RWANDA POLYTECHNIC

TVET LEVEL II

AGRICULTURE

Poultry Farming

TRAINEE MANUAL

RWANDA POLYTECHNIC

Approved by: Workforce Development Authority

USAID FROM THE AMERICAN PEOPLE

EDC Education Development Center

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POULTRY FARMING

Unit 1: Raise starters

Unit 2: Raise layers

Unit 3: Raise broilers poultry

Unit 1: Raise starter

Topics

1.1 Preparation of starter room house

1.2 Reception of chicks

1.3 Distribution of Feed and water

1.4 Monitoring physical parameters

Unit Summary:

This unit describes the skills, knowledge, and attitudes required to raise starter chickens. At the end of this unit, you will be able to prepare a starter room, receive chicks, distribute feed and water, and monitor the physical parameters of the starter house.

Self-Assessment: Unit 1

1. Look at the illustration. What is happening? What do you think this unit will be about?

2. Fill in the self-assessment below.

There are no right or wrong ways to answer this survey. It is for your own use during this course. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. At the end of this unit, we'll take this survey again.

My experience **Knowledge, skills and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify the equipment to be installed in a starter room house					
Explain the process of disinfecting a starter room house					
Explain the factors considered when establishing physical parameters					
Establish physical parameters for a starter room house					
Describe factors considered when organizing the transportation of chicks					
Explain the procedures for handling and installing chicks					
Conduct chick installation					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Conduct record keeping					
Identify the quality and quantity of feeds according to animal need					
Describe the impacts of and procedures for record keeping					
Weigh and distribute feeds and water to chicks					
Clean feeders and drinkers properly					
Describe the importance and factors of ventilation and light intensity in the chicken house					
Determine and explain the impact of humidity and temperature levels on chicks					
Explain the impacts of carbon dioxide and how to detect it					
Monitor ventilation and lighting in the chick house and interpret influencing factors					
Monitor and adjust humidity and temperature levels in the chicken house					
Determine the level of carbon dioxide and set the needed level in the chicken house					

Topic 1.1: Prepare starter room house

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the equipment to be installed in a starter room house	**1.** Install equipment in a starter room house	**1.** Detail-oriented
2. Explain the process of disinfecting a starter room house	**2.** Disinfect a starter room house	**2.** Methodical
3. Explain the factors considered when establishing physical parameters	**3.** Establish physical parameters for a starter room house	**3.** Proactive

Getting Started: What do we know and where are we going?

Topic 1.1 Task 1:

1. Discuss the following questions with a partner:

a. Do you know someone who has raised chickens?

b. Which type of chickens did they raise?

c. What safety and biosecurity measures do you think are necessary for a poultry house or room?

d. What other factors do you consider when preparing the room for raising chickens?

2. Share your ideas for **questions c and d** with the rest of the class. Compare your ideas

Problem Solving Activity

Topic 1.1 Task 2:

1. Recall the four physical parameters of an animal shelter from Animal Diseases Prevention:

a.

b.

c.

d.

2. Verify your answers with the trainer.

3. Using what you know about poultry diseases, discuss how you think the physical parameters should be arranged in a poultry starter house with a partner.

4. Now, brainstorm all the equipment you think would be needed in a poultry starter house.

5. Share and discuss your ideas with the rest of the class.

a. What are the different ideas?

b. Does everyone agree?

c. Can multiple responses be possible?

d. What evidence and knowledge do you have from previous units?

1.1 Key Facts

- **Equipment**
  - **Brooders**
    - Used to provide warmth and light to baby chicks in place of a hen
    - Reflect heat and light toward the chicks
    - Types: charcoal, gas, electrical, infra-red bulbs, reflectors, heaters
  - **Drinkers/Waterers**
    - Provide water to birds
    - Keep water clean and fresh
    - Types: basin, manual (see photo), automatic

- **Feeders**
    - Always keep clean
    - Number of feeders depends on the number of chickens
    - Consider placement: Inside (must be kept clean) or outside (must be kept dry and accessible during rain)

- **Litter**
    - May include paddy husks, wood shavings, ground maize cob, chopped straw, saw dust, groundnut shell, dried crushed sugarcane pulp
    - Select based on the local availability and cost
    - Should be dry and fresh
    - Cover floor with 5-6 centimetres of clean litter
- **Heating Elements**
    - Measure heat/temperature using thermometer
    - Brooders provide heat
- **Debeakers**
    - Types: mechanical, hot blade, electric, infrared
    - Used to trim beaks in order to prevent pecking injuries and cannibalism
    - Remove ¼ to ⅓ of the upper or upper and lower beaks[1]

- **Procedures for Installation**
    - **Preparation:** Be prepared for the chicks in advance.
    - **Cleaning and disinfection:** Clean and disinfect the chicken house, feeders, and waterers at least two weeks (14 days) before the chicks arrive.
    - **Placement** of equipment in house according to standard measures
        - Cover floor with 5-6 centimetres of clean litter
        - Start the brooder 24 hours before placing chicks under the hover. Check the thermostat and adjust temperature at the edge of the hover to 35°C.
        - Have feeders, waterers, and hover guards in place.
            - Place feeders and waterers clockwise, radiating from the hover and in the space surrounded by the chick guard, so that chicks will always be near a source of water and feed. Have feeders and waterers filled at proper level before chicks arrive.

[1] Tamil Nadu Agricultural University (TNAU). (n.d.). *Poultry farm equipments*. https://www.agritech.tnau.ac.in/expert_system/poultry/Poultry%20Farm%20Equipments.html

- Provide 2.5 centimetres of feeder space per chick for the first 2 weeks. This can be provided with a 1-1.5 metre feeder accessible from both sides for each 100 chicks.
- Feeder and drinkers must be adjusted to the height of the birds' backs in order not to contaminate with droppings or litter.

- **Physical Parameters**
  - **Ventilation**:
    - Ventilate the room to provide draft-free fresh air and to keep down dust and moisture.
    - A house with open sides is preferred
    - Wider buildings have less natural air flow; should limit to 8 metres in width
  - **Heat/Temperature:**
    - Minimum room temperature for the first week should be 30 to 35^0C.
    - Overheating leads to low production and even death
    - Heat stress begins at 40 °C; death at 46 °C and above
    - Poultry decrease body temperature through evaporative cooling (panting/breathing out water)
    - In temperate-tropical regions like Rwanda, the chicken house may be constructed with an east-west orientation to minimize exposure to direct sunlight.
    - Reduce heat: avoid reflecting materials, such as tin or other metals; incorporate ground cover (low-growing plants); provide shade
      Heat stress leads to decreased food and water consumption, growth rate, and production
  - **Light**:
    - Good lighting is important for feeding and overall poultry health
    - Increases reproduction/sexual maturity
    - Natural light is preferred, otherwise artificial light should be regular, reliable, and well-distributed
    - Intensity of light affects production
  - **Space**:
    - Avoid over-crowding of birds in housing
    - Check density of birds: should be around 30 chicks per square metre
    - Hens are comfortable with 3-4 birds per square metre
    - Less space leads to stress, disease vulnerability, and cannibalism
    - Can add perches to optimize space and protect from predators[2]

[2] Sonaiya, E. B., & J Swan, S. E. (2004). *Small-scale poultry production: Chapter 4: General management*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/y5169e/y5169e05.htm

Guided Practice Activity

Topic 1.1 Task 3:

1. Form small groups. Then, read and discuss the scenario below and the questions that follow in your respective groups.

Mutesi successfully applied for a starter fund from Business Development Fund (BDF) for chicken farming. She has come to you for assistance because you are a person who has knowledge and skills in chicken farming.

She wants to start by raising starter chicks. She needs your help to prepare the starter room house.

a. Help her identify all the possible equipment to be installed in the starter room house.

b. Explain the procedure of installing the equipment identified above in her starter room house.

c. Explain to her the factors and standards she should consider while setting litter

d. Explain to her the factors she should consider when establishing physical parameters for her starter room house

2. Mutesi wants to know more about the procedures for disinfecting her starter room.

a. What do you already know about disinfecting an area?

b. What do you think applies to disinfecting a starter house?

c. Consider the products, supplies, techniques, safety, and disposal.

3. Present your group's advice to Mutesi to the rest of the class.

4. Give each group feedback.

a. What did they do well?

b. Did they forget to include something?

1.2 Key Facts

- **Disinfection Procedures**
  From Poultry International magazine:

  1. **"Plan**:
     - Consider the tools, equipment, products, and time needed
  2. **Prepare**:
     - Remove dust from surfaces
     - Control insects: Spray with insecticide
     - Pre-spraying: Spray detergent to remove other dust
  3. **Arrange**:
     - Remove equipment
     - Remove and dispose of litter
  4. **Clean**:
     - Wash with water and detergent, then rinse with hot water
     - Drain and clean water and feeding systems between flocks
  5. **Disinfect:**
     - Select a disinfectant specifically for poultry bacteria and viruses
     - Wear PPE
     - Read the manufacturer's instructions
     - Dry the surfaces first, or disinfectant will become diluted and ineffective
  6. **Fumigate:**
     - Fumigate immediately after disinfection
     - Conditions: Damp surfaces, 21 °C, relative humidity above 65%
     - Keep the doors and windows closed for 24 hours
     - Ventilate before opening
     - Repeat after arranging litter
     - Wear PPE
     - Read manufacturer's instructions"[3]

[3] Clements, M. (2016, April 19). *10 tips for cleaning, disinfecting broiler houses*. WATT Ag Net. https://www.wattagnet.com/articles/26539-tips-for-cleaning-disinfecting-broiler-houses

Application Activity

Topic 1.1 Task 4:

1. Stay in your groups from the **Problem Solving Activity**. Each group is going to work together to design a starter room house.

2. Your trainer will assign you an area where your group will design a starter room house. It may be inside the classroom, somewhere outside, or at the school farm.

3. Observe the area that you will use as a starter room and each group will have to:
   a. Draw a sketch map of how they plan to prepare the starter room.

   b. Identify all equipment they will install in the starter room, including drinkers, feeders, litter, heating elements, and cleaning material and equipment.

   c. Write the procedures for installing the identified equipment in the starter room.

   d. Write the procedures for disinfecting the starter room house.

4. Each group will present their sketch maps and procedures.

5. Convene as a large group and discuss each group's performance.

Points to Remember

- You should always consider the direction of the wind when installing heating system.
- You should always conduct proper cleaning and disinfection before installing materials and equipment in a starter room house.

Formative Assessment

1. Select **True** or **False** for the following statements:

- ❑ Dry cleaning, which includes removing dust and controlling insects, is the second step in the process of cleaning and disinfection.
- ❑ During installation of materials, standard measures can sometimes be ignored.
- ❑ Before installation of materials and equipment, it is mandatory to prepare them.
- ❑ Litter does not need to be fresh and can even be moist if you don't identify any poultry diseases.
- ❑ The room should be cleaned and disinfected at least one month prior to receiving chicks.
- ❑ The ventilation, including air quality and direction, can alter the establishment of physical parameters in the room house.

2. Complete the following sentences:

a. Before disinfecting the start room house, surfaces should be ……. or the disinfectant will become …… and ineffective.

b. After fumigating, the doors and windows should be …….. for ……. hours.

c. Water and feeding systems should be …… and cleaned between flocks.

Topic 1.2: Receive chicks

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe factors considered when organizing the transportation of chicks	**1.** Organize transportation for chicks.	**1.** Forward-thinking
2. Explain the procedures for handling and installing chicks	**2.** Conduct chick installation	**2.** Methodical
3. Describe different records that need to be kept in order to meet farming standards	**3.** Keep proper records of installed chicks	**3.** Detail-oriented

Getting Started: What do we know and where are we going?

Topic 1.2 Task 1:

1. Brainstorm answers to the following questions individually:
   a. Do you or someone you know possess chickens?

   b. Where did the chickens come from?

   c. Have you ever seen chickens being transported?

   d. What vehicle was used? Where were the chicks kept?

   e. What did you notice about how the chickens were moved from the vehicle to the farm?

2. Share your ideas with a partner.

3. If you or your family owns chickens, please share your experience with transporting and handling chicks with the rest of the class.

Problem Solving Activity

Topic 1.2 Task 2:

1. Imagine the following situations and discuss them with a partner.
   a. You are transporting chicks from the Northern Province to the Southern Province. You must drive through Kigali to pick up some materials, and there is a lot of construction and traffic.
      i. How might this affect the chicks?

      ii. What can be done to address this situation?

   b. It is a hot day and the road you are taking is made of dirt.
      i. How might this affect the chicks?

      ii. What can be done to make them comfortable in this situation?

   c. Now, imagine you are responsible for buying feed for the chicks this season.
      i. How do you know how much feed to buy?

      ii. What information would be useful to know?

2. Share your ideas with the rest of the class.
   a. Did you have similar ideas?

   b. What are some ideas you had not considered?

   c. What information would you like to know?

1.3 Key Facts

- **Transportation Equipment**
  - Van or large vehicle
  - Small, dark boxes with air holes
  - Ventilation system
  - Litter
  - Blankets or rubber mats

- **Transportation Factors**
  - Goal is to minimize chick stress levels during transportation
    - Provide access to fresh air and water along the trip
    - Place chicks in dark boxes with small air holes so they can sleep and relax while feeling fresh air
    - Avoid loud noises, such as travel routes with traffic, construction, and rough roads
    - Reduce the amount of noise by placing crates on blankets or rubber mats[4]

- **Handling Chicks**
  - Gently take chicks one by one from the boxes/crates to the floor space inside brooder
  - Check health status of each chick; weak ones should be treated separately
  - Chicks are very fragile: It is normal to lose few chicks out of your day olds, but it can only happen in the within the first three to five days.

- **Installation Procedures**
  - Consider: Fragility of the chicks, physical parameters in the house, distance travelled, time of arrival
    1. Remove the chicks from the boxes and place under brooder unit immediately upon arrival.
    2. Start them on feed and water at once.
    3. Reduce the temperature of the hover by 3°C each week.
    4. Check the thermometer daily.
       - Avoid over heating or chilling. If the chicks crowd together under the hover, increase heat. If they stay away from the heat source lower the temperature.
    5. To prevent crowding and piling at night, lights are sometimes used.
       - A low wattage light bulb placed high over the brooder unit is enough.
       - Use lights for 1 week only.

- **Record Keeping**
  - Accurate and thorough record keeping has important long term benefits for decision making
  - **Identification Documents**
    - Record source, hatch date, supply company, breed, payment documents
  - **Feeding Form**
    - Record amount of feed consumed daily

[4] Bentoli. (n.d.). *4 tips for how to transport chickens and minimize the chances of poultry stress*. https://www.bentoli.com/how-to-transport-chickens-poultry-stress/

- Informs feeding and financial decisions
- **Preventative Activities Form**
  - Record vaccines taken, type of bird, and date
  - Used to analyse effectiveness of vaccines and plan future vaccine administrations
- **Nesting Record**
  - Record productivity of nesting hens
  - Eggs, reproduction, and meat records
  - Used to analyse animal health and make predictions for culling (slaughtering)[5]

Guided Practice Activity

Topic 1.2 Task 3:

1. Form small groups to collaborate on the following task. Discuss each question and write your ideas down.

2. Kamali ordered 1,200 chicks from a hatchery company and they will arrive at the Kanombe International Airport in Kigali on December 20 at 9:00 PM (or 21:00). Kamali's chicken house is in Rubavu District, which is 160 kilometres from Kigali. Answer following questions:

a. How will you organize the transportation of the chicks from Kigali to Kanombe?

b. List of all the necessary materials and equipment to be used to successfully transport the chicks.

c. What are the important preparations that must be in place before the arrival of the chicks?

d. Once you have arrived at the chicken house in Rubavu, describe the steps of installing chicks in the room house.

e. Propose a list of the records to be taken for the chicks.

3. Verify your answers with the trainer before moving on. Refer to **1.3 Key Facts** as needed.

[5] Purdue Agriculture. (n.d.). *Unit C: Field records*. https://ag.purdue.edu/ipia/hasil/Unit%20C%20Lesson%203%20Poultry%20Production%20and%20Record%20Keeping%20PPT%20-%20English.pdf and College of Agriculture & Natural Resources, Michigan State University. (n.d.). *Poultry record book: Kent County youth fair*. https://www.canr.msu.edu/uploads/234/41592/Poultry_Record_Book.pdf

Application Activity

Topic 1.2 Task 4:

1. With a partner, brainstorm 5 questions to ask a poultry farmer about receiving chicks.

1.

2.

3.

4.

5.

2. Share your questions with the rest of the class. Once all the questions have been gathered, vote on the best 10 questions to ask the farmer.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

3. Visit a local poultry farm with your class. Select two class representatives to interview the farmer or another farm worker with expertise. Note their answers to the questions below.

1.	**6.**
2.	**7.**
3.	**8.**
4.	**9.**
5.	**10.**

4. Now, observe the farm's starter room/house.

a. What equipment do you see?

b. Is it constructed according to the standards?

c. Ask the farmer or another worker for clarification as needed.

5. Finally, ask to see the records that the farm keeps.

a. Which types of records does the farm keep?

b. How are they organized?

c. Ask what these records are used for.

6. After the visit, ask your trainer any questions you have about the experience.

Points to Remember

- Without a brooder in place, receiving chicks will not be possible.
- Adequate care and attention given to chicks during starting period will determine the health and productivity of the chicken's cycle until the old age.
- This early period is the most critical of all the life cycles of a laying hen.

Formative Assessment

1. Tick which of the following equipment is needed for chick transportation:

- ❑ Boxes
- ❑ Feed
- ❑ Tin
- ❑ Water
- ❑ Grass
- ❑ Litter
- ❑ Vehicle
- ❑ Measuring stick
- ❑ Ventilation system (air holes)

2. Select **True** or **False** for the following statements:

- ❑ A thermometer is an instrument used to measure the direction of wind in a chicken house.
- ❑ A brooder should be started immediately when the chicks arrive.
- ❑ Chicks are fragile and should be handled carefully and one by one from the box to the installation area.
- ❑ Lights should never be used when installing chicks.

3. Why should farmers keep records of their chicks? Explain why and how some records can be used.

Topic 1.3: Distribute feed and water

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify the quality and quantity of feeds according to animal need	**1.** Weigh and distribute feeds and water to chicks	**1.** Accurate
2. Explain the methods of cleaning feeders and drinkers	**2.** Clean feeders and drinkers properly	**2.** Methodical
3. Describe the impacts of and procedures for record keeping	**3.** Conduct record keeping	**3.** Detail-oriented

Getting Started: What do we know and where are we going?

Topic 1.3 Task 1:

1. Brainstorm responses to the following questions:
   a. What do chickens eat and drink?

   b. Why is proper feeding and drinking distribution important?

2. Share your ideas with a partner and discuss.

3. Next, compare your responses with the rest of the class. Additionally, discuss as a class:
   a. What are important factors to consider when feeding chickens?

Problem Solving Activity

Topic 1.3 Task 2:

1. Consider the factors for chicken feeding discussed in the **Getting Started Activity.** Individually reflect and write answers to the following questions:
   a. How much should we feed chickens? How do you know?

   b. How much water do chickens need? How do you know?

2. Based on your own experience and what you know about chickens, predict how much feed and water are needed in the following situations:

a. Grams of feed needed for 1 chick that is 1 week old:

b. Grams of feed needed for 900 chicks that are 1 week old:

c. Litres of water needed for 1 chick that is 1 week old:

d. Litres of water needed for 900 chicks that are 1 week old:

3. Share your predictions with a partner.

a. Did you predict similar amounts of feed and water?

b. Explain how you determined the amount of feed and water necessary.

c. Discuss: How will you measure these amounts of feed and water?

4. Discuss your ideas and predictions with the rest of the class.

a. What information do you need to properly distribute feed and water?

1.4 Key Facts

- **Types of Feed**
  - Chick Starter feed: 1 day to 6 weeks
  - Grower feed: 7 to 18 weeks
  - Layer feed: 19 weeks and older

- **Distributing Feed and Water**
  - **Equipment**: numeric weighing balance; clean sac, bucket, or basin
  - **Determine quantities** needed using the chart below:

Quantity of Feed		Quantity of Water		Space for Water[6]	
Age (weeks)	**Grams/day /1 chick**	**Age (weeks)**	**Litres/day /100 chicks**	**Age (weeks)**	**Space in metres**
0-1	10	0-1	3	0-1	0.7
2	20	2-4	10	2-4	1.0
3	25	4-9	20	4-9	1.5
4	30	9 or more	25	9 or more	2.0
5	35	Layer	50	Layer	2.5
6	40				

- **Procedure**
    1. Deposit the quantity of feed to weigh in the apparatus.
    2. Using a weighing balance, weigh the appropriate quantity of needed feed according to the number of chicks received (see chart above).
    3. Before adding feeds into feeders, clean them and throw away old feed.
    4. Put new feed into feeders and observe how all the chicks are accessing the feed
    5. Distribute water into the appropriate number of drinkers and observe how all the chicks are accessing the water
    - One water basin = approximately 10 litres

- **Feed and Water: Cleaning and Tips**
    - Keep food and water containers clean and filled
    - Make sure water is in a container that chicks can't fall in and drown
    - Water should be at room temperature, so it won't chill the chicks
    - Verify if the chicks can feed and drink themselves
        - Dip chick beaks into the water when they first arrive to teach them how to drink
        - If they don't eat at first, try clipping up some tiny pieces of lettuce on top of the crumbles to get their attention[7]

[6] *Small-scale poultry production*. (n.d.). Home | Food and Agriculture Organization of the United Nations. https://www.fao.org/3/y5169e/y5169e05.htm

[7] Lombardo, L. (n.d.). *How to care for day old chicks*. The Self Sufficient HomeAcre. https://www.theselfsufficienthomeacre.com/2014/03/how-to-care-for-day-old-chicks.html

Guided Practice Activity

Topic 1.3 Task 3:

1. With a partner, consider the following scenario and complete the tasks:

A modern chicken farmer has successfully received and installed 900 one-day-old chicks in a properly prepared starter room house. It's the first time for the farmer to do such a project. On the first day that she/he receives the chicks, he/she calls you for help with the following:

a. Determine the type of feed needed.

b. Calculate the amount of feed needed for the chicks.

c. Calculate the amount of water needed for the chicks.

d. Describe the procedures for distributing the feed and water to the chicks, including the material and equipment needed.

e. Explain what the farmer should do if some of the chicks do not begin to eat and drink at first.

f. Give instructions on proper cleaning methods.

2. The farmer is considering keeping a record of her feeding activities.

a. Why should she keep a feed record?

b. What information is important to record?

3. Share your responses with the class. Compare your calculations to the predictions made in the **Problem Solving Activity**.

4. Briefly review **1.5 Key Facts** below and verify your responses to question 2.

1.5 Key Facts

- **Feed Record Keeping**
  - Feeding decisions-records are useful in deciding what types of feed rations, the quantity of feed rations, and the effectiveness of a specific feed ration.[8]
  - **Example Records:**

Feed Type	Feed Weight (kg)	Feed Cost (RWF)	Other Costs (RWF)	
Chick Starter			Chicks	
Grower			Fuel	
Layer			Water	
Total			Total	

Application Activity

Topic 1.3 Task 4:

1. Prepare to visit a local poultry farm by filling in the table below with **criteria** for a Feed Record:

Feed Type			Other Costs (RWF)	
Total			Total	

2. Visit a local poultry farm and ask the farmer the information needed to complete the table above. Calculate the total weight, cost of feed, and other costs.
   a. Ask the farmer where they buy feed and how often they buy it.

[8] Editor. (2019, October 22). *Record keeping: An important poultry farming tool*. Conversion Feeds Limited. https://conversionfeeds.com/record-keeping-an-important-poultry-farming-tool/

3. Observe and/or assist the farm staff as they feed the chickens.

a. What do you notice about the distribution of the feed and water?

b. What cleaning measures are taken?

Points to Remember

- Chick Starter is the only feed reserved to chicks.
- Quality and quantity are two important factors for successful chick-raising.
- If your chicks were vaccinated for coccidiosis, you should give them non-medicated feed.
- Never add new feeds to the old ones. This is the same for water distribution. Fresh feed and water are important to poultry health.

Formative Assessment

1. Select **True** or **False** for the following statements:

- ❑ Chicks can eat any type of feed if the quantity is enough.
- ❑ The number of chicks and the season determine the quantities of feed and water to be distributed.
- ❑ The amount of feed and water needed increases as chicks get older.

2. Fill in the table below:

Age in days	Number of chicks	The quantity of feed needed	The quantity of water needed
4	100		
11	300		
20	400		
30	150		

3. Complete the following sentences:

a. Keeping records can help make ……. decisions in the future.

b. Before distributing feeds to chicks, you should …… old feed.

c. …… and ……. are two important factors for successful chick-raising.

Topic 1.4: Monitor physical parameters

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe the importance and factors of ventilation and light intensity in the chick house	**1.** Monitor ventilation and lighting in the chick house and interpret influencing factors	**1.** Diligent
2. Determine and explain the impact of humidity and temperature levels on chicks	**2.** Monitor and adjust humidity and temperature levels in the chick house	**2.** Persistent
3. Explain the impacts of carbon dioxide and how to detect it	**3.** Determine the level of carbon dioxide and set the needed level in the chick house	**3.** Proactive

Getting Started: What do we know and where are we going?

Topic 1.4 Task 1:

1. Discuss with a partner:
   a. What are the main agricultural seasons in Rwanda?

   b. What are characteristics of each season?

   c. What is the impact of each season on agriculture?

   d. What impacts do you observe on livestock activities?

   e. What do you think the impacts are on chicken farming?

2. Now, recall the four physical parameters used in animal shelters from previous modules:
   1.
   2.
   3.
   4.

3. How do you think the agricultural seasons affect the physical parameters?

Problem Solving Activity

Topic 1.4 Task 2:

1. Based on what you know from previous topics, match the tool to its photo and what it measures. **Barometer** has been done as an example.

Tool	Photo	Measurement
Barometer		Light intensity
Thermometer		Gas levels
Photometer		Heat intensity
Hygrometer		Amount of water vapour in the air
Carbon dioxide meter/sensor		Air pressure

2. With a partner, discuss the following questions using what you already know about physical parameters and poultry health:
   a. What happens to chickens when there are high temperatures?

   b. What happens to chickens when there is high humidity?

   c. What happens to chickens when there is too much lighting?

   d. What happens to chickens when there is not enough ventilation?

3. Now, consider gases in the air. Do you know any types of gases? What could happen to chickens if there are harmful gases in the air?

4. Share your responses with the rest of the class and compare ideas.

5. Read through **1.6 Key Facts** together. Tell trainees to:
   - ✓ Check or tick information that the discussed and predicted correctly from the activity.
   - ❖ Star new information that they may need to review further.

1.6 Key Facts

- **Ideal Conditions for Chicks**
  - Warm floor during brooding
  - Adequate heating
  - Good air quality
  - No temperature fluctuations
  - No drafts
  - No environmental stresses

- **Ventilation:** Control of fresh air
  - Measurement Tool: Barometer
    - Measures air pressure
    - Ideal static (not moving) pressure = 0.05” and 0.12”
    - Control and monitor using air inlets
  - Can also use test methods
    - If too dry, ventilation must be decreased. If too wet/moist, ventilation must be increased

- Factors:
    - Air direction:
        - Consider the primary direction of the wind and the poultry house's location (on top of a hill, in a valley)
        - Increased wind moderates body temperature and reduces risk of heat stress
    - Construction structure:
        - Orient house to reduce direct sunlight and allow for natural airflow
- System Types:
    - Natural air flow system (wind)
    - Mechanical air movement (fans, air inlets)

- **Lighting:** Arrangement or production of light
    - **Measurement Tool**: Photometer
        - Measures light intensity
        - Ideal is 20 lux at post-hatch stage (1–7 days old)
            - Reduce to 3–5 lux and introduce intermittent lighting system
        - General recommendation is 16 hours light and 8 hours darkness
    - Good lighting increases activity, such as feed intake, physical, and physiological activities
    - Lighting periods that are too long and too intense may cause tiredness, cannibalism, immune responses, leg abnormalities and even death

- **Temperature:** Degree or intensity of heat
    - **Measurement Tool**: Thermometer
        - Measures heat
        - Normal body temperature = 39.4°C and 40°C
        - High temperatures lead to heat stress
    - **Effects of heat stress**:
        - Reduced eating
        - Increased water consumption
        - Reduced growth rate
        - Disturbances in reproduction[9]

[9] Oloyo, A., & Ojerinde, A. (2019, February 26). *Poultry housing and management*. In Tech Open. https://www.intechopen.com/online-first/poultry-housing-and-management

- **Humidity:** Amount of water vapour in the air
  - **Measurement Tool**:
    - Hygrometer
    - Measures relative humidity: Amount of water vapour in the air as a percentage of amount needed for saturation at that temperature
    - Should be between 50% and 70% after brooding; 60%-80% during brooding
  - Humidity can be decreased by increasing ventilation
  - Strong relationship with temperature

- **Carbon Dioxide (CO_2):** Chemical compound that can be harmful in high quantities
  - **Measurement Tool**: Carbon dioxide meter or sensor
    - Measures gas levels
    - Desirable below 1%
    - Can kill birds above 30%
  - Produced from bird faecal matter
  - Remove faecal matter regularly to reduce CO_2 concentration

- **Overall Monitoring**
  - Best done by visiting the house, preferably first thing in the morning.
  - What you feel in first 30-60 seconds is what the chicken lived with all night.
  - **Evaluate**:
    - Bird comfort, spread, activity
    - Feeling of "stuffiness" when first entering the room
    - Condensation/sweating (walls, drinker pipes, steel)

Guided Practice Activity

Topic 1.4 Task 3:

1. In small groups, consider the following scenario:

Mr. Senkoko is a new chicken farmer located in Bugesera District. After completing the installation of chicks and raising them until the 9th weeks of age, he observed some abnormal behaviour of the chicks and decided to call upon a qualified expert.

The expert noticed some abnormalities related to physical parameters and decided to monitor each of them using measurement tools. The table below shows what he found during his research.

Physical Parameter	Standard Rate	Findings	Effects on Chicks
Temperature	30 -32 ^{0}C	37.7^{0}C	
Humidity	50-70%	95%	
Light intensity	20 lux	31%	
Carbon dioxide	< 1%	6%	
Air pressure	65%	31%	

2. With your group, complete the following tasks:

a. Name the tool used by the expert to measure each physical parameter.

- Temperature:
- Humidity:
- Light intensity:
- Carbon dioxide:
- Air Pressure:

b. Fill in the last column of the table, Effects on Chicks, based on the findings and compared to the standard rate.

3. Discuss and write the factors that increase or decrease each of the physical parameters.

- Temperature:
- Humidity:
- Lighting:
- Carbon dioxide:
- Ventilation:

Application Activity

Topic 1.4 Task 4:

Visit a local poultry farm with your class.

1. Separate into five groups. The trainer will assign each group a physical parameter.

2. Assess your assigned parameter, using the appropriate measuring tools. Fill in the table below. Then, follow the trainer's instruction to rotate to a new parameter and assess again. Continue rotating until you have monitored each parameter and filled in the entire table. Ask your trainer and the farm staff for help as needed.

Physical Parameter	Done well	Needs improvement	Suggestion for correction
Lighting			
Ventilation			
Humidity			
Temperature			
Carbon dioxide			

3. With your group, write a report on your findings and submit it to the trainer for review.

Points to Remember

- Physical parameters may harm or end the lives of chicks if not monitored and controlled properly.
- Interpretation of chicks' wellbeing is important as the most changes come from abnormal physical parameters.
- Any excess is bad, try to always refer to standard rates.

Formative Assessment

1. Select **True** or **False** for the following statements:

a. The instrument used to measure temperature is a hygrometer.

b. The physical parameters are not a big problem when feeding and watering are well done.

c. Good lighting increases chick activity.

d. Carbon dioxide is the only gas present in chicken houses.

2. Complete the following sentences:

a. …….. …….. is a chemical compound that can be harmful in high quantities.

b. Physical parameters may …… the lives of chicks if they are not monitored and controlled properly.

c. The effects of heat stress include ……. eating, increased …… consumption, reduced growth rate, and disturbances in ……

Circle the correct answer for each statement:

3. The term ventilation refers to

a. Air movement to stabilize air flow in chick house.
b. The way chicken house supplies fresh air that is essential to sustain life.
c. A building orientation and site features to control air.

4. The recommended light intensity is

a. 20 lux during the post-hatch stage
b. 22 lux after one week
c. 20 lux during old age

5. Intermittent lighting is the

a. lowering of light intensity
b. change of light in darkness
c. alternating of short light and dark periods

Self-Reflection

1. You have come to the end of the unit. You are going to do the survey you did at the beginning of the unit again to help you do self-assessment of your knowledge, skills and attitudes.

Again, there are no right or wrong answers to this survey. It is for your own use to gauge your knowledge, skills and attitudes after the unit. Read the Knowledge, Skill or Attitude in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation.

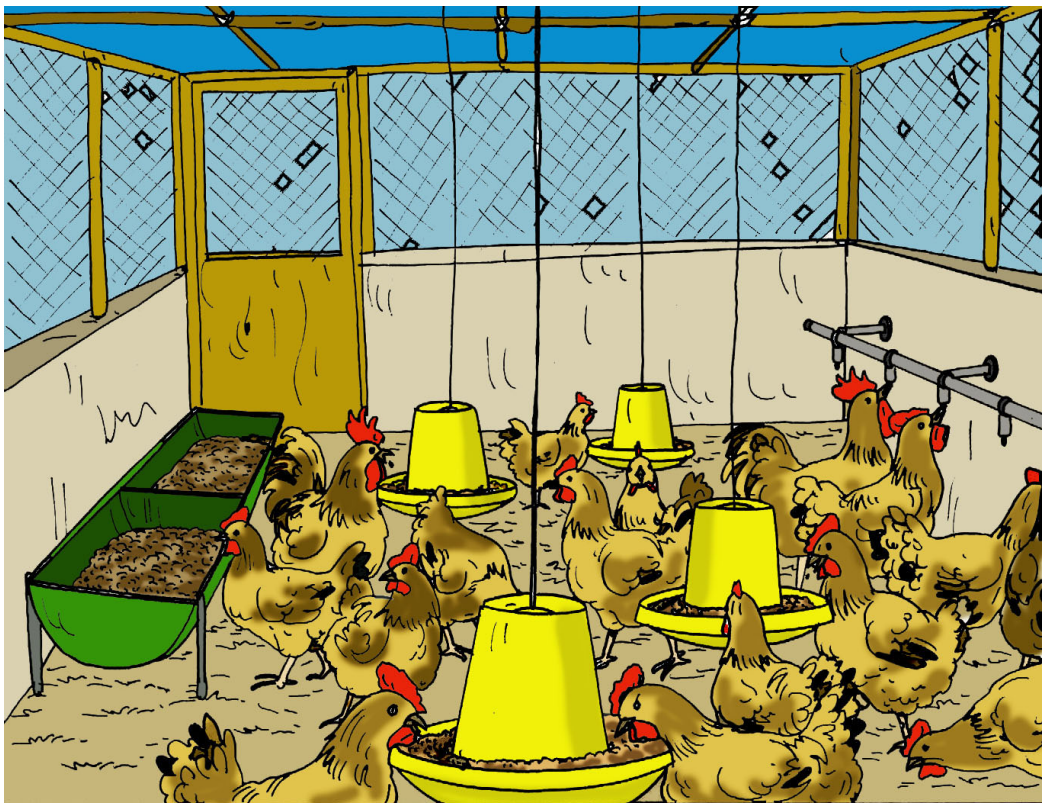
My experience **Knowledge, skills and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Identify the equipment to be installed in a starter room house					
Explain the process of disinfecting a starter room house					
Explain the factors considered when establishing physical parameters					
Establish physical parameters for a starter room house					
Describe factors considered when organizing the transportation of chicks					
Explain the procedures for handling and installing chicks					
Conduct chick installation					

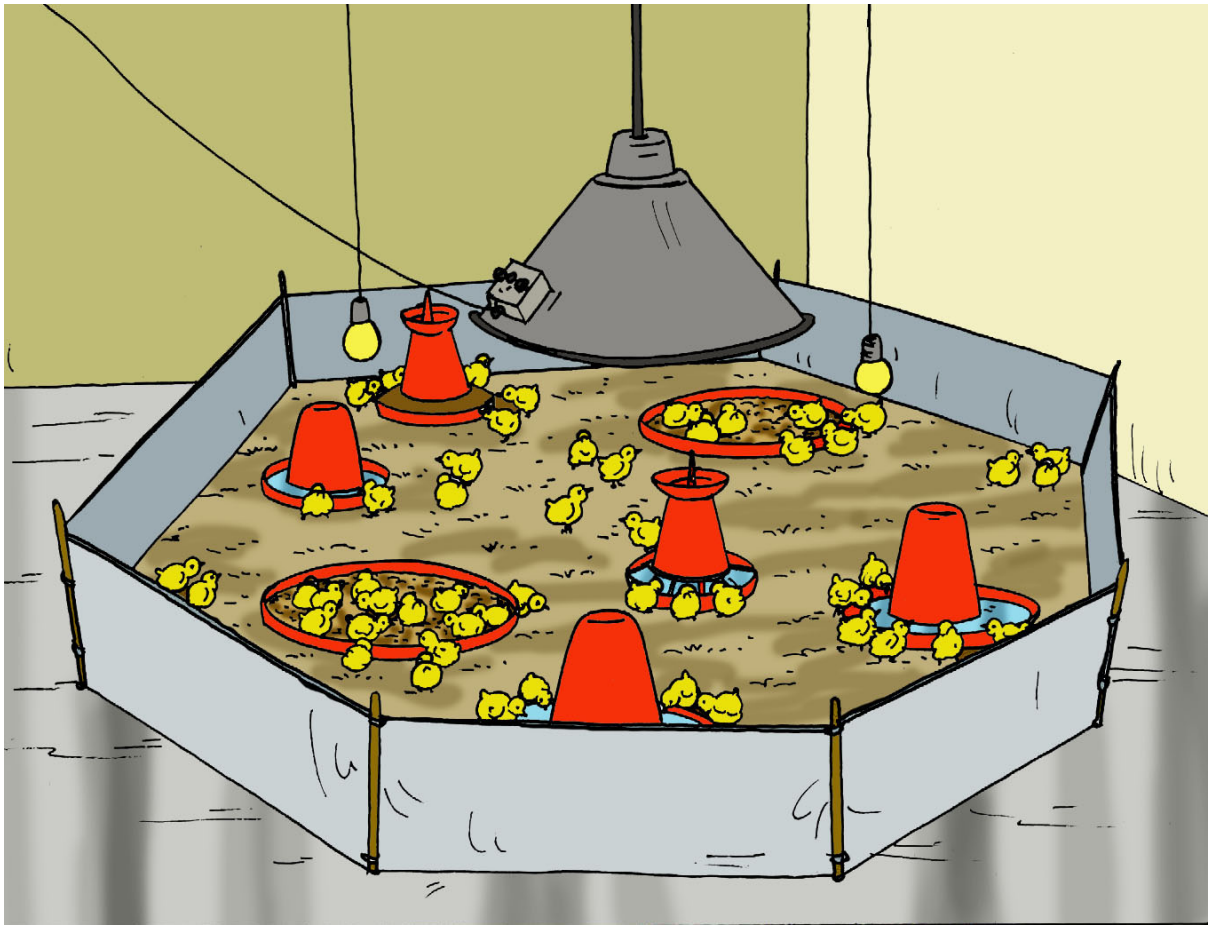
My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Conduct record keeping					
Identify the quality and quantity of feeds according to animal need					
Describe the impacts of and procedures for record keeping					
Weigh and distribute feeds and water to chicks					
Clean feeders and drinkers properly					
Describe the importance and factors of ventilation and light intensity in the chicken house					
Determine and explain the impact of humidity and temperature levels on chicks					
Explain the impacts of carbon dioxide and how to detect it					
Monitor ventilation and lighting in the chick house and interpret influencing factors					
Monitor and adjust humidity and temperature levels in the chicken house					
Determine the level of carbon dioxide and set the needed level in the chicken house					

2. Complete the table below by identifying areas from the unit where you have improved and where you need improvement with the actions/strategies you will use to help you improve when receiving and interpreting information at the workplace.

Areas of strength	Areas for improvement	Actions to take to improve
1.	**1.**	**1.**
2.	**2.**	**2.**

Unit 2: Raise layers





Topics

2.1 Prepare layers house

2.2 Receive layers

2.3 Distribute feed and water

2.4 Monitor physical parameters

2.5 Ensure egg quality

Unit Summary:

This unit describes the skills, knowledge, and attitudes required to raise layers. At the end of this unit, trainees will be familiar with how to prepare the houses for layers and receive layers. They will learn the methods for distributing feed and water, monitoring physical parameters, and ensuring egg quality.

Self-Assessment: Unit 2

1. Look at the illustration. What is happening? What do you think this unit will be about? What topics might be covered?

2. Fill in the self-assessment below.

There are no right or wrong ways to answer this survey. It is for your own use during this course. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. At the end of this unit, we'll take this survey again.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Describe and install the equipment in layers house					
Explain disinfection procedures for layers house					
Establish litter and physical parameters according to standards					
Describe appropriate transportation and preparation for pullets					
Carefully handle, check health, and keep records for pullets					
Explain the procedure of installing pullets in layers house					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Select high quality feeds and water for optimal animal health					
Determine and calculate the quantities of feed and water needed based on the number of chickens					
Explain methods of cleaning feeding equipment and record keeping					
Describe the importance and factors of ventilation and light intensity in the layer house					
Monitor ventilation and lighting in the layer house and interpret influencing factors					
Determine and explain the impact of humidity and temperature levels on layers					
Monitor and adjust humidity and temperature levels in the layer house					
Explain the impacts of carbon dioxide and how to detect it					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Determine the level of carbon dioxide and set the needed level in the layer house					
Describe factors for grading eggs according to standards					
Grade eggs according to standards					
Explain the techniques for storing eggs according to standards					
Describe methods of collecting and packaging eggs					

Topic 2.1: Prepare layers house

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe different types of equipment in layers house	**1.** Install equipment in layers houses according to standards	**1.** Accurate
2. Explain disinfection procedures for layers house	**2.** Apply disinfection techniques to layers house	**2.** Diligent
3. Identify standards for arrangement of litter and physical parameters	**3.** Establish litter and physical parameters according to standards	**3.** Detail-oriented

Getting Started: What do we know and where are we going?

Topic 2.1 Task 1:

1. In partners, discuss and debate: What came first, the chicken or the egg?

2. Share your ideas with the class.

3. Then, brainstorm individually:
   a. Where do eggs come from?

   b. What type of birds lay eggs?

   c. What equipment and materials do you think chickens need to lay eggs?

4. Discuss your responses with your partner. Your answers will be verified during this topic.

Problem Solving Activity

Topic 2.1 Task 2:

1. Recall the equipment needed in the starter house from Topic 1.1. What do chicks use to eat and drink?

2. Layers also use this equipment and there are several different types. With a partner, try to match the feeder and drinker type to its image.

Feeder/Drinker Type		Photo	
1. Circular Feeder	**2.** Water Basin	**A.** 	**B.** 
3. Linear Feeder	**4.** Manual Drinker	**C.** 	**D.** 
5. Automatic Feeder	**6.** Automatic Bell Drinker	**E.** 	**F.** 
7. Grit Box Feeder	**8.** Nipple Drinker	**G.** 	**H.** 
		I.	**J.**

3. Read through **2.1 Key Facts** individually and do the following as you read:

- ✓ Check or tick the information that is the same for starters.
- ❖ Star any information that is new or different from starters.

2.1 Key Facts

- **Feeders**
  - Number of feeders depends on the number of birds
  - Feeders must be cleaned regularly to maintain bird health
  - **Automatic**:
    - Large feed troughs with chain devices to move the feed
    - Used in modern large chicken farms
    - Powered by electricity
  - **Linear**:
    - Straight line, birds can eat from both sides
    - Used in small scale farm systems
    - Can be made of locally available materials like wood, bamboo, used plastics, etc.
  - **Circular**:
    - In circular form, sometimes hanging
    - Used in any farming system
    - Semi-automatic: Feed moves to the bottom as it is eaten
    - Accommodates 30% more birds than linear feeder
  - **Grit Box:**
    - Separate feeder to provide calcium to layers
    - Can contain broken seashells (shell grit) or a mixture of small stones (flint grit)
    - Additional calcium improves eggshell production

- **Drinkers**
  - **Pan and Jar/Manual:**
    - Circular shape
    - Jar is filled with water
    - Pan is where birds drink from
  - **Water Basin:**
    - Basin with various diameters/sizes
    - Can be made of wood or plastic
    - Use metal grill so birds cannot enter or fall in water
  - **Automatic Bell:**
    - Connected to water pipeline
    - Maintains clean and continuous water flow

- **Nipple Drinker:**
    - Used in layers cages
    - Releases drops of water when pressed

- **Nests**
    - Space where eggs are laid
    - Made of baskets, pots, or cardboard boxes
    - Place in a secure, shady secluded place out of the sun, lined with fresh litter, and kept clean

- **Perches**
    - Place for birds to sit, sleep, observe, and avoid predators at night
    - Built horizontally and parallel to the wall
    - Length depends upon the number of birds
    - Birds lower in the social peck order can also use the perches during the day[10]

- **Installing Equipment**
    - **Procedures**
        1. Prepare equipment
        2. Ensure equipment and layer houses are clean
        3. Place equipment in house according to standards
    - **Systems**
        - Cage: Conventional way of housing poultry, high density of chickens
        - Alternative: Allow more movement and include perches
    - **Standards**
        - Linear feeders: 6 cm per bird
        - Pan feeders: 1 feeder per 25 birds
        - Nipple drinkers: 1 drinker per 10-12 birds
        - Other drinkers: 1 drinker per 75-100 birds
        - Perches: 15 to 20 cm per bird
        - Nests:
            - One nest for 5 hens
            - Larger communal nests: 50 hens per 1 m^2
            - Basket or pot nest dimensions: 25 cm base diameter, 18 cm high walls, and a 40 cm open top diameter

[10] Eco Chicks Poultry. (n.d.). *A list of poultry farming equipment and their uses*. https://ecochickspoultry.com/a-list-of-poultry-farming-equipments-and-their-uses/

- Wood nest dimensions: 30 cm on all sides, with a nest floor area of about 0.1 m^2[11]

Guided Practice Activity

Topic 2.1 Task 3:

1. Work through the following scenario and questions in small groups. Write down your answers and be prepared to present them to the rest of the class. Ask your trainer for help and clarification.

After starting a chicken farming project, Mrs. Karemera is going to receive layers from the nearby farmer who raises chicks. Today, Mrs. Karemera wants to start preparing the house that will host the 500 layers. In order to maximize the chance of success, he calls you as an expert in poultry farming and wants you to help select a feeder and drinker he should use.

a. Make a list of the different types of feeders she can use.

b. Draw a picture of each type of feeder to illustrate what it looks like to Mrs. Karemera.

c. Explain how each feeder works and recommend one type to her.

d. Explain how this type of feeder must be installed.

e. Make a list of the different types of drinkers she can use.

f. Draw a picture of each type of drinker to illustrate what it looks like to Mrs. Karemera.

g. Explain how each drinker works and recommend one type to her.

h. Explain how this type of drinker must be installed.

2. With your group, present your recommendations to Mrs. Karemera using the flipchart. Answer questions from the rest of the class. When other groups present, ask them 1-2

[11] Sandilands, V., & Hocking, P. M. (2010). *Alternative systems for poultry: Health, welfare and productivity*. CABI.

questions about their recommendation.

3. As a class, discuss the role of disinfection in the preparing the layers house.
   a. Do you think it is similar or different from disinfecting the chicks' starter room house? Why?

4. Are there any other materials or equipment you think are needed in a layer house? Refer to **2.2 Key Facts** to learn about disinfection procedures, litter, and physical parameters.

2.2 Key Facts

- **Disinfection Procedures:**
  Taken from Cornell College of Agriculture and Life Sciences' Small Farms Program:
  1. **"Dry Cleaning**
     - Remove dust and dirt from floors, equipment, perches, and walls by sweeping and wiping.
     - Remove feed, water, and litter.
  2. **Wet Cleaning**
     - Soaking: Completely cover with water until remaining dirt becomes soft
     - Washing: Use detergent and brush to remove all dirt.
     - Rinsing: Removes remaining detergent.
  3. **Drying**
     - Mop water from floor.
     - Open windows and doors to ventilate.
     - Use fan if possible.
  4. **Repairs**
     - Fix any problems with the building, such as holes where predators can enter.
  5. **Disinfecting**
     - Apply disinfectant by spraying or fumigating.
     - Dilute according to manufacturer's instructions."[12]

- **Litter**
  - Made of sawdust, wood shavings, rice hulls, straw and paper products.
  - Becomes mixed with manure and feathers over time.
  - Quality: soft and fresh, not too dusty, clean, and dry.

[12] Darre, M. (2014, April 7). *Cleaning and disinfecting your poultry house*. Cornell College of Agriculture and Life Sciences: Small Farms Program. https://smallfarms.cornell.edu/2014/04/cleaning-and-disinfecting-your-poultry-house/

- Deep litter system: Add new layers of litter to cover faeces on old layers
    - Layers should be 10 to 20 cm deep.
    - An ideal floor for a deep litter house must be well drained and made of concrete.[13]

- **Physical Parameters**
    - **Temperature**
        - High temperatures cause heat stress in birds
        - Use non-reflective materials so walls do not get too hot during the day
        - Over-crowding causes increased temperatures; give birds enough space to rest, eat, and drink
        - Provide adequate water

    - **Ventilation**
        - Ensure enough oxygen and removal of carbon dioxide
        - Direct incoming air down towards the birds to keep them cool.
        - Tunnel ventilation is the most effective system for large houses in hot weather
        - Natural ventilation involves breezes and winds to enter the building

    - **Lighting**
        - Affects sexual maturation rate and egg production
        - Light colour, intensity, and length all affect poultry health
        - Blue light calms birds
        - Artificial lighting can be candescent and fluorescent (more efficient)[14]

Application Activity

Topic 2.1 Task 4:

1. Before visiting a local poultry farm, complete the following tasks with a partner:

a. Discuss: Are the disinfection processes similar or different for chicks and layers? Explain the similarities and/or differences.

[13] Poultry Hub. (n.d.). *Poultry litter*. https://www.poultryhub.org/production/husbandry-management/housing-environment/poultry-litter/

[14] Glatz, P., & Pym, R. (n.d.). *Poultry housing and management in developing countries*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/a-al734e.pdf

b. Brainstorm**:** Where can litter be found in your community? How do you know if it is good quality?

c. Calculate: If the poultry house floor is 6 metres by 11 metres and you want to cover it with 10 cm of litter, how much litter do you need in cm^3?

2. Visit a local poultry farm with your class. Observe the following materials and equipment and take notes on how they are installed or arranged:

a. Feeders

b. Drinkers

c. Nests

d. Perches

e. Litter

3. Now, ask the farmer or another worker about the physical parameters in the layer house. How do they monitor the temperature, ventilation, lighting, and humidity?

4. Ask the farmer or your trainer any questions you have about preparing a layer house.

5. Share your notes from this activity with the trainer.

Points to Remember

- For layers, any housing problems may alter the productivity if it is not addressed or controlled.
- Every excess is bad, whether it is too much or too little. It is always important to refer to the standards.
- One mistake in house preparation house can harm layers all over their lifecycles.

Formative Assessment

1. Select **True** or **False** for the following statements:

a. Lighting in the layer house affects the rate of sexual maturation and egg production.

b. Nests should not be situated in a secure, shady secluded place out of the sun, lined with fresh litter and kept clean.

c. Linear feeders are in a circular form and can be hanging.

d. The quality of litter is not important if you have enough to cover the floor.

2. What are the 5 steps for disinfecting the layer house?

1.
2.
3.
4.
5.

3. What are the effects of high temperatures on layers? What causes these high temperatures?

4. What are nests and perches used for?

Topic 2.2: Receive layers

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe appropriate transportation and preparation for pullets	**1.** Organize transportation and prepare for pullets	**1.** Forward-thinking
2. Identify proper handling, health maintenance, and record keeping techniques	**2.** Carefully handle, check health, and keep records for pullets	**2.** Attentive
3. Explain the procedure of installing pullets in layers house	**3.** Install pullets in layers house	**3.** Methodical

Getting Started: What do we know and where are we going?

Topic 2.2 Task 1:

1. Think back to Topic 1.2: Receive chicks. Individually brainstorm responses to the following questions:

a. What equipment was needed to transport chicks?

b. Do you think layers require the same equipment? Why or why not?

c. What factors were considered for transporting chicks?

d. Do you think the same considerations exist for layers? Why or why not?

2. Share your answers with a partner. Compare your ideas and explain your reasoning.

Problem Solving Activity

Topic 2.2 Task 2:

1. Consider the following questions. Discuss them with a partner.
   a. What are pullets?

   b. How are they different from chicks?

   c. How are they different from layers?

2. Verify your answers with the trainer.

3. Continue discussing with your partner:
   a. What is the proper way to handle a fully-grown bird? Demonstrate how to do this using an item in the classroom.

   b. What could happen if a bird is handled incorrectly?

4. Three volunteers can demonstrate their bird handling techniques to the full class. As a class, vote on which method is the best.

5. Once again with your partner, consider:
   a. Why is it important to assess animal health before transporting?

   b. Why is it important to assess animal health after transporting?

   c. What kind of information should you collect and record about incoming animals?

6. Discuss your responses to the Question 5 with the rest of the class.

7. Now refer to **2.3 Key Facts**. Verify your answers from the discussion.

2.3 Key Facts

- **Pullets**
  - Young hens, less than 1 year old
  - Has not yet started to lay eggs
  - Fully grown but still developing to reproduce

- **Layers**
  - Special species of hen
  - Raised from 1 day old
  - Lay eggs from 18-19 weeks old to 72-78 weeks old
  - May lay white or brown eggs depending on the breed[15]

- **Transportation**
  - Factors: Health status, age, stocking rates, climate, transit distances
    - Consideration of these factors is important for transportation
  - Poor transportation may lead to stress, bruising, suffocation, heat stroke, exhaustion, fighting, injuries, and more[16]

- **Organization**
  - Equipment: vehicles, crates
  - Divide flocks into small groups and then into crates
  - Plastic crates can be stacked on top of each other and re-used after being washed
  - Remove sharp edges, protrusions, hinges, or latches from entering the crates
  - Crates should be transported in an upright position
  - Make sure there is adequate ventilation and enough space for the birds to sit down and move their heads
  - Make sure you have adequate facilities to place your chicken in, before you unload them.

- **Handling and Health**
  - Catching and handling birds can be very stressful for them and for you
  - Pick birds up by their legs and prevent flapping wings from hitting solid objects
    - Avoid picking birds up by their wings, neck, head, or tail
  - Birds that are visibly sick, injured, or wet, or unfit for transport, must not be loaded

[15] Growel Agrovet Private Limited. (2015, March 10). *Layer poultry farming guide for beginners*. https://www.growelagrovet.com/layer-poultry-farming/

[16] Chambers, P. G., & Grandin, T. (2001). *Guidelines for humane handling, transport and slaughter of livestock: Chapter 6: Transport of livestock*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/x6909e/x6909e08.htm

- Carefully inspect your birds to ensure they have not sustained any injury during transportation and handling.

- **Installation Procedures**
  1. Check and record health status of the pullets
     - Compare the rearing system of provenance and the one of new destination; the systems should be similar to maintain animal health
  2. Loading
     - Preferably late in the afternoon
     - Handle birds carefully to prevent injuries
  3. Transport
     - Preferably during the night when it's cooler and darker, so the birds can be at rest
  4. Unloading
     - Should occur as soon as possible upon arrival at your destination
     - Preferably in the early morning
     - Unload chicken into an enclosed pen or cage with direct access to food and water
     - Space should already be thoroughly cleaned and disinfected

- **Record Keeping**
  - Essential to poultry management
  - Kept daily to ensure accuracy
  - Information to record:
    - Health problems
    - Disease outbreaks
    - Abnormal conditions and causes (if known)
    - Actions taken, such as vaccinations

Guided Practice Activity

Topic 2.2 Task 3:

1. In small groups, consider the following scenario and discuss the questions that follow. Write your responses to the questions.

   As a trained poultry farmer, after raising and brooding chicks, you receive a purchasing order from a newly interested farmer who wants to produce and sell eggs. The farmer

orders 500 hundred pullets of 8 weeks of age. He has already performed all the appropriate preparations. He asks you to help transport the pullets to his farm and help him with their installation in the prepared house. The farmer needs you to demonstrate this process while teaching him so that he can do it by himself next time. To begin, help him by answering these questions:

a. What are the main factors to consider while transporting pullets?

b. How can I organize a transport so that I get good results?

c. What are the steps to follow during installation of pullets?

d. Should I check to see if the pullets are healthy? Why?

e. Should I keep records? Where do I start and where do I end up?

2. Develop a presentation of your advice to the farmer with your group. Make sure each person has an opportunity to speak.

3. Present your advice to the rest of the class. Allow the class to give feedback on any missed details or requirements. Listen and give feedback to other groups as well.

Application Activity

Topic 2.2 Task 4:

Visit a local poultry farm, preferably one that has transported layers to or from the farm.

1. Ask the farmer or another worker about how they conduct these 5 activities: preparation of the layer house, transportation, handling, installation, record keeping. Fill in their answers in the chart below under “Finding on field visit.”

Activity	Finding on field visit	Compare to Key Facts and class discussions
Preparation		
Transportation		

Handling		
Installation		
Record Keeping		

2. Then, observe the area where the chicks and/or layers are kept. Add any additional notes and observations to the "Finding on field visit" sections.

3. Now, add in your own comparison of what was taught in the Key Facts and class discussions to what the farmer or their staff has said.

a. Are the processes the same?

b. Are they different? How? What does the farmer do differently?

4. Finally, as a class, ask the farmer or another worker to explain some of the differences you have observed. Note the explanations below.

Points to Remember

- **DO NOT:** Carry chickens by their head, neck, wings or tail; transport birds in bags; transport birds with their legs tied; transport birds in the boot or trunk of a car; mix different species of chicken in a single crate/cage during transport.
- Source pullets from suppliers that are near the laying facility to minimize transportation time.

Formative Assessment

1. Complete the following sentences:

a. It is preferred to load pullets late in the …… and transport at ……. when it's cooler and ……. outside.

b. Never mix different ……. of chickens in a single crate during transport.

c. The layer house should already be thoroughly cleaned and ……. before unloading begins.

d. …….. ……. is essential to poultry management and should be kept every …….

2. Madam Muhoza is farmer willing to start her business of chicken farming at Huye District, Southern Province. Recently she ordered 600 pullets of six weeks old from a supplier company located in Rulindo District, Northern Province. Give some tips for transporting, handling, and installing the pullets in her layer house.

a. Transportation:

1.

2.

b. Handling:

1.

c. Installing:

1.

2.

Topic 2.3: Distribute feed and water

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify appropriate feed and water for layers	**1.** Select high quality feeds and water for optimal animal health	**1.** Attentive
2. Determine the appropriate quantities of feed and water for chickens	**2.** Calculate the quantities of feed and water needed based on the number of chickens	**2.** Accurate
3. Explain methods of cleaning feeding equipment and record keeping	**3.** Properly clean feeding equipment and keep records to ensure animal health	**3.** Methodical

Getting Started: What do we know and where are we going?

Topic 2.3 Task 1:

1. Brainstorm responses to the following questions individually:
    a. What are nutrition and malnutrition? What do you think they are?

    b. Have you ever seen a person or animal suffering from malnutrition problems?

    c. What do you think about a chicken with malnutrition problems?

    d. What do you think causes malnutrition in chickens?

    e. What can you do to prevent your chickens from malnutrition and its consequences?

2. Share your ideas with a partner. Explain your reasoning.

3. Discuss nutrition and its relationship to raising chickens with the rest of the class.

Problem Solving Activity

Topic 2.3 Task 2:

1. In small groups, recall Unit 1: Raise chicks, Topic 4: Distribute Feed and Water. Apply your knowledge from raising chicks to raising layers.

a. How do you know how much feed and water to provide to layers?

b. Does the quantity of feed and water increase, decrease, or stay the same when the number of layers increases?

c. What materials do you need to calculate the amount of feed and water needed?

d. Based on the chart below, predict that amount of water needed for 100 chickens that are 3 weeks old:

Water For 100 Chickens		
Age (weeks)	**Daily consumption (litres)**	**Water space (m)**
0 - 1	3	0.7
2 - 4		1.0
4 - 9	20	1.5

2. Discuss your group's ideas with the rest of the class.

3. Now, with your group members, consider what you know about animal health. Predict:

a. What are important factors when considering which feed and water to provide to your chickens?

b. How can you assess the quality of feed and water?

c. What might happen if your chickens are given poor quality feed and water, or if the feeders and drinkers are not cleaned properly?

4. Discussion prevention methods to avoid chicken malnutrition with the class.

2.4 Key Facts

- **Quality of Feeds**
  - **Significance**: All birds must receive feed that meets their daily nutrient requirements to maintain good health, meet physiological demands, and avoid metabolic and nutritional disorders/diseases
  - **Balanced Diet**: Check ingredients and nutrient composition
    - Nutrient deficiencies can adversely affect the growth of pullets and the level of production of layers.
  - **Physical Evaluation**: Get basic information on material, including weight, colour, smell, and if there has been any contamination by other materials
    - Feed that has become stale, mouldy, or contaminated must not be used, and must be replaced immediately.
  - **Chemical Evaluation**: Feed is made up of water and dry matter. Check for organic and inorganic compounds.
    - Need a laboratory to take samples

  Information from: https://poultry.extension.org/articles/poultry-management/raising-chickens-for-egg-production/

- **Quality of Water**
  - **Significance**: Helps regulate body temperature, digest food, and eliminate wastes
  - **Physical Evaluation**: Colour, taste, and odour of water; drinking water must be clear, tasteless, odourless, and colourless.
  - **Chemical Evaluation**: Presence of bacteria or other microbes is an indication of contamination

- **Quantity of Feeds and Water**
  - At normal temperatures, chickens typically consume twice as much water as feed.
  - During periods of high temperature, water consumption can double or quadruple. To remain healthy, chicken flocks require water of adequate quality and quantity.

- **Quantity and Distribution**

Feed For 100 Chickens		
Age (weeks)	**Daily feed consumption (kg)**	**Feeder space (m)**
1 - 4	1.4 - 5.0	2.5
4 - 6	3.2 - 7.3	3.8
6 - 9	5.0 - 9.5	6.1
10 - 14	7.3 - 15.9	9.6
15 – 19	9.1 - 11.4	12.7
Layers	12.0-13.0	13

  - Access to feed must always be provided and delivered in ways that minimize aggression, poor body condition, and injuries

Water For 100 Chickens		
Age (weeks)	**Daily consumption (litres)**	**Water space (m)**
0 - 1	3	0.7
2 - 4	10	1.0
4 - 9	20	1.5
9 or more	25	2.0
Layer	50	2.5

  - Provide enough drinkers so that most birds can drink frequently, especially in warm weather
  - Keep water cool in warm weather
  - Drain and clean water lines regularly
  - Ensure that birds are drinking after placement and that equipment is functioning properly
  - Adjust water pressure and drinker height as necessary
  - Use the same type (e.g. nipple, cups) of drinker in both the pullet and layer barns

- **Cleaning Feeders and Drinkers**
  - Remove from the flock

- Remove old/leftover feed and water
- Clean and disinfect using fresh water and available disinfectant
    - Use nontoxic cleaners
- Dry, leaving them in the sunshine when possible
- Replace in house according to the standard spacing

- **Record Keeping**
    - Record feed and water consumption daily
        - Install a water meter to assist with monitoring consumption rates
    - Record body weight, egg quality, and egg production to monitor the effectiveness of the feeding system
    - Record body weight to monitor growth rates

Guided Practice Activity

Topic 2.3 Task 3:

1. In small groups assigned by your trainer, read through the following scenario and discuss the questions.

After completing a training on entrepreneurship, Miss Mukamana got a sponsorship from the government through the Business Development Fund (BDF).

The funder asked her to present a business plan of the project she wishes to do. She chose a chicken farming project, raising 2000 layers. She has drafted the business plan, but she is missing the feeding part.

She decided to call you for an assistance to complete the plan. She needs your help answering the following questions:

a. How can I identify good quality feed and water for the chickens?

b. How much feed and water do I need for the number of layers I have?

c. How much space should be between each feeder and drinker for the layers?

d. How will I clean the feeders and drinkers?

e. What information should I include in my records?

2. After completing the project document, Mukamana received the funds and started the project. Now you are preparing to visit her at her farm. At the same time, the school where you were trained wants you to guide other new trainees based on the success story of Mukamana.
   a. Collaborate with your group members to write a manual for distributing feed and water to layers.

   b. Use your own words. Do not re-write the exact information from **2.4 Key Facts**. Determine the most important information. Feel free to add any additional knowledge you have from your own experiences.

   c. Be sure to address the questions above, including quality of feed and water, quantity of feed and water, equipment and/or tools needed, record keeping, and cleaning procedures.

3. Submit your manual to the trainer for review. After reviewing the document, your trainer will give feedback including areas for improvement.

Application Activity

Topic 2.3 Task 4:

1. Visit a local poultry farm with your class.

2. Using the available materials and equipment, practice the following in small groups and with the assistance of the trainer, the farmer, and other workers:
   a. Identify feed and water sources.

   b. Clean the feeders and drinkers.

   c. Weigh feeds and measure the quantity of water needed according to the number of layers.

   d. Distribute feeds and water.

   e. Observe farm records and take records on egg quality and production.

3. Ask the farmer or another worker any questions you have about distributing feed and water to layers.

4. After the field visit, discuss your experiences with the class.
   a. What did you learn?

   b. What surprised you?

   c. What information would you still like to know?

Points to Remember

- Never re-distribute leftover water and feeds.
- Always check the way feeds are stored and verify if they are not contaminated before distribution.
- Always check the packaging to ensure chickens are receiving the correct type of feed based on their age.

Formative Assessment

1. Circle the correct answer for the following questions:

   1. Which of these is NOT recorded to measure effective feeding:
      a. Body weight
      b. Egg quality
      c. Shelter construction
      d. Egg production

   2. Water should be distributed and/or available:
      a. Once per day
      b. Twice per day
      c. Only at night
      d. At all times

   3. Which of these is NOT assessed during a physical evaluation of feed:
      a. Weight, colour, and smell
      b. The type of feed (i.e. grower or layer feed)
      c. If there is any contamination
      d. Presence of bacteria or microbes

2. Select **True** or **False** for the following statements:

a. Access to feed minimizes aggression, poor body condition, and injuries.

b. The quantity of feed and water stays the same when the number of birds increases.

c. Leftover or old feed can be redistributed to birds without any problems.

d. Feeders and drinkers should be drained, cleaned and disinfected regularly.

3. Complete the following sentences:

a. In warmer temperatures, the quantity of ……. consumption increases.

b. Contamination of water is indicated by the presence of …… or other microbes.

c. Water helps regulate body ……., digest food, and eliminate ……

Topic 2.4: Monitor physical parameters

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe the importance and factors of ventilation and light intensity in the layer house	**1.** Monitor ventilation and lighting in the layer house and interpret influencing factors	**1.** Diligent
2. Determine and explain the impact of humidity and temperature levels on layers	**2.** Monitor and adjust humidity and temperature levels in the layer house	**2.** Persistent
3. Explain the impacts of carbon dioxide and how to detect it	**3.** Determine the level of carbon dioxide and set the needed level in the layer house	**3.** Proactive

Getting Started: What do we know and where are we going?

Topic 2.4 Task 1:

1. Individually, recall the physical parameters monitored in the chick house from Unit 1. What were they? What tools do we use to measure them?

Physical Parameter	Measurement Tool
1.	**1.**
2.	**2.**
3.	**3.**
4.	**4.**
5.	**5.**

2. With a partner discuss:

a. What are the impacts of physical parameters on chicks' health?

b. Do you think they are the same for layers?

c. Why or why not?

Problem Solving Activity

Topic 2.4 Task 2:

1. Consider the importance of air quality by performing the task and discussing the questions with a partner:
   a. Try to stop breathing for 2 minutes.

   b. What happens?

   c. What factors make it difficult for you to breathe?

   d. Why is clean, fresh air important for human health?

   e. Why do you think it is also important for chicken health?

   f. What factors make it difficult for chickens to breathe?

   g. How do you know if a chicken is having difficulty breathing?

2. Using what you know from Topic 1.4: Monitor physical parameters in a chick starter house, how do you think we can monitor the physical parameters in a layer house?
   1. Ventilation:

   2. Lighting:

   3. Humidity:

   4. Temperature:

   5. Carbon Dioxide:

3. Read through **2.5 Key Facts** with a partner and discuss the different between the physical parameters for starters and layers.

2.5 Key Facts

- **Factors that influence physical parameters:**
  - Local climate
  - Space in and construction of animal shelter
  - Flock size
  - Management system

- **Ventilation**
  - Measurement tool: barometer (air pressure)
  - Provides fresh air and removes stale, contaminated air
  - Assists in managing temperature, humidity, and gases (e.g. ammonia, methane, carbon dioxide, and carbon monoxide), and dust
  - Prevents moisture which affects litter quality
  - Ammonia (NH_3) is a hazardous, invisible gas that enters the air through animal manure/faeces and harms birds by decreasing growth and production rates
    - Ammonia problems are more likely to occur in early morning and during the winter, when humidity levels may be higher[17]

- **Lighting**
  - Measurement tool: photometer (light intensity)
  - Average light intensity: 5 lux
  - Establish a regular lighting schedule that provides a minimum of 8 hours of darkness per day in houses with artificial light
  - Reduce light intensity to prevent or stop injurious behaviour, such as cannibalism and feather pecking
  - Avoid areas of direct sunlight or intense brightness inside the barn
  - Measure and record light intensities on a regular basis using reliable equipment

- **Temperature**
  - Measurement tool: thermometer (degrees/heat intensity)
  - Layers are warm blooded and have constant body temperature
    - Average body temperature: 41°C and 42.2°C
  - Monitor temperature
    - By observing behaviour, abnormal body position, extern abnormalities, abnormal plumage/feathers, coughing/sneezing, activeness
    - Signs of cold stress: birds huddle together
    - Signs of heat stress: birds start panting

[17] Karimi, M. (2019, July 24). *5 tips to successfully manage poultry house ammonia levels*. Biomin. https://www.biomin.net/science-hub/5-tips-to-successfully-manage-poultry-house-ammonia-levels/

- Adjust feed intake depending on temperature
    - Cold temperatures: increase feed
    - Hot temperatures: decrease feed[18]

- **Humidity**
    - Measurement tool: hygrometer
    - Optimal relative humidity is 60-80%
    - Produced by:
        - Outside temperature compared to inside temperature
        - Moisture from heaters
        - Chickens breathing
    - Monitor by observing how moist or dry the layer house feels
        - Moist: wet litter
        - Dry: dust or other particles in the air

- **Carbon Dioxide (CO_2)**
    - Measurement tool: Carbon dioxide meter/sensor
    - Chemical compound/gas that is deadly at high concentrations
    - Can't be smelled (unlike Ammonia)
    - Produced from air exhaled by birds
    - Affects respiratory/breathing ability of birds
    - Control methods:
        - Good ventilation system and mixing of incoming air with the house air
        - Odour control chemicals: eliminate gases, but decrease temperature and increase humidity

Guided Practice Activity

Topic 2.4 Task 3:

1. In small groups, read the following scenario and respond to the questions.

Mr. Mukiza is a farmer raising 6,000 layers installed in 6 consecutive rooms. After one month, he observed some abnormal signs from the reports compiled from the record keeping books. Here are some of the signs:

a. Difficulty breathing for approximately ¾ of the layers most of time during the middle of the day.

[18] Poultry Hub. (n.d.). *Climate in poultry houses*. https://www.poultryhub.org/production/husbandry-management/housing-environment/climate-in-poultry-houses/

b. The presence of an unusual, bad smell during morning that increases gradually throughout the day.

c. Decreased feed and water consumption.

d. Some cases of cannibalism.

2. Mr Mukiza thinks these abnormalities are linked with physical parameters in the farm, but he is not able to solve the problem. Now he calls you, a trained expert, to help him answer the following questions:

a. Which physical parameters could be affecting the birds in each situation? How do you know?

Situation	Parameter	Reasoning/Evidence
i.		
ii.		
iii.		
iv.		

b. Going forward, how can he monitor:

i. the ventilation system?

ii. the light intensity?

iii. the temperature?

iv. carbon dioxide and levels of other gases?

Application Activity

Topic 2.4 Task 4:

Visit a local poultry farm.

1. Separate into 5 groups, one for each physical parameter. The trainer will assign your group a physical parameter.

2. Use the table to monitor and assess your assigned parameter. Is it too high or too low? Are the chickens comfortable? Then add suggestions for improving the state of this parameter.

3. Follow your trainer's instructions to rotate parameters. Repeat until you have observed all 5 parameters and the table is completed.

Physical Parameter	Assessment	Suggestions for Improvement
Ventilation		
Lighting		
Temperature		
Humidity		
Carbon Dioxide/Gases		

4. Ask the farmer or another worker any remaining questions you have about monitoring physical parameters in a layer house.

Points to Remember

- Ventilation is the key factor that differentiate the chicken house from the other houses.
- Carbon dioxide cannot be detected by odour or by smell and it is deadly in high concentrations.

Formative Assessment

1. Select **True** or **False** for the following statements:

a. Both the ammonia and dioxide carbon can be detected by smell.

b. A good ventilation system is an effective way to eliminate harmful gases in the layers houses.

c. In layers houses, you should only record maximum inside temperatures daily.

2. Complete the following sentences:

a. ……. can be produced by water vapour from heaters and chickens breathing.

b. A …… is used to measure and record light intensities on a regular basis.

c. When experiencing ……. stress, birds tend to huddle together.

d. Cannibalism and feather pecking can sometimes be stopped by reducing …….

3. What are two factors that influence physical parameters?

1.

2.

Topic 2.5: Ensure egg quality

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe factors for grading eggs according to standards	**1.** Grade eggs according to standards	**1.** Detail-oriented
2. Explain the techniques for storing eggs according to standards	**2.** Store eggs according to standards	**2.** Attentive
3. Describe methods of collecting and packaging eggs	**3.** Package and collect eggs according to standards	**3.** Methodical

Getting Started: What do we know and where are we going?

Topic 2.5 Task 1:

1. Imagine and consider the following questions:
   a. Have you ever cooked an egg before to eat?

   b. What did it look like outside and inside?

   c. Where did you buy it from and where was it being stored?

2. Share your ideas with a partner.

3. Continue discussing with your partner: How do you know the difference between a good egg and a bad egg? Explain.

Problem Solving Activity

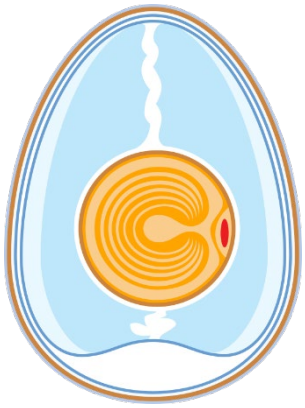
Topic 2.5 Task 2:

1. Complete the first two exercises individually. First, identify the parts of an egg. Draw a line from the term to its location in the egg.[19]

Air cell

White

Yolk



[19] Png Wing. (n.d.). *Chicken eggshell anatomy bird egg* [Illustration]. https://www.pngwing.com/en/free-png-nhoxc

2. Put the following egg processes in the correct order:

Storage	Collection
Packaging	Grading

1.
2.
3.
4.

3. Verify your answers to Questions 1 and 2 with the trainer.

4. In small groups, discuss: Why do you think it's important to grade, or assess the quality, of eggs before selling them?

a. What are the advantages of grading?

b. What are the risks of not grading?

5. Now, consider with your group: How do you think we can assess the quality of the *inside* of an egg (without breaking it open)? Be creative!

6. Share your ideas with the rest of the class.

7. Read through **2.6 Key Facts** to verify your answers.

2.6 Key Facts

- **Collection**
  - **Equipment**: simple basket, filler tray, and/or polystyrene (foam) packages
  - **Nests**:
    - Keep the nests as dark and cool as possible,
    - Maintain a thick and comfortable layer of litter in the nests,
    - Make sure the nests can be reached easily,
  - **Process**:
    - The typical production cycle lasts about 13 to 18 months (58 to 72 weeks)
    - Hygienic practices should be used to protect the egg from surface moisture in order to minimize microbial growth
    - Eggs should be collected and handled in a manner that minimizes contamination and/or damage to the egg or eggshell
    - Collect frequently

        - Prevents hens from brooding eggs or trying to eat them
        - Prevents the eggs from becoming damaged or dirty
    - Separate cracked, broken, or dirty eggs
        - Broken eggs and incubator eggs should not be used for human consumption and be disposed of in a safe manner[20]

- **Grading**
    - **Quality**
        - **Exterior:** Shell colour, shell shape, eggs size, soundness of shell, and shell cleanliness
        - **Internal:** Air cells (depth of air cells determines its quality), egg yolk**,** egg whites and spots

    - **Internal Quality Standards:**
        - From AA (high quality) to B (lowest quality) to inedible (cannot be sold or consumed)[21]

Quality Factor	AA Quality	A Quality	B Quality	Inedible
Air Cell	.318 cm or less depth	.476 cm less in depth	More than .476 cm	Doesn't apply
White	Clear Firm	Clean, may be reasonably firm	Clean may be weak and watery	Doesn't apply
Yolk	Outline slightly defined	Outline may be well defined	Outline clearly visible	Doesn't apply
Spots (blood or meat)	None	None	Blood or meat spots aggregating not more than 1/8 in diameter	Blood or meat spots aggregating more than 1/8 in diameter

    - **Advantages:**
        - Aids orderly marketing by reducing waste, confusion, and uncertainty with respect to quality values
        - Facilitates quality standardization throughout the world
    - **Method 1: Candling**

[20] Food and Agriculture Organization of the United Nations. (2003). *Egg marketing: A guide for the production and sale of eggs: Chapter 1: Egg production*. https://www.fao.org/3/y4628e/y4628e03.htm

[21] Pescatore, T., Jacob, J., & Cantor, A. (2011, February). *Grading table eggs*. University of Kentucky College of Agriculture. https://www.extension.iastate.edu/story/sites/www.extension.iastate.edu/files/story/4-Hprojects/Poultry/1%20Grading_table_eggs.pdf and User:EricT_CulinaryLore. (2018, March 4). *How do they decide whether an egg is grade AA, A, or B?* Culinary Lore. https://culinarylore.com/food-science:how-is-the-quality-of-eggs-determined/

    - Only method of testing for internal and external quality without breaking eggs
    - Inspect an egg with a beam of light that makes the interior quality visible
    - Example: Place a candle in a dark room and position an egg in front of the flame to look at the interior quality
  - **Method 2: Water Test**
    - Put eggs in a bucket of water to see if they float
    - Fresh eggs sink; old eggs float
- **Storage**
  - **Temperature and Humidity**:
    - Ideally 10°C or lower
    - Realistically between 10 to 15°C at all times
    - At 80% relative humidity
  - **Spaces**:
    - Use insulated containers or vehicles during transport
    - If they must be stored in hot weather without cooling, transport to the market at least every third day
    - Do not leave in the sun or a very hot room
    - Keep storage rooms well-ventilated
  - **Cleaning**:
    - Washing eggs removes layer that protects from bacteria and keeps moisture inside
      - Eggs are 74% water and lose moisture easily, eventually shrinking in size
    - Dry cleaning is preferred: rub dirty areas with rough cloth or steel wool
    - Wet cleaning only when water is warm, and detergents or disinfectants are non-toxic
      - Complex and expensive
      - Not recommended
  - **Raw and Cracked Eggs:**
    - Raw eggs may be frozen after cracking and separating egg whites from yolks
    - Cracked eggs should be processed or packaged as soon as possible after collection[22]

- **Packaging**
  - **Requirements/Equipment:**
    - Placed in cardboard or plastic trays and packed in boxes or cases

[22] Sonaiya, E. B. (2004). *Small-scale poultry production: Chapter 9: Marketing*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/y5169e/y5169e0a.htm

OR

- Packed with rice husks, wheat husks, chopped straw in firm baskets or crates

- **Advantages**
  - Proper packaging prevents breakage
  - Can transport eggs long distances to sell[23]

Guided Practice Activity

Topic 2.5 Task 3:

1. In small groups, read the scenario and discuss responses to Mr. Mukiza's questions:

Mr. Mukiza is now in the production phase. His chickens are producing well. However, Mr. Mukiza's farm is located a bit far from the big market. For this reason, before supplying his clients, he first collects eggs from the farm, stores them, grades them, and transports them.

During this process, he has observed some financial and egg losses. Mr Mukiza wants now to hire you to help solve the problem.

He asks you the following:

a. What are the techniques for packaging eggs?

b. Is it necessary to grade eggs? If yes, what are the advantages?

c. What factors should be considered when storing eggs?

2. Share your group's ideas with the rest of the class. Give as much detail as possible.

3. Now, consider with your groups:

Mr. Mukiza shows you some of his eggs.

a. Determine which grade the eggs are based on the yolks:

[23] Food and Agriculture Organization of the United Nations. (2003). *Egg marketing: A guide for the production and sale of eggs: Chapter 3 - Egg packaging, transport and storage*. https://www.fao.org/3/Y4628E/y4628e05.htm

 [24]

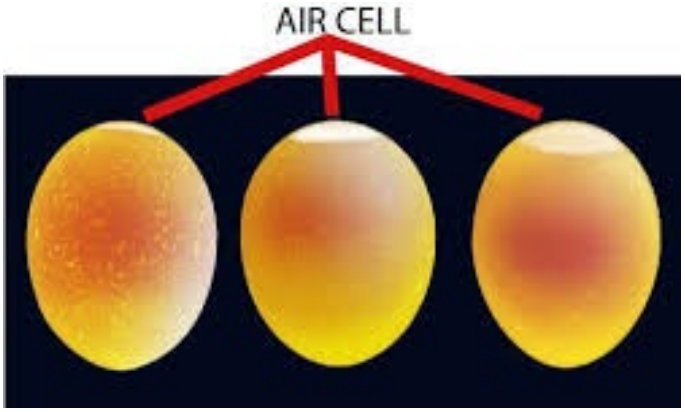
1 ***2*** ***3***

1. Outline slightly defined
   Grade: …….

2. Outline well defined
   Grade: ……

3. Outline clearly visible
   Grade: …….

b. Determine which grade the eggs are based on the air cells:



[25]

Grade: …… Grade: ……. Grade: ……

4. It appears that most of Mr. Mukiza's eggs are good quality. Then why is he experiencing so many losses?
   a. Consider how he is storing and packaging the eggs.

5. Share your group's assessments from Question 3 and ideas from Question 4 with the rest of the class.

[24] User:EricT_CulinaryLore. (2018, March 4). *How do they decide whether an egg is grade AA, A, or B?* Culinary Lore. https://culinarylore.com/food-science:how-is-the-quality-of-eggs-determined/
[25] User:EricT_CulinaryLore. (2018, March 4). *How do they decide whether an egg is grade AA, A, or B?* Culinary Lore. https://culinarylore.com/food-science:how-is-the-quality-of-eggs-determined/

Application Activity

Topic 2.5 Task 4:

Visit a local shop that sells eggs.

1. Observe how the eggs are stored.

2. Select representatives to ask the seller the following questions. Everyone should write the responses. Add three of your own questions at the end.

Question	**Answer**
Where do your eggs come from?	
When did you receive these eggs?	
How were the eggs transported to you? How were they packaged?	
Do you test the quality of the eggs before buying them? If yes, how?	
Question	**Answer**
What advice do you have for grading, storing, and packaging eggs?	

Points to Remember

- Eggs are fragile and can get quickly contaminated. They need special attention.
- A contaminated egg is very dangerous to human life.

Formative Assessment

1. Identify and describe the two methods for grading eggs.

1.

2.

2. What are two factors that describe an AA Grade quality egg?

1.

2.

3. Complete the following sentences:

a. Be careful when wet cleaning eggs, because washing them with water removes the layer that protects from ……. and keeps ……. inside.

b. If eggs must be stored in hot weather, you should transport them to the market at least every ……. day.

c. Eggs should be collected …… to prevent them from becoming damaged, dirty, or eaten.

Self-Reflection

1. You have come to the end of the unit. You are going to do the survey you did at the beginning of the unit again to help you do self-assessment of your knowledge, skills and attitudes.

Again, there are no right or wrong answers to this survey. It is for your own use to gauge your knowledge, skills and attitudes after the unit. Read the Knowledge, Skill or Attitude in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation.

My experience **Knowledge, skills and attitudes**	**I don't have any experience doing this.**	**I know a little about this.**	**I have some experience doing this.**	**I have a lot of experience with this.**	**I am confident in my ability to do this.**
Describe and install the equipment in layers house					
Explain disinfection procedures for layers house					
Establish litter and physical parameters according to standards					
Describe appropriate transportation and preparation for pullets					
Carefully handle, check health, and keep records for pullets					
Explain the procedure of installing pullets in layers house					

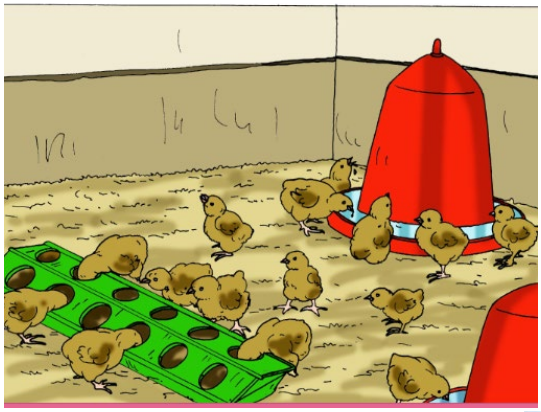
My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Select high quality feeds and water for optimal animal health					
Determine and calculate the quantities of feed and water needed based on the number of chickens					
Explain methods of cleaning feeding equipment and record keeping					
Describe the importance and factors of ventilation and light intensity in the layer house					
Monitor ventilation and lighting in the layer house and interpret influencing factors					
Determine and explain the impact of humidity and temperature levels on layers					
Monitor and adjust humidity and temperature levels in the layer house					
Explain the impacts of carbon dioxide and how to detect it					

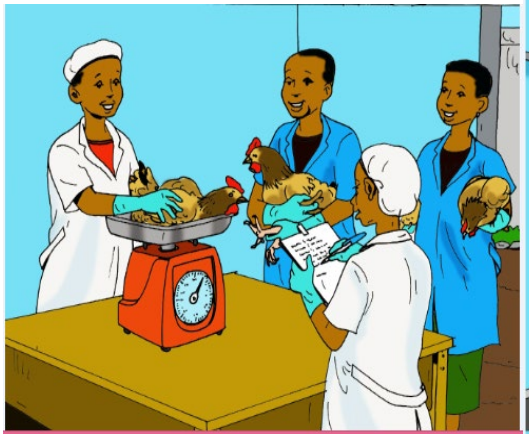
My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Determine the level of carbon dioxide and set the needed level in the layer house					
Describe factors for grading eggs according to standards					
Grade eggs according to standards					
Explain the techniques for storing eggs according to standards					
Describe methods of collecting and packaging eggs					

2. Complete the table below by identifying areas from the unit where you have improved and where you need improvement with the actions/strategies you will use to help you improve when receiving and interpreting information at the workplace

Areas of strength	Areas for improvement	Actions to take to improve
1. **2.**	**1.** **2.**	**1.** **2.**

Unit 3: Raise broilers





Topics

3.1 Prepare broilers house

3.2 Receive broilers

3.3 Distribute feed and water

3.4 Monitor physical parameters

3.5 Perform slaughtering

Unit Summary:

This unit describes the skills, knowledge, and attitudes required to raise broilers chicken. At the end of this unit, trainees will be able to prepare broiler houses, receive broilers, distribute feed and water, monitor physical parameters, and perform slaughtering.

Self-Assessment: Unit 3

1. Look at the illustration. What is happening? What do you think this unit will be about? What topics might be covered?

2. Fill in the self-assessment below.

There are no right or wrong ways to answer this survey. It is for your own use during this course. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation. At the end of this unit, we'll take this survey again.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Describe the installation process of equipment in broiler houses					
Explain the disinfection process of broiler houses					
Explain litter and physical parameter management in broiler houses					
Install materials and equipment in broiler houses					
Disinfect broiler houses					
Establish physical parameters and manage litter in broiler houses					
Describe best practices for organizing transportation of broilers					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Maintain broiler health by handling and checking them appropriately					
Describe and follow broiler installation and record keeping procedures					
Assess the quality of feeds for broilers					
Determine adequate quantity feeds for broilers by calculation and weighing					
Distribute feed and water to broilers according to farming standards					
Describe the standards for lighting and ventilation in the broiler house					
Monitor lighting and ventilation in the broiler house					
Describe the standards for temperature and humidity in the broiler house					
Regulate temperature and humidity levels in the broiler house					
Describe the standards for carbon dioxide levels in the broiler house					
Detect and monitor carbon dioxide in the broiler house					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Explain the different slaughtering techniques					
Describe the methods for storing chicken meat					
Explain the factors for meat transportation					

Topic 3.1: Prepare broiler houses

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe the installation process of equipment in broiler houses	**1.** Install materials and equipment in broiler houses	**1.** Methodical
2. Explain the disinfection process of broiler houses	**2.** Disinfect broiler houses	**2.** Proactive
3. Explain litter and physical parameter management in broiler houses	**3.** Establish physical parameters and manage litter in broiler houses	**3.** Detail-oriented

Getting Started: What do we know and where are we going?

Topic 3.1 Task 1:

1. So far, you have learned how to raise starter chicks and egg layer hens.

a. What is the age and purpose of starter chicks?

b. What is the age and purpose of layers?

2. This unit is about broiler chickens. Tick which statements are true about broilers:

- ❑ Broiler chickens are raised for their meat.
- ❑ Broiler chickens are raised for their eggs.

- ❑ Broiler chickens are typically slaughtered at 10 weeks of age
- ❑ Broiler chickens are typically slaughtered at 6 to 7 weeks of age
- ❑ Broilers are females only.
- ❑ Broilers are males and females.

3. Verify your answers to questions 1 and 2 with the trainer.

4. Discuss with a partner:
   a. Where do you find chicken meat to eat in your community?

   b. Where does the meat come from?

Problem Solving Activity

Topic 3.1 Task 2:

1. Let's explore the differences between layers and broilers. Using what you have learned about layers and what you may already know about broilers, discuss with a partner:
   a. Do you think broilers use the same equipment as layers? Why or why not?

   b. Do you think the disinfection process for broiler houses is the same as for layer houses? Why or why not?

   c. Do you think the physical parameters are the same for broilers and layers? Why or why not?

2. Now, brainstorm with your partner: What do you think are the key differences between broilers and layers? Consider their sex, age, and purpose.

3. Discuss your ideas and predictions with the rest of the class.

4. Finally, let's review proper disinfection techniques based on your prior knowledge.
   a. Put the steps for disinfection in the correct order:

Wet cleaning: Soaking, washing, rinsing	**1.**
Drying: Mopping and ventilating	**2.**

Disinfecting: Spraying or fumigating **3.**

Dry cleaning: Sweeping and removing dirt or dust **4.**

Repairing: Fixing structural problems **5.**

b. Why is it important to properly clean and disinfect broiler houses?

5. Verify your answers by reading **3.1 Key Facts**.

3.1 Key Facts

- **Feeders**
  - Number of feeders depends on the number of birds
  - Feeders must be cleaned regularly to maintain bird health
  - **Automatic**:
    - Large feed troughs with chain devices to move the feed
    - Used in modern large chicken farms
    - Powered by electricity
  - **Linear**:
    - Straight line, birds can eat from both sides
    - Used in small scale farm systems
    - Can be made of locally available materials like wood, bamboo, used plastics, etc.
  - **Circular**:
    - In circular form, sometimes hanging
    - Used in any farming system
    - Semi-automatic: Feed moves to the bottom as it is eaten
    - Accommodates 30% more birds than linear feeder
  - **Grit Box:**
    - Separate feeder to provide calcium to layers
    - Can contain broken seashells (shell grit) or a mixture of small stones (flint grit)
    - Additional calcium improves eggshell production

- **Drinkers**
  - **Pan and Jar/Manual:**
    - Circular shape

    - Jar is filled with water
    - Pan is where birds drink from
- **Water Basin:**
    - Basin with various diameters/sizes
    - Can be made of wood or plastic
    - Use metal grill so birds cannot enter or fall in water
- **Automatic Bell:**
    - Connected to water pipeline
    - Maintains clean and continuous water flow
- **Nipple Drinker:**
    - Used in layers cages
    - Releases drops of water when pressed[26]

- **Nests**
    - Space where eggs are laid
    - Made of baskets, pots, or cardboard boxes
    - Place in a secure, shady secluded place out of the sun, lined with fresh litter, and kept clean

- **Perches**
    - Place for birds to sit, sleep, observe, and avoid predators at night
    - Built horizontally and parallel to the wall
    - Length depends upon the number of birds
    - Birds lower in the social peck order can also use the perches during the day

    - **Installation Standards**
    - **Suggested space between feeders:**
        - 0-2 weeks: 3 cm
        - 3-4 weeks: 5 cm
        - 4 weeks or older - 8 cm
    - **Suggested space between drinkers:**
        - 0-2 weeks: 1.3 cm
        - 3-5 weeks: 2.5 cm
        - 5 weeks or older: 5.0 cm
    - **Notes:**
        - Space between drinkers should be increased by 20 percent during hot/dry seasons.

[26] Eco Chicks Poultry. (n.d.). *A list of poultry farming equipment and their uses*. https://ecochickspoultry.com/a-list-of-poultry-farming-equipments-and-their-uses/

- Distribute uniformly so that birds do not need to walk more than 150 cm to reach a feeder or 300 cm to a drinker.
- Adjust height of the feeders and drinkers so that the brim is at the same level as the back of the bird to avoid wastage and spillage.[27]

- **Disinfection Procedures:**
  Taken from Cornell College of Agriculture and Life Sciences' Small Farms Program:
  1. **"Dry Cleaning**
     - Remove dust and dirt from floors, equipment, perches, and walls by sweeping and wiping
     - Remove feed, water, and litter
  2. **Wet Cleaning**
     - Soaking: Completely cover with water until remaining dirt becomes soft
     - Washing: Use detergent and brush to remove all dirt; use water at high pressure
     - Rinsing: Removes remaining detergent
  3. **Drying**
     - Mop water from floor
     - Open windows and doors to ventilate
     - Use fan if possible
  4. **Repairs**
     - Fix any problems with the building, such as holes where predators can enter
  5. **Disinfecting**
     - Apply disinfectant by spraying or fumigating
     - Dilute according to manufacturer's instructions"[28]
  - **Importance**:
     - Promotes broiler growth and production
     - Reduces risk of diseases

[27] Eco Chicks Poultry. (n.d.). *A list of poultry farming equipment and their uses*. https://ecochickspoultry.com/a-list-of-poultry-farming-equipments-and-their-uses/

[28] Darre, M. (2014, April 7). *Cleaning and disinfecting your poultry house*. Cornell College of Agriculture and Life Sciences: Small Farms Program. https://smallfarms.cornell.edu/2014/04/cleaning-and-disinfecting-your-poultry-house/

Guided Practice Activity

Topic 3.1 Task 3:

1. In small groups, read the scenario and write answers to the questions that follow.

Abahujintambwe is a cooperative raising broilers for market production. They want to recruit an expert to help them in supervise and implement their project. Suppose that you are recruited and assigned to prepare first the house, which will receive 4,500 broiler chicks that will be 3 weeks old when they arrive. They will arrive in 2.5 weeks. They want you to supervise on the following:

a. What equipment is needed?

b. How should the equipment be installed?

c. When should the house be disinfected?

d. Explain the 5 steps for disinfection:

1.

2.

3.

4.

5.

e. What other factors should be considered when preparing a broiler house? What other material is needed?

2. Compare your responses to the other groups and verify them with the trainer.

3.2 Key Facts

- **Litter**
  - Total height of 5 cm
  - Should be kept as dry as possible
  - Rake litter every day to break up material and facilitate drying
  - Prevent excess ammonia
  - Moisture
    - Increases due to water in bird faeces, which leads to ammonia production
    - Ammonia causes stress and decreases feed intake and growth rates
    - High moisture levels may also cause lameness, disinclination to move, and weight loss
    - To assess moisture levels, squeeze a handful of litter
      - If the litter forms a cake, the moisture level is too high.
      - If it crumbles into fine dust, the moisture level is very low, which will make the environment dusty.
      - If it remains a loose mass, moisture level is ideal

- **Physical Parameters Standards**
  - **Temperature:** 22-30^{0}C
  - **Ventilation:** Ammonia levels below 25 ppm; litter moisture 15-25%
  - **Lighting:** 16 hours per day; lighting beyond typical 12 hours of natural light will increase feed intake and improve growth rates
  - **Humidity:** 30-60 % relative humidity[29]

[29] *Small-scale poultry production*. (n.d.). Home | Food and Agriculture Organization of the United Nations. https://www.fao.org/3/y5169e/y5169e05.htm

Application Activity

Topic 3.1 Task 4:

1. Visit a local poultry farm with broiler chickens.

2. Assess the following equipment and parameters in the broiler house using the table below. Ask the farmer or another work for help as needed.

Item	Assessment/Measurement	Meets Standards? Yes or No
Temperature		
Humidity		
Lighting		
Ventilation		
Litter		
Feeders		
Drinkers		
Perches		
Nests		

Points to Remember

- The local breeds of Rwandan poultry are called “Inyarwanda.”
- Exotic broiler breeds in Rwanda care Cobb 500 and Hubbard.
- Rwanda’s weather conditions are good for broilers.

(Information from: Poultry in Rwanda Factsheet by Ministerie van Buitenlandse Zaken)

Formative Assessment

1. Name the 4 different types of feeders and 4 different types of drinkers.

Feeders	**Drinkers**
1.	**1.**
2.	**2.**
3.	**3.**
4.	**4.**

2. Explain how moisture forms in litter and its effects.

3. Select the correct answer for each question:

1. Broiler manure/faeces should be not removed and does not have any impact on the presence of gases in the broiler house.

a. True

b. False

2. Litter is raked regularly because….

a. it smells bad and makes the broilers uncomfortable

b. it needs to be dried in order to reduce gases

3. Artificial lighting beyond the hours of natural light will…

a. increase feed intake and improve growth rates

b. increase feed intake and maintain growth rates

c. decrease feed intake and maintain growth rates

4. The place for birds to sit, sleep, observe, and avoid predators at night are called:

a. Nests

b. Perches

c. Cages

Topic 3.2: Receive broilers

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe best practices for organizing transportation of broilers	**1.** Organize transportation of broilers to broiler houses	**1.** Proactive
2. Identify how to handle broilers and check their health	**2.** Maintain broiler health by handling and checking them appropriately	**2.** Detail-oriented
3. Describe broiler installation and record keeping procedures	**3.** Follow installation and record keeping procedures	**3.** Diligent

Getting Started: What do we know and where are we going?

Topic 3.2 Task 1:

1. Individually brainstorm answers to the following questions using knowledge from previous units:

a. What are some tips or best practices for transporting chicks and layers?

b. What are factors to consider for installing chicks and layers?

2. Compare and discuss them with a partner.

3. Share with the rest of the class. Clarify any errors or misunderstandings with the trainer.

4. Discuss if or how you think these practices and factors will apply to receiving broilers.

Problem Solving Activity

Topic 3.2 Task 2:

Answer the questions and complete the tasks with a partner:

1. Given that broilers are raised for slaughtering, how often do you think they are transported during their lives?

2. Which body parts do you think are important to observe when checking the health of broiler chickens?

3. Based on previous units, why is record keeping important?

4. Read through **3.3 Key Facts** and do the following:
   - ✓ Check or tick information that is the same as chicks and layers
   - o Circle information that is different from chicks and layers
   - ❖ Star information that is interesting or that you want to learn more about

5. Verify your responses to questions 1-3 with the trainer based on **3.3 Key Facts**.

3.3 Key Facts

- **Transportation**
  - Broilers are transported twice in their lives:
    - As day-old chicks to the broiler house/farm
    - As adults to the slaughterhouse
  - Chicks:
    - Transported in transport modules (chick boxes) from the hatchery to the farm
    - Dropped into modules from a conveyor belt
    - Immunized with spray vaccine as they are dropped into modules
  - Physical Parameters
    - Temperature: 24-26°C
    - Humidity: 60-65% relative humidity
    - Ventilation: holes in modules
  - **Importance**:
    - Successful transportation influences chicken growth and performance

- Improper transportation may result in injuries and/or illness[30]

- **Handling & Checking Health**
  - Disinfect the house before broiler chicks arrive
  - Provide additional warmth during the first 2-3 weeks (see below)
  - Flock thinning: Removing a portion of broilers once stocking density is at maximum
    - Not recommended
    - Suddenly lowers temperatures
    - Causes stress[31]
  - Check each chick's health before and after transportation
    - Immediately isolate any sick or injured chicks to be treated immediately
    - Isolating chicks prevents the spread of diseases and stress of other chicks

  - **Health Factors to Observe:**
    - **Eyes:** Chicken eyes should be clear and shiny. When a chicken is alert and active, its eyelids shouldn't be showing. You shouldn't see any discharge or swelling around the eyes.
    - **Nose:** Both nostrils should be clear and open, with no discharge from the nostrils.
    - **Mouth:** The chicken should breathe with the mouth closed, except in very hot conditions. If cooling the bird doesn't make it breathe with its mouth closed, it is ill.
    - **Wings:** The wings of chickens should be carried close to the body in most breeds. The wings shouldn't droop or look twisted.
    - **Activity level:** a healthy chicken is rarely still during the daylight hours. Some breeds are more nervous and flightier; others are calm but busy. In very warm weather, all chickens are less active.[32]

- **Installation**
  - Received as day-old chicks
  - Turn on brooder at least 24 hours before broiler chicks arrive
  - Adjust the temperature to 35°C at the edge of the brooder and 5 cm above the litter during the first week

[30] Farm Animal Welfare Compendium. (2019, December 16). *The life of: Broiler chickens*. Compassion in World Farming. https://www.ciwf.org.uk/media/5235306/The-life-of-Broiler-chickens.pdf
[31] Mitchell, A. (2015, December 1). *Flock thinning to be banned on RSPCA assured farms*. The Poultry Site. https://thepoultrysite.com/news/2015/12/flock-thinning-to-be-banned-on-rspca-assured-farms
[32] Willis, K., & Ludlow, R. T. (n.d.). *9 signs of a healthy chicken*. Dummies.com. https://www.dummies.com/home-garden/hobby-farming/raising-chickens/9-signs-of-a-healthy-chicken/

- Lower the temperature by 2.8°C each week until it reaches 21°C
- Keep at 21°C during growth period
- **Importance**: Too high or low temperatures cause poor growth rates and performances

- **Record Keeping**
  - **Importance**:
    - Shows actual growth and performance
    - Shows profit and losses of farm
  - **Sample:**

Date	Age in days	Opening # of Birds	Deaths	Sales	Feed issued	Medicines/ Vaccines	Other Notes

Guided Practice Activity

Topic 3.2 Task 3:

Recall the case study of the *Abahujintambwe* cooperative from Topic 3.1. Their project is now at the phase of receiving broiler chicks at the farm. They call you again for assistance. At farm they ask you to help them answer the following questions. Write your responses below with the help of your group members and **3.3 Key Facts**.

1. How are the broilers chicks transported? How should be physical parameters be put in place?

2. What information should be collected and recorded during intake? Why?

3. What five factors of the broiler chicks' health should be observed? What should be done if birds are injured or sick?

Application Activity

Topic 3.2 Task 4:

1. On a visit to a poultry farm, interview a farmer about best practices for transporting and installing broilers at the farm. You will write his responses in the table below. Add one of your own questions to the table as well.

Questions	**Answers**
Where do you receive broilers from?	
How do you handle the broilers as soon as they arrive?	
What methods do you use to check the broilers' health? What do you observe?	
What information do you record when broilers arrive? Why?	
What do you want to improve about your process for receiving broilers?	
Your Question:	

2. After the visit, discuss your experience with the class:

- **a.** What did you learn?
- **b.** What information from the farmer surprised you?
- **c.** What would you do differently?

Points to Remember

- Remember that transportation-related injuries and death lower farm profits.
- Given that the life cycle of broiler is very short, you should be sure to control all the physical parameters and transportation practices as best you can.

Formative Assessment

1. Write answers to the following:

a. What are two of the consequences of flock thinning?

1.

2.

b. Name two health factors and what signs indicate illness or injury.

Health Factor	Signs of illness or injury

2. Write **True** or **False** for the following statements:

a. _____: The temperature of chicks remains the same from the day they are received through growth.

b. _____: Broiler chicks are sprayed with immunization spray as they are loaded into the modules for transportation.

c. _____: Broilers are transported only once in their lives.

d. _____: The broiler house does not need to be disinfected before the chicks arrive.

Topic 3.3: Distribute feed and water

Key Competencies:

Knowledge	Skills	Attitudes
1. Identify suitable feeds for broilers	**1.** Assess the quality of feeds for broilers	**1.** Detail-oriented
2. Determine adequate quantity feeds for broilers	**2.** Calculate and weigh feed quantities	**2.** Accurate
3. Explain how to distribute feed and water to broilers	**3.** Distribute feed and water to broilers according to farming standards	**3.** Methodical

Getting Started: What do we know and where are we going?

Topic 3.3 Task 1:

1. With your partner, discuss the Rwandan expression: *Umudiho uva mu itako*, which translates to "A real good dancer's step comes from the thigh."
   a. What does this expression mean?

   b. Why is applied to a dancer?

   c. How does it relate to chicken production?

   d. What do you expect to learn in this topic?

2. Share your ideas with the class.

Problem Solving Activity

Topic 3.3 Task 2:

1. Recall what you know about feed distribution for layers. Predict answers to the following questions:
   a. Do you think broilers eat more or less than layers?

b. Why?

c. What are the three types of feed?

d. How do you know which type of feed to give a chicken?

2. Share your responses with a partner and compare your answers.

3. With your partner, discuss:

a. What are the potential impacts of distributing the wrong type of feed to a chicken?

b. Why is record keeping important? What can we use records for?

c. How you know how much feed to provide to the flock? How can you calculate it?

4. Volunteer to share the key points of your discussion with the rest of the class.

5. As a class, read through **3.4 Key Facts**:

- ✓ Check or tick information that you correctly predicted from question 1 and 3.
- o Circle information that is new.
- ❖ Star information you find interesting or important.

6. Verify your responses to questions 1 and 3 using **3.4 Key Facts** and guidance from the trainer.

3.4 Key Facts

- **Identification of Feed**
  - Starter feed = crumbs or mini-pellets; Grower and finisher feeds = pellets
    - Poor quality crumbs and pellets will reduce feed intake and performance.
    - Good quality crumbled and pelleted feeds are preferred to mash feed
    - Base selection primarily on performance and profitability rather than purely on diet cost
  - Mash feed
    - Particles should be sufficiently coarse and uniform in size
    - Include some fat to reduce dustiness and make more uniform
  - **Importance**: Good quality feed improves broiler growth and efficiency of feed use

- **Measuring**
  - Read the manufacturer's label to know how much feed is required per bird
  - Apply kg of feed per bird (kg/bird) to the total number of birds
  - Use a weighing balance to measure the amount of feed needed
  - Estimated quantities:
    - First 6 weeks: 4.5 kg per bird per week
    - After 6 weeks: 1.8 kg per bird per week
  - Calculate the amount of feed needed:

$$\frac{\text{Given kg of feed}}{\text{Given number of birds}} = \frac{\text{Total kg of feed needed}}{\text{Total number of birds}}$$

Information from: https://images.agri-profocus.nl/upload/16021_day_3_Joost_PUM_Feeding_Broilers_Zambia1479378305.pdf

- **Distribution**
  - ME = Metabolised Energy
  - CP = Crude Protein

	Starter	**Grower**	**Finisher 1**	**Finisher 2**
Age in days	0-10	11-22	23-30	>31
ME/kg	3000	3050	3150	3200
CP %	23	20	19	17.5

  - Frequency
    - Feed twice per day with feeders at half volume or less
    - Feed chicks immediately when they arrive
  - Water
    - Should always be fresh[33]

- **Cleaning**
  - Keep feeders and drinkers clean and filled
  - Arrange, wash, dry, and disinfect for full cleaning
  - Clean feeders and drinkers to prevent the spread of diseases

- **Record Keeping**
  - Feeding decisions-records are useful in deciding what types of feed rations, the quantity of feed rations, and the effectiveness of a specific feed ration.
  - Bird growth (weight) should also be recorded to measure progress

[33] PUM: Netherlands senior experts. (n.d.). *Feed broilers*. AgriProFocus. https://images.agri-profocus.nl/upload/16021_day_3_Joost_PUM_Feeding_Broilers_Zambia1479378305.pdf

- **Example Feed Records:**

Feed Type	Feed Weight (kg)	Feed Cost (RWF)	Other Costs (RWF)	
Starter			**Chicks**	
Grower			**Fuel**	
Finisher			**Water**	
Total			**Total**	

Guided Practice Activity

Topic 3.3 Task 3:

1. Assess the given scenario and respond to the question in small groups, using **3.4 Key Facts** for guidance:

Mr. Manasseh is a broilers farmer. He is going to bringing 200 one day old chicks to the farm. He wants to make a provision of feeds that will last 2 weeks. Respond to the following questions:

a. What kind of feed will he buy and what are the necessary feed components?

b. How much feed will he need to buy for the first two weeks?

c. After two weeks how will he know if chicks are adequately fed?

2. Compile your responses into a presentation. With your group, present your advice to Mr. Manasseh to the class. Explain your reasoning and calculations. Cite information from **3.4 Key Facts** or other sources, as needed.

3. After all groups have presented, receive feedback from the trainer and verify the correct responses.

Application Activity

Topic 3.3 Task 4:

Visit a local poultry farm with broilers.

1. Begin by asking the farmer the following questions, plus one of your own questions:

Questions	Answers
Where do you buy your feed from?	
How often do you feed the broilers?	
What are the challenges with feed and water distribution?	
Your Question:	

2. Observe the farmer as he or she demonstrates how to distribute the feed and water to the broiler chickens.

3. In small groups, work together to distribute feed and water to the broiler chickens. Measure the quantities needed.

4. After the visit, reflect and discuss with your class:
   a. What did you learn?
   b. What are ways to address the challenges with feed and water distribution that the farmer mentioned?
   c. What other questions do you have?

Points to Remember

- During feeding and watering, the birds should be disturbed as little as possible.
- Feeding and watering should be done at the same time every day to minimize stress.
- Poor physical feed quality will have a negative impact on broiler performance.

Formative Assessment

1. Circle the correct answer to the following questions:

1. How often should feed be distributed?

a. Three to four times per day.
b. Twice per day.
c. Once per day.

2. What type of feed should a broiler that is 14 weeks old receive?

a. Starter feed
b. Grower feed
c. Finisher feed

3. Which of the following is NOT useful information to record to improve financial decisions in the long-term?

a. Feed cost
b. Kg of feed distributed per day and week
c. Colour of vehicle that delivered the feed

2. Write answers to the following:

a. Why is it important to clean feeders and drinkers?

b. Why is it important to select good quality feed?

c. Why is it important to keep records of feed intake?

Topic 3.4: Monitoring physical parameters

Key Competencies:

Knowledge	Skills	Attitudes
1. Describe the standards for lighting and ventilation in the broiler house	**1.** Monitor lighting and ventilation in the broiler house	**1.** Forward-thinking
2. Describe the standards for temperature and humidity in the broiler house	**2.** Regulate temperature and humidity levels in the broiler house	**2.** Detail-oriented
3. Describe the standards for carbon dioxide levels in the broiler house	**3.** Detect and monitor carbon dioxide in the broiler house	**3.** Methodical

Getting Started: What do we know and where are we going?

Topic 3.4 Task 1:

1. Fill in the rest of the chart individually based on previous units and topics:

Physical Parameter	Measurement Tool	Importance
	Thermometer	
		Removes excessive moisture, gases, and dust from the air
Lighting		
	Barometer	
		High levels can kill birds

2. Compare your answers with a partner.

3. Verify your answers with the trainer.

Problem Solving Activity

Topic 3.4 Task 2:

1. Recall what you know about physical parameters in poultry farm from Units 1 and 2. Discuss with a partner: What are the potential negative impacts of….
   a. too high temperatures/too much heat?

   b. too much moisture in the poultry house?

   c. not enough lighting?

   d. over 30% carbon dioxide levels?

2. Volunteer to share your ideas with the rest of the class.

3. As a class, discuss the relationship between the environment and physical parameters.
   a. What is their relationship?

   b. How do they influence each other?

   c. Why is it important to use sustainable environmental practices on the farm?

4. With the class, read through **3.5 Key Facts**. While you read:
   - ❖ Star ways to monitor each physical parameter
   - ○ Circle the standards for each parameter in a broiler house
   - \+ Add any additional information you know based on previous knowledge and experience.

3.5 Key Facts

- **Ventilation**
  - Purpose: maintain fresh, clean air; remove excess heat, harmful gases, moisture, and dust from the broiler house
  - Measurement Tool: Barometer
  - Poor ventilation can lead to high level of ammonia in the air
    - Ideal level of ammonia is less than 10 ppm
    - High levels can damage lungs and growth rate
  - Air direction
    - Depends on design of inlets

    - Fully open inlets cause sir to drop on top of birds
    - Somewhat closed inlets caused increased pressure
  - Air pressure
    - Affects air speed
    - Too much pressure moves the air too quickly so that it does not remove heat, gases, moisture, and dust
  - Adjust
    - Use fans and open doors and windows to increase air flow
    - Use open-sided housing to allow natural air flow
  - Monitor
    - Hang pieces of paper in the broiler house and observing their movement
    - Compare feeling of air flow outside the broiler house to inside[34]

- **Lighting**
  - Purpose: Proper lighting allows broilers to feed beyond daylight hours and therefore improves growth rates
  - Measurement Tool: Photometer
  - Ideal: 17 to 20 hours of light per day
    - Over-lighting may lead to: decreased growth rate, decreased food intake, increased mortality, decreased broiler welfare
  - Should be uniformly distributed in the house and light seepage into the house prevented
  - Monitor
    - Arrange artificial lighting according to natural daylight hours (typically 6 AM to 6 PM in Rwanda)[35]

- **Temperature**
  - Purpose: Prevent heat stress which negatively impacts growth and could lead to death
  - Measurement Tool: Thermometer
  - Ideal: 22-30^{o}C
    - Can change depending on humidity

- **Humidity**
  - Purpose: Too high humidity will allow moisture into the room which could lead to mould in feed and difficulty breathing
  - Measurement Tool: Hygrometer

[34] Linden, J. (2014, August 8). *Air velocity management for optimum broiler performance*. The Poultry Site. https://thepoultrysite.com/articles/air-velocity-management-for-optimum-broiler-performance

[35] Schwean-Lardner, K., & Classen, H. (2010). *Ross Tech: Lighting for broilers*. Aviagen. https://en.aviagen.com/assets/Uploads/RossTechLightingforBroilers.pdf

- Ideal: 50-60% relative humidity (after brooding)
- Evaporative Cooling:
    - Increases humidity by evaporating water vapour and moisture into the air
    - Cools down birds and prevents heat stress
- Monitor:
    - Observe moisture/wetness of litter
    - Compare to outdoors

- **Carbon Dioxide**
    - Purpose: Monitor levels of CO_2 closely to prevent high levels
    - Measurement Tool: Carbon dioxide meter/sensor
    - Can kill birds at high levels
    - Monitor:
        - Cannot be sensed or smelled and must be monitored using a meter or sensor[36]

Guided Practice Activity

Topic 3.4 Task 3:

1. Read the following scenario and complete the tasks in small groups:

Miss Ganza is a farmer who recently began a broilers production project. She just bought and installed the first lot of 1,500 broilers. She plans to maximize their growth rate and productivity by optimizing the design of the broiler house.

a. Design a broiler house for Miss Ganza. Include arrangements for establishing and controlling lighting, ventilation, temperature, humidity, and carbon dioxide levels.

b. Write a letter to Miss Ganza describing the ideal settings for each physical parameter and how she should monitor them.

c. Use **3.5 Key Facts** to guide you.

2. Present your designs to the rest of the class. Allow them to ask a few questions afterward and ask your own questions after others' presentations.

3. Receive feedback from your trainer and adjust your design and letter accordingly.

[36] Aviagen.https://en.aviagen.com/

4. Resubmit the final version of your work to the trainer.

Application Activity

Topic 3.4 Task 4:

Visit a local poultry farm with broilers with your class.

1. Observe the physical parameters and note what you see in the chart below. This may include the design, the equipment used, or other controls.

Physical Parameter	Observation
Lighting	
Ventilation	
Humidity	
Temperature	
Carbon Dioxide	

2. Then, ask the farmer for best practices for each physical parameter. Write his or her advice below:

Physical Parameter	Best Practices
Lighting	
Ventilation	
Humidity	
Temperature	
Carbon Dioxide	

Points to Remember

- Too much or too little—the extremes—of any parameter will result in decreased growth rates.
- Always refer to proven standards.

Formative Assessment

Complete the following sentences:

1. Over-lighting may lead to: …… growth rate, …… food intake, …… mortality, and/or …… broiler welfare.

2. You can adjust ventilation in the broiler house by using …… and opening doors and …… to circulate fresh air.

3. Carbon dioxide can kill birds at …… levels.

Write 1-2 sentence answers to the following:

1. How does evaporative cooling affect humidity?

2. What is the purpose of artificial lighting?

3. What are the consequences of poor ventilation?

Topic 3.5: Perform slaughtering

Key Competencies:

Knowledge	Skills	Attitudes
1. Explain the different slaughtering techniques	**1.** Supervise the slaughtering process	**1.** Being Rapid
2. Describe the methods for storing chicken meat	**2.** Store meat according to standards	**2.** Detail-oriented
3. Explain the factors for meat transportation	**3.** Organize adequate meat transport	**3.** Commitment

Getting Started: What do we know and where are we going?

Topic 3.5 Task 1:

1. Discuss the following questions with a partner:
   a. What is the purpose of broilers?

   b. Have you ever killed a chicken or seen someone killed a chicken?

   c. If yes, explain the process and the precautions you should take when killing a chicken.

2. Share your ideas with the class.

3. With the class, discuss:
   a. How do you think the process of killing a single chicken applies to small-scale poultry farming?

   b. How does the process change?

   c. What stays the same?

Problem Solving Activity

Topic 3.5 Task 2:

Animal welfare is preserving the well-being of animals. This means meeting their physical and mental needs, such as providing enough feed and minimising the amount of pain and discomfort they experience.

1. In small groups, discuss the following:
   a. Why is animal welfare important?

   b. How can we preserve the welfare for broilers in the slaughtering process?

2. Share and compare your ideas with the class.

3. Try to put the following steps of the slaughtering process in the correct order.

Chilling	Plucking	Stun and kill	Washing	Transport
Evisceration	Scalding	Packaging	Washing	

1.

2.

3.

4.

5.

6.

7.

8.

9.

4. Read through **3.6 Key Facts** and do the following with a partner:
   a. Verify your answers to question 3.

   b. Identify the three methods for stunning and why the practice of stunning is used.

   c. Identify two additional processes that may occur after slaughtering.

   d. Explain what you think the biggest challenge for transportation is.

5. Share and discuss your responses with the rest of the class.

3.6 Key Facts

- **Slaughtering**
  - **Chicken Welfare:**
    - Ensure that chickens are treated with the minimum amount of pain, discomfort, fear, and distress
  - **Preparation:**
    - Do not feed 4 hours beforehand so that bodies are empty, and faeces are dry
    - Pick up birds gently by hand and load into crates to avoid bruising or breaking bones
    - Keep birds calm—excited birds may overheat which lowers meat quality[37]

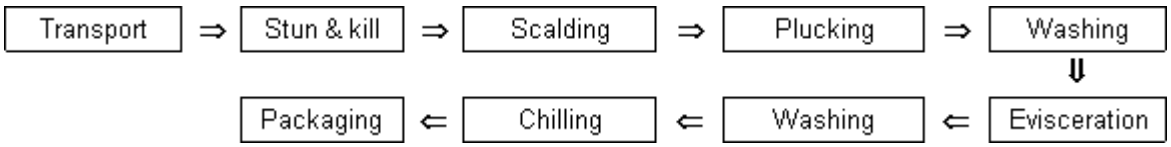
- **Stunning Techniques**
  - **Overview**:
    - Stunning is used to maintain animal welfare
    - Makes birds unconscious, insensible to pain, and unable to walk or move
    - Always inspect equipment and wear PPE before use
  - **Electrical Method:**
    - Used globally
    - Sends electric current through the body to immediately stun bird
    - Select the correct current for the size of the bird
    - Be sure to check for unconsciousness after stunning
    - Effective: neck arched with eyes completely open; extended legs; wings close to the body; constant body tremors
      - Wings may flap briefly after stunning due to spinal reflex
    - Cut or dislocate the neck immediately after stunning[38]
  - **Gas Method:**
    - Used mostly in large-scale factories with specialised equipment
    - Apply anoxic gases to deprive birds of oxygen
    - Not recommended for small-scale operations without the appropriate equipment
  - **Percussion Method:**
    - Fire a gun that gives a strong blow to the skull (concussion)
    - Brain is not stabbed; animal is not killed

[37] Herenda, D., Chambers, P. G., Ettriqui, A., Seneviratna, P., & Da Silva, T. J. (2000). *Manual on meat inspection for developing countries: Chapter 1: Meat inspection procedures*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/t0756e/T0756E01.htm

[38] Humane Slaughter Association. (n.d.). *Use of electrical stunning equipment*. https://www.hsa.org.uk/stunning-and-slaughter-electrical-stunning/use

- Clean and service guns regularly[39]

- **Slaughtering Process**



[40]

  - **Evisceration:**
    - Remove internal organs
  - **Cleaning and Chilling:**
    - Put carcasses in a cooler as soon as possible
    - Slows bacteria growth and lengthens time
  - **Inspection:**
    - Ensure animals are health and normal before selling them
    - Separate abnormal animals

- **Second Processes**
  - **Cutting:**
    - Remove wings and legs, and cut back
    - Parts can be packaged; the rest is moved for more processing
  - **Deboning:**
    - For "bone-out" or "boneless" products
    - Cut meat away from the bone using knives
    - Trim and clean using scissors
    - Usually packaged fresh

- **Storage/Packaging**
  - **Use and Importance:**
    - Preserves the product
    - Protects from physical damage
    - Confines and packs into larger containers
    - Can influence if someone buys your product or not

[39] Chambers, P. G., & Grandin, T. (2001). *Guidelines for humane handling, transport and slaughter of livestock: Chapter 7: Slaughter of livestock*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/x6909e/x6909e09.htm#b8-Percussion%20stunning

[40] Food and Agriculture Organization of the United Nations. (n.d.). *Slaughtering process* [Flow chart]. http://www.fao.org/3/y4392e/y4392e2h.gif

- **Types:**
    - Over-wrapping: wrap tray with clear film; most popular
    - Bag wrapping: whole birds placed in a clear bag
    - Vacuum packaging: tight, air-less plastic wrap which prevents contamination and bacteria exposure[41]

- **Transportation**
    - Handle birds carefully and gently
    - Clean and disinfect trucks/vehicles thoroughly
    - Must maintain proper refrigeration temperatures
    - Keep travel time as short as possible
    - Frozen meat can be transported all over the world
    - Fresh meat must be transported to the store within 2 days

Guided Practice Activity

Topic 3.5 Task 3:

1. Recall Miss Ganza's broiler project from Topic 3.4. She now wants to build her own slaughterhouse. Before gathering the funds, she wants to draft a project and needs key technical information on slaughtering techniques. Help Miss Ganza by writing answers the following questions with your small group. Use **3.6 Key Facts** to guide you.

a. What are the main steps in the broilers slaughtering process?

b. Which stunning method do you recommend to Miss Ganza? Why?

c. What are important factors to consider when transporting chicken meat?

2. For now, Miss Ganza only wants to sell the main parts of the chicken, such as the wings and legs. She also has a lot of trays and clear/plastic film in her storage.

a. Which of the second processes will she need to go through?

b. What tool(s) will she need?

[41] Silverside, D., & Jones, M. (1992). *Small-scale poultry processing: Chapter 3: Operation of small scale poultry processing plants*. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/t0561e/T0561E03.htm

c. Which packaging method do you recommend she uses?

3. Discuss your recommendations to Miss Ganza as a class. Confirm or correct your answers to the questions.

Application Activity

Topic 3.5 Task 4:

Visit a local slaughterhouse with your class.

1. Tour the area and observe where the different steps of the slaughtering process take place.

a. Identify the stunning method used:

b. Identify any second processes used:

c. Identify the packaging method used:

2. Interview the farmer using the following questions, plus one of your own:

Questions	Answers
What is the most challenging part of the slaughtering process in your opinion?	
What measures do you take to preserve animal welfare?	
Where do you transport the chickens/meat to or from?	
What are the challenges of transportation?	
Your Question:	

3. After the visit, discuss with your class:

a. What did you learn?

b. What surprised you?

c. What information do you still need to know about slaughtering broilers?

Points to Remember

- Clean and disinfect stunning tools and equipment before and after using.
- Fresh meat should be transported to the market or store within two days of slaughtering.
- Chilling meat slows the growth of bacteria and lengthens "shelf life," or the amount of time the meat is fresh enough to eat.

Formative Assessment

Choose the correct answer for the following questions:

1. Which of the following is NOT one of the uses of packaging meat?
   a. Confines for packing into larger containers
   b. Preserves the product
   c. Removes bones
   d. Protects from physical damage

2. Which stunning method makes the bird unconscious by giving it a concussion?
   a. Gas method
   b. Electric method

   c. Percussion method

3. Which process slows bacteria growth and lengthens shelf-life?
   a. Deboning

   b. Chilling

   c. Evisceration

   d. Transportation

Complete the following sentences:

1. …… meat can be transported all over the world, whereas …… meat must be brought to the market or store within two days.

2. Chicken welfare ensures that chickens are treated with the minimum amount of ……, discomfort, fear, and ……

3. Do not feed birds for ……. hours before slaughtering so that their bodies are empty, and their faeces are ……..

Self-Reflection

1. You have come to the end of the unit. You are going to do the survey you did at the beginning of the unit again to help you do self-assessment of your knowledge, skills and attitudes.

Again, there are no right or wrong answers to this survey. It is for your own use to gauge your knowledge, skills and attitudes after the unit. Read the Knowledge, Skill or Attitude in the left column. Think about yourself: do you think you can do this? How well? Read the statements across the top. Put a check in column that best represents your situation.

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Describe the installation process of equipment in broiler houses					
Explain the disinfection process of broiler houses					
Explain litter and physical parameter management in broiler houses					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Install materials and equipment in broiler houses					
Disinfect broiler houses					
Establish physical parameters and manage litter in broiler houses					
Describe best practices for organizing transportation of broilers					
Maintain broiler health by handling and checking them appropriately					
Describe and follow broiler installation and record keeping procedures					
Assess the quality of feeds for broilers					
Determine adequate quantity feeds for broilers by calculation and weighing					
Distribute feed and water to broilers according to farming standards					
Describe the standards for lighting and ventilation in the broiler house					
Monitor lighting and ventilation in the broiler house					

My experience Knowledge, skills and attitudes	I don't have any experience doing this.	I know a little about this.	I have some experience doing this.	I have a lot of experience with this.	I am confident in my ability to do this.
Describe the standards for temperature and humidity in the broiler house					
Regulate temperature and humidity levels in the broiler house					
Describe the standards for carbon dioxide levels in the broiler house					
Detect and monitor carbon dioxide in the broiler house					
Explain the different slaughtering techniques					
Describe the methods for storing chicken meat					
Explain the factors for meat transportation					

2. Complete the table below by identifying areas from the unit where you have improved and where you need improvement with the actions/strategies you will use to help you improve when receiving and interpreting information at the workplace

Areas of strength	Areas for improvement	Actions to take to improve
1. **2.**	**1.** **2.**	**1.** **2.**

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