *picture of stack of compost*

- *Get stones and bamboo/elephant grass as foundation layer*
- *Have chopped material followed by a layer of cowdung/farm yard manure and last layer of very soft plant material. Bacterial activity will produce heat. If you check using a stick and the temperature is normal then the material is ready.*

Activity3.9 Making compost manure

a) *Traditional method*

- *Choose a site near your crop garden for making compost*
- *Get the materials, tools and equipment (hoes, shovel, spade, rake, wheel burrow, panga, tape measure and ruler*
- *Clear away the vegetation*
- *Measure a 1m x1 m area*
- *Dig two or more hole of 1mx 1 m and 1metre apart. Each hole/pit should 1m deep*
- *Begin by putting your household wastes, dry grass, weeds, banana peelings and wastes into the first hole*
- *Remove big braches, plastic materials, glass or metallic objects*
- *When the materials are 25cm high add some soil or dung/FYM*
- *Put another layer of material to 50cm high then add some ash and dung/FYM.*
- *Sprinkle some water because wet things rot faster*
- *Allow this material to rot for 2 weeks and transfer it to the second pit. This will make the material on top to be placed at the bottom and have even rotting*
- *Erect a shade over your pit to prevent rain and excess heat*
- *After 8weeks the material should be ready*
- *Start preparing compost in March for use in May*

b) **Innovative way of making compost manure**

- ❖ Get the materials like cow dung/ poultry droppings, green plant materials, dry plant material and water
- ❖ Clear the ground where you are going to make your compost from
- ❖ Chop the green plant materials and dry plant materials in the ration 2:3

- First put three buckets of dry plant material spread in a diameter of I metre then sprinkle a bucket of water
- This is followed by two buckets of green plant material and I bucket of cow dung
- Repeat the same above two steps 6 times, to complete making a heap and cover it.
- Temperature will increase to 55^0 - 70^0C
- You need to turn 8times the material and every time squeeze the material to do a moisture test. If there is low moisture add green plant material and high moisture content add dry plant material.

2. **Farm yard manure**

This is the straw, food remains and animal beddings mixed with urine and faeces allowed to rot and decompose to be used as fertilizers. It is a mixture of rotten beddings and animal wastes. It normally made by people who keep animals and put dry grass on the floor or ground where animals are kept. The grass materials absorb the urine and feaces. After sometime these animal beddings are collected with the food remains and are put in a heap to be allowed to rot and decompose.

The composition and quality of Farm Yard Manure (FYM) varies or depends on:
-the type of animal kept: poultry, pigs goats, sheep usually produce FYM which is high in nutrients than horses and cattle.

- the age of the animal:
- the diet of the animal
- the type of bedding used
- the time given for rotting and decomposition

3. **Green manure**

This is growing crops which are cut or ploughed into the soil just before flowering to provide soil nutrients. Any fast growing green crops are used in making green manure. The most effective green manure crops are legumes. This family of plants has nodules on their roots in which the *Rhizobia* bacterium lives. These bacteria have the ability to fix nitrogen of the air into the soil. They use nitrogen gas for their own chemical processes but as a result convert it into nitrates. Legumes such as cowpeas, beans, soya, peas, and groundnuts or Lablab, Sesbania, Mucuna and Caliandria are used.

4. **Plant Mulch**

This is the dry plant material or dry grass applied to the surface of the soil then allowed to rot and decompose to provide nutrients.

5. **Biological tea**

This is where plant material is exposed to a way of extracting nutrients then the liquid is applied to growing crops. There are two kinds namely compost and manure.

- *Preparing biological tea*
- *Get a drum, bag/sack, wood ash, sticks and vegetative/plant material*
- *Put the wood ash and plant material into the bag. The bag should be half full*
- *Put the stick through the bag near the mouth or tie it with ropes*
- *Place the drum under a shade to protect it from sunshine and rain*
- *Hang the bag in the drum filled with water to three quarter volume*
- *Allow the bag to hang in the drum for 3 or 4 weeks*
- *Remove the bag from the drum*

The remaining liquid is liquid plant tea
The process is the same only that you use animal manure instead of plant material

Figure3.9 Picture of a drum with a bag hanged in with cross bar

Inorganic fertilizer

These are chemical or rock material specifically prepared and manufactured for agricultural use. Their compositions are known and are used in small quantities to provide plant nutrients.
Inorganic fertilizer refers to manmade or chemical fertilizers or soil amendments. Soil rarely contains all the nutrients needed to support optimal plant growth. Organic or inorganic fertilizers must be added to improve soil quality. Inorganic fertilizers are quick-release formulas that make the necessary nutrients almost instantly available to the plants. Inorganic fertilizers enrich the soil with specific nutrients which may be lacking. There are two ways of categorizing the inorganic fertilizers as shown below:

1. **Straight fertilizers**

These contain only one nutrient element. For example Nitrogen (N), Phosphate (P) or Potassium (K) and Sulphate (S). These can include Urea (46-0-0), Ammonium nitrate (34-0-0), Calcium Ammonium Nitrate - (CAN), Single Super Phosphate-(SSP), Rock phosphate is an inorganic fertilizer type that provides phosphorus to the soil. Sodium nitrates are also referred to as chilates or Chilean nitrate. These fertilizers contain amounts of nitrogen of up to 16 percent. These fertilizers make nitrogen, the most important component in plant growth, immediately available to plants. Sodium nitrates are considered a valuable source of nitrogen and are commonly added to the soil as a top and side dressing, especially when

fertilizing younger plants and garden vegetables. Sodium nitrate fertilizers are especially useful in acidic soil.

2. **Compound fertilizers**

These contain at least two or more fertilizing agents or nutrient elements. For example DAP, NPK- 25:5:5, Sulphate of potash is the inorganic fertilizer which supplies the third-most needed nutrient, potassium, to the soil

Those who sell fertilizers must be able to tell you the amount of each nutrient in the fertilizer. For example single superphosphate contains 20 percent P_2O_5 and about 11.9 percent S. There buy the right fertilizer to give you the nutrients needed. Calculate the amount of fertilizer to give the amount of nutrient.

While NPK -10:10:20 means that this fertilizer contains 10kg of Nitrogen (N), 10 kg of Phosphorous (P) and 20kg of Potassium per 100kg bag or for every 100kg. Therefore a bag of 50kg will have 5 of nitrogen, 5 of phosphate and 10 of potassium

While with 2:1:1 (24) this number in brackets indicates that 24percent of the material in the bag is the fertilizer elements and 76 percent is the carrier material. So you can compute the amount of in 50kg bag as 24%. This will be only 12kg of the fertilizer elements. Hence 2/4 x 12=6kg is nitrogen, 1/4x12 =3kg of phosphate and 1/4x12 =3kg of potassium.

Methods of applying fertilizer

Fertilizers must be placed where the plants can get it. In the soil proper placement means that the fertilizer is close enough for roots to get it but not so close to damage the plant roots or leaves. This makes the times suitable for applying fertilizers namely:

1-Pre planting/before planting (broadcasting-scattered on the soil surface)

2-At planting (drill-put in the planting hole, band-put in rows along the holes)

3-Post planting (applied when the plant is growing through top or side dressing –placed 15cm from the root area of the plant, ring placement –fertilizer is applied in a ring around the plant and spraying on the soil surface or leaves of the growing plants(in case of copper or zinc deficiency)

However the methods of applying fertilizers include:

a) **Broadcasting:** this where the fertilizer material is scattered or spread all over the garden or soil surface. This can be done at the same time or during planting

b) **Ring method:** this where the fertilizer material is applied in circle of radius 60-90cm around the plant.

c) **Drill method**: this where the fertilizer material is applied in the planting hole before the planting material has been put.

d) **Spraying:** this where the fertilizer material is made into a solution and applied in form of sprays on the plant or garden

e) **Top dressing**: this where the fertilizer material is applied over the ground where the crop is growing. Here it is expected that rainfall or dew will dissolve the fertilizer material and it will get soaked into the soil.
f) **Side dressing**: this where the fertilizer material is applied along the sides of the rows of growing crops. This is about 15-30cm away from the root zone

Factors to consider when applying fertilizers

The information needed to determine fertilizer requirement by the farmer are:
i-which nutrient or nutrients are deficient or missing in the soil and the degree of deficiency. There is some confusion over where to apply fertilizers. Some feel that they should be put at the same rate in all their land. Some feel that they should be put more heavily in the poor soils so that they could make crops grown their yield better. Other feel be put on best soils. The last thinking is the most appropriate. This is because such soil receives and holds water, have good amount of organic matter and are mostly silt loam soils. Sandy soils do not hold much water and quickly gets warm. While clay soils holds much more water but much of it is not available to crops. This makes it to hold the fertilizer nutrients as well. So you need to apply lime to it so that you flocculate it.
ii-methods of application where phosphorous is most effective when drilled with or near the seeds. It takes time to dissolve. Placing a band of phosphate fertilizer near developing roots of annual crops is the most effective way.

However do not broadcast phosphates in pastures or forages as it will delay response owing to its slow movement into the root zones. While nitrogen fertilizers can be broadcasted as it quickly dissolve in water, move readily in moist soil and can be leached to deeper layers where it will not be available to crops. So placement with or very near the seed is not necessary. Therefore apply nitrogen fertilizers by broadcast, side band, top dressing or row.
iii-the estimated response of the crop to a given level of fertilizer application. Crops respond differently to the same amount of fertilizer. The most accurate way to determine crop response is by a soil test. However presence of weeds in the garden will lower the yield potential of the crop. These weeds will compete for nitrogen fertilizer that is applied. This will make the crop respond poorly. Also delayed planting will decrease crop response to fertilizers. While crops with high yield potential generally respond better to higher nitrogen fertilizer application.
iv-the assessment of economic returns from the use of fertilizer. In some instances the cost of fertilizer cannot be recovered from the profit gained by the sale of the crop products. So it does not make sense to apply the fertilizers. For example crops grown in an area which has been under fallow will often require little or no additional nitrogen. Whereas non legume crops can give profitable returns if you apply 250kg of nitrogen fertilizers per acre. This is because there are three main source of nitrogen to non legume

crops namely that stored in the soil particles, that released from soil organic matter or crop residues and manure , then through application of nitrogen fertilizers.

v-Type of fertilizer. Plants need a large amount of the major nutrients and very small amount of trace elements. Therefore chemical analysis of the soil will tell you whether there are too much or too little nutrients. This information will help to tell the type of fertilizer to apply. Very often the soil cannot provide enough nutrients as plants are harvested and carried away with plenty of nutrients. When this happens then nutrients must be provided by buying and applying the right type of fertilizers. Buy the right fertilizer to give the nutrient needed or lacking in the soil.

vi -Amount of fertilizer. Those who sell or use fertilizers must be able to tell you the amount of each nutrient found in a given fertilizer. For example single super phosphate (SSP) contains 20 % P_2O_5. While triple superphosphate contains 43% P_2O_5. So you will need twice as much single super phosphate (SSP) as you can get from a given amount of triple superphosphate to give the same quantity of P_2O_5. Further you will need 65 gm of SSP per plant

Figure3.10 Bag of fertilizers with its analysis

Safety, health and environmental protection measures when handling fertilizers

Ministry of Agriculture Animal Industry and Fisheries (MAAIF) have a brochure on the safe use of fertilizers. It highlights and provides advice on all health, safety and environmental issues that arise when using fertilizers on the farm or in our gardens. The issues include

- ❖ Personal safety when handling fertilizer products
- ❖ Good housekeeping practices for indoor or inside and outdoor storage
- ❖ The need for security when storing fertilizers following the following things:
- ✔ do not store fertilizers where there is public access
- ✔ do not leave fertilizers or unused fertilizer in the field/garden overnight
- ✔ do not store fertilizers near to, or visible from the children and public roads or highway
- ✔ do not buy ammonium nitrate fertilizer without the proper certificate. It is an offence by law
- ✔ do purchase fertilizer from approved supplier and outlet
- ✔ do retain and file in your records all fertilizer delivery notes or purchase receipts
- ✔ do store all your agrochemicals including fertilizers under key and lock building
- ✔ do make regular checks on stocks

✔ do report any stock discrepancy or loss of fertilizer material to the police

❖ How to minimize environmental impact during storage and use

❖ The importance of following instructions, reading of product labels and manufacturers safety information

❖ The proper care required along the whole fertilizer value chain right from product development, purchase and handling of raw materials, the process of manufacturing, packaging, storage and transportation right up to the end delivery, application, use and disposal of unwanted materials on the farm

❖ wear protective gear including gloves, gumboots, mouth and nose

❖ wash thoroughly your body after handling fertilizer

❖ clean the applicators and other equipment

Activity3.10 Identifying inorganic fertilizers

Individually or in pair you should identify inorganic fertilizers

You are provided with sample of fertilizers A, B and C. Study them carefully when wearing the protective gears and answer the questions below.

1. List down three observable characteristics of fertilizers.

Fertilizer A	Fertilizer B	Fertilizer C

2. What are the four characteristics of a good fertilizer?
3. Enumerate five advantages and disadvantages of artificial fertilizers
4. Extended work in groups:

"Carry out integrated soil fertility management in order and demonstrate how it caters for environmental protection"

Possible answer

What are the characteristics of the plants visited?

✔ *dark green colour, vigorous growth and healthy looking plants*

✔ *stunted growth, pale yellow leaves, slender stems, purple leaves, small roots*

Where do the nutrients come from?

Plant nutrients come from soil made of mineral matters

How do plants use the nutrients?

Plants absorb plant nutrients and water from the soil through their roots by osmosis, diffusion and transpiration

Which nutrient is needed most by plants?

Nitrogen, potassium, phosphorus, carbon, oxygen, hydrogen, water, carbon dioxide, organic matter,

Other nutrients needed in small quantities are zinc, copper, molybdenum, chlorine,

How does soil get nutrients replaced once lost

Applying fertilizers, the death of plants and animals that rot and decay into organic matter and humus

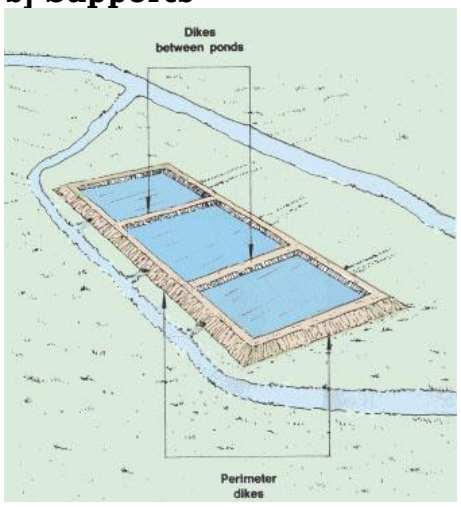
Learners in each project will provide a range of answers according to the approach. The emphasis here is not what answer is correct or right but the involvement and participation achieved

Activity of Integration

a) Context

Ministry of Agriculture Animal Industry and Fisheries developed the Kumi wetlands fish farming project is seeking to promote the conservation and sustainable utilization of wetlands and wetland resources in Kumi District while at the same time improving nutritional intake and widening the income base of the rural communities. The major activities include developing training on soil for fish pond construction and management. But the soils used to construct ponds in wetlands are not firm and they allow water to seep across the pond banks and through the bottom. Therefore, the lime applied is continuously lost through seepage and more lime is continuously required to keep the acid levels low.

b] Supports



c] Task

Make a presentation to members of one community in Kumi about how they should go about pond construction in the wet land available to them to start reaping from fish farming

EVALUTION CRITERIA

	RELEVANCE	**ACCURACY**	**COHERENCE**	**EXCELLENCE**
Soil type	Pond to be constructed on Sandy loam soil Find out about soil depth Roll it in your hand to make a ball dry the ball for 1 hour in shade.	Acid soils in a wet land Soil profile is not deep Drop the ball from a height of 60-100cm to the ground shallow of 0.5metres and deep end of 1.5 metres height	Soils in Kumi wetland are to be used to construct ponds are not firm. you check by making them wet If the ball formed does not break, then the soil is firm and sticky enough to build a pond with a strong wall.	Dimensions of the pond from 2-15 metres by 6-20 metres Sketch of the pond Estimates of costs Collaboration with community leadership Communication
Dig out soil to construct the pond	Use hoes, spades and shovels Bore holes down to1.5m Constructing a pond on a gentle slope is easy.	Ponds should be rectangular or square Less soil is removed, Plant grass around the pond	Dig out the pond and pile the soil around the pond to form a dyke. The dykes are stable Grass reduces soil erosion	
pH test	Test soil acidity and water acidity	Apply lime	This is to keep acid levels low since the soil allow seepage	

Conversation on the making a presentation

Pond construction

• Clear the site of vegetation.

• Measure the pond size and mark it out with sticks and string so you can see how big it will be before you start construction.

• Ponds should be rectangular or square (not circular) with a minimum size of 10 metres by 10 metres. Bigger ponds, up to 50 metres by 100 metres, are easier to manage. The sides should slope outwards.

• The pond should be 0.5 metres deep at the shallow (water inlet) end and 1.5 metres at the deep (water outlet) end and have a sloping floor.

• Dig out the pond using hoes, spades and shovels and pile the soil around the pond to form a dyke.

The water source, quality and quantity of ponds must be relatively unlimited. Little and seasonal water is difficult to manage for fish production.

ii. The soils must be impervious to water (do not allow water to drain away).

iii. Pond water should fill and drain by gravity. It is expensive to pump water in or out of the pond.

iv. Ponds should be above the water table (that is water should not seep from the bottom). Otherwise it is difficult to drain.

v. The farm should be accessible to markets and supplies (good road)

vi. Ponds should be large enough (from 20m x 50m to more than 2 hectares) for commercial fish production. Larger ponds are less costly to build per square metre but require large equipment to operate.

vii. Rectangular ponds are easier to manage

viii. The average pond water depth of 1.5m is recommended but the pond bottom should not be flat. The shallow end should be 0.5m – 1.0m and the deeper end should be 1.0m to 1.7m.

ix. The pond bottom slope should be 1% – 2%, that is a drop by 1cm to 2 cm in every 1m from the shallower towards the deeper end.

x. The dyke height should be within 30cm to 50cm above the pond water level. The dyke is the space surrounding the pond or between two ponds (see figure 1.0).

xi. Dyke slope from top to bottom should be 1.5: 1.

xii. The dyke should be protected from erosion (by compacting hard and by planting grass cover

xiii. The open land space adjacent to the ponds should be wide enough to allow walking in or sufficient space for vehicles/tractors.

- Small ponds can only provide fish for household food and nothing more for sale.
- A pond size starting from 20m x 25m ($500m^2$) can produce 120 kg of Tilapia a year, which can be sold at UGX Shs. 180,000. This amount of money can be significant in the rural areas. Therefore, the pond size of 20m x 25m can be regarded as the minimum small-scale commercial size
- Larger ponds from 20m x 50m to more than 2 hectares are recommended for commercial fish production. The larger the pond the more commercial it becomes.

Figure 4.1

COMPETENCY: You should be able to select a suitable vegetable for a locality and to carry out all the processes required in order to grow and market the vegetable.

Key words

- Seedbed
- Nursery
- Harden off
- Mulching
- Transplanting
- Seedlings
- Thinning
- Weeding
- Pest
- Pathogens
- Pricking out
- Staking
- Pruning
- Nutrient

By the end of this chapter, you should be able to:

i. Know a range of vegetables grown locally and understand their values in both nutritional and financial terms
ii. Understand how to select an appropriate vegetable for growing locally
iii. Establish a nursery, apply good practice of vegetable growing
iv. Show skills in preparing bi pesticides and plant derivatives
v. Handle vegetables during and after harvest in order to maintain quality
vi. Market vegetables effectively
vii. Follow food safety guidelines for harvested fresh vegetables

b)

WEEK1

Teacher Preparation

1. MAKE A REQUISTION TO THE SCHOOL ADMINISTRATION FOR ALL MATERAILS REQUIRED IN THIS CHAPTER OF VEGETABLE GROWING ONE WEEK BEFORE START OF TERM 3. DISCUSS THE MATTERS INVOLVED WITH AUTHORITIES CONCERNED.
2. Read and understand the introduction to vegetable <u>two days</u> before the lesson
3.Write down on a flip chart or print the reflection question <u>one day</u> before the lesson
4.Visit the community to identify vegetables found and prepare a list <u>two days</u> before the lesson
5. Secure two local vegetables widely eaten by learners in your school <u>one day</u> before the lesson
6.Photocopy the table for learners to complete <u>one day</u> before the lesson

Teacher instruction

1. *Presented to the learners two local vegetables and ask them to identify them and their uses*
2. *Ask the learners to sing a song*

Capsicum belongs to the chili family

Iam chili chili x3
Iam a big fat chili
With a big round belly
Sometimes i am used in India
Sometimes i am used in Congo
Sometimes i am used Nigeria
Many times i am not very pungent
The good thing
I do make your food tasty
But I do not make your belly burn
I am chili who make you love to learn

3. *Ask learners to open the first page of the learners book to read and respond to the reflection questions*
4. *Ask learners to be in pairs, think and share what vegetables are their community*
5. *Guide learners to state the parts of vegetables that are commonly eaten*
6. *Ask learners to discuss the value of vegetables and complete the table*
7. *Make sure learners are divided into groups as you deem it fit*
8. *Guide learners in groups on why vegetables are important in their diet then ask them to present to the class*
9. *Guide learners to do activity 3.1 in the learners' textbook. Ask learners to complete the blank column in their exercise books.*

***DISCOVERY** (10 minutes)*

Come to class with two real local vegetable widely eaten in your school for the learners to see and identify

***LITERACY and ANALYSIS (**30 minutes)*

- *Ask and guide learners to read the text below in the learners' book before doing activity 4.1*
- *Asking different learners to read one sentence each and making a reflection using questions like: What does it mean? What is new in the sentence? What is the sentence telling us to? What can we change in our community after understanding the sentence?*
- *Why is it important to promote our own local vegetables?*

Introduction

Most people in Uganda grow crops for food in their gardens or farms. Producing crops when, where and how we want them requires a lot of skill. We need to know how they grow and what makes them grow better. The most important requirements are good variety, good soil management and proper agronomic practices for good crop yield. Most people grow crops like vegetables, fruits, grains and root crops for food and income.

Ensure Understanding

Growing vegetables using appropriate methods and tools can lead to sustainable community welfare. Vegetable are crops that take short period to grow and can be growing in several climatic conditions. They can be classified into root, leafy, fruit, and flower and bulb vegetables depending mainly on their parts eaten.

Teach It!

Say as you conclude this text below that "all vegetables grown have been domesticated by man and each has a place of origin".

Value of vegetables

A vegetable is an edible part of plants rich in vitamins and minerals. Vegetables are eaten as part of a balanced diet. Some vegetable grow on their own while others are grown by human beings in their home stead. Even those growing on their own can be planted to ensure regular supply and big quantity.

Activate Prior Knowledge

APPLICATION (25 minutes) *Make sure learners are divided into groups as you deem it fit and Instruct learners to do activity 4.1*

Activity 4.1 Vegetables and their value in my community

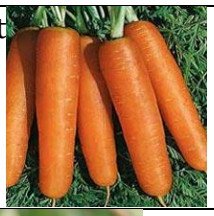
a) In groups answer the following questions

i) What vegetables are found in your community?

ii) Which parts of these vegetables are commonly eaten?

iii) Vegetables are grouped as shown in the table below. Complete the blank columns

Table 4.1 Categories of vegetables

Group	**Names of the Example**	**Other examples in my community**
Leafy 		
 Fruit		
Root 		
 Bulb		
Legumes 		
 Flower		

iv) Why are vegetables important in your diet?

e) Think-pair-share, to identify the common vegetables in their locality and discuss the value of vegetables in the diet and as a commodity, presenting conclusions in drawings and/or a written report.

Possible responses

Teach It!

Say as you conclude that vegetables can be grouped according to their characteristics, part eaten or use, nutritional or economic value and a place of origin

Examples of different vegetables are:

- ✔ *leafy: Lettuce, spinach, scallions, cabbage, beet green, black night shade, spider plant*
- ✔ *fruit: egg plants, tomatoes, cucumber, chili/green/red pepper, pumpkin, okra*
- ✔ *root: carrots, ginger, Irish potatoes, turnips, beet root, radish, yam*
- ✔ *bulbs: onion, garlic, leek, shallots*
- ✔ *flower: broccoli, cauliflower*
- ✔ *legume: beans, soya, pigeon peas, peanuts, peas, green/black gram*

Teach It!

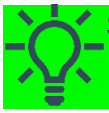
Say as you conclude that all vegetables important in human diet for the enormous nutritional and health benefits

Why are vegetables important in our diet?

- ✔ *provide vitamins, minerals, fibre, and plant protein*
- ✔ *important to earn income*
- ✔ *it is food for animals/livestock*
- ✔ *it is a form of employment*

LITERACY and WRAP UP *(15 minutes)*

Ensure Understanding



Selecting a vegetable to grow

Selecting a vegetable to grow is an important step to consider because you cannot grow all at once. How do you select one to grow? Your choice may depend whether you want to eat the vegetables or sell. Vegetable from home gardens can be eaten or sold in the market. By selling vegetables you can earn money. Before you choose which vegetable you are going to grow, you need to find out what vegetables are grown locally and most preferred in the area.

Say as you conclude that all vegetables grown have undergone a process of selection and improvement from the wild species to the current types and variety we see today. This process uses the knowledge and practice of science. The preferred vegetables in most areas have been made so by application of science.

Teacher Preparation

1. *Request the head of school to formally write a letter to the local market authority and local traffic police seeking permission to move learners and deliver it two weeks before the visit or before start of term 3*
2. *Write an introduction letter for the learners through head of school then have it on a headed paper signed and stamped*
3. *Negotiate with fellow staff members to allow you visit the market during the last two periods of the day*
4. *Inform the learners and other staff members about the visit one week early*
5. *Set a criteria of the possible areas for the generating questions during the visit which include but not limited to name and source of vegetable, price and measurement used for selling, reason for selling or buying vegetable; how one vegetable is grown*
6. *FENCE OFF THE LAND OR SPACE WHERE LEARNERS ARE GOING TO ESTABLISH THEIR GARDEN*

Teacher instruction

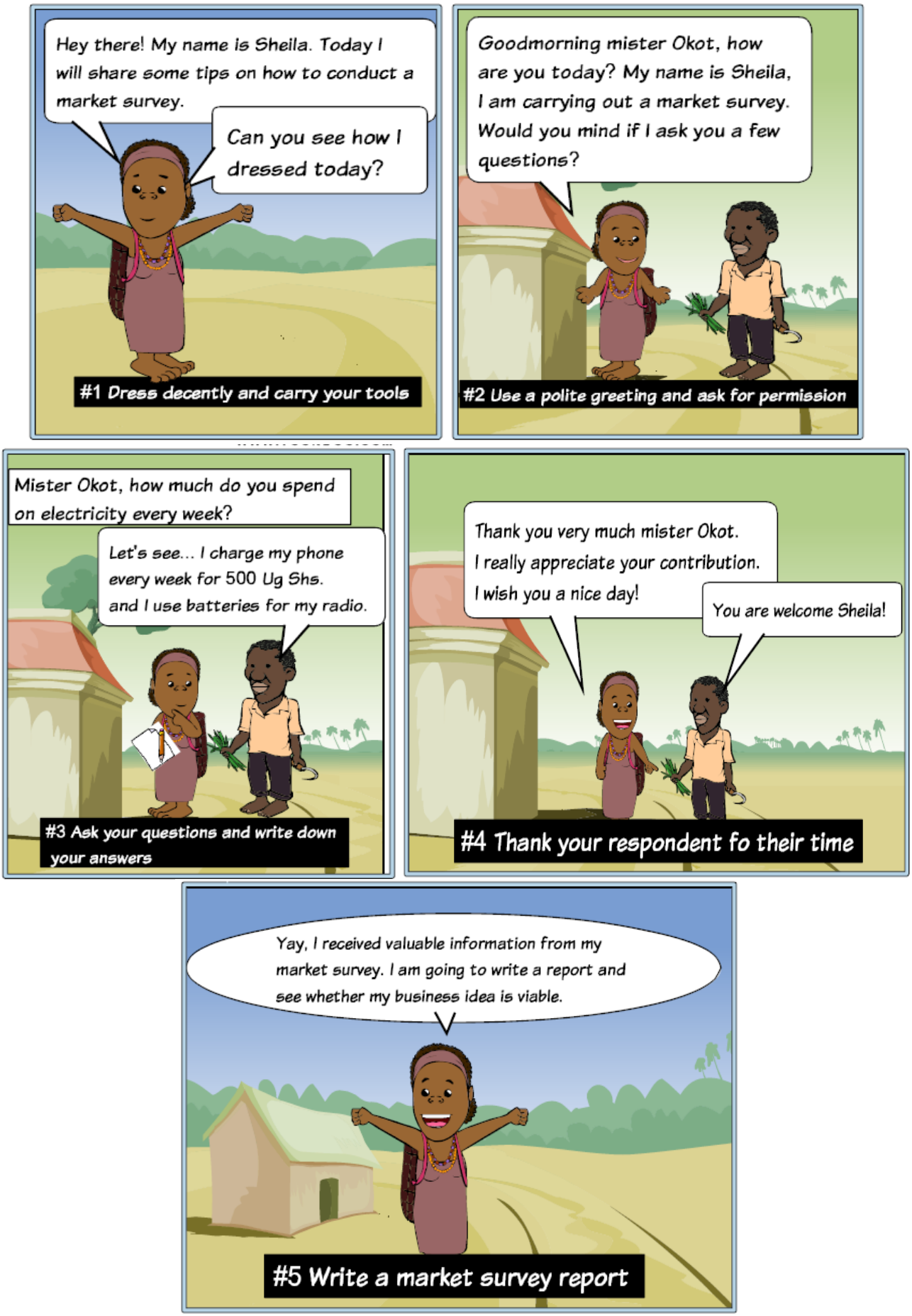
1. *Select the right market – there should be sufficient people to talk to, but it should also be within reach (5 minutes walk or 20 minutes by vehicle)*
2. *Seek permission from the school administration to take learners out.*
3. *Visit the area in advance and obtain permission from the local leader including police.*
4. *Prepare and print introduction letters for each group.*
5. *Make sure the learners are divided into groups for interviewing different people*
6. *Give groups a five minutes to agree on the roles of group leader, note keeper, observer and presenter. Make sure boys and girls are equally represented.*
7. *Inform learners about the location, time and agree on which rules they should follow*
8. *Teach the learners using the pictures below on how to conduct the interview*
9. *Observe how the interaction is in the market and note the most effective and least.*
10. *Guide learners to choose the vegetable to grow after the presentation (5 minutes each group)*

DISCOVERY and ANALYSIS (80 minutes)

Activate Prior Knowledge

Prepare the learners for this activity following the instruction above and pictures on next page. Say to the learners that dress decently, carry your tools, know your 5 questions at heart, be polite, greet the people, seek permission to interview any person or take pictures, write the responses given and conclude the interview by thanking the person for having given that opportunity. Ask the learners to make a report to present.

Teach It! ***Figure4.2:*** **A market survey of Sheila**



Ensure Understanding
Teach it

Figure 4.3

Possible responses

How are the vegetable grown?
✔ *Direct sowing*
✔ *Self germination*
✔ *Nursery bed and transplanting*
In the presentation emphasize the names of vegetables, the quantities available, the most bought or sold, why and how they are grown.

WEEK 2
Teacher Preparation
1. Secure the land or space where learners are going to establish their garden from the school administration (this can be a verandah/balcony on a storeyed building, space for flower beds or an area on the farm depending on the condition)
2. Secure tools, equipment and materials to use from the market and school store.
3. Get the top soil, coarse sand and manure to demonstrate how to make a soil media
4. Prepare a chart for KWL and on reason for growing vegetables in a nursery bed

Teacher instruction
✔ *Ensure that learners are reading the text individually or as a class*
✔ *Observe learners when establishing a nursery bed and check on adherence to instructions and procedures*
✔ *Use a KWL chart to explore the reasons*

DISCOVERYAND LITERACY (20 minutes)
Ensure Understanding
✔ *Ask learners to read loudly after you the three paragraphs. Do it twice.*
✔ *Ask learner to identify new words after the second reading. Note these down in one corner on the chalkboard/whiteboard/flip chart*

Establish a nursery bed

Vegetables are planted differently. Some are planted first in a nursery bed and others are sown directly in the garden.
A vegetable nursery is a place or an establishment for raising or handling of young vegetable seedlings until they are ready for more permanent planting.
Vegetable nursery bed making like any other activity involves money coming in and money getting out of one's hands. Therefore it is important to know the costs incurred in making your nursery bed. Things budgeted for include, tool, labour and construction material

Teach It!
EXPLORING (40 minutes)
*Discuss with learners using KWL (what do you **K**NOW; what do you **W**ANT to know; what have you **L**EARNT) chart on reasons for growing vegetables*


The reasons for growing vegetables in a nursery bed are to:

1) Look with care after these 'young' seedlings
2) Provide favourable growth conditions that is germination as well as growth
3) Control weeds, pests and diseases
4) Have uniform vegetable crop
5) Have a good start for higher yields
6) Have a shorter growing season
7) Accurately predict the harvest date.

Ensure Understanding by teaching
WRAP UP (20 minutes)
✔ *Teach it and ask learners to write a presentation on how they have made a soil media for their nursery bed.*
✔ *Highlight four key things to look at in the presentation (Relevancy; Accuracy; Coherence and Excellence-RACE)*


Before you sow or plant vegetable seeds. You must prepare a good soil mix or soil media for a nursery seedbed. A good soil mix must contain plant food that will help vegetable seedlings to grow well.
A combination of loose or well drained soils; organic matter and sand should be used. Wearing protective gear, sterilize the soil by drying or heating with fire for 12 hours to kill the pests and pathogen. Mix the top soil, coarse sand and manure in ratios of 2:1:1.This will inquire the use of garden tools in chapter 2.

Before sowing the seeds in a prepared seedbed you must first make small furrows in the soil mix of the nursery bed. When sowing seeds in a bed they are put in rows in order to grow well. After covering the seeds with a thin layer of soil the bed is covered with dry grass. Later on after germination seeds construct a shade.
Seeds that germinate in the nursery in figure 4.6 must be looked after properly until they are ready for transplanting to where they will grow. Some of the important tasks that you must do to care for seedlings include watering, pricking out, weeding, controlling pests and diseases and hardening off.

Possible responses

1. New words

✔ *Nursery bed*
✔ *Cost*
✔ *Budget*
✔ *KWL chart*
✔ *Furrow*
✔ *Germinate*
✔ *Transplanting*
✔ *Pricking out*
✔ *Weeding*

2. Soil media

2 parts topsoil
- *1 part farmyard manure*
- *1 part sand*
- *Check on your type of top soil*
- *Mix thoroughly the topsoil, manure and sand must be evenly distributed.*
- *Sieve to remove stones and coarse particles*

3. Presentation

Criteria for making a soil mix

Relevancy **Ideas are closely connected** *to making a soil media*	*Accuracy* **It conforms to the correct activities or standards** *in preparing*	*Coherence* **It brings together in a logical way the preparation activities as a whole** *for making a soil media*	*Excellence* **The presentation shows extra things and generic skill**s *of problem solving, critical thinking, responsibility, team work, achievement striving*
Top soil *Sand* *Manure*	*Measurement* *Ratios* *Materials*		*Identify best response to a problem, persist to the very end, not discouraged by*

			challenges

WEEK 2

Teacher Preparation

1. Develop a budget for constructing a nursery bed, procuring materials, establishing a nursery bed and raising vegetable seedlings
2. Develop and design a poster/power point presentation/ video clip of vegetables that the class can plant in term 3
3. Draw a poster of the examples of bird's-eye-views.
4. Develop group project guideline for learners to use

Teacher instruction

1. *Guide learners on how to identify entries into a budget for constructing a nursery bed, procuring materials, establishing a nursery bed and raising vegetable seedlings*
2. Guide learners in how to establish a vegetable nursery up to the transplanting stage
3. Observe learners in their groups and record the extent of leadership, organization, collaboration, creativity and communication as groups dynamics come into play
4. Ask learners to draw their ideal garden and display it in a designated corner
5. Ask each group to keep a record of events as they carry out the project

DISCOVERY AND EXPLORATORY (10 minutes)

Activate Prior Knowledge

Begin by asking learners about their vegetable garden experience, who has a vegetable garden at home, who has parents or guardians with vegetable gardens? Have learners brainstorm a little about why someone would grow vegetables garden? Ask learner what they do if they want a number thing for use but have a given amount money at hand

Teach It! To Ensure Understanding *(20minutes)*

NUMERACY and DISCOVERY

✔ *Through explaining to learners that this term 3 the class has to make a vegetable garden as* ***a group project*** *and all learners need to get to help plan what they will plant.*

✔ *By discussing the different types of vegetable gardens. Discuss what they will need to make the vegetable garden. What are things we need to consider when planning out a vegetable garden?*

✔ *Create a class list of the things learners want to have a garden, add a tick mark each time a plant is included. Ask learners to put a price on each item*

✔ *Discuss similarities and differences between learners' garden bed plans. How could the class combine all the learners' gardens into a class garden? Looking at the class list, pick the top 3 or 4 vegetables to plant.*

DISCOVERY and APPLICATION (30minutes)

✔ *What do plants need to grow? –Find out Are there certain types of vegetables that won't grow in our garden*

✔ *Show learners the poster/power point presentation/ video clip of vegetables that the class can plant in term 3. Find out which of the vegetables these learners tried or grown before at home or primary school? Find out how that vegetable was grown by the learners. Then ask the learners to do activity 3.3*

✔ *Ask learners if they can guess what a "Bird's-eye-view" may be? Show learners the poster of the examples of bird's-eye-views. Talk about perspective and how you are going to draw a picture from the perspective of a bird looking down on a garden. This is a chance for each individual learner to illustrate what his or her ideal vegetable garden and nursery bed would look like.*

✔ *Ask learner to display their ideal vegetable gardens made on flip chart papers or sheet on walls in the classroom*

Have learners consider the following:

- *What do they want to **plant?***
- *Have them think about how much **space** different types of plants might need to grow and mature*
- ***How many** of each plant do they want ?– Would you want only one carrot plant, 50 hot pepper plants or 100 Amaranths plants?*

Teach It!

APPLICATION AS A GROUP PROJECT-WRAP UP AND LITERACY (20 minutes)

✔ *Share the guidelines for the project work including allocating learners to groups*

✔ *Ask learners to read activity 3.3 in pairs noting down new words whose meaning they will have to look for in the library or internet search*

Activity 4.3 How to establish a vegetable nursery bed

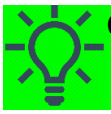
You will need; soil, garden tools, notebook, pen, protective gear

a) As a class, develop and document a budget for constructing a nursery bed, procuring materials, establishing a nursery bed and raising vegetable seedlings

b) In groups, select one vegetable of choice and establish a fixed or portable a nursery following the given practices;

1. Selecting a site for a nursery bed
2. *Preparing a good soil for the nursery bed*
3. *Sterilizing soil for a nursery seedbed*
4. Budgeting materials for making a nursery
5. Resource required in constructing a nursery bed
6. Constructing a nursery bed
7. Sowing seeds
8. Sowing seeds in a seedbed
9. Caring for seedlings in anursery bed
10. Pricking
11. Weeding
12. Fertilizer application (organic and inorganic)
13. Pest control
14. Disease control
15. Hardening off

Teach it and ensure understanding



Growing vegetables in the garden

When vegetable seedlings are ready for transplanting, they are taken to the main garden. This will involve planting, proper spacing, fertilizer addition, pest and disease control.

Pesticides are substances that are used to control insects and disease causing organisms that damage vegetables. . Unfortunately many farmers do not have enough money to buy them. On the other hand some pesticides are not suitable for small holder use. Over time farmers have found organic pesticides suitable for small holder use. These are found in native and exotic plants. **Pesticides** that naturally control caterpillars include neem oil and bacterial sprays. Neem tree seeds are naturally insecticidal, and proprietary neem-based pesticides are formulated using extracts from the seeds. Bacterial sprays contain bacteria that attack the pest but aren't harmful to humans.

Some of these plants are just grown side by side with the crops. They usually send off a bad smell to drive away the insects or disease causing organisms.

Possible responses

1. List down the items with the price for constructing a nursery bed, procuring materials, establishing a nursery bed and raising vegetable seedlings

2. Individuals grow vegetable for nutrition, income, health, fitness, fun, beauty, passion)

3. The different types of vegetable gardens are nursery bed, field bed, flower pot/bed, sack, old tyres, old containers and wooden box

4. Plants need air, oxygen, water, light, space, temperatures, weather

5. Things one would need tools, site, water, sun, seeds, plants, teamwork, collaboration, negotiation and digital skills

WEEK 3

Teacher Preparation

1. *Make a chart for display showing the spacing of 5 common vegetables by looking at the table below*

Crop	*Distance between plants*	*Distance between rows*	*Planting depth*
Cabbage	*30-60cm*	*45-60cm*	*2.5 cm*
Egg plant	*45cm*	*90cm*	*2.5 cm*
Pepper	*45-60cm*	*60-90cm*	*2.5 cm*
Bean	*15cm*	*90-120 cm*	*4.0 cm*
Tomato	*45-60cm*	*100cm*	*4.0cm*

2. *Revise how to calculate area or use of formula in an excel sheet*
3. *Know how to make a business model for vegetable by completing one*

Teacher instruction

1. Allocate learners planting beds or space for their vegetables on transplanting
2. Ask learners to prepare their main planting bed so that it is ready receive seedlings
3. Demonstrate to learners how to calculate the number to be put in a given area
4. Ask learners to complete activity 3.4 particularly the business model and list of materials for making bio pesticides for vegetables.

Teach It! Activate Prior Knowledge

DISCOVERY AND NUMERACY (25 minutes)

1. Start by showing a 3 chart of crops that are very close, far apart from each other and those are correct spacing. Ask learners to make comments on the charts
2. Tell the learners that the planting space a vegetable needs varies from one crop to another. It important to have space in crops when you plant them in the garden. Ask learners to give reasons for this.

3. Ask the learners to tell you how farmers get the correct spacing for the crop. Inform the learners that one way of working out the correct spacing is to calculate the space of a fully grown vegetable. And this was done already. You do this by asking learners carefully digging out a plant with all full length of its roots and the soil around it. Then ask learners to carefully wash the soil off these roots. After that you ask learners to measure the length of the roots and leaves.
4. Emphasize that the spread of the root of the plant will be similar to the spread of the leaves. However a plant needs enough space to grow fully without pushing into the next plant. This space is about 10-30 cm.

APPLICATION, EXPLORATION AND NUMERACY (30 minutes)

1. From your chart on common spacing guide learners on how to determine how many plants can be put in a given area. In case you have ICT tools like computer take learners to the laboratory and ask them to open the spread sheets or excel sheet.

Procedure

- *Get the correct spacing*
- *Convert this spacing into metres*
- *Calculate the area using the formula length *width= area*
- *Divide the total area of an acre which is 40000 square metres by the unit area calculated above. The answer will give you how many plants can be found in an acre.*

2. Using this; you can determine the number of plants in the space allocated to each.

*3. Demonstrate for cabbage: If you are to grow cabbage whose spacing is 60cm*60cm. it is be planted in a flower bed of 4m by 2m. Ask the learners to do the following step by step in their exercise book*

- ✔ *conversion to get metres 60 divide by 100 and this is 0.6 m*
- ✔ *calculating area 0.6*0.6 equal to 0.36*
- ✔ *calculating the area of the flower bed 4m*2m equal to 8m*
- ✔ *finding the number of cabbage plant that will be put in the flower bed is by dividing 8m by 0.36 which equal to 22 cabbage plants.*

4. Ask learner to determine the number of cabbage crops in an acre

5. Ask learners to do activity 3.4 below

Activate Prior Knowledge (15 minutes)

Ask learners to don activity 3.4 on a flip chart sheet and display it for a gallery walk and feedback from the class

Activity 4.4 Managing vegetables in the garden

You will need; garden, garden tools, pesticides and a market

a) In groups,draw a vegetable business model below. Complete it with informations required

Table 4.2 Business model for vegetables

<table>
<tr><td rowspan="2">Partners in vegetable growing</td><td>Activities done in vegetable growing</td><td rowspan="2">Kind of vegetable or its product that will be for sale in themarket</td><td>The kind of relations they will have with vegetable customers</td><td rowspan="2">What different customers will they sell to the vegetable by age, sex, way of using them ?</td></tr>
<tr><td>Materials and external resources needed to grow the selected crop</td><td>How best the customers will get/sell vegetable as and when they need them?</td></tr>
<tr><td colspan="2">How much money is being used in growing and managing a vegetable?</td><td colspan="3">What amounts of money is expected from their vegetable garden by looking the number of plants?</td></tr>
</table>

DISCOVERY AND LITERACY: Ensure Understanding (10 minutes)

Ask learners to read the text below on vegetable growing management in pair and refer to it when managing the project

Possible responses

1. Comments on the chart are widely/sparsely spaced, low crop population, closely spaced, dense crop population, optimum /recommended population

2. This will avoid plants competing for nutrients, sunlight, water, and space to grow well as well as estimating plant population per unit area.

3. How do farmers get the correct spacing for the crop? Using their feet, using a tape measure/ruler or sticks.

4. The number of cabbage crops in an acre is 40000 divide by 0.36 is 111,110

5. Business model for vegetable growing

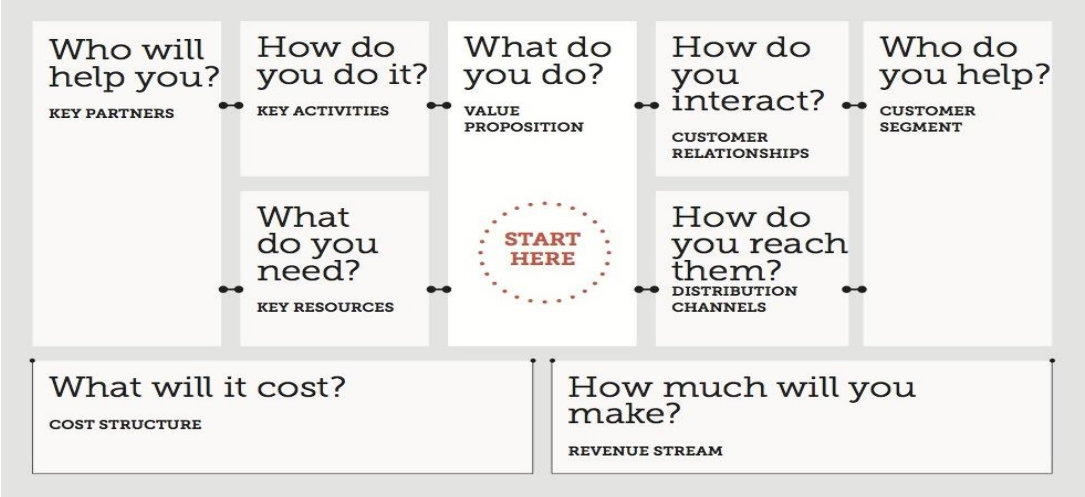


Figure 4.4 Business model canvas

Ensure understanding
VEGETABLE GROWING MANAGEMENT

Watering

Seedlings in a nursery bed need water. Water is important because it helps in dissolving nutrients in the soil.

Pricking

When you seedlings have germinated find out if they are overcrowded. Some seedlings will need to be removed from the seedbed to another one. This will avoid overcrowding and will create spaces for the seedlings to grow well.
The removed seedlings can be replanted in anew seedbed, fed to livestock or used to make compost manure. The process of separating and removing seedlings in the nursery bed is called pricking out. Pricking out is best done when seedlings and their roots are still small.

Weeding

Many times you find unwanted plants in your nursery bed. These unwanted planted are called weeds. Removing weeds from seedlings and the soil around young seedlings is important. If weeds are not removed and controlled, they will compete with the seedlings for nutrients, water, and growing space. Weeds also can bring disease causing organisms and pests. Weeds can take over the nursery bed if not kept under control. So keep checking your seedlings to see if weeding is required.

WEEK 3

Teacher Preparation

- *Develop a series of card for the steps in transplanting*
- *Write guidelines of things to be include in the journal*
- *Write guidelines for observation*

Teacher instructions

- *Ask learners to brain storm on the steps in groups and arrange cards in the correct order of transplanting*
- *Check to be sure that the learners are keeping correct records of data of seed growth in their journal*.

APPLICATION AND EXPLORATION (20 minutes)

Activate Prior Knowledge

- *Start by asking learners that what is done with seedlings grown in a nursery bed. Inform them that seedlings must be moved from their garden to allow them grow and develop fully or mature. This process is called transplanting.*
- *Ask learners to describe the steps farmer follow when transplanting*

OBSERVATION and Teach It! (30 minutes)

- *How to write down observations and use a table or chart; demand that they display measured growth of vegetable seedlings in metric units. Encourage learners to do some research like after the seeds have sprouted have learners change the position of the seedbed box, position of the roots or stems in one cup to see if it has effects on the growth of the plant. Record plant observations for one up to three week*

- *Ask learners to go to the nursery bed to observe and identify things that are different on their seedlings in the nursery bed. Tell them that as seedlings grow, they are likely to be eaten or damaged. Ask learners to read the text below and refer to it as they grow vegetable seedling.*

DISCOVERY AND LITERACY (30 minutes)

Ask learners to identify new words and search for the meaning in the library or internet

Teach it and ensure understanding of text

Controlling pest in a nursery

Figure 4.5 Caterpillars on some vegetable leaves

Caterpillars can be a major pest of fall **vegetables**, particularly cabbage, pumpkins, kale, collards, broccoli, and cauliflower.

If you can find and remove caterpillars and eggs from your plants, you can stay a step ahead of these pesky pests. Caterpillars are the larval stage of butterflies and moths. After mating, butterflies and moths lay eggs on their host plant, often on the underside of the leaves. If you check your plants daily, you can often spot a caterpillar or pest infestation before it gets out of control.

As soon as you see one caterpillar or pest, check the plant for more and for tiny eggs, which may be laid singly or in clusters. Remove all the caterpillars or pests you see, dropping them into a bucket of soapy water if you're too squeamish to squash them. Crush all the eggs or pick off the whole leaf and destroy it if the plant has plenty to spare. Repeat the process daily

Vegetable pests can be insects, birds, snails or animals. Pests will spoil your vegetables if you do not keep them away. Keeping pests away from your crops is called pest control.

Controlling diseases in a nursery bed

Figure 4.6 Diseased tomato fruit and leaves

You frequently see diseases affecting your vegetables. They make the vegetable curled, dry up or start to rot. Probably you might have seen these signs on vegetables in previous seasons; these are the symptoms of diseases that attack vegetables. The diseases are caused by organisms are called **pathogens**. Examples of pathogens include bacteria, fungi, viruses and nematodes. These pathogens make your vegetables to rot, wilt, get deformed or die. Unfamiliar diseases could cause significant problems. Sometimes leading to death and total loss of the crop.

Possible responses

1. *What is done with seedlings grown in a nursery bed: recording of activities, pricking out, weeding, hardening off, and transplanting*
2. *Have cards with pictures and words this as the correct order: i. seedlings grown to correct size; ii. Cloudy day with no wind; iii. Best time is late afternoon; iv. Water seedling 2 hours before; v. Loosen the soil around the seedling; vi. Have damp soil around the roots; vii. Dig holes in the main garden to correct depth; viii. Water the hole before seedlings is put in case it has not rained; ix. Plant the seedlings in the hole; x Pack top soil around the roots of the seedlings; xi. Water the transplanted seedlings; xii. Protect the seedlings from the sun*
3. *New words include transplanting, pest, pathogens, journal*

WEEK 4

Teacher Preparation

2. *Read about pest and diseases control methods*
3. *Write on a flip chart a recipe for local bio pesticide used by farmers*
4. *Collect different materials and make a common or local bio pesticides for your vegetables*
5. *Prepare a video recorder or camera/phone to capture images of symptoms and signs of pest and disease damage*
6. *Create time to make regular visit to the site of the growing vegetables from the time of establishing the nursery until they are mature*

Teacher instructions

1. *Ask learners the different methods used to control pests and pathogens found on vegetables.*
2. *Demonstrate how to make bio pesticides for vegetables follwing a recipe*
3. *Observe and record with drawings and words or video to upload over at least the growing period of vegetables from the time the seeds sprouted*
4. *Make a pest and disease album of all pest and pathogen you identify on the growing vegetables*

DISCOVERY AND LITERACY (35 minutes)

Activate Prior Knowledge

1.Ask learners to suggest the different methods used to control vegetable pests and pathogens
2.Display some parts of vegetable damaged or attacked and ask learners to suggest the control measure used to protect the plant

3. Ask learner to read the text below and refer to it as they grow vegetables

Ensure understanding

Pest and disease control in vegetables

Pests and diseases come from different sources at the different stages of your vegetables. Knowing where pests and diseases come from will help you to prevent or reduce their harmful effects on the vegetable seedlings. It is important to keep a watchful eye on seedling to observe any sign of pests and diseases damaging seedlings. If you observe pests and diseases causing harm to the seedlings, you take appropriate measures and action to control them.

Pest and diseases control should therefore start from seedbed preparation and proceed to harvesting.

You can control pests and diseases using the following methods:

- Cultural;
- Mechanical ;
- Biological ;
- Chemical;
- Plant derived pesticides/organic pesticides;
- Integrated pest management;

Table 4.3: Examples of the control measures

Method of control	Description	Examples
-Cultural	Using ordinary agronomic practices to prevent pests and diseases	Crop rotation, early planting, disease free planting materials, quarantine, field hygiene
-Mechanical	Using equipment tools and machines to control pests and diseases	Net, Hand hoe
-Biological	Using other living plants and animals to control pests	*Tagetes minuta, Ladybird beetle, wasps,*
-Chemical	Using chemicals or manufactured inorganic materials to control pests	Fungicides, pesticides
-Plant derived pesticides or Organic pesticides	Using a collection of materials extracted from plants or animals to control pests	Red pepper, tobacco, wood ash, *Tithonia*, Botanical tea

Pesticides

Pesticides are substances that are used to control insects and disease causing organisms that damage vegetables. Many pesticides are poisonous to man. Therefore all safety measures must be followed strictly when using them. Some after using them pesticides will start to degrade but this will take time. The time taken for them break down varies between different pesticides.

So farmers need to know how long it will take for the pesticide to break down to a level that will not be harmful to human beings. Pesticides are chemicals which are used to prevent damage by insects and other destructive organisms. Unfortunately many farmers do not have enough money to buy them. On the other hand some pesticides are not suitable for small holder use. Because of lack of safe and affordable chemicals the farmers harvest is often destroyed and lost.

Over time farmers have found a solution to this challenge. They have discovered that a number of native and exotic plants do have substances in their leaves, roots, wood or fruits and seeds that can be used to protect their crops from being eaten or destroyed.

Pesticides that naturally control caterpillars include neem oil and bacterial sprays. Neem tree seeds are naturally insecticidal, and proprietary neem-based pesticides are formulated using extracts from the seeds. Many neem products are concentrates, and you must dilute the product before using it. For example, one commonly used neem oil product must be diluted at a rate of 2 tablespoons per gallon of water. Bacterial sprays contain bacteria that attack the pest but aren't harmful to humans

Some of these plants are just grown side by side in the crops. They usually send off a bad smell to drive away the insects or disease causing organisms. While others attract the insects or disease causing organisms and they spare the crop.

Plant derivatives

Most important we can make pesticides from these plants and they will be called **plant derived pesticides.** Examples of plant used are Neem tree (*Azadirachta indica*) and Chili (*Capsicum frutescens*) whose seeds and leaves.

APPLICATION and *Teach It! (45 minutes)*
Demonstrate making a local bio pesticide using a provide a recipe
Ask learners to carry out the following steps

- *Wear hand gloves*
- *Put collected chilli pods into a bucket*
- *Squeeze the seeds and pods into a fine paste*
- *Add one litre of water and then rub the paste to form a mixture*
- *Add 20gms (one headed table spoon) of powdered soap*
- *Leave the mixture in the bucket for 12 hours*
- *Filter out the resulting solution*
- *Pour the solution into the sprayer*
- *Add water to a marker of 10litres*
- *Spray you crops immediately*

Possible response
Materials include: ash, urine, pepper, tobacco
Recipe of local bio pesticide of chilli pods, soap and water

WEEK 4 SITUATION OF INTEGRATION

a)Context
All life depends on plants. Humans use plants to meet their needs. Of the 350,000 plant species on earth , some of these are vegetables but due to their sheer number there is no official list as to how many vegetables there are in the world. For instance, there are 4,000 varieties of tomatoes alone. In 2016, approximately 177 million metric tons of tomatoes were produced worldwide. The question is how much of this was produced in your community.

b)Support

Figure 4.7 Seedlings for transplanting

c) Task

Prepare a paper on how you can convince your community to produce more tomato seedlings to contribute large volumes in the market. ***Let them choose the success criteria or learning outcomes to show that transplanting, caring for tomatoes growing in the garden and harvesting has been done correctly. So this will be taken as what matter the most in the work you want to do****.*

Possible response

Evaluation grid of a paper or report

	Relevance	**Accuracy**	**Coherence**	**Excellence**
Transplanting				
Care in the garden				
Harvesting				

WEEK 5

Teacher Preparation

1. *Get one vegetable at three different stage of growth that is young to be harvested, ready for harvesting and too late for harvesting one day before the lesson*
2. *Design a table on a flip chart or using word in ICT to make a format below in landscape or excel.*

Stage of growth	*Why is it not ready for harvesting*	*Why it is ready for harvesting*	*Why it is too late for harvesting*
1			
2			

3. *Read through the text on harvest handling in vegetables*

Teacher instructions

1. Display the three different stages of growth of the selected vegetables in the position where each learner can see
2. Ask learners to suggest the factors on which vegetable harvesting time depends
3. Ask learners to copy the table
4. Ask learners to brainstorm on the methods used in harvesting different vegetables

DISCOVERY AND EXPLORATION (55 MINUTES)

Ensure understanding

1.Start by displaying or show the selected vegetables for learners to ***observe, reflect, interprete and decide (ORID)*** *why it is not ready for harvesting; why it is ready for harvesting and why it too late for harvesting (15 minutes)*
2. Tell learner to suggest in groups (5 minutes) the factors on which harvesting time depends and ask them to present (3 minutes)
3. Ask learner to copy the table or create a table in landscape then complete.(7minutes)

4. Brainstorm (25 minutes) on the methods used in harvesting different vegetables

LITERACY AND DISCOVERY (25 minutes)

Ask learners to read and refer to it when harvesting vegetables

Harvest handling in vegetable

The term harvesting is the process of gathering ripe crops. When vegetables are ripe they are picked from the garden. Harvesting marks the end of the growing seasons for a particular crop.

Vegetables show different signs or conditions when they are mature to show that they are ready. Fresh vegetables are extremely perishable and have relatively short shelf lives. They are living, respiring tissues that start changing immediately at harvest. Freshly harvested vegetables are mostly comprised of water with most having 90 to 95% moisture content.

Water loss after harvest is one of the most serious postharvest conditions. Consequently, special effort is required to reduce the effects of these naturally occurring processes if quality harvested in the field will be the same at the consumer level

Pre harvest preparation should include lining up sufficient labor, supplies (containers and packaging items), cleaning the grading/ packing shed, and determining if all equipment is operable. Once the produce reaches harvest maturity, delays for any reason can result in major quality and crop losses. In addition, the nutritive content of produce is not static either

Techniques to extend postharvest shelf life:

- Reducing respiration by lowering temperature
- Slow respiration by maintaining optimal gaseous environment
- Slow water loss by maintaining optimal relative humidity
- Variety selection

Post harvest handling

Postharvest handling includes all steps involved in moving a commodity from the producer to the consumer including harvesting, handling, cooling, curing, ripening, packing, packaging, storing, shipping, wholesaling, retailing, and any other procedure that the product is subjected to. Because vegetables can change hands so many times along the value chain, therefore a high level of management is necessary to ensure that quality is maintained. Each time someone fails to be conscientious in carrying out his or her assigned responsibility, quality is irreversibly sacrificed.

Figure 4.8 Mature tomatoes ready for harvest

Maintaining produce quality from the farm to the buyer is a major prerequisite of successful marketing. The initial step required to insure successful marketing is to harvest the crop at the optimum stage of maturity. Full red, vine-ripened tomatoes may be ideal to meet the needs of a roadside stand, but totally wrong if the fruit is destined for long distance market or shipment.

Factors such as size, color, content of sugar, starch, acid, juice or oil, firmness, tenderness, heat unit accumulation, days from bloom, and specific gravity can be used to schedule harvest.

The old Gallo wine commercial with Orson Wells stated that “I shall sell no wine before its time.” Determining when it’s time to harvest involves more care than you might think. That’s because there is a difference between a vegetable being “ripe” versus being “ready.”

The rules for when to harvest depend on what vegetables you’re growing. For leaves, stems and some root crops, you want to pick them early – while they are still at their most tender state. Do you ever eat amaranths? It’s ripe, but it’s so much tastier when picked while it’s young.

*Whether pickling, making jam or putting up fresh garden produce, we have the **canning supplies** you’ll need — jars, caps, lids, pickling spice — to keep the harvest through scarcity but also to increase shelf life and beyond**.***

Possible response

1.The factors on which vegetable harvesting time depends include plant colour of the part to be harvested; plant size; number of young leaves on the plant; the maturity stage of the leaves, fruit, buds or pods on the plant; maturity stage of the roots, stems or stalk and the smell coming from the plant part eaten.

2. Methods used in harvesting different vegetables: hand picking, cutting, uprooting, plucking and pruning

3. *Learners should mention and describe colour, size, taste, softness, smell, shape, quality, smoothness*

Stage of growth	Why is it not ready for harvesting	Why it is ready for harvesting	Why it is too late for harvesting
1.Ripe			
2.Unripe			
3.Overipe			

WEEK 6

Teacher Preparation

1. *Arrange three flip chart with the questions here "(a) Have you ever gone to buy vegetables and you did not find any? (b)What did you do? (c)Why would vegetable farmers grow something that they could not sell?"*
2. *Place the flip charts in three different places where it is visible*
3. *Prepare a story and have many copies on how relationship with other people affect vegetable growing*
4. *Prepare many copies of the story below*

Teacher instructions

1. *Ask learners to read the story.*
2. *Ask learners if they can think of every-day ways in which they use the barter and money - trade system.*
3. *Ask each learner research one of his or her favourite vegetables to find out where it is grown and how it reaches the final consumers.*
4. *Pair up learners for activity 4.5 and 4.6*

DISCOVERY AND EXPLORATION (25 minutes)

Ensure understanding

1. *START BY READING A STORY*

"Have you ever traded vegetables in your garden for someone else's groundnuts paste and carrot? How about one small pumpkin for another big one, or tomatoes or egg plants?
Before there was money, people gathered vegetables from the bush and wilderness, people exchanged what they had for one or more things they needed and did not have or grow. Ancient people exchanged things like dry vegetables, medicinal herbs and seeds for meat. Some of the earliest European moved to India and Asia to get spices.
In our country's early history, most families gathered their own vegetables from around their homes and this was supported by growing a few selected vegetables crop. Sometimes one family would have goats, chickens or fish ponds. Then the family with fishing products exchanged them for beans and other things they needed. This is called bartering.
Money has taken the place of bartering today but people still have to depend on other people to meet all their needs. For example, people who live in town and cities cannot grow their own vegetables. In urban areas are factories that produce the equipment and inputs farmers need to keep their vegetable farmers going. They take the money for buying vegetables to grocery store, markets, vendor or roadside vegetables stall".

2. *Ask learners to answers these questions*

What message does the story tell you? What are the new words in the story? What did you find in the story that you already know or did not know?

Figure 4.9 Vegetable stall in the market

APPLICATION and Teach It! (20 minutes)

Ask learners to read the paragraph below and answer the questions in activity 4.5 on flip chart sheets

Marketing of vegetables

Have you ever gone to buy vegetables and you did not find any? What did you do? You had little choice. It could have been possible that you had your meals without vegetables. Although the reason for vegetable shortage may not be obvious, several things could have happened. The absence of vegetables is due to many things other than production

Activity 4.5 Marketing of vegetables

a) In pairs discuss the possible reasons why you may not find vegetables to buy when you need them. Suggest ways you can use to have vegetables whenever you need them

b) In pairs, learners develop and apply a marketing strategy for their vegetables

EXPLORATION and** Teach It! **(35 minutes)

Ask learners to carry out activity 4.6 on flip chart sheets on completing explaining this

Among these is transporting the vegetables to the right place, in the right form and at the right time. This is marketing! **Marketing is the process of getting goods and services that consumers want to them in the forms that they want.** It links the farmers with the people who use the farm products and services. This will involve the movement of food, fibre, shelter materials and services from the producer to the consumer-the person who uses them. However many things have to be done to get food or vegetables on the farm ready for the consumer on the dining table.
Marketing begins when you decide to produce something like vegetables.
The vegetable grower must study and examine the situation. **It is important to note that only vegetables or products that can be sold at a price high enough to make a profit should be produced**.

Activity 4.6

a) In pairs list down the sources of information a vegetable farmer can use and assess that demand for a particular vegetable exists in the community. Remember if vegetables that cannot be sold are produced, the farmer is stuck with it and it will go bad quickly. Why would vegetable farmers grow something that they could not sell? The main reason is lack of information or poor decision making

b) In pairs, research and brainstorm on the food safety guidelines for harvested fresh vegetables and design a set of criteria to explain the guidelines to the community

Possible response

A. *Barter trade of vegetables; vegetables also include animals and fish; vegetables are no longer for gathering but are grown crops for money; people who live in town and cities cannot grow their own vegetable; factories that produce the equipment and inputs farmers need to grow vegetables*

B. *Vegetables, vendor, grocery, bartering, spices, urban*

C. *Vegetable growing is seasonal or may have been lost due to pests and diseases; production may be very low; lack of transportation from the farmers to the market; limited market information being available to farmers ;high prices*

D. *Marketing; marketing technology; vegetable chain infrastructure*

E. *Marketing information*

WEEK 7

Teacher Preparation

1. *Prepare the picture from the market showing different vegetables*
2. *Prepare a running dictation by writing the 9 key steps of delivering vegetables to the market and some activities*
3. *Prepare a gallery walk area for activity 4.7*

Teacher instructions

1. *Ask learners the methods used to deliver vegetables to the market or point of sale and the containers used*
2. *Ask learners to read in pairs the nine steps used in delivering vegetables to the market*
3. *Put learners in groups of 3 then ask two to run, read and do a dictation to the third to write then exchange the written work with next group before asking them to read in the learner's book.*
4. *Have learners present their work in activity 4.7 using a gallery walk*

LITERACY, EXPLORATION and** Teach It! **(80 minutes)

1. Start with examining the Figure 4.10 and 4.11 or picture of a market stall with a variety of vegetables. Ask learners to list down the different types of vegetables and containers used (20minutes)

2. Follow up this with a running dictation and assist learners to make correction (40 minutes)

3. Finally carry out activity 4.7 and have a gallery walk (20 minutes)

Ensure understanding

Delivering vegetables to the market

Once right decisions are made the farmer will proceed to deliver vegetables to the consumers. The nine-step process to properly prepare for, receive, and handle an incoming vegetable delivery.

1. **Prepare the backroom**. Get rid of trash, stack empty boxes, and condense merchandise to make room for the load

***Figure 4.10 Vegetable stall on the road* side shade**

2. **A place for everything, and everything in its place.** You can create maps of your space to find out where the coldest and warmest spots are located to help you store your produce at the right temperature for the best flavor and the least spoilage. Keep items in the same place each day so you can quickly find needed product. When unloading the truck, try to park items in set areas to minimize handling them multiple times.

Activity 4.7

In pairs

i. Study the picture and identify the different vegetables being sold
ii. Suggest materials where vegetables are kept before sale
iii. In case you are among the vendors how different could you increase the life of vegetables
iv. Present your work in a gallery walk

3. Know your temperature zones. When picking up or receiving vegetable delivery, accept only produce items that are within their recommended temperature ranges. Otherwise, they may not last as long in storage or on display. Maintain the “cold chain.” Cold stuff stays cold. Warm items, and get them stacked outside of the cooler. Packaged salads lose a day’s shelf life for every hour kept out of refrigeration. Basic knowledge about storage will help minimize waste and maximize profits.

4. Handle with care! Never throw or drop produce. This can cause damage and shrink (that is loss of stock or money). Be careful not to subject fragile items, such as berries or mushrooms, to crushing. Dropping a box of apples as little as three inches can drastically decrease their shelf life and increase waste. Inspect items as you put them away for signs of damage. If you see a produce item that you would not buy, neither will your customers!

5. **Rotate items using the First-In-First-Out (FIFO) method.** Place newer items below or behind older items so that you can be sure to rotate all your produce stock out onto the sales floor before it goes bad. When stacking cases, make sure the printing on the outside of boxes is visible so that you know what is being stacked where. This will make selection a breeze and save valuable time.

6. Dating keeps track of aged stock. Cartons have a way of overstaying their welcome, so by marking cases with a received-on date (either with a marking pen or price gun) you can see at a glance which items must be moved first.

7. **A clean ship is a happy (and safe) ship.** Stack away empty pallets, dump the trash, sweep, and mop the floor.

8. Check the load you just put away. Did everything arrive as ordered, compared to your invoice? This is the time to note outages or shorts and make adjustments with your supplier or warehouse.

9. When a load is put away, step into the cooler and dry storage area and ask these questions:

• Is everything accessible? Can I quickly tell which egg plant varieties are which? Which shelf holds chilies or onions? Which shelf has cabbage?

• Are the items in the cooler rotated and dated?

• Are sensitive items protected (i.e. nothing heavy crushing boxes of tomatoes, mushrooms are not being dried out by the fan/wind current,

• Finally, is the storage area safe? Free from excess water or debris and well lit?

Ask yourself if the rack has WACCS. Is the Water right? Is Air circulation okay? Are Color breaks good? Do Categories make sense? Can customers Shop it easily? Then take pride in your work!

Figure 4.11 Vegetable storage rooms

Possible response

1. *identify the different vegetables being sold that include cabbages, carrots, broccoli, tomato, onions, pepper*
2. *Suggest materials where vegetables are kept before sale to include baskets, boxes, racks, and sacks*
3. *methods used to deliver vegetables to the market or point of sale include: carrying on the head; bicycle, motor cycles, trucks*
4. *containers used to deliver vegetables to the market or point of sale include boxes, sacks, baskets*
5. *In the running dictation you will find that some learners will not place the right activity under the correct key step so assist them to make correction*

WEEK 8

Teacher Preparation

1. Secure leafy vegetables that are in different stages of the marketing chain; start with the harvested ones, then the sort others into categories by size and colour, cleaned, chopped, dried and cooked or makes picture words cards illustrating those conditions of the marketing chain.
2. Have a good number of those picture word cards by printing or photocopying

Teacher instructions

1. *Put the leafy vegetables in different stages of the marketing chain in a disorganized setup or an array of picture cards and ask learners to arrange them in the best order.*
2. *Photocopy or print picture word cards according to the number of groups*
3. *Draw the marketing value chain on a chart*
4. *Allocate learners to groups for each of the activities 4.8, 4.9 and 4.10*

LITERACY, EXPLORATION, ANALYSIS and *Teach It!* ***(80 minutes)***

1. *Start with brainstorming on marketing channels used by farmers to sell their vegetables*
2. *Ask learners to read in pairs and define in their own words the term agricultural marketing technology and marketing function*
3. *Ask learners to do activity 4.8, 4.9 and 4.10*

Agricultural marketing technology

Agricultural marketing technology is all the processes in providing products of agricultural origin to consumers in the forms they want when they want them. Many things have to be done because people want to get their food in ready-to-cook form. On top of that farmers must produce what someone wants. Marketing technology then will provide the link between the producer and the consumer. Different marketing channels exist today. Some vegetable farmers only want to grow and get their output to a processor. Others want deal directly with customer. In all this the quantity produced is important in selecting the marketing channel to use.

Activity 4.8

In groups

i. Brainstorm on the different marketing channels vegetable farmers can use to sell their produce.

ii. Which of these channels is the most appropriate for vegetable you are growing?

Marketing functions

The various activities involved in getting products to the consumers in the desired forms is known as marketing functions. A marketing function is an activity or process that converts a product or performs a role in making products readily available for consumers.

Marketing is more than selling what has been produced. Many people when they hear the term marketing they view it as changing of ownership of products and services. It is far more than this. For instance the ownership may change several times between the producer and the consumers.

Activity 4.9

In groups

i. Identify the different people who handle tomatoes before they reach the dining table when they are ripe on the plant. What does each one of these person do?

ii. Draw flow diagram to show how they are related to each other

Ten marketing functions

a) Harvesting: this is the first step in getting what has been grown ready for the consumer. It is the picking of **vegetables** as soon as they are ripe. This often encourages the plant to produce even more. Different vegetables require different methods of harvesting.
Harvesting can be digging (Irish potato/carrot), cutting (cabbage), picking (tomatoes, egg plants), uprooting, or reaping. Care must be used to assure a good product. While vegetables must be protected from wilting and injury.
b) Assembling: this is the collecting of large quantities of the vegetables or products to a central place. People want to deal with large volumes.
Yet some gardens or farms do not have the large enough volumes to fill a lorry, unless they combine with others harvest. This would require having a vegetable packing shade.
c) Grading: this is the sorting of products or vegetable for uniformity. It occurs after assembling. Standards are used in grading. The purpose is to protect the consumer from unsafe vegetables and assure uniformity. From you experience do you think our vegetables are graded. Definitely little is being done by the farmers.

Grading often involves sorting based on several factors: size, colour, blemishes (defect in the product), weight, varieties, and type of production (organic or conventional). This means every product or vegetable has its own standard.
d) Inspection: is an examination of a vegetable or product to assure that it is free of disease or other defects. Other inspections are to assure that quality standards are met.
e) Transporting: this is the movement of vegetables or products and services from one place to another.
f) Processing: this is the transforming of a raw product into new products.
g) Packaging: this where products are put in containers. The containers retain product quality and make handling easy. There are different packaging materials. For instance tomatoes may be put in paper packages.

h) Labeling: this is a way of identifying a product. It is a step in packaging. It gives a name as well as the weight, date, place of origin, nutritional value certification and expiry

Figure 4.12 Vegetable with labels

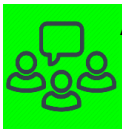
i) Storing: most products have to be kept until when they are needed. Some are kept for a long time with little loss of quality, if properly stored. Others will deteriorate even under the best conditions. But to ensure that vegetables and products are available whenever people want them, the farmers must devise ways of keeping them. This may include use of coolers, or refrigerator houses.

j) Advertising: is method of communicating information to people to show that certain products exist. It is intended to persuade or inform them to come and buy. Advertising may use things like posters, mails, magazines, newspaper, radio, television, internet apps, you tube, blogs, billboards and many other. The purpose is to motivate people to purchase your vegetable or products. This is because farmers want people to buy what they have to sell.

k) Promoting: is something that encourages more people to know and buy. Promotion may involve providing free samples of vegetables.

l) Selling: is the process of making a transaction between the seller and a buyer. A sale occurs when the ownership of a product or vegetable changes. Most people use money to buy products; however, sometimes things of equal value are exchanged. Vegetables like all agricultural products may be sold several times during the marketing process. All people involved try to make a profit when they sell. In that way they become actors in the value chain.

m) Distributing: is the process of getting products to the right place at the right time. The right amount must arrive when needed. All along the way the vegetables must be kept in a good wholesome condition.



Activity 4.10 Making a vegetable package

In groups

i. Design a package for your vegetable.

ii. What will it contain to be able to attract the attention of buyers

iii. Display it and evaluate it against a set criteria

iv. Suggest ways you have come across where producers are encouraging more people to know and buy their products

v. What have they done? Suggest how you could attract more people to buy your vegetable and present it to the class

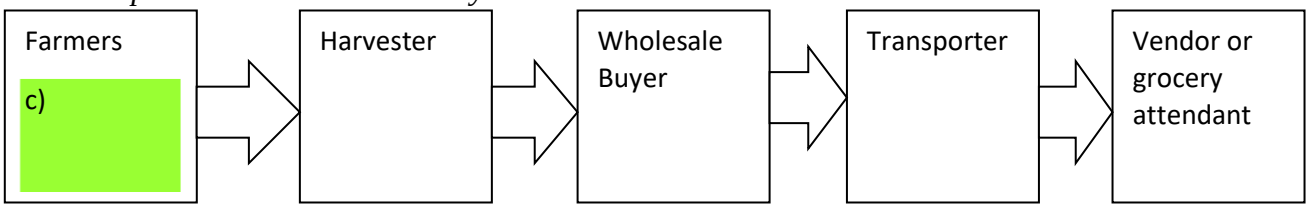
vi. From the work of others what do you learn that you have included and why

Possible response

1. Marketing channels used by farmers to sell their vegetables which include word of mouth, country buyer, cooperative society, traders,

2. Having an organized marketing group to help farmer sell their produce and doing away with middle men

3. How ripe tomatoes are handled by these value chain actors



WEEK 10
Integration activity
a) Context

In your community it is reported that there is a pest attack of army worm (black caterpillars). It is destroying farmer's crops. The army worm eats all green parts of vegetable and other plants. You may help your community growing vegetables to face this problem happening

b) **Support**

Figure 3.9 Mulched vegetable gardens

c) **Task**

Prepare a short presentation of 5 -10 minutes long; you will use to inform the vegetable farmers on how to supply safe and healthy vegetables to the market after controlling weeds, pests and pathogens.

Or

Your class has been asked to use the flower gardens in front of a building and it is 600cm by 200cm. The school administration wants cabbages whose spacing is 60cm by 60cm and each plant would require 65gms of fertilizers. Each cabbage seedlings is UGX 120 and NPK cost is UGX 3000 per kgs.

Prepare a short report of 1 or 2 pages to the school administration seeking support to use the flower garden for cabbage

Criteria: Evaluation grid/assessment

	Relevance (of the response)	Accuracy in the use of the resources taught in classes	Coherence (of the output)	Excellence(the quality that will be unique/new/innovative
Task 1:Presentation	The presentation is about safe supply of vegetables to the market	The presentation explains well the pests, pathogens and measures to fight against them (the information is scientifically correct)	The presentation is ordered, logic and structured with terms used in agriculture.	The presentation shows integrated pest and disease management; organic farming practices
Task 2: Report	The learner writes a report to advocate for a cabbage plantation in the place identified. He/she gives 1 or 2 arguments in favor of the initiative.	The learner uses the data provided and applies the following techniques: 1.Conversion of units into SI units 2.Finding area 3.Applying optimum spacing 4.Budgeting	The report is ordered, logic and structured. It has introduction, development and a conclusion.	The report shows images of area, optimum spacing , advantages of vegetables over growing flowers ; a budget with clear indication of profit

Extended Activity of integration

Context

Balances are commonplace in markets. They are used to weigh fruit and vegetables from as little as 100 g to more than 5 kilos. Many types exist, some using weights and others where there is only 1 pan. The customers look at the position on which a balance are put and wonders what is going on in this vegetable market. Is their accuracy acceptable? Are balances or weighing machines being used accurately by the sellers?

Supports




Task

How would promote vegetable market standard in this community? Write a message for sellers to convince buyers that use of balances is the way to go.

ANNEX 1
Common vegetables in Uganda

Scientific name	**Common name**	**Part used**
VEGETABLES		
Amaranthus dubius	Amaranthus spinach	Leaves
Phaseolus lunatus	Lima beans	Seed
Phaseolus vulgaris	French beans	Leaves and seed
Amaranthus lybridus	Amaranthus spinach	Leaves
Vigna unguiculata	Cow peas	Leaves
Gynandropsis gynandra	African spinderherb	Leaves
Lagenovia siceraria	Calabash gourd	Leaves
Solanum gito	Bitter berries	Leaves
Solanum nigrum	katunkuma	Leaves
Cucurbita maxima	Pumpkin	Leaves and fruit
Zingiiber officinalis	Ginger	Stem
Capsisum frutescens	Chillis	Fruit
Solanum indicum	Bitter berries	Fruit
Vigna unquiculata	Cow peas	Fruit
Colocasia schimperi	Cocoyam	Leaves
Oxytenanthera abyssinica	Bamboo shoots	Stem

Amaranthus lividus	*Ebugga*	Leaves
Gynandropsis (Cloeme) gynandra	Ejjobyo	Leaves
Solanum indicum	*Katukuma* Fruits	
Solanum gilo	Entula	Fruits
Solanum aethiopicum	Nakati	Leaves

Glossary and index

Agriculture *is growing of crops and rearing animals to produce food, fibre and fuel for human beings*
Alkaline *is the measure of salty*
Combustion *burning*
Cotyledons *structure found in inside a seed which stores food for the young embryo*
Embryo *a very young, new organism which has developed from a zygote*
Farmer *is a person who engages in practicing of agriculture to produce food, fuel and fibre*
Fertile *able to grow crops well*
Friable *is when soil aggregates/lumps or granules can easily break up*
Hardening –off *is the acclimatization of seedlings to field conditions so as to prepare them for field conditions by removing the shade and reducing watering*
Hunting and gathering is *a method of getting food from wild plants and wild animals in the bush*
Pathogen is *an organism that causes disease*

Pest *is a living organism that eats or damages a growing crop or its harvested products*
Planning *making an outline of what you want to do*
Prepare *getting ready*
Pricking out *is the separating and removal of excess seedlings to another nursery bed so that they can grow well*
Pruning *is the removal of the unwanted, diseased or damaged parts of a crop*
Nutrients *plant food in the growing medium like soil or water*
Seedling *is the young crop plant*
Soil *is the natural material on the earth surface in which plants grow*
Soil Horizon *is the horizontal layer of soil in a soil profile*
Soil Erosion *is the gradual removal/washing/blowing away of tops oil from one area to another*
Soil Profile *is the vertical cross section through the soil from top to bottom bed rock*
Weathering *is the process in which large rocks break down or split into small particle*
Weeds *unwanted plants growing in a garden*