MINISTRY OF EDUCATION

BUILDING CONSTRUCTION & WOODWORK TECHNOLOGY

For Senior High Schools

TEACHER MANUAL



YEAR THREE

NaCCA
NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

MINISTRY OF EDUCATION

REPUBLIC OF GHANA

BUILDING CONSTRUCTION AND WOODWORK TECHNOLOGY

For Senior High Schools

Teacher Manual

Year Three

NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

BUILDING CONSTRUCTION AND WOODWORK TECHNOLOGY TEACHER MANUAL

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Introduction for the Year Three Teacher Manual

The National Council for Curriculum and Assessment (NaCCA) has developed the third and final set of curriculum materials to support the implementation of the new Senior High School curriculum.

This Year Three Teacher Manual for *Building Construction & Woodwork Technology* covers all aspects of the content, pedagogy, teaching and learning resources, and assessment required to effectively support learners in their final year of Senior High School. It contains information for all 24 weeks, including the nine key assessments required for the Student Assessment Portal (SAP). All the necessary information for the SAP has been included in the Year Three Teacher Manual to simplify the development of weekly learning plans, meaning that teachers have a single reference document.

The Year Three Teacher Manual has two main objectives:

- To support learners to consolidate and deepen their understanding of the content, pedagogy, and assessment across all three years of the new Senior High School curriculum in preparation for the West Africa Senior Secondary Certificate Examination (WASSCE).
- To equip teachers with the tools and resources needed to deliver revision-focused, assessment-led lessons that build on the knowledge learners have acquired from Year One to Year Three.

In this third year, teachers will be supporting learners to prepare for the WASSCE. Each section of the Teacher Manual is therefore structured around the highest Depth of Knowledge (DoK) levels, allowing learners to build progressively on knowledge acquired from Year One to Year Three. For each week, learning tasks and pedagogy are built around the assessment, ensuring that classroom activities directly prepare learners for the demands of the examination. Two sets of sample examination papers are also provided — one administered at Week 10 as a first semester practice examination, and one at Week 20 as a mock examination — to gauge learners' competencies and identify areas requiring remediation.

To further support teachers in delivering Year Three, NaCCA, working with the Ghana Education Service, has developed a subject-specific App for each subject using the Playlab AI platform. These Ghanaian-owned Apps — the first of their kind at this scale in Africa — are directly linked to the revised curriculum and will assist teachers in:

- holding their weekly Professional Learning Community (PLC) sessions
- developing weekly learning plans and applying the learner-centred pedagogies and varied modes of assessment required for the new SHS curriculum
- incorporating differentiation, Social and Emotional Learning (SEL), and Gender Equality and Social Inclusion (GESI) into lessons

Information about how to use the Apps, including QR codes, is provided in the Year Three Subject-Specific PLC Handbooks.

The Year Three PLC sessions have been revised in response to findings from the 2025 annual evaluation survey. The survey confirmed that teachers have made strong progress in lesson planning, use of varied instructional methods, ICT integration, and modes of assessment. To address the identified gap in explaining concepts clearly using examples familiar to learners, each PLC session now includes a dedicated Content Exploration segment. This ten-minute segment brings the subject group together to work through one challenging problem or concept from the week's Teacher Manual content — not to plan how to teach it, but to ensure that every teacher in the group fully understands it. Each PLC session continues to include:

- Planning and Reviewing of Learning Plan (45 minutes) — using the subject-specific App to explore content, plan lessons, and prepare the week's key assessment
- Content Exploration (10 minutes) — collaborative group work on a challenging problem or concept from the week's content
- Enactment (30 minutes) — teaching an activity from the learning plan with structured peer observation and feedback
- Reflection (5 minutes) — sharing views on the session and identifying next steps

The PLC sessions in Year Three also place particular emphasis on connecting the week's content to equivalent topics taught in Years One and Two. Teachers are encouraged to note the recap weeks signposted throughout the Teacher Manual and to use the App to explore how content across all three years links together.

As in previous years, teachers are expected to integrate National Values, Gender Equality and Social Inclusion (GESI), Social and Emotional Learning (SEL), and 21st-century skills into their learning activities, assessment tasks, and rubrics and mark schemes. The subject-specific App will support teachers in doing this throughout the year.

NaCCA acknowledges the dedication of the teachers who have implemented the new curriculum across Years One and Two and recognises that Year Three represents both the culmination of that effort and a critical moment for learners. The Year Three Teacher Manual and its accompanying resources have been developed to ensure that every learner — regardless of background, ability, or school context — is fully prepared to demonstrate what they know and can do in the WASSCE and to progress confidently to further studies, the world of work, and adult life.

Acknowledgements

Special thanks to Professor Samuel Ofori Bekoe, Director-General of the National Council for Curriculum and Assessment (NaCCA) and all who contributed to the successful writing of the Teacher Manuals for the new Senior High School (SHS) curriculum.

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APPLIED TECHNOLOGY
YEAR 3 20- WEEK PLAN

Week	Unit	Strand	Sub- Strand	Name Of Learning Indicator	Page Number
SECTION 1					BOOK 3
1	1	Building Construction Technology	Sub –Structure and Superstructure	Discuss the reasons for providing services	
2	2	Woodwork Technology	Tools and machines in woodwork industry	Select an appropriate machine for a specific operation independently	
3	3	Building Construction Technology	Sub –Structure and Superstructure	Distinguish between Electricity supply, Code Water installation and Waste Disposal	
4	4	Woodwork Technology	Tools and machines in woodwork industry	Select an appropriate machine for a specific operation independently	
5	5	Building Construction Technology	Sub –Structure and Superstructure	Explain schedule of works involved in electricity supply	
6	1	Woodwork Technology	Tools and machines in woodwork industry	Demonstrate how to care for and maintained machines	
7	2	Building Construction Technology	Sub –Structure and Superstructure	Explain schedule of works involved in cold water supply	
8	3	Woodwork Technology	Materials and artefacts production in woodworks industry in Ghana	Determine the availability and sources of Lesser- Known Timber Species (LKS), Lesser- used Timber Species (LUS) and Non-Timber Forest Product (NTFP)	
9	4	Building Construction Technology	Sub –Structure and Superstructure	Explain schedule of works involved in Waste Disposal	
10	5	Woodwork Technology	Materials and artefacts production in woodworks industry in Ghana	Classify Lesser –Known Timber Species (LKS), Lesser –Used Timber Species (LUS) and Non -Timber Forest Product (NTFP)	

11	1	Building Construction Technology	Sub –Structure and Superstructure	Explain schedule of works involved in Surface drainage system	
12	2	Woodwork Technology	Materials and artefacts production in woodworks industry in Ghana	Discuss the uses of Lesser –Known Timber Species (LKS), Lesser-Used Timber Species (LUS) and Non – Timber Forest Product (NTFP)	
13	3	Building Construction Technology	Sub –Structure and Superstructure	Discuss finishes	
14	4	Woodwork Technology	Materials and artefacts production in woodworks industry in Ghana	Basic Techniques in Mass Production in Furniture industry	
15	5	Building Construction Technology	Sub –Structure and Superstructure	Discuss finishes applied to floors	
16	1	Woodwork Technology	Materials and artefacts production in woodworks industry in Ghana	Impact of Woodwork industry on the Environment	
17	2	Building Construction Technology	Sub –Structure and Superstructure	Discuss finishes applied to walls	
18	3	Woodwork Technology	Materials and artefacts production in woodworks industry in Ghana	Basic Entrepreneurship in Woodwork industry	
19	4	Building Construction Technology	Sub –Structure and Superstructure	Discuss finishes applied to roof carcases	
20	5	Building Construction Technology	Sub –Structure and Superstructure	Discuss finishes applied to ceiling joists	

SECTION 1: SERVICES IN BUILDING AND WOODWORK MACHINES

The section covers the following unit (strands); building construction technology and woodwork technology.

In this section, learners will acquire knowledge and understanding of building services, reasons for providing services and differences between electricity supply, cold-water installation and waste disposal. In the woodwork technology unit, learners are expected to gain the knowledge and understanding of the selection of appropriate machines and use an appropriate machine for a specific operation. All the above are treated from unit 1 to unit 4.

UNIT1

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of basic services*

Learning Outcome: *Outline the purpose of Services and determine the schedule of works involved in installing Electricity, Cold-water, Waste disposal and surface drainage system in a typical 3-bedroom self-contained house*

INTRODUCTION AND SECTION SUMMARY

This unit introduces learners to services, types of services used in buildings and the purpose for providing services in buildings. Building services refer to the system, installation, and utilities that make a building functional, comfortable, safe and habitable for the user. The main categories of building services are; electricity, water and plumbing, ventilation and air conditioning and other essential services. Building services are important because they ensure human comfort and wellbeing, maintain health and safety standard, enable the building to function for its intended purpose, improve energy efficiency and sustainability, meet regulatory requirements and add value to the building. The teacher will guide learners to understand the key concepts of services in building. Learners having understood services, will appreciate its importance and usefulness in building

The unit covers only week 1: ***Discuss the reasons for providing services.***

Recap weeks

Year 2	Week 6: Excavation

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm the meaning of services. Conducting experiential learning by organising field trips to construction sites where learners will observe services in building. Organise learners into mixed ability groups and assist them to explain services, types of services and their importance in buildings. Help learners to develop a deeper understanding of the concept of using services in buildings. Learners will be capacitated as they engage in critical thinking without any form of inhibition. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions which will in turn capture the diverse knowledge of all learners.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include class exercise, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment.

Indicators	DOK Level	Assessment Strategy and/ or Mode
Discuss the reasons for providing services	3 (Strategic reasoning)	Class Exercise

WEEK 1

Learning Indicator: *Discuss the reasons for providing services*

FOCAL AREA 1: REASONS FOR PROVIDING SERVICES

Building services refer to the system, installation, and utilities that make a building functional, comfortable, safe and habitable for the user. The main categories of building services are; electricity, water and plumbing, ventilation and air conditioning and other essential services. Building services are important because they; ensure human comfort and wellbeing, maintain health and safety standard, enable the building to function for its intended purpose, improve energy efficiency and sustainability, meet regulatory requirements and add value to the building. Figure 1.1 Shows Electrical installation, Fixed wire testing, Electrical remedial works and LED lighting surveys supply and installation and Figure 1.2 shows electricity supply from the transformer to the house.

Electricity Supply Services Refers to services such as:

1. Power distribution systems
2. Lighting systems
3. Energy power systems
4. Communication and data network system



Figure 1.1 *Shows Electrical installation, Fixed wire testing, Electrical remedial works and LED lighting surveys supply and installation*



Figure 1.2 *Electricity Supply, Lightening protection and circuit breaker installation*

Cold Water supply (portable supply) Supply Services Refers to services such as:

Figure 1.3 shows cold water supply to building from the company's main, Figure 1.4 direct cold-water installation in building and Figure 1.5 shows Plumbing works.

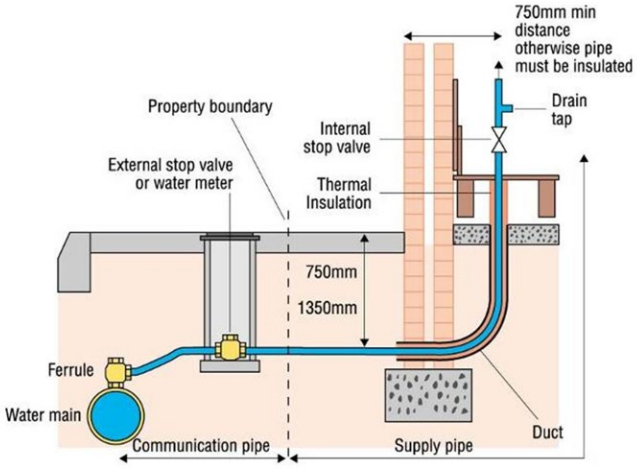


Figure 1.3 *Cold water supply to the building from the company's main*

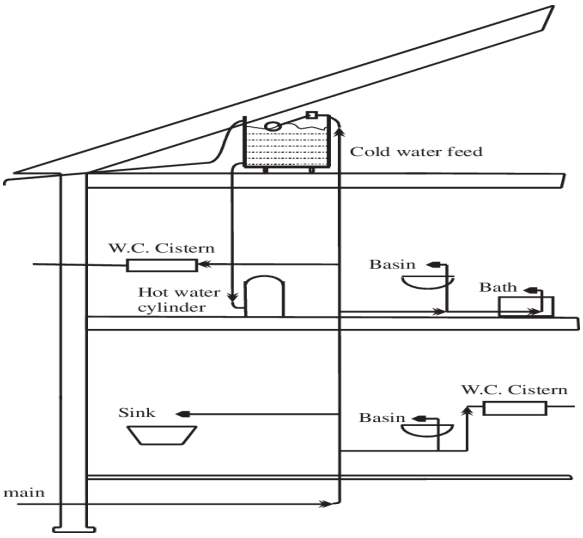


Figure 1.4 *Direct cold-water installation in building*

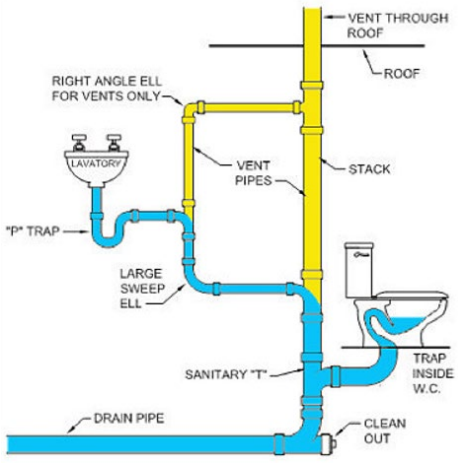


Figure 1.5 *Foul or Sewerage pipe works*

Heating, Ventilation and Air Conditioning Supply Services Refers to services such as:

1. Heating systems
2. Air conditioning
3. Ventilation and air quality management
4. Temperature and humidity control

Figure 1.6 shows the testing and maintenance of air condition and Figure 1.7 shows Installation of Air Condition in a Building.



Figure 1.6 *The Testing and Maintenance of Air Condition*



Figure 1.7 *Installation of Air Condition in a Building*

Other Services Refers to services such as;

1. Gas supply system
2. Fire protection system
3. Security system

Learning Tasks

1. Explanation of services.
2. Outline of different types of services provided to houses.
3. Discuss the purpose for providing services.

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and explain services.

Group work/Collaborative Learning: Organise learners into mixed ability groups and assist them to discuss types of services, outline the functions services

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and discuss the purpose for providing services in buildings.

Key Assessment: Class Exercise

1. Evaluate the challenges of integrating contemporary building services into an old building you are renovating without compromising its design.
2. Analyse how building services contribute to the comfort of the user.

PLC Session 1

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).

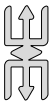
Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***class exercise***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the exercise (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to

a. transfer your chats into your learning planner template.

b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).

c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 1 Review

Unit 1 of week 1. This unit produces learners with a deeper understanding of concept of services. The pedagogical exemplars used in this section included group work/collaborative learning, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercise, practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Additional Reading: Building services Handbook: covers installations methods, commissioning, and maintenance.

Drafting, Project Specifications: Guide lines on defining scope, quality, and material standards.

Resources: Pictures, videos, written presentations and using flip charts. (Building Construction) visits to the construction industry, research using the internet to find out about processes involved in providing services in a 3- bedroom house.

UNIT 2

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Tools and Machines in Woodwork Industry

Content Standard: *Demonstrate the ability to use woodwork Machines.*

Learning Outcome: *Be able to select and use appropriate machine for a specific operation independently.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners to select an appropriate machine for a specific operation independently. Woodworking machines for a specific operation are machines designed to perform specific tasks such as cutting, shaping, drilling, lathing and smoothing wood. These machines allow for a variety of woodworking projects, and with practice, learners can create beautiful and functional pieces.

Learners will confidently choose the right machine for specific tasks in the workshop.

The unit covers only week 2: Select an appropriate machine for a specific operation independently.

Recap weeks

Year 2	**Week 5:** Select and use appropriate machine for a specific woodwork operation.

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in selecting an appropriate machine for a specific operation independently. The teacher should employ pedagogies such as critical thinking and talk for learning, group work/collaborative learning and experiential learning. These strategies should be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts in this unit require learners to select and use appropriate machine for a specific woodwork operation independently. The assessments should largely cover levels 1, 2 and 3 of the DoK. Teachers should employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' growth and give quick feedback. Teachers should also administer assessments such as class exercises (including individual worksheets) after each lesson, homework, scores on practical group activities on the various *selection of an appropriate machine for a specific operation independently* and document learners' results in continuous assessment records. Teacher can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Select an appropriate machine for a specific operation independently	3 (Strategic reasoning)	Discussion

WEEK 2

Learning Indicator: *Select an appropriate machine for a specific operation independently*

FOCAL AREA 1: MACHINES FOR A SPECIFIC OPERATION

Machines for specific operations in woodworking are designed to carry out particular tasks with efficiency and precision.

1. **Mortising/Drilling machine:** There are three main types of mortising machines. These are: Hollow chisel mortiser, chain mortise and horizontal borer.

   a. **Hollow chisel mortise:** It can cut stub mortise with square and flat lower ends. Several strokes have to be made when boring deep holes. The lower end of the cutter head is fitted with a chuck to receive boring auger bits and chisels of various sizes. When the chisel and auger bit are correctly set up, the bit should project 1 mm to 2 mm below the chisel. The auger bit revolves through the length of the chisel, which cuts away a major part of the timber, leaving the chisel to cut away the corners. The chips are broken up small enough to pass up the flutes of the auger and are ejected through the aperture on the wall of the chisel. Its operation is slower. Figure 1.8 shows parts of a chisel mortiser.



Figure 1.8: *Chisel mortiser*

   b. **The Chain Mortiser:** This is used for cutting mortises more quickly but tends to split at the end from which the chain emerges from the timber. Deeper mortises can be cut. When stub mortises are required, the lower ends will be rounded. The cutters are the links of an endless chain made of special tool steel and ground with a hook of 25o on their outside. When the correct tension has been applied to the chain, it should have a 6mm slack at its centre. Figure 1.9 shows parts of the chain mortiser and Figure shows chain assembly showing 6mm slack.

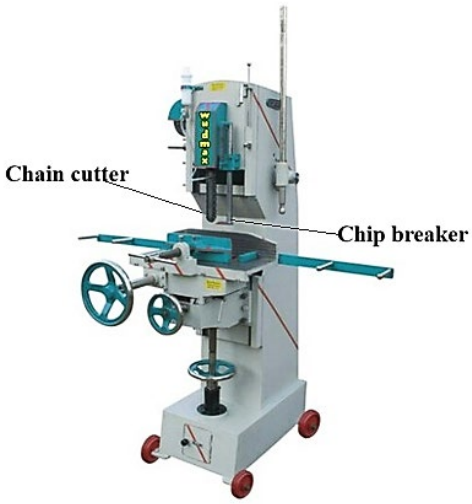


Figure 1.9 *Chain mortise*

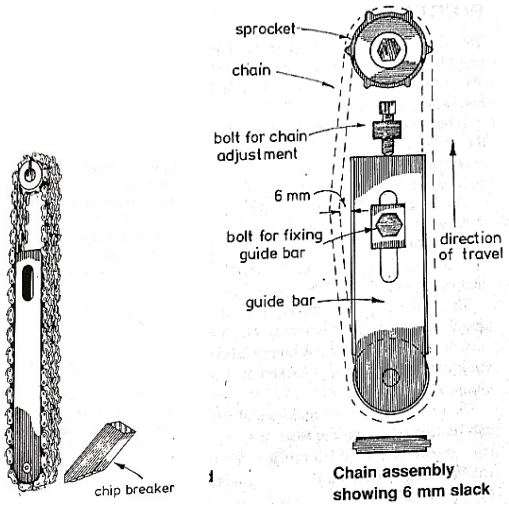


Figure 1.10: *Chain assembly showing 6mm slack*

c. **Horizontal Slot Boring Machine:** This machine uses a mortise bit for cutting small mortises. It has a horizontal spindle on which, at one end, a chuck is mounted. A table designed for clamping the timber with two clamping devices is located horizontally. It has vertical and horizontal movement which ensures positioning of the timber in height and transverse feeding on to the bit. Slot boring machine is used with a hand mechanical feed. Figure 1.11 shows parts of the router shaping machine and the boring bit.

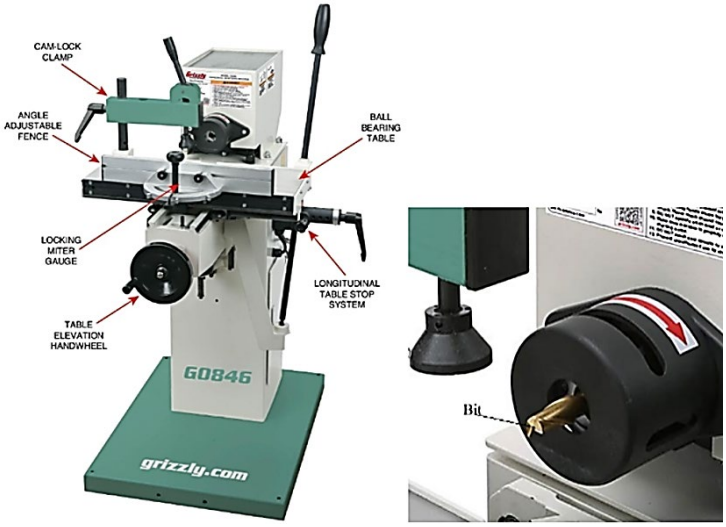


Figure 1.1*1 Router Shaping machine*

2. **Spindle moulder:** The spindle moulder has a box-shaped base, completely closed, in which the motor, the rise and fall mechanism, the belt adjustment and the spindle shaft are accommodated. The spindle is driven by the built-in motor over a short vee-belt. Speeds are changed from one step to the other. The table also has a series of tapped holes on its surface, to which is fitted the straight fence, various attachments and an eccentric ring fence. The following operations are carried out on the machine:

   a. Straight and irregular moulding.

   b. Rebating.

   c. grooving

   d. shaped curved work

With special attachments, it is also capable of tenoning, planning, trenching, recessing, lap and through dovetailing. A straight split fence, each half of which can be adjusted separately, is used for straight work. A circular or ring fence is used for curved work. Figure 1.12 shows parts of the spindle moulder machine and an example of a moulded piece with a cutter.

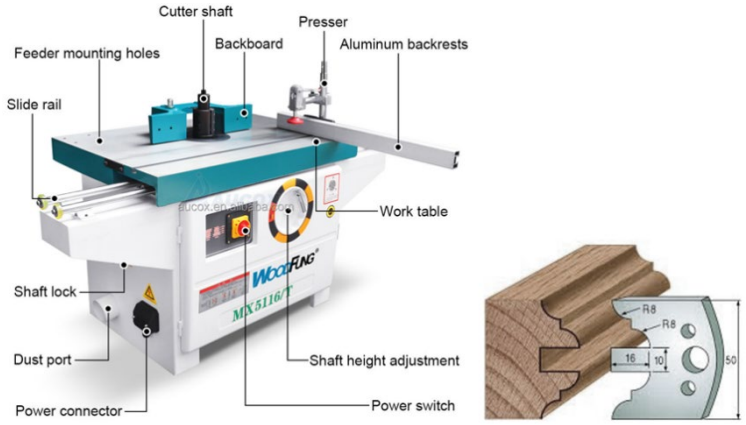


Figure 1.12 *Spindle moulder machine*

3. **Router Shaping machine:** This multipurpose woodworking machine creates precise edges, grooves, profiles, and decorative patterns on wood surfaces. It has a high-speed head and worktable. The router's spindle rotates at high speeds (up to 30,000 RPM) to cut and shape wood efficiently. The table is carried on vee-slides and can be lowered or raised by a hand wheel and screw. The head of the machine which houses the cutter is mounted on wide vee-slide ways. It comes under its weight and is lifted by a foot pedal. Using a special cutter and special attachments, the following operations can be carried out on the machine:

   a. square and moulded profile

   b. all kinds of intricate recessed work,

   c. grooving,

   d. rebating dovetailing

   e. cutting rebates



Figure 1.13 *Router Shaping machine*

4. **Grinding machine:** This is a specialised tool used in woodworking for sharpening tools. It plays a crucial role in maintaining the precision and efficiency of cutting tools and improving the finish of wooden surfaces. Figure 1.14 shows a grinding machine.



Figure 1.1*4 Grinding machine*

5. **Lathe machine:** The main function of the lathe is to turn or shape wood into circular sections. This may be down along the grain or across the grain. A variety of items-: drawer handles, tool handles, turned table and chair leg, bowls, trays, etc., are made on the lathe.

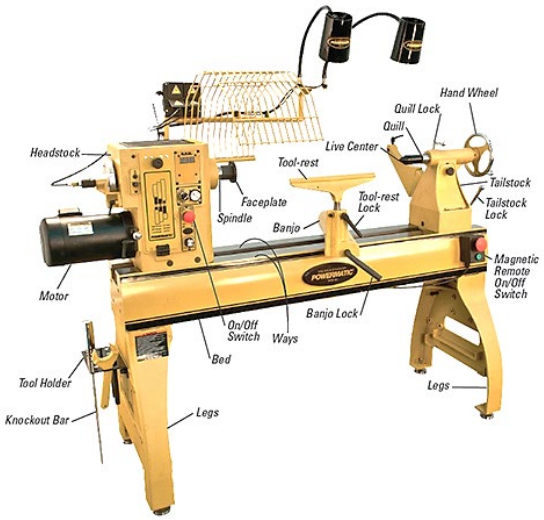
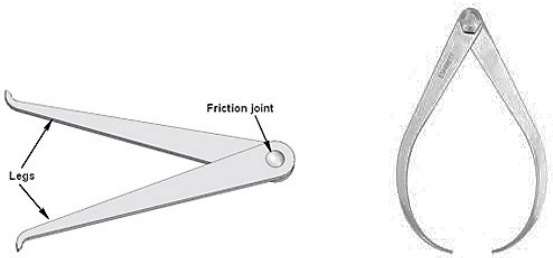
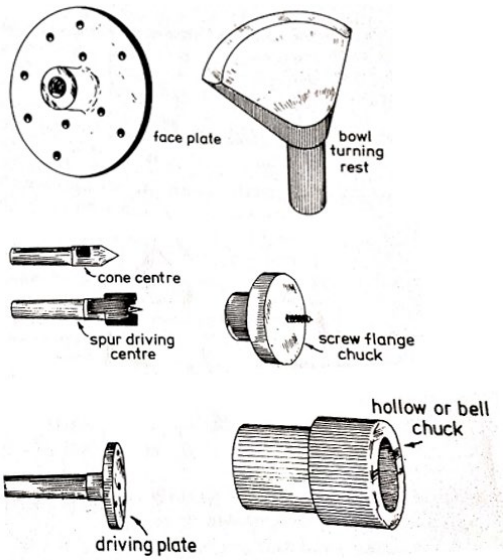


Figure 1.1*5 Lathe*

Table 1.1: *The following are tools and equipment used on the lathe machine:*

Nº	Tools and Equipment	Image
1	**Chisels edges** used on the Lathe machine	

2	**Inside** and **Outside** callipers for checking the inside and outside dimension of the work being turned.	
3	**Lathe devises:** they are various items required for holding timber between the head and tail stocks.	

Drum sander Machine

This is a woodworking machine designed to smooth and level large wood surfaces efficiently. The machine is like a Thicknesser machine but with cylindrical abrasive drums instead of cutter blocks. Some of these machines have three drums, fitted with varying grades of abrasive paper. The first drum carries the coarse paper and removes all unevenness from the surface uniformly, the second drum, a fine paper, makes the surface uniform, and the third drum, a fine paper gives a smooth, flat finish. The machine has a dust-collecting system. It sucks away the dust from the work. Figure 1.16 shows parts of drum sander.



Figure 1.1*6 Drum sander*

Learning Tasks

1. Identify at least three machines used in the woodwork shop for a specific operation.
2. Explain at least three uses of the various woodwork machines used for a specific operation.
3. Demonstrate how to use woodwork machines for a specific operation on a piece of wood.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners through a video demonstration of the types of woodwork machines and brainstorm on the identification of woodwork machines used for a specific operation. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and review explanations from them.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss the uses of the various woodwork machines used for a specific operation. The teacher should circulate the classroom ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Experiential learning: Take learners on industrial trip to explore the selection of appropriate machine and its uses for a specific operation on a piece of wood. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Key Assessment: Discussion

You have been tasked to make a wooden table with straight edges and a smooth surface.

1. Discuss the appropriate machine you would choose for each step:
   a. cutting the wood to sizes,
   b. making the joints,
   c. smoothing the surface.
2. Discuss why each machine is the appropriate choice for that specific task.

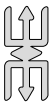
PLC Session 2

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.

b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)

c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app

   a. The key assessment for the week is ***discussion***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the discussion (NTS 3k-3q).

10 minutes **Content Exploration**

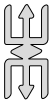
5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then

   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)

   b. all teachers in the group work through a similar problem individually for 3–4 minutes

   c. the group then works through the problem together step by step

   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).

   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.

   b. After the enactment, ask for structured feedback from the group

      i. was the concept explained in a way that a learner with no prior knowledge could follow?

      ii. were the examples grounded in contexts familiar to Ghanaian learners?

iii. did any misconceptions surface and if so, how were they addressed?

5 minutes	Reflection

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 2 REVIEW

Unit 2 of week 2 introduced learners to the selection *of* an appropriate machine for a specific operation independently. The pedagogical exemplars used in this section included talk for learning, group work/collaborative learning, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercises, homework, practical group activities are structured to cater for all the varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, real object (woodwork machines)

Reflection: Are learners able to select and explain the uses of appropriate machines for a specific woodwork operation.

UNIT 3

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of basic services*

Learning Outcome: *Outline the purpose of Services and determine the schedule of works involved in installing Electricity, Cold-water, Waste disposal and surface drainage system in a typical 3-bedroom self-contained house.*

INTRODUCTION AND SECTION SUMMARY

The unit introduces learners to the differences between services such as electricity supply, cold water installation and waste disposal to the consumers. Outline the different authorities involved in supplying the services and the fixtures used by the different companies in providing this service. Electricity services provide power for lighting, appliances, HVAC systems and equipment that run throughout the building with distribution points. Cold water installation delivers clean water for drinking, washing and other water needs and requires pressure maintenance and quality control. Waste disposal systems remove sewage and wastewater from the building to maintain hygiene and prevent contamination. Regulatory authorities are the Electricity services, the Energy Commission and its service provider is the Electricity Company of Ghana. Water supply, Water Resources Commission and its service provider is Ghana Water Company Limited (GWCL). Waste Water Disposal System, Environmental Protection Agency (EPA) and its service provider is the Municipal Waste Department. Installation Materials and Components. Electricity; wiring, conduit, circuits breakers, distribution boards, outlets, switches and earthing systems. Cold water; PVC/CPVC/Copper pipes, valves, tanks, pumps meters, fittings, and pressure regulators. Waste disposal; Large diameter of PVC/Cast iron pipe, traps, inspection chambers, vents and gradient systems. The teacher will guide learners to understand the key concepts of different services and their installations and supplies in building. Learners who have understood services will appreciate its importance and usefulness in building.

The unit covers only week 3: ***Distinguish between Electricity Supply, Cold Water Installation and Waste Disposal***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm and explain the difference between the following services; Electricity, Cold water installation and Waste disposal. Conducting experiential learning by organising field trips to construction sites where learners will observe different types of services in building. Organise learners into mixed ability groups and assist them to explain different types of services such as electricity, cold water installation and waste disposal. Assist learners to outline the various authorities responsible for providing different types of services into buildings and Materials used for supplying and installations of services. Help learners to develop a deeper understanding of the concept of using different types of services in buildings. Learners will be capacitated as they engage

in critical thinking without any form of inhibition. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions which will in turn capture the diverse knowledge of all learners.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include homework, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment. Regulatory authorities are; Electricity services, Energy Commission and its service provider is Electricity Company of Ghana. Water supply, Water Resources Commission and its service provider is Ghana Water Company Limited (GWCL). Waste Water Disposal System, Environmental Protection Agency (EPA) and its service provider is Municipal Waste Department. Installation Materials and Components. Electricity; wiring, conduit, circuits breakers, distribution boards, outlets, switches and earthing systems. Cold water; PVC/CPVC/Copper pipes, valves, tanks, pumps meters, fittings, and pressure regulators. Waste disposal; Large diameter of PVC/Cast iron pipe, traps, inspection chambers, vents and gradient systems.

Indicators	DOK Level	Assessment Strategy and/or Mode
Differences Between Electricity Supply, Cold Water Installation and Waste Disposal	3 (strategic reasoning)	Home work

WEEK 3

Learning Indicator: *Distinguish Between Electricity Supply, Cold Water Installation and Waste Disposal*

FOCAL AREA 1: DIFFERENCES BETWEEN ELECTRICITY SUPPLY, COLD-WATER INSTALLATION AND WASTE DISPOSAL

Different types of building services are; Electricity, Cold water installation and Waste disposal. Electricity services; provide power for lighting, appliances HVAC systems, and equipment's that runs throughout the building with distribution points. Cold water installation delivers clean water for drinking, washing and other water needs and requires pressure maintenance and quality control. Waste disposal systems; Removes sewage and wastewater from the building to maintain hygiene and prevent contamination. The main categories of building services are; electricity, water and plumbing, ventilation and air conditioning and other essential services. Regulatory authorities are; Electricity services, Energy Commission and its service provider is Electricity Company of Ghana. Water supply, Water Resources Commission and its service provider is Ghana Water Company Limited (GWCL). Waste Water Disposal System, Environmental Protection Agency (EPA) and its service provider is Municipal Waste Department. Figure 1.17 shows electricity supply to buildings.

1. **Purpose:** Provides electricity power for light, appliances, and other devices.
2. **Installation**: Involves wiring, panel boxes and connections to appliances
3. **Function:** Convert electrical energy to various forms of power



Figure 1.17 *Electricity Supply*

Figure 1.18 shows direct cold-water supply in building

1. **Purpose:** Supplies potable water for drinking, cooking, cleaning and some appliances.
2. **Installation:** Includes pipes, valves, and connections to fixtures like sink, toilet and baths.
3. **Function:** Delivers water from the water source to various points of use.



Figure 1.1*8(a) Connection to main, stop-cock/valve on rising main*



Figure 1.1*8(b) Connection to main, stop-cock/valve on rising main*

Figure 1.19 shows truck waste disposal

1. **Purpose:** Handles wastewater and solid waste from the house.
2. **Installation:** Involves pipes, traps and connections to a sewer system or septic tank.
3. **Function:** Collects and transports wastewater and to a collection facility or septic tank.



Figure 1.1*9 Vacuum tanker or Sewerage tanker*

Figure 1.20 shows pipe or drainage waste disposal.

1. **Purpose:** Handles wastewater and solid waste from the house.
2. **Installation:** Involves pipes, traps and connections to a sewer system or septic tank.
3. **Function:** Collects and transports wastewater and waste to a treatment facility or sometimes via a storage tank.



Figure 1.2*0 Treatment facility Sometimes via a storage tank*

Learning Tasks

1. Explanations on different services supplied to consumers in buildings.
2. Outline different Authorities involved in the supply of services.
3. Differentiation of systems, means, gadgets and fixtures used by different companies for providing different services.

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Organise learners into mixed ability groups and assist them to explain different types of services such as electricity, cold water installation and waste disposal.

Group work/Collaborative Learning: Assist learners to outline the various authorities responsible for providing different types of services into buildings.

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and discuss materials used for the supply and installations of services into building.

Key Assessment: Group Project

1. A new three-bedroom self-contained house has been constructed in an area with unreliable municipal services. Propose 1 strategy each that addresses potential failure points of electricity, water and waste water disposal.
2. The local electricity authority is implementing smart grid technology, while the water authority is upgrading to automated meter reading. Evaluate how these technological changes will influence the provision of building services.

HINT

Assign Group Project to learners and give them reasonable time to complete it. Use the SS App to generate the project as well as the rubric. Learners' projects should be marked immediately and scores entered into the SAP.

PLC Session 3

45 minutes **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous session, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand.
   b. identify three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q).
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).

Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Use your app to plan and administer the mode of assessment for the Student Assessment Portal (SAP).
   a. The key assessment for the week is ***group project***. Chat with your app to plan this assessment by reviewing or developing the assessment items/tasks and marking schemes/rubrics for the project (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or topic/idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through the problem individually for 3–4 minutes
   c. the group then works through it together the problem, step by step
   d. highlight the most common errors made at each step (NTS 1c, 1e, 2c, 2e, 3e-3j).

Note

- *This part is not 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 3 Review

Unit 3 of week 3. This unit produces the learners with a deeper understanding of the concept of different services supplied to consumers in buildings. The pedagogical exemplars used in this section included group work/collaborative learning, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, homework, and practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Additional Reading: Building Regulations and Compliance Guide: Local Building Regulations (LI1630 in Ghana)

Domestic Building Services Compliance Guide (Heating, hot water, ventilation) to ensure energy efficiency.

Resources: Pictures, videos, written presentations and using flip charts. (Building Construction)

UNIT 4

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Tools and Machines in Woodwork Industry

Content Standard: *Demonstrate the ability to use woodwork Machines.*

Learning Outcome: *Be able to select and use appropriate machine for a specific operation independently.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners to independently select and use appropriate woodwork machines for specific operations. They will explore different types of machines, understand their functions, and apply them in practical tasks. The unit also focuses on safety practices and proper handling. By the end of the unit, students will be able to confidently choose and operate machines that best suit the task at hand, promoting both efficiency in the workshop.

The unit covers only week 4: ***Use an appropriate machine for a specific operation independently.***

Recap weeks

Year 2	**Week 5:** Select and use appropriate machine for a specific woodwork operation.

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in using an appropriate machine for a specific operation independently. The teacher should employ pedagogies such as critical thinking and talk for learning, group work/collaborative learning and experiential learning. These strategies should be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts under this unit require learners to use an appropriate machine for a specific operation independently. Hence, the assessments should largely cover levels 1, 2 and 3 of the DoK. Teachers should employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' progress and give prompt feedback. Teachers should also administer assessments such as class exercises (including individual

worksheets) after each lesson, homework, scores on practical group activities on the various use of an appropriate machine for a specific operation independently and document learners' results in continuous assessment records. Teachers can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Use an appropriate machine for a specific operation independently	3 (Strategic reasoning)	Practical Assessments

WEEK 4

Learning Indicator: *Select an appropriate machine for a specific operation independently*

FOCAL AREA 1: USE AN APPROPRIATE MACHINE FOR A SPECIFIC OPERATION (CNC)

A wood CNC (Computer Numerical Control) machine is a specialised machine designed to work with wood materials that uses computer-controlled tools to cut, carve, and shape wood with high precision and accuracy.

1. **Mortising/Drilling machine (CNC):** This is a computer-controlled machine used in woodworking to carve out precise mortises, holes, complex patterns and other forms of joinery. It is vital for high-precision furniture making, cabinetry, and other woodworking industries where accuracy and efficiency are critical. It operates using Computer Aided Design/Computer Aided Mechanism (CAD/CAM) software to design and program the drilling or mortising patterns. Figure 1.21 shows CNC mortising/drilling machine.



Figure 1.21: *CNC Mortising/drilling machine*

2. **Router shaping machine (CNC):** A CNC router shaping machine is a computer-controlled tool used for precise cutting and shaping, engraving and carving, 3D Sculpting, Joinery and Assembly in woodworking and other materials like plastics and soft metals. It automates complex tasks, making it indispensable in industries like furniture making, cabinetry, sign-making, and custom woodworking. CAD (Computer-Aided Design) software is used to create designs, which are translated into machine instructions by CAM (Computer-Aided Manufacturing) software. Figure 1.22 shows a CNC router machine and Figure 1.23 shows a portable CNC router machine mounted on a table.



Figure 1.22 *CNC router machine*



Figure 1.23 *Potable CNC router machine*

3. **Grinding machine (CNC):** A **CNC woodwork grinding machine** is a computer-controlled machine used to sharpen, shape, and refine woodworking tools such as blades, chisels, and bits, as well as to finish and polish wooden surfaces or edges. This machine is critical in woodworking industries for maintaining precision tools and achieving high-quality finishes on wood. Figure 1.24 shows a CNC router machine.



Figure 1.24 *CNC router machine*

4. **Lathe machine (CNC):** This is a computer-controlled machine used for shaping wood by rotating a workpiece against cutting tools. It automates traditional woodturning processes to create precise and complex designs efficiently. CNC lathes are widely used in furniture making, crafting decorative wooden components, and manufacturing turned parts like spindles, bowls, and columns. It allows designs created in CAD software to be translated into machine paths using CAM software. Figure 1.25 shows parts of a CNC lathe machine.

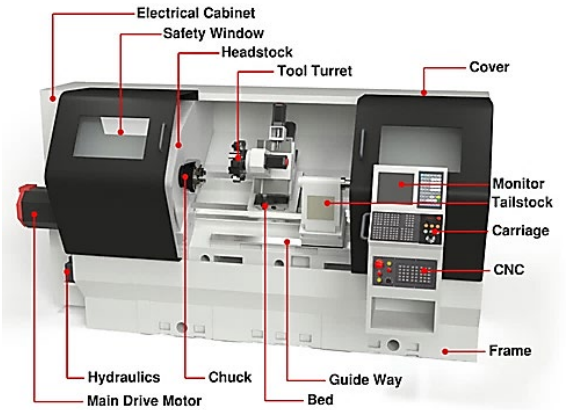


Figure 1.25 *CNC Lathe machine*

5. **Drum sander machine (CNC):** This is a computer-controlled sanding machine designed to provide consistent and precise surface finishing (Smoothing) on wooden materials. Unlike manual drum sanders, a CNC drum sander automates the sanding process, ensuring uniformity, efficiency, and precision. It is widely used in industries such as furniture manufacturing, cabinetry, and custom woodworking for surface preparation and finishing. It extracts dust and debris during sanding, maintaining a clean working environment. Figure 1.26 shows CNC drum sander machine.



Figure 1.26 *CNC drum sander machine*

Learning Tasks

1. Identify at least three Computer Numerical Control (**CNC**) machines used in the woodwork shop for a specific operation.
2. Explain at least three uses of the various woodwork computer numerical control (**CNC**) machines used for a specific operation.
3. Demonstrate how to use woodwork computer numerical control (**CNC**) machines for a specific operation on a piece of wood.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners in mixed ability groups through a video demonstration on the types of Computer Numerical Control (**CNC**) woodwork machines and brainstorm on the identification of (**CNC**) woodwork machines used for a specific operation. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and review their explanations.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss the uses of the various computer numerical control (**CNC**) woodwork machines used for a specific operation. The teacher should circulate the classroom, ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Experiential learning: Experiential learning: Take learners on an industrial trip to explore the selection of an appropriate machine and its uses for a specific operation on a piece of wood. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Key Assessment: Practical Assessment

As a woodwork student, you have been tasked to produce a dining chair with the following specifications:

a. Curved backrest components requiring precise shaping

b. Mortise and tenon joints for structural connections

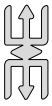
c. Turned legs with uniform dimensions

1. Demonstrate how to cut the given specification
2. Discuss why each machine is the appropriate choice for that specific task.

PLC Session 4

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***practical assessment***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the practical (NTS 3k-3q).

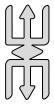
10 minutes | **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)

b. all teachers in the group work through a similar problem individually for 3–4 minutes

c. the group then works through the problem together step by step

d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).

   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.

   b. After the enactment, ask for structured feedback from the group

      i. was the concept explained in a way that a learner with no prior knowledge could follow?

      ii. were the examples grounded in contexts familiar to Ghanaian learners?

      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to

   a. transfer your chats into your learning planner template.

   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).

   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 4 REVIEW

Unit 4 of week 4 introduced learners to the use of an appropriate machine for a specific operation independently. The pedagogical exemplars used in this section included talk for learning, group work/collaborative learning, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercises, homework, practical group activities are structured to cater for all the varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, real object (woodwork CNC machines)

Reflection: Are learners able to use the appropriate woodwork computer numerical control (**CNC) machines** for a specific woodwork operation independently.

Reference:

1.Raf bagnall, Beginners Guide to (CNC) Machine in Wood, Complete Guide to (CNC) Woodworking, and (CNC) Woodworking for the Absolutely Beginner

2. Randy Johnson, & George Vondriska: Experts Providing Practical Hnads-on instruction for shop operations, co-authoring (CNC) Router Essentials

MARKING SCHEMES/RUBRICS FOR THE KEY ASSESSMENTS

Question 1

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Electrical services challenges	*Evaluates specific electrical integration challenges (wiring routes, panel locations, lighting fixtures) with clear examples of design conflicts*	*Identifies some electrical challenges with basic evaluation*	*Mentions minimal electrical issues with limited evaluation*	*Mentions element of electrical issues without evaluation*
Plumbing/water services challenges	*Evaluates specific plumbing integration challenges (pipe routing, fixture placement, water pressure needs) with clear examples of design conflicts*	*Identifies some plumbing challenges with basic evaluation*	*Mentions minimal plumbing issues with limited evaluation*	*Mentions one plumbing issues with limited evaluation*
Strategic integration approach	*Proposes thoughtful strategies that effectively balance modern functionality with preservation, showing understanding of creative solutions (e.g., false walls, dedicated service zones)*	*Suggests some integration strategies with partial consideration of the balance*	*Offers minimal strategies with limited consideration of the preservation-function balance*	*offers one strategy without consideration of the preservation-function balance*

Question 2

Criteria	Excellent (4marks)	Very Good (3 marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of Comfort Factors	*Explains multiple aspects of user comfort (thermal, visual, acoustic, air quality, convenience) and how building services directly influence these factors*	*Describes some comfort factors with partial explanation of their relationship to building services*	*Shows limited understanding of comfort factors with minimal connection to building services*	*Shows one element of understanding of comfort factors without connection to building services*
Electrical services analysis	*Analyses how electrical services affect comfort through lighting quality, power availability, and temperature control with specific examples*	*Describes some ways electrical services impact comfort with basic analysis*	*Mentions minimal connections between electrical systems and comfort with limited analysis*	*mention a connection between electrical systems and comfort with limited analysis*
Plumbing/water analysis	*Analyses how water systems contribute to comfort through accessibility, temperature control, pressure, and sanitation with specific examples*	*Describes some ways water systems impact comfort with basic analysis*	*Mentions minimal connections between water systems and comfort with limited analysis*	*mention a connection between water systems and comfort with limited analysis*
Integrated systems analysis	*Analyses how the coordination of multiple building services creates a complete comfort experience, with explanation of how systems work together*	*Makes some connections between different services with basic analysis of their combined effect*	*Makes minimal connections between services with limited understanding of their integrated impact*	*Makes a simple connection between services without integrated impact*

UNIT 2

Question 1 (20 marks)

Criteria	Excellent (4 marks)	Very Good (3marks)	Satisfactory (2marks)	Needs improvement (1mark)
Machine Selection: Cutting	Correctly identifies an appropriate cutting machine (e.g., circular saw, table saw) and justifies its use clearly	Correct machine identified with basic explanation	Machine identified but explanation is unclear or partially correct	Ability to identify a Machine
Machine Selection: Jointing	Clearly identifies suitable machine (e.g., mortiser, router, spindle moulder) and explains how it is used	Correct machine named with some explanation	Machine identified with little or no justification	Ability to identify a Machine
Machine Selection: Smoothing	Accurately selects a relevant machine (e.g., t belt sander) and explains its role	Suitable machine chosen with basic justification	Limited understanding of machine function	Ability to identify a Machine
Clarity of Explanation	Response is clear, logical, and shows deep understanding of woodwork machines	Response is mostly clear with minor errors or gaps in logic	Response is somewhat unclear or lacks detail	Response is confusing or lacks understanding
Use of Technical Vocabulary	Uses correct woodwork terms (e.g., surfacing, jointing, planning) consistently and appropriately	Uses some correct terminology with minor misuse	Limited use of technical terms or some incorrect use	Incorrect technical vocabulary used

Question 2 (10marks)

Questions	Answer	Marks
Specific task of machine	Jointer/surfacer: The jointer is the essential first machine in table production because its design specifically addresses the need for perfectly flat surfaces and square edges. Thicknesser: After creating a flat reference surface on the jointer, the planer is the appropriate machine for bringing all table components to consistent, parallel thickness. Dimension saw: The table saw is the optimal machine for cutting table components to their final width and length because its design ensures straight, accurate cuts with exceptional repeatability..	(10 marks, 2 marks for each points)

	Router: The router is the appropriate choice for edge treatments and joinery in table construction because its rotary cutting action with interchangeable bits allows for precise, consistent shaping. *Sander: For the final surface preparation, various sanders are appropriate because their design addresses the specific need for smooth, refined surfaces without altering dimensions significantly*	

UNIT 3

Question 1

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding the problem	*Identifies how unreliable services affect the house and why backup systems are needed*	*Identifies some problems caused by unreliable services*	*Minimally identifies problems with unreliable services*	*identification of problems in services.*
Solution for electricity	*Proposes a practical backup electricity solution with clear explanation of how it works when municipal power fails*	*Proposes a workable electricity solution with some explanation*	*Proposes a basic electricity solution with limited explanation*	*Propose basic electricity solution without explanation*
Solution for water supply	*Proposes a practical backup water solution with clear explanation of how it works during water shortages*	*Proposes a workable water solution with some explanation*	*Proposes a basic water solution with limited explanation*	*Propose basic water solution without explanation*
Solution for waste water	*Proposes a practical waste water solution with clear explanation of how it works when municipal systems fail*	*Proposes a workable waste water solution with some explanation*	*Proposes a basic waste solution with limited explanation*	*propose basic waste solution without explanation*
Practical	*Solutions are affordable, easy to maintain, and appropriate for a three-bedroom house*	*Solutions are somewhat practical with some consideration of cost and maintenance*	*Solutions show limited practicality with minimal consideration of real-world factors*	*solutions show practicality one element without consideration of real-world factors*

Question 2

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of technologies	*Explains how smart grid and automated meter reading systems work and their basic components*	*Provides a general description of the technologies with some technical details*	*Provides only basic identification of the technologies with minimal details*	*Provides one basic element of the technologies without details*
Impact electricity services	*Evaluates how smart grid affects power reliability, efficiency, and cost in buildings with specific examples*	*Describes some impacts of smart grid on building services*	*Lists limited impacts with minimal explanation*	*Lists one correct impact without explanation*
Impact on water services	*Evaluates how automated meter reading affects water management, leak detection, and billing in buildings with specific examples*	*Describes some impacts of automated meter reading on building services*	*Lists limited impacts with minimal explanation*	*Lists one correct impact without explanation*
Integration of services	*Explains clearly how these technologies work together to improve overall building service management*	*Makes some connections between the technologies and their combined effects*	*Makes minimal connections between the technologies*	*Make one connection between the technologies*
Benefits and challenges	*Evaluates both advantages and potential problems for building users and maintenance staff*	*Identifies some benefits and challenges*	*Mentions limited benefits or challenges*	*Mention one benefits or challenges*

UNIT 4 (20 marks)

Criteria	Excellent (4 marks)	Very Good (3marks)	Satisfactory (2marks)	Needs improvement (1mark)
Cutting: Curved Backrest Components	*Accurately marks and cuts smooth, symmetrical curves using the correct tools (e.g., router shaping machine, bandsaw).* *Safety precautions observed at all stages of producing the components. E.g. use of PPE, hair tied back, etc.*	*Correct machines used; curve is shaped well with minor uneven areas* *Safety precautions observed at some stages of producing the components.*	*Curve is roughly shaped; technique or machine use needs improvement.* *Not properly dressed using PPE while producing the components.*	*Shaped component produced; however, the component is poorly cut or inaccurate.* *Safety not observed at all while producing the components.*
Cutting: Mortise and Tenon Joints	*Cuts precise, tight-fitting joints using appropriate methods and tools (e.g., mortiser/ drilling machine).* *Safety precautions observed at all stages of producing the components. E.g. use of PPE, hair tied back, etc.*	*Cuts acceptable joints with small gaps or misalignments.* *Safety precautions observed at some stages of producing the components.*	*Joints are loose or uneven; may affect strength.* *Not properly dressed using PPE while producing the components.*	*Joints poorly made or unusable; technique not followed.* *Shaped component produced; however, the component is poorly cut or inaccurate.* *Safety not observed at all while producing the components.*
Cutting: Turned Legs	*Turns legs to uniform dimensions and smooth profile using lathe machine safely and skilfully.* *Safety precautions observed at all stages of producing the components. E.g., use of PPE, hair tied back, etc.*	*Legs mostly uniform with minor differences; lathe use shows fair control.* *Safety precautions observed at some stages of producing the components.*	*Inconsistencies in leg shape or size; limited tool control.* *Not properly dressed using PPE while producing the components.*	*Legs poorly turned; inconsistent dimensions; incorrect or unsafe lathe use.* *Shaped component produced; however, the component is poorly cut or inaccurate.* *Safety not observed at all while producing the components.*

Smoothing: Curved Backrest and Components	*Surfaces are cleanly smoothed (e.g., sander machine) and ready for finishing* *Safety precautions observed at all stages of producing the components. E.g., use of PPE, hair tied back, etc.*	*Smoothed surfaces with minor tool marks or uneven areas.* *Safety precautions observed at some stages of producing the components.*	*Smoothing attempted, but rough areas remain.* *Not properly dressed using PPE while producing the components.*	*Surfaces poorly smoothed; incorrect machine use or skipped step.* *Shaped component produced; however, the component is poorly cut or inaccurate.* *Safety not observed at all while producing the components.*
Smoothing: Joints, Flat Surfaces and Turned Leg	*All joint faces and flat parts are planed/sanded neatly; fit and finish are excellent.* *Legs are uniformly smoothed on the lathe machine or post-turning with consistent finish.* *Safety precautions observed at all stages of producing the components. E.g., use of PPEs, hair tied back, etc.*	*Most surfaces smoothed well; small imperfections.* *Legs are mostly smooth; minor tool or sanding marks present.* *Safety precautions observed at some stages of producing the components.*	*Some surfaces are rough or unfinished.* *Inconsistent smoothing; parts feel rough.* *Not properly dressed using PPEs while producing the components.*	*Many parts unsmoothed; lacks finishing skill or effort.* *Surface unfinished or poorly done; tool/ safety not followed.* *Shaped component produced; however, the component is poorly cut or inaccurate.* *Safety not observed at all while producing the components.*

SECTION 2: ELECTRICITY, WATER SUPPLY AND MAINTENANCE OF MACHINES AS WELL AS LKS, LUS, NTFPs

The section covers building construction technology and woodwork technology unit (strands).

In this section, learners will acquire knowledge and understanding of basic services in schedule of works involved in electricity and installing cold water supply. In the woodwork technology unit, learners are expected to gain the knowledge and understanding on how to care for and maintain machines and the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). All the above are treated from unit 5 to unit 8.

UNIT 5

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of basic services*

Learning Outcome: *Outline the purpose of Services and determine the schedule of works involved in installing Electricity in a typical 3-bedroom self-contained house.*

INTRODUCTION AND SECTION SUMMARY

This unit introduces learners to the process of installing an electrical system in a building. The schedule of works involved in installing this system involves procuring permits, planning, design, material selection, installation, incorporating and ensuring safety, testing as well as commissioning the system. In effect, such an Electrical installation would provide power for lighting, appliances, and devices as well as heating, and cooling. A Proper installation would help prevent electrical fires, shocks and ensure functionality. A well-designed system can also increase property value and reduce energy costs. The teacher will guide learners to understand the key concepts of services in building. Learners having understood services, will appreciate its importance and usefulness in building

The unit covers only week 5: ***Explain the schedule of works involved in installing Electricity.***

Recap weeks

Year 1	**Week 15:** Roles of Professionals

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm the meaning of electrical installation. Conducting experiential learning by organising field trips to construction sites where learners will observe electrical installation in building. Organise learners into mixed ability groups and assist them to explain electrical installation, processes involved in the installation and general benefits they bring to the functioning of the building. Learners will be capacitated as they engage in critical thinking without any form of inhibition. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions which will in turn capture the diverse knowledge of all learners.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include class exercise, debating and other oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate level 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment.

Indicators	DOK Level	Assessment Strategy and/or Mode
Discuss the schedule of works involve in the installation of electricity in the building.	3 (Strategic reasoning)	Debate

WEEK 5

Learning Indicator: *Explain schedule of works involved in electricity supply*

FOCAL AREA 1: SCHEDULE OF WORKS INVOLVED IN ELECTRICITY SUPPLY

The planning and design of electrical system installation is the first and most important step in the process. This is where the architect and engineer work to determine the electrical needs of the building. Such needs include the number of outlets, lights, and appliances. They will also need to consider the location of these electrical fixtures and appliances, as well as the type of electrical wiring and equipment that will be used. The planning and design process also takes into account the local electrical codes which are designed to ensure the safety of the building occupants and to prevent electrical fires and shocks.

The Material selection is the second stage in electrical system installation. The engineer at this stage selects the materials required for the installation based upon the planning and design done. Some of these materials include**:**

1. Electrical wires: carrying electricity from the source to appliances and fixtures.
2. Electrical boxes: housing components like switches and outlets.
3. Electrical fixtures: distributing electricity to appliances and fixtures.
4. Electrical grounding: providing protection against electrical shock by connecting the system to a grounding rod buried in the ground.

The third stage in electrical system installation is Installation itself. The activities performed before the actual wiring are drilling, notching and chasing to accommodate runs and boxes. Wiring which involves the running of electrical wires from the power source to the electrical outlets and fixtures.

1. Wiring connections which entail making the necessary connections between the electrical wires. Wiring protection involving installation of the necessary electrical protection devices, such as fuses and circuit breakers. These devices will protect the electrical system from overloads and short circuits.
2. Testing the electrical system to make sure it is working properly.
3. Documentation of the electrical installation, including a wiring diagram and a list of the materials and equipment used.
4. Insulation resistance test**:** This test checks the insulation resistance of the electrical wires to ensure that they are properly insulated and that there is no risk of electrical shock.

The fourth stage in electrical system installation is Testing and commissioning. It is the process of verifying that an electrical system is installed correctly and is operating as intended. The activities performed here include:

1. Pre-commissioning checks: These checks are performed before the electrical system is energised to ensure that all of the components are installed correctly and that the system is ready.
2. In electrical system installation is Maintenance and repair. Electrical maintenance includes inspecting, testing, and cleaning the electrical system to ensure that it is working properly.

Maintenance and repair work can be considered as:

1. Replacing damaged or faulty electrical wiring.
2. Equipment Soldering or crimping electrical connections.
3. Installing new electrical outlets and fixtures.



Figure 2.1 *Electrical installation in a building*

Learning Tasks

1. Explanation of Electrical Installation.
2. Outline the major schedule of works involved in Electrical Installation.
3. Discuss the different stages of Electrical Installation.

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and explain Electrical Installation.

Group work/Collaborative Learning: Organise learners into mixed ability groups and assist them to Outline the major schedule of works involved in Electrical Installation.

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and discuss the different stages of Electrical Installation.

Key Assessment: Debate

1. A building requires electrical installation to be completed within a tight 6-week timeframe. Evaluate the most 3 critical factors that must be considered when scheduling.
2. A client requires the integration of smart building technologies into the electrical installation of a building. Evaluate how any two smarts building technologies can be integrated and how these can affect the traditional scheduling approach for electrical works.

PLC Session 5

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to

a. explain the week's concepts in a practical way that will make it easier for learners to understand

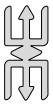
b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).

3. Use your subject specific app to plan your lesson. Ask the app to

a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.

b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)

c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app

a. The key assessment for the week is ***debate***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the debate (NTS 3k-3q).

10 minutes **Content Exploration**

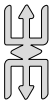
5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then

a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)

b. all teachers in the group work through a similar problem individually for 3–4 minutes

c. the group then works through the problem together step by step

d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).

a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.

b. After the enactment, ask for structured feedback from the group

   i. was the concept explained in a way that a learner with no prior knowledge could follow?

   ii. were the examples grounded in contexts familiar to Ghanaian learners?

   iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to

   a. transfer your chats into your learning planner template.

   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).

   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 5 Review

Unit 5 of week 5. This unit produces the learners with a deeper understanding of concept of Installing Electricity into a house. The pedagogical exemplars used in this section included group work/collaborative learning, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercise, debate, practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, Videos, real object, visit to construction

UNIT 6

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Tools and Machines in Woodwork Industry

Content Standard: *Demonstrate the ability to use woodwork Machines.*

Learning Outcome: *Be able to select and use appropriate machine for a specific operation independently.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners to care for and maintain machines used in the woodwork shop. Proper care and maintenance of machines are essential to ensuring their efficiency, longevity, and safety. In woodworking and other industries, well-maintained equipment not only delivers precise results but also reduces the risk of breakdowns and accidents. Regular maintenance helps identify potential issues early, saving time and costs associated with repairs or replacements. Employees involved in maintenance should be competent, having had appropriate training for each type of machine, and be specifically designated as such.

The unit covers only week 6: ***Demonstrate how to care for and maintain machines.***

Recap weeks

Year 2	**Week 7:** Explain how to care for and maintain hand tools and machines

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in caring for and maintaining machines. The teacher will employ pedagogies such as critical thinking and talk for learning, group work/ collaborative learning and experiential learning. These strategies will be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts under this unit require learners to care for and maintain machines. The assessments should largely cover levels 1, 2 and 3 of the DoK. Teachers will employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' progress and give prompt feedback. Teachers will administer assessment such as class exercises (including individual worksheets) after each lesson, homework, scores on practical group activities on how to care for and maintain machines and document learners' results in continuous assessment records. Teachers can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Demonstrate how to care for and maintain machines	3 (Strategic reasoning)	Demonstration as an Assessments

WEEK 6

Learning Indicator: *Demonstrate how to care for and maintain machines*

FOCAL AREA 1: CARE AND MAINTAINANCE OF SPECIFIC MACHINES

General maintenance

Care and maintenance of Woodworking machines are crucial for optimal performance, safety, and longevity. Correct maintenance of woodworking machines will ensure faster and better-quality work with less risk of kickback and other incidents and also help to reduce noise emissions.

The Factories Ordinance 1952 governs the use of woodworking machines in Ghana and anybody using the machines must have a thorough knowledge of the regulations. Figure 2.2 shows maintenance on a CNC machine.



Fig. 2.2: Maintenance on machines

Safety precautions during maintenance:

1. Always dress appropriately using appropriate PPEs (i.e., nose mask, gloves, goggles, overall, overcoat, etc.)
2. Always disconnect the machine from its power source before performing maintenance.
3. Employ the correct tools and equipment for servicing the machine.
4. Run a test operation to confirm the machine is functioning correctly.
5. Understand and follow manufacturer operating procedures.
6. Only perform maintenance when other workshop activities are not in progress

General maintenance for Woodworking Machines (CNC)

1. Always dress appropriately using appropriate PPEs (i.e., nose mask, gloves, goggles, overall, overcoat, etc.)
2. Remove dust, chips, shavings, and debris after each use to prevent clogging and wear.

3. Regularly check electrical components, belts, and safety features.
4. Refer to the machine's manual for specific maintenance schedules and procedures.
5. Monitor Software and Firmware: Update the CNC control system to benefit from improvements and fixes.
6. Store tools and accessories in dry, organised conditions to prevent damage.
7. Ensure operators are trained in both machine use and maintenance procedures.
8. Address issues promptly and replace worn or damaged parts to prevent further damage.
9. Maintain accurate records of maintenance, repairs, and inspections to track machine history.
10. Lock out and tag machines under maintenance to prevent accidental activation
11. Do not leave the machine unattended whilst it is in motion or running down.
12. Establish and enforce safety protocols for machine operation and maintenance.

Sharpening of cutters/blades and saws

1. **Care and maintenance of Mortising/Drilling Machine (CNC):**
    a. Always dress appropriately using appropriate PPEs (i.e. nose mask, gloves, goggles, overall, overcoat, etc.)
    b. Ensure mortising and drilling bits are sharp and properly aligned.
    c. Regularly test and recalibrate (a gauge or instrument) with a standard scale of readings) the CNC system for precision.
    d. Prevent rust and wear by applying lubricant to all moving parts.
    e. Ensure workpiece clamps are in good condition and provide firm support.
2. **Care and Maintenance of Grinding Machine (CNC)**
    a. Always dress appropriately using appropriate PPEs (i.e. nose mask, gloves, goggles, overall, overcoat, etc.)
    b. Check for cracks or wear and replace, when necessary, on the **grinding wheels**.
    c. Ensure wheels are properly balanced and aligned to prevent vibrations.
    d. Maintain the coolant system to avoid overheating or rusting.
    e. Verify that the spindle operates at the correct speed for the task.
    f. Keep the moving parts lubricated for smooth grinding operations.
3. **Care and Maintenance of Router Shaping Machine (CNC)**
    a. Always dress appropriately using appropriate PPEs (i.e., nose mask, gloves, goggles, overall, overcoat, etc.)
    b. Ensure bits are sharp and free from damage before use.
    c. Apply lubricant to guide rails and bearings for smooth operation.
    d. Regularly verify the machine's accuracy and recalibrate as needed.
    e. Use a dust collection system to prevent build-up around the machine.
    f. Keep the CNC control software updated for optimal functionality.

4. **Care and maintenance of Woodworking Lathe Machine (CNC):**
    a. Always dress appropriately using appropriate PPEs (i.e., nose mask, gloves, goggles, overall, overcoat, etc.)
    b. Ensure the workpiece is securely mounted and the spindle runs smoothly.
    c. Regularly sharpen cutting tools for efficient and precise turning.
    d. Check for wear or tension issues in the belts and replace them if needed.
    e. Remove shavings and debris to prevent wear and maintain accuracy.
    f. Apply oil or grease to the tool post, tailstock, and guideways.
5. **Care and maintenance of Drum Sander Machine (CNC)**
    a. Always dress appropriately using appropriate PPEs (i.e., nose mask, gloves, goggles, overall, overcoat, etc.)
    b. Monitor abrasives for wear and replace them when they lose effectiveness.
    c. Ensure belts are tight and aligned to prevent uneven sanding.
    d. Keep the system clear of clogs to maintain efficient dust removal.
    e. Lubricate and replace worn-out bearings or rollers as needed.

Learning Tasks

1. Describe how to care for and maintain machines in the workshop.
2. Explain the **safety precautions during the maintenance** of machines in the workshop.
3. Demonstrate how to care for and maintain any three **(CNC)** machines in the woodwork shop.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners through a video demonstration on the care and maintenance of CNC machines, and brainstorm on the different ways of caring and maintaining the CNC machines with open-mindedness. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and collect relevant explanations from learners.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss and explain the safety precautions during maintenance of machines in the woodwork shop. The teacher should circulate the classroom ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Experiential learning: Experiential learning: Take learners on industrial trip to explore the selection of an appropriate CNC machine and demonstrate how to care for and maintain the selected machine taking into consideration skill level and safety rules. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Key Assessment: Mid-Semester Examination

Your school has acquired new machines to be added to the old machines in the workshop.

1. Demonstrate how you will care for and maintain the new woodwork machines.
2. Demonstrate how you will care for and maintain the old woodwork machines.
3. Demonstrate safety precautions to be observed in caring for and maintaining CNC woodwork machines.

HINT

*Conduct **Mid-semester examination**. It should cover contents taught from Week 1 to 5. Refer to the **Table of Specification and Structure of the Paper**. Learners' papers should be marked immediately and scores entered into the SAP.*

Structure

Section A = 25 Multiple Choice Questions

Section B = 2 Essay Questions

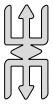
Table of specification for item construction for section A and B

Week	Focal area	Types of questions	DoK Levels				Total
			1	2	3	4	
1	Reasons for providing services	MCQs	2	2	-		4
		ESSAY	-	-	-		-
2	Machines for a specific operation	MCQs	2	2	2		6
		ESSAY	-	-	1		1
3	Differences between electricity supply, cold-water installation and waste disposal	MCQs	-	2	1		3
		ESSAY	-	-	-		
4	Use an appropriate machine for a specific operation (cnc)	MCQs	3	2	1		6
		ESSAY					
5	Schedule of works involved in electricity supply	MCQs	1	3	2		6
		ESSAY			1		1
		Total	8	11	8		27

PLC Session 6

45 minutes **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous session, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand.
   b. identify three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q).
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



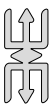
Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Use your app to plan and administer the mode of assessment for the Student Assessment Portal (SAP).
   a. The key assessment for the week is ***mid-semester examination***. Chat with your app to plan this assessment by reviewing or developing the assessment items/tasks and marking schemes/rubrics for the mid-semester examination (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or topic/idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through the problem individually for 3–4 minutes
   c. the group then works through it together the problem, step by step
   d. highlight the most common errors made at each step (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*

- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 6 REVIEW

Unit 6 of week 6 introduced learners to how to care for and maintain machines. The pedagogical exemplars used in this section included talk for learning, group work/ collaborative learning, digital learning and experiential learning, which helped meet all learners' varied needs. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercises, homework, and practical group activities, are structured to cater to all the varied learning activities. These assessments were classified under the DoK level 1, 2 and 3.

Reflection: Are learners able to care for and maintain (**CNC**) machines for a specific woodwork operation.

Resources: Pictures, Videos, object- Woodworking machines

UNIT 7

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of basic services*

Learning Outcome: *Outline the purpose of Services and determine the schedule of works involved in installing Electricity, Cold-water, Waste disposal and surface drainage system in a typical 3-bedroom self-contained house*

INTRODUCTION AND SECTION SUMMARY

The unit introduces learners to schedule of works involved in cold water supply. This refers to the detailed document that outlines the sequence, timing and responsibilities required to complete all activities involved in the installation. It serves as a roadmap for the installation process. Pre-Installation Planning; This refers to stages such as Site Assessment; to evaluate water sources, pressure requirements, and building layout. and storage requirements. Materials Specification; to select appropriate pipes, fittings, valves based on water quantity and building needs. Regulatory Approval; to obtained necessary permits from Water Company and Local Authorities. Installation Sequence: Underground Work; Excavation for main water line trenches, Connection to municipal or district water supply, Installation of main shut-off valve, Backfilling and compacting. First Fix (During structural/framing stage); Installation of rising main, Water storage tank installation (if required), Main distribution pipework installation, Branch lines to fixture locations and Services valves installation. Second Fix (After wall finishes or Before final finishes); Connection of fixtures (sink, toilet, showers etc), Installation of water meters, Pressure regulators and specialised valves and Final connections to appliances requiring water. The teacher will guide learners to understand the key concepts of schedule of works involved in cold water supply. Learners having understood these, will also appreciate the importance of Pre and final schedule of works involved in Installing cold water in buildings

The unit covers only week 7: ***Schedule of works involved in Cold Water Installation.***

Recap weeks

Year 2	Week 6: Excavation

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm and explain schedule of works involved in cold water supply. Conducting experiential learning by organising field trips to construction sites where learners will observe and appreciate the importance of Pre and final schedule of works involved in Installing cold water in buildings. Organise learners into mixed ability groups and assist them to explain Pre and Final schedule of work involved in cold water installation in buildings. Assist learners to outline the various activities under Pre-Installation Planning and final phases of installation (Schedule of works

involved in cold water installation). Help learners to develop a deeper understanding of the concept of schedule of works involved in cold water Installation in buildings. Learners will be capacitated as they engage in critical thinking without any form of inhibition. The collaborative environment, which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions, which will in turn capture the diverse knowledge of all learners.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include debate, homework, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment.

Indicators	DOK Level	Assessment Strategy and/or Mode
Explain schedule of work involved in Installing cold water supply.	3 (strategic reasoning)	Debate

WEEK 7

Learning Indicator: *Explain schedule of work involved in installing cold water supply*

FOCAL AREA 1: SCHEDULE OF WORKS INVOLVED IN COLD WATER SUPPLY

Schedule of works involved in cold water supply refers to the detailed document that outlines the sequence, timing and responsibilities required to complete all activities involved in the installation. It serves as a roadmap for the installation process. Pre-installation planning refers to stages such as site assessment, system design, materials specification and regulatory approval. The final installation planning stage is divided into two i.e. first fix (during structural/framing stage) installation of rising main, water storage tank installation (if required), main distribution pipework installation, branch lines to fixture locations and services valves installation. The second fix (after wall finishes or before final finishes) connection of fixtures (sink, toilet, showers etc), installation of water meters, pressure regulators and specialised valves. Figure 2.3 shows pre-installation of cold-water supply from water company indicating system design, determine pipe sizes, routes and fixture locations.



Figure 2.3: *Pre-installation of cold-water supply*

Figure 2.4 shows the final installation planning of cold-water supply, indicating the rising main, distribution pipework, branch lines to fixture locations and services valves, and connection of fixtures (sink, toilet, showers, etc.).



Figure 2.4 *Final installation planning of cold-water supply*

Learning Tasks

1. Explanations on Schedule of works involved in cold water installation.
2. Discuss and outline the phases of works involved in schedule of work for cold water installation in buildings.

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and explain schedule of works involved in cold water supply.

Group work/Collaborative Learning: Assist learners to outline the various activities under Pre-Installation Planning and final phases of installation (Schedule of works involved in cold water installation).

Conducting experiential learning: Organise field trips to construction sites where learners will observe and appreciate the importance of Pre and final schedule of works involved in Installing cold water in buildings.

Key Assessment: Debate

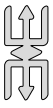
1. A building requires a cold-water installation to be completed within a tight timeframe. Evaluate the three most critical factors that must be considered when scheduling.

A client requires the integration of smart building technologies into the cold-water installation of a building. Evaluate how any two smart building technologies can be integrated and how these can affect the traditional scheduling approach for cold-water installation works.

PLC Session 7

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*

- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***debate***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the debate (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).

Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to

a. transfer your chats into your learning planner template.

b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).

c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 7 Review

Unit 7 of week 7. This unit produces the learners with a deeper understanding of the concept of Schedule of works involved in cold water installation in buildings. The pedagogical exemplars used in this section included group work/collaborative learning, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, homework, and practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Additional Reading; Building Regulations and Compliance Guide: Local Building Regulations (LI1630 in Ghana)

Buildings services handbook: covers installations methods, commissioning, and maintenance.

Resources: Pictures, videos, written presentations and using flip charts. (Building Construction)

UNIT 8

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Materials and artefacts production in woodwork industry in Ghana

Content Standard: *Demonstrate knowledge and understanding of Sustainability of Timber Industry in Ghana.*

Learning Outcome: *Demonstrate knowledge and understanding of Sustainable Timber Industry in Ghana.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners to determine the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP) are underutilised wood types that possess properties comparable to, or even surpassing, those of more commonly exploited species. In Ghana, the promotion and utilisation of these species are gaining momentum to alleviate pressure on overexploited traditional timber species and to support sustainable forest management.

The unit covers only week 8: ***Determine the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in determining the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The teacher will employ pedagogies such as critical thinking and talk for learning, group work/collaborative learning and experiential learning. These strategies will be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts under this unit require learners to determine the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The assessments should largely cover levels 1, 2 and 3 of the DoK. Teachers will employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' progress and give prompt feedback. Teachers will administer assessment such as class exercises (including individual worksheets) after each lesson, homework, scores on practical group activities on availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP) and document learners' results in continuous assessment records. Teacher can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Determine the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)	2 (Skills of conceptual understanding)	Research

WEEK 8

Learning Indicator: *Determine the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)*

FOCAL AREA 1: DETERMINATION OF LESSER-KNOWN TIMBER SPECIES (LKS), LESSER USED TIMBER SPECIES (LUS) AND NON-TIMBER FOREST PRODUCT (NTFP)

1. **Lesser-known and lesser-used species:** Refer to underutilised timber species from Ghana that have properties similar to those of other popular species. There are more than 50,000 species of timber worldwide, but only a small proportion of these are used commercially. Currently, Ghana has nearly 90 species that are regularly exploited and traded as timber. Lesser-known and lesser-used species can have similar and even better performance for some specific end-uses; they can also have a more distinctive and unique appearance compared to more popular ones. Using these species is not only a good business decision but also has the potential to improve livelihoods and protect biodiversity.

Table 2.1: *Some Ten (10) Lesser-Known and Lesser-Used Species Based*

Nº	Species name/ Appearance	Image	Availability and Sources
1	**AFINA** **Scientific name:** *Strombosia glaucesens*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 300,000m³, conversion into **lumber, poles and veneer.**
2	**ALSTONIA** **Scientific name:** *Alstonia boonie*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 178,900m³, conversion into **lumber, veneer and plywood.**
3	**DANTA / (KOTIBE')** **Scientific name:** *Nesogordonia papaverifera*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 120,000m³, conversion into **lumber veneer and plywood**.

4	**RED OAK / (KWATAFOMPABOA)** **Scientific name:** *Berlinia confuse*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 60,000m³, conversion into **lumber, veneer and plywood.**
5	**WATAPUO** **Scientific name:** *Cola gigantea*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 65,400m³, conversion into **lumber.**
6	**APOME / (ANANTA)** **Scientific name:** *Cynometra Ananta*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 248,000m³, conversion into **lumber and pole.**
7	**AVODIRE** **Scientific name:** *Turraeanthus africanus*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 16,000m³, conversion into **lumber, veneer and plywood.**
8	**DENYA / (OKAN)** **Scientific name:** *Cylicodiscus gabunensis*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 500,000m³, conversion into **lumber and pole.**
9	**EFFEU** **Scientific name:** *Hannoa Klaineana*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 65,500m³, conversion into **lumber, billets, veneer and plywood.**

10	**WAWABIMA / (BROWN STERCULIA)** **Scientific name:** *Sterculia rhinopetala*		Log production is from sustainably managed natural forests based on the Ghana forest management standard. Annual round log production is equivalent to the annual allowable cut estimated at 170,000m^3, conversion into **lumber, veneer and plywood.**

2. **Non-Timber Forest Products (NTFPs)**: These are goods of biological origin other than timber, harvested from natural forests, plantations, and agroforestry systems. These include fruits, nuts, seeds, medicinal plants, resins, oils, fibres, mushrooms, honey, animal products like bush meat. vegetables, fish and game, medicinal plants, resins, essences and a range of barks and fibres such as bamboo, rattans, and a host of other palms and grasses. Figure 2.5 shows images of some Non-Timber Forest Products (NTFPs) in Ghana.

   a. **The availability of NTFPs depends on:**

      i. **Forest type and biodiversity:** Tropical rainforests, savannah woodlands, and wetlands offer different varieties of NTFPs.

      ii. **Seasonality**: Many NTFPs are seasonal (e.g., mushrooms and fruits).

      iii. **Conservation and forest management practices:** Overharvesting, deforestation, and land degradation can reduce availability.

      iv. **Community involvement:** Communities practicing sustainable harvesting help maintain supply.

   b. **Sources of NTFPs include:**

      i. Wild harvesting of leaves, fruits, bark, and roots. Example: Shea nuts, dawadawa seeds, and baobab fruit from Ghanaian woodlands.

      ii. Products grown alongside crops or in home gardens**.** Example: Moringa leaves, plant-based medicines, and honey from beekeeping.

      iii. Cultivation of specific NTFPs like bamboo, rattan, or medicinal herbs. Example: Cashew and neem plantations.

      iv. Protected areas managed by local people often used sustainably for NTFP collection. Example: Wild herbs and spices in traditional sacred groves.

Learning Tasks

1. Explain the term Lesser-known and lesser-used species in Ghana.
2. Explain the term Non-Timber Forest Products (NTFPs) in Ghana
3. Discuss the availability and sources of Lesser-known, lesser-used species and Non-Timber Forest Products (NTFPs) in Ghana.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners through a video demonstration on Lesser-known, lesser-used species and Non-Timber Forest Products (NTFPs) in Ghana, and brainstorm on the Lesser-known, lesser-used species and Non-Timber Forest Products (NTFPs) in

Ghana with open-mindedness. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and collect relevant explanations from learners.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss the availability and sources of Lesser-known, lesser-used species and Non-Timber Forest Products (NTFPs) in Ghana. The teacher should circulate the classroom ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Key Assessment: Research

Research three Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP) and:

1. Create a simple map showing their geographic distribution.
    a. **Denya (LKS):** Primarily found in the moist semi-deciduous forest zones of Ghana, particularly in the Eastern, Ashanti, and Western regions. Also appears in parts of Côte d'Ivoire and Liberia. **(2marks)**
    b. **Danta (LUS):** Distributed across the high forest zone of Ghana, with concentrations in the Western, Central, and Ashanti regions. Also, found in smaller quantities in the Eastern region. **(2marks)**
    c. **Rattan (NTFP):** Grows in the understory of moist evergreen forests in the Western and Central regions of Ghana, particularly in forest reserves and areas with consistent rainfall. **(2marks)**
2. Describe how these materials are harvested, processed and incorporated into woodwork products. **(9marks, 3marks for each point)**

PLC Session 8

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
    a. explain the week's concepts in a practical way that will make it easier for learners to understand
    b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
    a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
    b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
    c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).

Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***research***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the research (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).

Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).

8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 8 REVIEW

Unit 8 of week 8 introduced learners to determine the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The pedagogical exemplars used in this section included talk for learning, group work/collaborative learning, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercises, homework, practical group activities are structured to cater for all the varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, real object (Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)

Reflection: Are learners able to determine the availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP).

MARKING SCHEMES/RUBRICS FOR THE KEY ASSESSMENTS

UNIT 5

Question 1

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2 mark)	Needs Improvement (1mark)
Understanding of Electrical Installation Process	*Describes the sequence of electrical installation activities and how they relate to the 6-week timeframe*	*Provides a general understanding of electrical installation with some sequencing knowledge*	*Shows limited understanding of electrical installation processes*	*Shows one understanding of electrical installation processes*
Identification of Critical Factors	*Identifies 3 truly critical factors that significantly impact electrical installation scheduling with clear explanation*	*Identifies factors of moderate importance to electrical installation scheduling*	*Identifies basic or obvious factors with limited relevance to scheduling*	*Identification of one basic or obvious factors without relevance to scheduling*
Prioritisation and Justification	*Explains why the identified factors are the most critical, with logical reasoning about their impact on the 6-week timeline*	*Provides some explanation for why factors are important, with basic reasoning*	*Offers minimal justification for why factors were selected*	*Offers one justification for why factors were selected*
Practical Application	*Demonstrates how these factors would be applied in a real-world electrical installation scenario with specific examples*	*Shows some practical application with general examples*	*Shows limited practical application with few or no examples*	*Shows one practical application without examples*
Consideration of Constraints	*Addresses how the 6-week timeframe affects planning and identifies potential challenges*	*Mentions some time constraints and general challenges*	*Minimally addresses time constraints or challenges*	*One addresses time constraints or challenges*

Question 2

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of Smart Building Technologies	*Explains two specific smart building technologies and their key functions in modern buildings*	*Provides general descriptions of two smart technologies with some understanding of their functions*	*Identifies two technologies with limited explanation of how they function*	*Identification of one technology and its function*
Integration with Electrical Systems	*Explains how the selected technologies connect with and depend on the building's electrical system*	*Describes some connections between the technologies and electrical systems*	*Mentions basic connections with minimal technical detail*	*Mentions one basic connections without technical detail*
Impact on Traditional Scheduling	*Evaluates how these technologies change the sequence, timing, and coordination of electrical installation work compared to traditional approaches*	*Describes some changes to scheduling with partial explanation of why they occur*	*Lists minimal scheduling changes with little explanation*	*Lists one scheduling and explanation*
Additional Requirements	*Identifies specific additional materials, skills, or testing procedures needed for smart technology installation*	*Identifies some additional requirements with basic explanation*	*Mentions few additional requirements with minimal detail*	*Mentions one additional requirement without detail*
Practical Considerations	*Evaluates realistic challenges and benefits of implementation, including cost, training, and future maintenance*	*Describes some practical considerations with partial analysis*	*Lists few practical considerations with limited analysis*	*Lists one practical considerations without analysis*

UNIT 6

Question 1 (20 marks)

Criteria	Excellent (4 marks)	Very Good (3marks)	Satisfactory (2marks)	Needs improvement (1mark)
Knowledge of Maintenance	*Explains and demonstrates multiple correct maintenance procedures (e.g., cleaning, oiling, tightening parts).*	*Demonstrates key maintenance procedures with minor omissions.*	*Shows limited understanding; misses key steps or gives vague answers.*	*Lacks basic knowledge of maintenance; most steps missing or incorrect.*
Demonstration Technique	*Steps are shown in a logical, safe, and organised manner.*	*Steps mostly organised and safe, with minor issues.*	*Demonstration is somewhat disorganised or unsafe.*	*Poor technique; unsafe or confusing demonstration.*
Tool and Material Use	*Selects and uses the correct tools and materials appropriately and safely.*	*Uses mostly correct tools with a few errors.*	*Uses some incorrect or unsafe tools or materials.*	*Tools and materials are misused or missing.*
Safety Practices	*Demonstrates full awareness of safety (e.g., PPE, machine off before maintenance).*	*Mostly follows safety procedures with minor lapses.*	*Some important safety practices ignored.*	*Ignores basic safety rules.*
Clarity of Explanation	*Clearly explains each maintenance step with reasons.*	*Explains steps but with limited detail or clarity.*	*Gives brief or unclear explanations.*	*Gives little or no explanation.*

Question 2 (20 marks)

Criteria	Excellent (4 marks)	Very Good (3marks)	Satisfactory (2marks)	Needs improvement (1mark)
Machine Cleaning Procedures	*Demonstrates thorough, regular cleaning methods using correct materials and tools/machines*	*Shows appropriate cleaning steps with minor omissions*	*Incomplete cleaning steps or unclear procedure*	*Little or no cleaning shown; uses improper machines/tools or materials*
Lubrication and Moving Parts Care	*Correctly identifies and applies lubricant to all necessary parts as per safety procedures*	*Lubrication mostly corrects; slight errors in process or coverage*	*Lubrication done but not thoroughly or incorrectly applied*	*No or incorrect lubrication; unsafe or careless method*

Inspection and Safety Checks	*Performs detailed inspection of belts, blades, cords, and guards; identifies issues confidently*	*Performs general checks but may overlook some small details*	*Limited inspection or vague on what to look for*	*Fails to inspect or identifies few/ no maintenance needs*
Dust and Waste Management	*Demonstrates proper removal of sawdust/ chips and cleaning of dust ports or filters regularly*	*Dust cleaning done with some areas missed or done occasionally*	*Basic cleaning shown, but critical areas ignored*	*No dust management or careless handling of machine hygiene*
Machine Handling and Storage	*Properly stores tools/machine and accessories; protects machine parts from rust and damage*	*Stores most items well; may overlook minor safety/storage concerns*	*Some disorganisation or improper storage practices*	*Tools/machines left exposed, dirty, or improperly stored*

Question 3 (20 marks)

Criteria	Excellent (4 marks)	Very Good (3marks)	Satisfactory (2marks)	Needs improvement (1mark)
Identification of Precautions	*Accurately identifies all key safety precautions (e.g., unplugging machine, using PPE, clear workspace).*	*Identifies most important precautions with minor omissions.*	*Identifies only a few precautions or includes some incorrect ones.*	*Rarely or incorrectly identifies safety precautions.*
Practical Application	*Consistently applies all safety measures during demonstration.*	*Applies most safety precautions correctly with few errors.*	*Applies some precautions, but with noticeable errors.*	*Applies few precautions; but with noticeable errors.*
Use of Safety Personal Protective Equipment (PPEs)	*Uses all appropriate personal protective equipment (PPE) properly.*	*Uses most PPE correctly.*	*Uses some PPE incorrectly or omits important ones.*	*Does not use PPE or uses it incorrectly.*
Communication of Safety Steps	*Clearly explains the purpose of each safety step during the process.*	*Explains most steps, but with limited detail.*	*Explains few steps or gives unclear reasons.*	*Gives little to no explanation of safety procedures.*
Awareness of Hazards	*Shows strong awareness of potential dangers and how to prevent them.*	*Aware of common hazards; some minor gaps in prevention.*	*Limited hazard awareness; misses key safety issues.*	*Lacks awareness of hazards; unsafe behaviour shown.*

UNIT 7

Question 1 (20 marks)

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of cold-water installation process	*Describes the sequence of cold-water installation activities and their interdependencies*	*Provides a general understanding of cold-water installation with some knowledge of process steps*	*Shows limited understanding of cold-water installation processes*	*Shows one understanding of cold-water installation processes*
Identification of critical factors	*Identifies 3 truly critical factors that significantly impact cold water installation scheduling with clear explanation*	*Identifies factors of moderate importance to cold water installation scheduling*	*Identifies basic or obvious factors with limited relevance to scheduling*	*Identification one basic factor with limited relevance to scheduling*
Prioritisation and justification	*Explains why the identified factors are the most critical, with logical reasoning about their impact on the installation timeline*	*Provides some explanation for why factors are important, with basic reasoning*	*Offers minimal justification for why factors were selected*	*Offers one justification for why factors were selected*
Practical Application	*Demonstrates how these factors would be applied in a real-world cold-water installation scenario with specific examples*	*Shows some practical application with general examples*	*Shows limited practical application with few or no examples*	*Shows one practical application without example*
Consideration of timeframe constraints	*Addresses how the tight timeframe affects planning and identifies potential challenges and solutions*	*Mentions some time constraints and general challenges*	*Minimally addresses time constraints or challenges*	*Addresses a time constraint or challenge*

Question 2 (20 marks)

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of smart water technology	*Explains two specific smart water technologies and their functions in modern plumbing systems*	*Provides general descriptions of two smart water technologies with some understanding of their functions*	*Identifies two technologies with limited explanation of how they function*	*Identify one technology with explanation of its function*
Integration with cold water systems	*Explains how the selected technologies connect with and enhance the building's cold-water system*	*Describes some connections between the technologies and cold-water systems*	*Mentions basic connections with minimal technical detail*	*Mention one basic connections without technical detail*
Impact on traditional scheduling	*Evaluates how these technologies change the sequence, timing, and coordination of cold-water installation compared to traditional approaches*	*Describes some changes to scheduling with partial explanation of why they occur*	*Lists minimal scheduling changes with little explanation*	*Lists one scheduling changes without explanation*
Additional installation requirements	*Identifies specific additional materials, testing procedures, or coordination needs for smart water technology installation*	*Identifies some additional requirements with basic explanation*	*Mentions few additional requirements with minimal detail*	*Mention one additional requirement without detail*

Practical considerations	*Evaluates realistic challenges and benefits of implementation, including water efficiency, leak prevention, and maintenance implications*	*Describes some practical considerations with partial analysis*	*Lists few practical considerations with limited analysis*	*Lists one practical considerations without analysis*

UNIT 8

Species	Harvesting	processed	Woodworking Applications
Denya (LKS)	*Selective logging using chainsaw or mechanical harvesters. Due to its large size (can reach 45m tall), harvesting requires careful planning*	1. *Requires extended air drying (6-12 months) or careful kiln drying to avoid warping* 2. *Difficult to saw due to hardness; requires carbide-tipped tools* 3. *Pre-drilling necessary for nailing or screwing*	1. *Heavy construction beams and supports* 2. *Marine construction and bridges* 3. *Outdoor furniture requiring exceptional durability* 4. *Flooring in high-traffic commercial settings*
Danta (LUS)	*Conventional selective logging methods, often overlooked in favour of more popular species*	1. *Requires extended air drying (6-12 months) or careful kiln drying to avoid warping* 2. *Difficult to saw due to hardness; requires carbide-tipped tools* 3. *Pre-drilling necessary for nailing or screwing*	1. *High-quality furniture including chairs and tables.* 2. *Interior joinery and cabinetry* 3. *Decorative veneers* 4. *Architectural mouldings and trim*
Rattan (NTFP)	*Hand-harvested by cutting stems at the base; sustainable harvesting allows plants to regenerate*	1. *Stripped of outer skin while fresh* 2. *Straightened through heat application* 3. *Dried in the sun for 3-5 days* 4. *Split into various widths for different applications*	1. *Furniture framing combined with wood elements* 2. *Woven seats and backs for chairs* 3. *Decorative elements in woodwork projects* 4. *Binding material for joints in traditional woodworking*

SECTION 3: WASTE DISPOSAL, DRAINAGE SYSTEM IN BUILDING AND LKS, LUS, NTFPs

The section covers building construction technology and woodwork technology unit (strands).

In this section, learners will acquire knowledge and understanding of basic services in the schedule of works involved in waste disposal and the surface drainage system. In the woodwork technology unit, learners are expected to gain the knowledge and understanding on the classification and uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). All the above are treated from unit 9 to unit 12.

UNIT 9

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of basic services*

Learning Outcome: *Outline the purpose of Services and determine the schedule of works involved in installing Electricity, Cold-water, Waste disposal and surface drainage system in a typical 3-bedroom self-contained house.*

INTRODUCTION AND SECTION SUMMARY

This unit helps learners to schedule of works involved in waste disposal. This refers to the detailed document that outlines the sequence, timing and responsibilities required to complete all activities involved in the installation. It serves as a roadmap for the installation process. The main different between solid waste and liquid waste is that solid waste has a definite shape and volume and can physically be handled. Liquid waste takes the shape of its container. It is typically more than 80% water content. Pre-Installation planning phase; this refers to stages such as site investigation; to determine soil condition, ground water level and location of public sewer. System design: to plan pipe routes, sizes, gradients and inspection points. Materials Specification; selection of appropriate pipes, (PVC, cast iron, etc) based on building requirements. Regulatory Approval; to obtained necessary permits from Environmental Protection Agency. Installation Sequence: Excavation of trenches for main drainage pipes, installation of connections to public sewer/septic system, installation of inspection chambers, manholes, backfilling and compaction. First Fix (during structural/framing stage); Installation of vertical soil stacks, installation of vent pipes through roof, horizontal branch pipes installation, Installation of floor traps, drainage points and Preservation of correct gradients. Second Fix (After wall finishes or before final finishes); Connection of sanitary fixtures (sinks, toilets, baths etc), Installation of gully traps and external drainage, connection of appliance to waste outlet

(washing machines) etc. Testing of pipe system (Drainage system): Water Test; Fill the system with water to check for leakages. Ball Test; Pass ball through the system to check for blockages. Smoke Test; Fill the system with smoke to identify or check for leaks. Gradients; check for slop to allow for easy flow of waste. The teacher will guide learners to understand the key concepts of schedule of works involved in waste disposal. Learners having understood these will also appreciate the importance of Pre and final schedule of works involved in waste disposal in buildings

The unit covers only week 9: ***Schedule of Works Involved in Waste Disposal.***

Recap weeks

Year 2	Week 6: Excavation

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm and explain schedule of works involved in waste disposal. Conducting experiential learning by organising field trips to construction sites where learners will observe and appreciate the importance of Pre and final schedule of works involved in waste disposal in buildings. Organise learners into mixed ability groups and assist them to explain Pre and Final schedule of work involved in waste disposal in buildings. Assist learners to outline the various activities under Pre-Installation Planning and final phases of installation (Schedule of works involved in waste disposal). Help learners to develop a deeper understanding of the concept of schedule of works involved in waste disposal in buildings. Learners will be capacitated as they engage in critical thinking without any form of inhibition. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions which will in turn capture the diverse knowledge of all learners.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include homework, oral and written presentations and using flip charts. Teachers must keep track of the performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment.

Indicators	DOK Level	Assessment Strategy and/ or Mode
Explain schedule of work involved in Waste Disposal.	3 (strategic reasoning)	Homework

WEEK 9

Learning Indicator: *Explain the Schedule of Work Involved in Waste Disposal*

FOCAL AREA 1: SCHEDULE OF WORKS INVOLVED IN WASTE DISPOSAL

Schedule of works involved in waste disposal. This refers to the detailed document that outlines the sequence, timing and responsibilities required to complete all activities involved in the installation. It serves as a roadmap for the installation process. Pre-Installation Planning; This refers to stages such as Site Investigation, System Design, Materials Specification and Regulatory Approval. Final Installation Planning; This stage is divided into two i.e. First Fix (During structural/framing stage) Installation of vertical soil stacks, installation of vent pipes through roof, Horizontal branch pipes installation, Installation of health and safety during working in the trench e.g. shoring, safe access, existing services etc., Installation of floor traps, Drainage points and Preservation of correct gradients. Second Fix (After wall finishes or Before final finishes) Connection of sanitary fixtures (sinks, toilets, baths etc.), Installation of gully traps and external drainage, connection of appliance to waste outlet (washing machines) etc. Testing of pipe system (Drainage system): Water Test; Fill the system with water to check for leakages. Ball Test; Pass ball through the system to check for blockages. Smoke Test; Fill the system with smoke to identify or check for leaks. Gradients; check for slop to allow for easy flow of waste disposal. Figure 3.1 Shows laid waste pipes, inspection chamber and directed to the sea as point of waste disposal.



Figure 3.1 *Laid waste pipes*

Figure 3.2 Shows a waste pipe connected to septic tank as point of waste disposal.



Figure 3.2 *Laid waste pipes connected through manhole, septic tank and soak away*

Learning Task

1. Explanations on Schedule of works involved in waste disposal.
2. Difference between foul waste and surface water.
3. Difference between Pre-Installation Planning Phase and Final Installation Planning Phase of waste disposal
4. Testing of pipe system and points of waste disposal.

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and explain schedule of works involved in waste disposal.

Group work/Collaborative Learning: Assist learners to outline the various activities under Pre-Installation Planning and final phases of installation (Schedule of works involved in waste disposal).

Conducting experiential learning: Organise field trips to construction sites where learners will observe and appreciate the importance of Pre and final schedule of works involved in waste disposal.

Key Assessment: Homework

1. A new residential development's waste disposal system requires excavation work scheduled during the rainy season. Analyse how the rain as a weather condition can impact the waste disposal installation schedule.
2. Analyse any two-drainage test related challenges which could impact the waste disposal installation work schedule.

PLC Session 9

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).

Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***homework***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the homework (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).

Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes	Reflection

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 9 Review

Unit 9 of week 9. This unit produces the learners with a deeper understanding of the concept of Schedule of works involved in waste disposal in buildings. The pedagogical exemplars used in this section included group work/collaborative learning, homework, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, homework, and practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, written presentations and using flip charts. (Building Construction)

UNIT 10

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Materials and artefacts production in woodwork industry in Ghana

Content Standard: *Demonstrate knowledge and understanding of Sustainability of Timber Industry in Ghana.*

Learning Outcome: *Demonstrate knowledge and understanding of Sustainable Timber Industry in Ghana.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners to classify Lesser-Known Timber Species (LKS), Lesser-Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). Forests provide a wide range of valuable resources beyond the commonly used timber species. In addition to popular timber, many lesser-known and lesser-used timber species offer similar qualities and can serve as sustainable alternatives. Forests also yield Non-Timber Forest Products (NTFPs) such as fruits, seeds, oils, and medicinal plants that support livelihoods and promote forest conservation. Understanding these classifications helps reduce pressure on overexploited species and encourages sustainable forest use.

The unit covers only week 10: ***Classify Lesser-Known Timber Species (LKS), Lesser-Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in classifying Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The teacher will employ pedagogies such as critical thinking and talk for learning, group work/collaborative learning and experiential learning. These strategies will be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities, should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts under this unit require learners to participate in classifying Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The assessments should largely cover levels 1, 2 and 3 of the DoK. Teachers will employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' progress and give prompt feedback. Teachers will administer assessment such as class exercises (including individual worksheets) after each lesson, homework, scores on practical group activities on availability and sources of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP) and document learners' results in continuous assessment records. Teacher can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Classify Lesser-Known Timber Species (LKS), Lesser-Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)	3 (Strategic reasoning)	Class exercises as an Assessment

WEEK 10

Learning Indicator: *Classify Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)*

FOCAL AREA 1: CLASSIFICATION OF LESSER-KNOWN TIMBER SPECIES (LKS), LESSER USED TIMBER SPECIES (LUS) AND NON-TIMBER FOREST PRODUCT (NTFP)

Classification of lesser-known and lesser-used species

Lesser-Known Timber Species (LKS)	Lesser-Used Timber Species (LUS)
Afena	Avodire
Watapuo	Danta / (kotibe')
Apoma / (ananta)	Red oak / (kwatafompaboa)
Effeu	Denya / (okan)
Wawabima / (brown sterculia)	Alstonia

Description of properties

1. **Appearance**
   a. **Colour:** Refers to the natural colour of the wood, which is developed due to the accumulation of extractives during heartwood formation.
   b. **Texture:** Refers to the size and proportional number of woody elements and this can be described in relation to pore sizes as fine, medium and coarse.
   c. **Lustre:** Refers to how light reflecting from the wood appears to penetrate into and then shine from the surface of the board. It is classified as dull, moderate and lustrous.
   d. **Fibre length:** Refers to how straight and unbroken a single fibre is under microscope. It influences the strength properties wood and pulping characteristics, and is measure in mm.
   e. **Grain:** Indicates the orientation of the cells of the axial system or fibre direction as in "straight", "wavy", and "interlocked".
2. **Physical properties:** Refers to the qualities of wood that indicate its ability to resist applied external forces. They are an important criterion in determining the relative suitability of the different wood species for various uses.
   a. **Basic density:** Refers to the weight or mass of wood divided by the volume of the specimen at a given moisture content. It is one of the most important physical properties of wood. The following scale shows the classification used in accordance with TIDD (2012) and Farmer (1972).
   b. **Movement in service (Moisture movement):** This refers to the changes in the moisture content of the wood according to the environment surrounding it. As humidity increases, the moisture content increases, and the wood swells, causing expansion. A decrease in humidity decreases the moisture content, thereby causing the wood to shrink.

3. **Strength properties**

   a. Modulus of Elasticity (MOE): Refers to the resistance to deformation of wood during bending. It is the stiffness or the flexibility of wood when external forces are applied. These species are classified into five (5) strength groups or classes in accordance with BS 2568-2.

   b. Modulus of Rupture (MOR): Refers to the measure of the strength of wood before rupture during bending, also known as shear modulus. The hardwoods included here are classify as weak, medium, strong and very strong.

   c. Compression parallel to the grain: Refers to the resistance to external forces acting longitudinally on a piece of wood.

   d. Shear parallel to the grain: Refers to the ability of a piece of wood to resist internal slipping of one part upon another along the grain when external forces act upon it in such a way that one portion tends to slide upon another adjacent to it.

   e. Janka side hardness: Refers to the resistance to indentation and/or abrasion (surface scratching).

4. **Performance properties**

   a. Durability: Refers to the ability of the wood species to resist the attacks of deteriorating organisms. Although wood is not completely immune to such attacks, some species possess superior resistance. The natural durability of the species is grouped according to ASTM D-2017 (2005).

   b. **Treatability:** Refers to the ease with which a species of wood takes in preservatives using vacuum or pressure processes. The classification is described in the table below:

Table 1.1: *Treatability description*

N°	Classification	Description
1	Permeable	Timber species for which preservatives can be penetrated completely under pressure without difficulty
2	Moderately resistant	Species which are fairly easy to treat and are possible for lateral penetration to be obtained or penetration of large proportion of the vessels is possible
3	resistant	Species that are difficult to impregnate under pressure and require a long period of treatment
4	Extremely resistant	Species with the possibility of absorbing only a small quantity of preservative even under long pressure treatments. Preservatives are not able to penetrate to an appreciable depth laterally and longitudinally.

Table 1.2: *Appearance and basic density of LKS and LUS in Ghana*

LKS and LUS Species	Appearance (colour)	Basic Density (kg/m^3)
Afena	**Heartwood:** Brown or pale-brown with purple streaks **Sapwood:** - pale brown.	Very heavy (850-1,020)

Watapuo	**Heartwood:** Grey-brown, brown-orange. **Sapwood:** Whitish-yellow	**Medium (470)**
Apoma / (ananta)	**Heartwood:** Dark red with darker streaks. **Sapwood:** pink brown.	Very heavy (910-1,000)
Effeu	**Heartwood and sapwood: White or Yellowish-white**	Low (350)
Wawabima / (brown sterculia)	**Heartwood:** Dark red-brown. **Sapwood: -** Pale red-brown.	Very heavy (720-890)
Avodire	**Heartwood and sapwood: Creamy-white to pale-yellow, darkening to golden-yellow**	**Medium (460-660)**
Danta / (kotibe')	**Heartwood:** Red-brown. **Sapwood:** Pale red-brown.	Heavy (740)
Red oak / (kwatafompaboa)	**Heartwood:** Reddish-brown. **Sapwood:** Whitish to greyish	**Medium (610-720)**
Denya / (okan)	**Heartwood:** Yellow brown to yellowish-red **Sapwood:** Greyish-pink.	Heavy (770-1,100)
Alstonia	**Heartwood and sapwood: Yellowish-white**	Low (360-420)

Classifications of Non-Timber Forest Products (NTFPs)

1. **Herbs:** Herbs are a widely distributed and widespread group of plants, excluding vegetables and other plants consumed for macronutrients, with savoury or aromatic properties that are used for flavouring and garnishing food, for medicinal purposes, or for fragrances. Culinary use typically distinguishes herbs from spices. Figure 3.3 shows herbs use as medicine.



Figure 3.3 *Herbs*

2. **Non-edibles:** NTFPs Non–edible is a non-timber forest product that is not eaten but have economical values. Some examples of these NFTPs include rattan, cane, and food-wrapping leaves. Some important wood-based NTFPs are for walking sticks, furniture, and baskets. Many forest plants are also harvested and used in the floral industry. For example, some can be harvested for floral arrangements. Figure 3.8-3.10 shows rattan, sweet prayers plant and bamboo.



Figure 3.8*: Rattan*



Figure 3.9: *sweet prayers plant*



Figure 3.10: *Bamboo*

Learning Tasks

1. Classify Lesser-known and lesser-used species in Ghana.
2. Discuss the **properties** associated with Lesser-known and lesser-used species in Ghana.
3. Discuss the classification of Non-Timber Forest Products (NTFPs) in Ghana.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners through a video demonstration on Lesser-known and lesser-used species in Ghana, and brainstorm on the classification of Lesser-known, lesser-used species in Ghana with open-mindedness. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and collect relevant explanations from learners.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss the properties associated with Lesser-known, lesser-used species and Non-Timber Forest Products (NTFPs) in Ghana. The teacher should circulate the classroom, ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss the classification of Non-Timber Forest Products (NTFPs) in Ghana. The teacher should circulate the classroom ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Key Assessment: Class Exercise

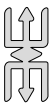
1. Compare two physical properties of lesser-known Timber Species (LKS) and Lesser Used Timber Species (LUS) trees in Ghana.
2. Explain the term shear parallel to the grain and provide its weak and strong value range of Lesser-Known Timber Species (LKS) and Lesser Used Timber Species (LUS).

3. Explain the two treatability of Lesser-Known Timber Species (LKS) and Lesser Used Timber Species (LUS).

PLC Session 10

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



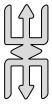
Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***class exercise***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the exercise (NTS 3k-3q).

10 minutes | **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*

- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 10 REVIEW

Unit 10 of week 10 introduced learners to classify Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The pedagogical exemplars used in this section included talk for learning, group work/collaborative learning, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercises, homework, practical group activities are structured to cater for all the varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, real object (Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)

Reflection: Are learners able to classify Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP).

UNIT 11

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of basic services*

Learning Outcome: *Outline the purpose of Services and determine the schedule of works involved in installing Electricity, Cold-water, Waste disposal and surface drainage system in a typical 3-bedroom self-contained house*

INTRODUCTION AND SECTION SUMMARY

The unit introduces learners to schedule of works involved in Surface drainage system. It is a system of an engineered network designed to collect, channel and dispose of excess water from the surface of land, road, buildings and pavements. The primary purpose of this system is to prevent water accumulation, control runoff, soil erosion, foundation problems and protect buildings and infrastructure from water damage. Pre-Installation Planning Phase; This refers to stages such as Site Survey, Hydrological Assessment, System Design, Material Specification and Regulatory Authority. Generally, there are three main types of Surface Drainage System namely: Open Channel System, Inlet systems and Combined System. Open Channel System; there are 3types of open channel system. Ditches and Swales, Gutters and Canals. Ditches and Swales; is a man-made channel with sloped sides. Gutters; they are shallow channels along roadways or building perimeters. Canals; it refers to a larger engineered waterway for significant water volume. Inlet Systems; there are 3types of inlet system. Catch Basins, Grates and Gratings, and Curb Inlet. Catch Basins; sunken receptacles that trap debris while allowing water to enter drainage pipes. Grates and Gratings; this refers to a perforated cover allowing water entry while blocking larger debris. Curb Inlet; openings in roadways curb to capture street runoff. Combined System; there are 2types of combined system. French Drain and Bioswales. French Drain; Trenches filled with gravel and perforated pipes. Bioswales; Vegetated channels designed to concentrate and filter stormwater. There are 5 key components to consider when designing surfaces drainage system. Collection points, Conveyance Structures, outlet structures, Gradient systems and Erosion Control Measures. Collection point; this refers to the point where water initially enters the system. Conveyance Structure; the channels, pipes, or swales that transport water. Outlet Structure; this refers to the point where water is discharged from the system. Erosion Control Measures; prevents soil loss during water movement.

The unit covers only week 11: ***Explain schedule of work involved in surface drainage system.***

Recap weeks

Year 2	Week 6: Excavation

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm and explain surface drainage system. Conducting experiential learning by organising field trips to construction sites where learners will observe different types of surface drainage system at construction sites and identify the key components to consider when designing surface drainage system. Organise learners into mixed ability groups and assist them to explain different types of surface drainage system. Assist learners to outline the 3 main types of surface drainage system and indicate where each of them can be used. Help learners to develop a deeper understanding of the concept of surface drainage system. Learners will be capacitated as they engage in critical thinking without any form of inhibition. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions which will in turn capture the diverse knowledge of all.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include case study, homework, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment. Surface drainage system, it is a system of an engineered network designed to collect, channel and dispose of excess water from the surface of land, road, buildings and pavements. The primary purpose of this system is to prevent water accumulation, control runoff, soil erosion, foundation problems and protect buildings and infrastructure from water damage. Generally, there are three main types of Surface Drainage System namely: Open Channel System, Inlet systems and Combined System. There are 5 key components to consider when designing surfaces drainage system. Collection points, Conveyance Structures, outlet structures, Gradient systems and Erosion Control Measures. Collection point; this refers to the point where water initially enters the system. Conveyance Structure; the channels, pipes, or swales that transport water. Outlet Structure; this refers to the point where water is discharged from the system. Erosion Control Measures; prevents soil loss during water movement

Indicators	DOK Level	Assessment Strategy and/ or Mode
Explain schedule of work involved in surface drainage system.	3(strategic reasoning)	Essay

WEEK 11

Learning Indicator: *Explain schedule of work involved in surface drainage system*

FOCAL AREA: SURFACE DRAINAGE SYSTEM

Explanation of surface drainage system. It is a system of an engineered network designed to collect, channel and dispose of excess water from the surface of land, road, buildings and pavements. The primary purpose of this system is to prevent water accumulation, control runoff, soil erosion, foundation problems and protect buildings and infrastructure from water damage. Pre-Installation Planning Phase; This refers to stages such as Site Survey, Hydrological Assessment, System Design, Material Specification and Regulatory Authority. Generally, there are three main types of Surface Drainage System namely: Open Channel System, Inlet systems and Combined System. There are 5 key components to consider when designing surfaces drainage system. Collection points, Conveyance Structures, outlet structures, Gradient systems and Erosion Control Measures. Collection point; this refers to the point where water initially enters the system. Conveyance Structure; the channels, pipes, or swales that transport water. Outlet Structure; this refers to the point where water is discharged from the system. Erosion Control Measures; prevents soil loss during water movement. Figure 3.11 shows an open channel surface drain system between two fields.



Figure 3.11 *Surface drain system*

Figure 3.12 Shows the Inlet surface drainage system at compound of an office.



Figure 3.12 *Inlet surface drainage system*

Figure 3.13 shows a French drain at the boundary of two compound.



Figure 3.13 *French drain system*

Figure 3.14 shows a French Drain at the frontage of a house.



Figure 3.14 *French drain at the frontage of a house*

Learning Tasks

1. Explanation of Surface Drainage System.
2. Outline the primary purpose of surface drainage system.
3. Outline the Pre-Installation phases of surface drainage system.
4. Explain the key components to consider when designing surfaces drainage system.

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and explain surface drainage system.

Group work/Collaborative Learning: Assist learners to outline the primary purpose of surface drainage system and Pre-Installation phases of surface drainage system.

Conducting experiential learning: Organise field trips to construction sites where learners will observe different types of surface drainage system at construction sites and identify the key components to consider when designing surface drainage system.

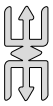
Key Assessment: Essay

1. Evaluate three different surface drainage approaches and recommend the most appropriate type that can be used in a wetland area.
2. Analyse the long-term benefits of a comprehensive surface drainage system.

PLC Session 11

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***essay***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the essay (NTS 3k-3q).

10 minutes | **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).

Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 11 Review

Unit 11 of week 11. This unit produces the learners with a deeper understanding of concept of Schedule of works involved in waste disposal in buildings. The pedagogical exemplars used in this section included group work/collaborative learning, case study, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, case study, practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, written presentations and using flip charts. (Building Construction)

UNIT 12

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Materials and artefacts production in woodwork industry in Ghana

Content Standard: *Demonstrate knowledge and understanding of Sustainability of Timber Industry in Ghana.*

Learning Outcome: *Demonstrate knowledge and understanding of Sustainable Timber Industry in Ghana.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners to discuss the uses of Lesser-Known Timber Species (LKS), Lesser-Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). Forests provide a wide range of valuable resources beyond the commonly used timber species. In addition to popular timber, many lesser-known and lesser-used timber species offer similar qualities and can serve as sustainable alternatives. Forests also yield Non-Timber Forest Products (NTFPs) such as fruits, seeds, oils, and medicinal plants that support livelihoods and promote forest conservation. Understanding these classifications helps reduce pressure on overexploited species and encourages sustainable forest use.

The unit covers only week 12: ***Discuss the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP).***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in discussing the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The teacher will employ pedagogies such as critical thinking and talk for learning, group work/ collaborative learning and experiential learning. These strategies will be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities, should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts under this unit require learners to discuss the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The assessments should largely cover levels 1, 2 and 3 of the DoK. Teachers will employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' progress and give prompt feedback. Teachers will administer assessment such as class exercises (including individual worksheets) after each lesson, homework, scores on practical group activities on the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP) and document learners' results in continuous assessment records. Teacher can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Discuss the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)	3 (Strategic reasoning)	Practice Paper 1 Homework as an Assessment

WEEK 12

Learning Indicator: *Discuss the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP)*

FOCAL AREA 1: USES OF LESSER-KNOWN TIMBER SPECIES (LKS), LESSER USED TIMBER SPECIES (LUS) AND NON-TIMBER FOREST PRODUCT (NTFP)

Using Lesser-Known Timber Species (LKS) and Lesser-Used Timber Species (LUS) in Sustainable Forest Management (SFM) offers several uses and economic benefits. It contributes to forest conservation while supporting local livelihoods.

The following are the uses of Lesser-Known Timber Species (LKS) and Lesser Used Timber Species (LUS) in Ghana:

1. **Afena:** It is used for the following:



Figure 3.1*5 Uses of Afena*

2. **Watapuo:** It is used for the following**:**



Figure 3.1*6 Uses of* **Watapuo**

3. **Apoma/(ananta):** It is used for the following:

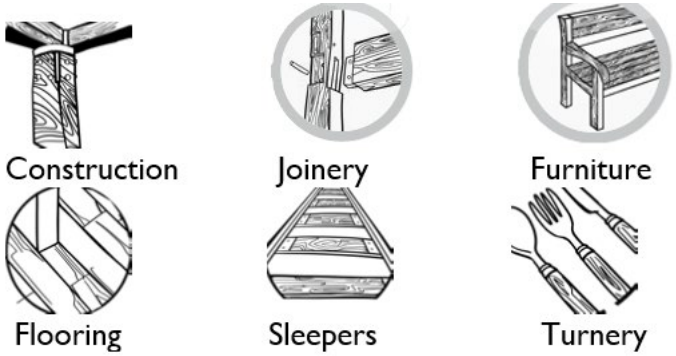


Figure 3.1*7 Uses of* **Apoma/(ananta)**

4. **Effeu:** It is used for the following:

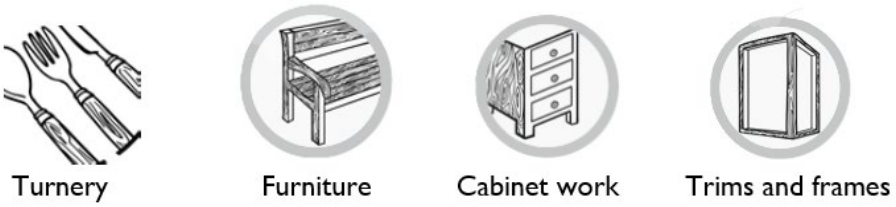


Figure 3.1*8 Uses of Effeu*

5. **Wawabima /(brown sterculia):** It is used for the following:

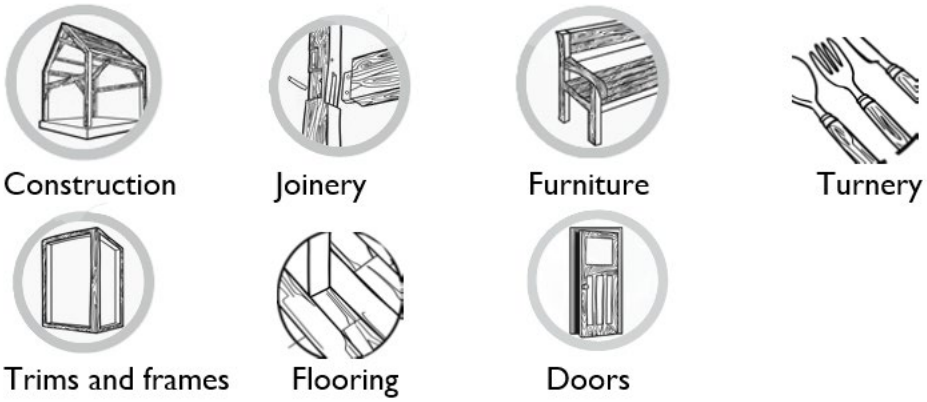


Figure 3.1*9 Uses of* **Wawabima**

6. **Avodire:** It is used for the following:



Figure 3.2*0 Uses of* **Avodire**

7. **Danta/('kotibe'):** It is used for the following:

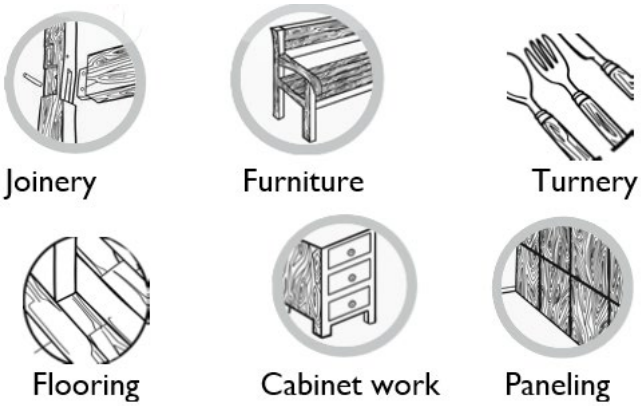


Figure 3.2*1 Uses of* **Danta/('kotibe')**

8. **Red oak / (kwatafompaboa):** It is used for the following:

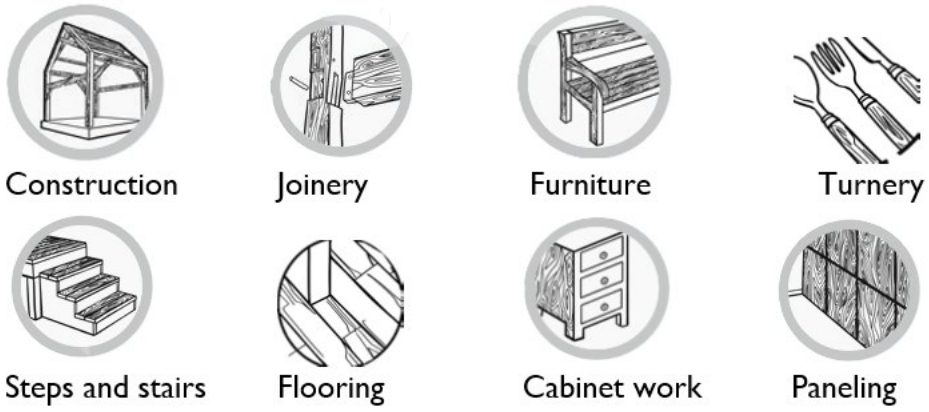


Figure 3.2*2 Uses of* **Red oak**

9. **Denya / (Okan):** It is used for the following:



Figure 3.2*3 Uses of* **Danya /(Okan)**

10. **Alstonia:** It is used for the following:

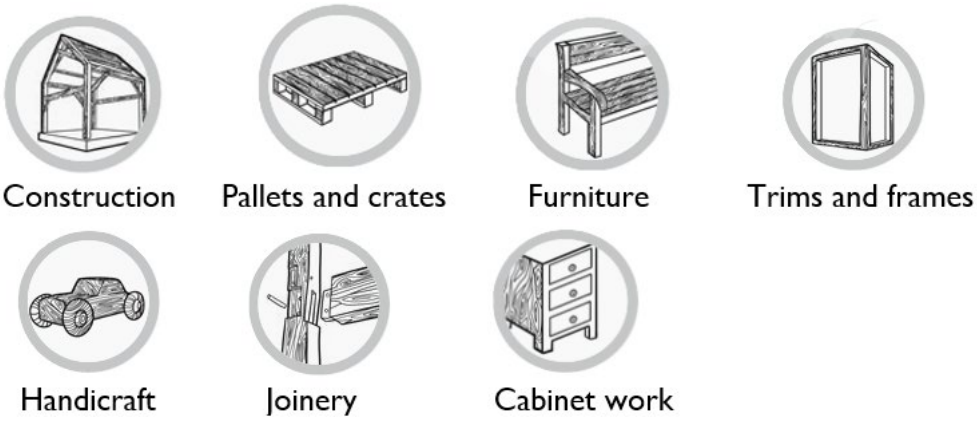


Figure 3.2*4 Uses of* **Alstonia**

Table 1.1: *Economic Benefits Comparison of LKS and NTFPs*

Economic Factor	Lesser-Known Timber Species (LKS)	Non-Timber Forest Products (NTFPs)
Revenue Potential	Medium to high (₵3,000-10,000/m³)	Variable but often immediate (₵500-5,000/hectare/year)

Investment Timeline	Long-term (harvest cycles of years/decades)	Short-term (often seasonal or annual harvests)
Capital Requirements	High (harvesting equipment, processing facilities)	Generally low (simple collection and processing tools)
Market Development	Requires 2-5 years to develop consumer acceptance	Many have existing traditional markets
Employment Creation	2-3 jobs per 100m³ harvested annually	4-8 seasonal jobs per hectare for collection/processing
Value Addition	5-10× multiplication through processing	Up to 500% for processed products (oils, medicines)
Risk Profile	Lower price volatility once established	More seasonal fluctuations but portfolio effect
Accessibility	Benefits those with harvesting rights/equipment	More accessible to marginalised groups including women

The following are the uses of Non-Timber Forest Product (NTFPs) in Ghana:

1. Rattan: Local uses of rattans for the production of mats, baskets, fish traps, dyes, and medicines, while for the international market, rattans are mostly used in the production of cane furniture. The list of products includes furniture items such as beds, chairs, tables, and cabinets. Figure 4.6 shows furniture from rattan. Figure 3.25 shows, rattan, non-edible NFTPs.



Figure 3.25 *Rattan Furniture*

2. Bamboo: is a significant example of a non-edible product derived from forests, valued for its versatility, renewability, and wide range of uses across different sectors. As a non-edible, bamboo serves various functions that make it an essential resource globally. Figures 3.26 and 3.27 show a Bamboo chair and a bamboo bicycle.



Figure 3.26 *Bamboo chair*



Figure 3.27 *Bamboo bicycle*

3. Cane: It is very flexible, so it can be used to create beautiful and intricate designs for all kinds of applications, and it is very easy to maintain, which will last a long time, making it a cost-effective choice for venues. Figure 3.28 shows a basket made from cane.



Figure 3.28 *Cane basket*

4. Food packaging leaf: Food packaged in green leaves or earthenware was one of the best dishes the aged preferred to be served with until now. Some other leaves used in packaging foods are those of plantain and pawpaw. Various type of foods such as waakye, beans, rice, 'Kafa,' 'Tuo-zaafi,' Banku, kenkey and "apapransa" can be served in leaves. Figure 3.29 shows leaf used for packaging.



Figure 3.29 *Leaf for food packaging*

Learning Tasks

1. Discuss the uses of Lesser-known and lesser-used species in Ghana.
2. Explain economic benefit of Lesser-known and lesser-used species in Ghana.
3. Discuss the uses of Non-Timber Forest Products (NTFPs) in Ghana.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners through a video demonstration on Lesser-known and lesser-used species in Ghana, and brainstorm on the uses of Lesser-known, lesser-used species with open-mindedness. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and collect relevant explanations from learners.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss the uses of Lesser-known, lesser-used species and Non-Timber Forest Products (NTFPs). The teacher should circulate the classroom, ensuring all learners are

supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Experiential learning: Take learners on a field trip to explore some of the uses of Non-Timber Forest Products (NTFPs) and. ask learners to discuss the uses of d Non-Timber Forest Products (NTFPs). Highly Proficient learners can be assigned to assist groups in discussions in addition to the teacher.

Key Assessment: Practice Paper 1

1. Compare three economic benefits of using Lesser-Known Timber Species (LKS) and Non-Timber Forest Products (NTFPs) in sustainable forest management.
2. Explain how the increased use of Lesser Used Timber Species (LUS) could affect the timber industry in Ghana.
3. Sketch three uses of Lesser-Known Timber Species (LKS).

HINT

*Conduct **Practice Paper 1**. It should cover the contents taught from Year 1 to 3. Refer to the **Table of Specification and Structure of the Paper** at the end of this section. Learners' papers should be marked immediately and scores entered into the SAP.*

PRACTICE PAPER 1 TABLE OF SPECIFICATION

PAPER 1 (Multiple Choice Questions)

STRAND	LEARNING INDICATORS	LEVEL OF ASSESSMENT				TOTAL
		1	2	3	4	
Building Construction Technology	Explain the stakeholders involved in building construction project	1				1
	Discuss formwork	1				1
	Identify the professionals involved in building construction project		1			1
	Describe the roles of stakeholders in building construction project	1	1			2
	Discuss the various types of foundations used given the soil condition			1		1
	Distinguish Electricity Supply, Cold-Water Installation and Waste Disposal as different forms of Services.			1		1
	Discuss floor Construction		1			1
	Explain what setting out is.		1			1
	Discuss the reasons for mobilisation	1		1		2
	Explain the schedule of works involved in installing waste disposal.			1		1

	Discuss methods of excavating foundation trenches.	1		1		2
	Discuss roofs.			1		1
	Explain surface drainage system.		1			1
Woodwork technology	Classify the two main types of wood species.	1		2		3
	Outline the processing phases of timber in the woodwork industry		1	1		2
	Explain the types of manufactured boards made from Wood and non-wood residues		1			1
	Outline the uses of manufactured boards made from Wood and non-wood residues	1				1
	Discuss the advantages and disadvantages of manufactured boards over solid wood.		1			1
	Select and use appropriate machine for a specific woodwork operation.	1				1
	Identify, classify, select and use appropriate joints for a specific woodwork operation	1	1			2
	Explain the uses of different types of adhesives	1				1
	Explain the uses and application of different types of finishes	1	1			2
	Use an appropriate machine for a specific operation independently			1		1
	Discuss the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS)			1		1
Automotive technology	Identify types of engines and describe the main components of the engine		1			1
	Demonstrate safety measures applied to servicing, repair and maintenance of engine systems		1			1

Metal technology	Explain the uses of various types of measuring, marking out, holding, striking and cutting tools	1				1
	Explain ferrous and non-ferrous metals with engineering applications and state the uses of non-metallic materials.			1		1
Electrical technology	Discuss safety in the use of electricity		2			
Electronics technology	Explain the concept of electrical and electronic circuits		1			
	Apply the principles of Diodes in designing circuits		1			
Total		12	16	12		40
		30%	40%	30%		100%

PAPER 2 (Essay)

STRAND	LEARNING INDICATORS	LEVEL OF ASSESSMENT				TOTAL
		1	2	3	4	
Building Construction Technology	Differentiate Clearly between site preparations and hoarding of Site to facilitate constructional works.	3				3
	Discuss the various types of foundation used given the soil condition					
	Explain how the locations of temporal structures are specified, as well locations of Services, welfare facilities and Equipment at the new construction Site to ensure					
	Describe the roles of stakeholders in building construction project					
	Describe the roles of Professionals in building Construction projects					

Woodwork technology	Apply the appropriate safety measures in the woodwork shop.	3	3
	Classify the two main types of wood species.		
	Explain the uses and application of different types of finishes		
	Explain Basic Techniques in Mass production in Furniture Industry		
	Explain the types of manufactured boards made from Wood and non-wood residues		
	Explain the uses and application of different types of finishes		
	Classify Non-Timber Forest Products (NTFPs)		
	Classify Lesser-Known Timber Species (LKS), Lesser-Used Timber Species (LUS)		
Total		6 100%	6

PAPER 3 (Practical test)

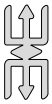
STRAND	LEARNING INDICATORS	LEVEL OF ASSESSMENT				TOTAL
		1	2	3	4	
Building Construction Technology (Alternative to practical)	Explain the schedule of works involved in installing cold water.	6				6
	Explain non- load bearing members of the Superstructure. Explain load bearing and non-load bearing members of the superstructure.					
	Discuss methods of excavating foundation trenches.					
	Explain the schedule of works involved in installing waste disposal.					
	Discuss finishes applied to the floor.					

	Explain what setting out is.		
	Discuss the various types of foundation used given the soil condition		
Woodwork technology (Practical Test)	Apply Computer Aided Design [CAD] in designing and making of artefacts	1	1
	Produce working drawings from the final solution		
	Select the appropriate material suitable for producing the final solution		
	Produce an artefact from your working drawing		
Total		7	7
			100%

PLC Session 12

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous session, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand.
   b. identify three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q).
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

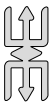
- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Use your app to plan and administer the mode of assessment for the Student Assessment Portal (SAP).

a. The key assessment for the week is ***Practice Paper 1***. Chat with your app to plan this assessment by reviewing or developing the assessment items/tasks and marking schemes/rubrics for the practice paper (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or topic/idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through the problem individually for 3–4 minutes
   c. the group then works through it together the problem, step by step
   d. highlight the most common errors made at each step (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).

c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 12 REVIEW

Unit 12 of week 12 introduced learners to the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP). The pedagogical exemplars used in this section included talk for learning, group work/collaborative learning, digital learning and experiential learning which helped to meet the varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercises, homework, practical group activities are structured to cater for all the varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, real objects (Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP).

Reflection: Are learners able to discuss the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS) and Non-Timber Forest Product (NTFP).

MARKING SCHEMES/RUBRICS FOR THE KEY ASSESSMENTS

UNIT 9

Question 1 (20 marks)

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2 mark)	Needs Improvement (1mark)
Understanding of Waste Disposal Systems	*Explains the excavation work required for waste disposal systems and why it is vulnerable to rain*	*Provides a general understanding of waste disposal installation with some knowledge of excavation needs*	*Shows limited understanding of waste disposal systems and excavation requirements*	*Shows one understanding of waste disposal systems*
Weather Impact Analysis	*Analyses multiple specific ways rain affects excavation work with clear cause-effect relationships*	*Identifies some ways rain impacts excavation work with basic explanations*	*Lists minimal impacts with little explanation of how they occur*	*Lists one impacts without explanation of how they occur*
Schedule Disruption Factors	*Identifies and explains at least 3 specific scheduling problems caused by rain with details about their severity*	*Identifies 1-2 scheduling problems with some explanation*	*Mentions general delays without specific schedule impacts*	*Mentions one general delays without specific schedule impacts*
Safety and Quality Considerations	*Analyses how rain affects both worker safety and the quality/ integrity of the waste disposal system*	*Describes some safety or quality concerns with partial analysis*	*Mentions minimal safety or quality issues with little analysis*	*Mention one safety or quality issues without analysis*
Mitigation Strategies	*Proposes practical strategies to address rain-related challenges with explanation of how they protect the schedule*	*Suggests some general strategies with limited explanation*	*Offers few or impractical strategies with minimal explanation*	*Offers one strategy with or without explanation*

Question 2

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of Drainage Testing	*Explains the purpose and procedures of drainage testing in waste disposal installations*	*Provides a general understanding of drainage testing with some knowledge of procedures*	*Shows limited understanding of drainage testing with minimal technical knowledge*	*Shows one understanding of drainage testing without technical knowledge*
Identification of Challenges	*Identifies two significant and realistic drainage test challenges with specific details*	*Identifies two general drainage test challenges with some details*	*Identifies basic or vague drainage test challenges with limited details*	*Identification one basic or vague drainage test challenges without details*
Analysis of First Challenge	*Analyses how the first challenge affects testing procedures and results with clear cause-effect relationships*	*Describes how the first challenge affects testing with some analysis*	*Mentions the first challenge with minimal analysis of its effects*	*Mentions any one challenge with minimal analysis of its effects*
Analysis of Second Challenge	*Analyses how the second challenge affects testing procedures and results with clear cause-effect relationships*	*Describes how the second challenge affects testing with some analysis*	*Mentions the second challenge with minimal analysis of its effects*	*Mention one challenge without analysis of its effects*
Schedule Impact Evaluation	*Analysis of how both challenges specifically impact work scheduling, including timeframes and sequence changes*	*Describes some scheduling impacts with partial connections to the installation timeline*	*Mentions general delays without specific schedule impacts*	*Mention one general delay specific schedule impact*

UNIT 10

Question 1

Comparison of Physical Properties *(**6**marks, **2**marks for each point)*

Property	Denya (LKS)	Danta (LUS)
Density	*Very high (1000-1100 kg/m³)*	*Medium-high (700-800 kg/m³)*
Colour	*Yellow-brown to dark brown*	*Reddish-brown*

Grain	*Interlocked, sometimes irregular*	*Straight to slightly interlocked*
Texture	*Coarse texture*	*Fine to medium texture*

Question 2

a. Shear parallel to the grain: Refers to the ability of a piece of wood to resist internal slipping of one part upon another along the grain when external forces act upon it in such a way that one portion tends to slide upon another adjacent to it.

(2marks).

b. Weak value range: 4-9 and strong value range16-19. ***(1mark).***

Question 3

Treatability ***(2marks, 1mark for each point)***

No	Classification	Description
1	*Permeable*	*Timber species for which preservatives can be penetrated completely under pressure without difficulty*
2	*Moderately resistant*	*Species which are fairly easy to treat and are possible for lateral penetration to be obtained or penetration of large proportion of the vessels is possible*
3	*resistant*	*Species that are difficult to impregnate under pressure and require a long period of treatment*
4	*Extremely resistant*	*Species with the possibility of absorbing only a small quantity of preservative even under long pressure treatments. Preservatives are not able to penetrate to an appreciable depth laterally and longitudinally.*

UNIT 11

Question 1

Criteria	Excellent (4 marks)	Good (3 marks)	Satisfactory (2 marks)	Needs Improvement (1 marks)
Knowledge of Drainage Approaches	*Clearly and accurately describes 3 different drainage approaches*	*Describes 3 approaches with minor inaccuracies*	*Describes 2 approaches with limited clarity*	*Describes fewer than 2 or unclear descriptions*
Evaluation of Each Approach	*Thoughtful comparison of all 3, highlighting strengths and weaknesses in detail*	*Gives a clear comparison with some reasoning*	*Makes a basic comparison with few details*	*Little or no evaluation provided*
Relevance to Wetland Conditions	*Shows strong understanding of wetland needs and links them to each drainage approach*	*Shows some understanding of wetland conditions*	*Basic link to wetland environment with little explanation*	*Weak or no connection to wetland conditions*

Justification of Recommendation	*Provides a logical, well-supported choice with clear reasons*	*Gives a good recommendation with some reasons*	*Makes a recommendation with limited justification*	*Recommendation is unclear or poorly supported*
Organisation and Clarity of Ideas	*Very well-organised with clear structure and logical flow*	*Organised with few errors*	*Some parts are clear but others confusing*	*Disorganised and difficult to follow*

Question 2 (20 marks)

Criteria	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
Understanding of Surface Drainage	*Clearly explains what a surface drainage system is and how it works*	*Gives a clear definition with basic explanation*	*Gives a definition with little explanation*	*Definition is unclear*
Identification of Long-term Benefits	*Accurately identifies and explains at least 4 long-term benefits*	*Identifies and explains 3 benefits*	*Identifies and explains 2 benefits*	*Identifies 1 or no clear benefit*
Depth of Analysis	*Provides detailed and logical reasoning for how each benefit is achieved*	*Provides some explanation with a few details*	*Provides general ideas with weak explanations*	*Lacks explanation or reasoning*
Organisation and Clarity	*Information is very well-organised and clearly presented*	*Well-organised with minor errors*	*Some parts are clear; others are hard to follow*	*Disorganised and unclear ideas*
Use of Technical Terms	*Accurately uses relevant technical terms and concepts throughout*	*Uses some technical terms correctly*	*Uses few technical terms with some errors*	*Rarely uses or misuses technical terms*

UNIT 12

Question 1

Economic Benefits Comparison *(3marks, 1mark for each point from the options below).*

Economic Factor	Lesser-Known Timber Species (LKS)	Non-Timber Forest Products (NTFPs)
Revenue Potential	*Medium to high (¢3,000-10,000/ m³)*	*Variable but often immediate (¢500-5,000/hectare/year)*

Investment Timeline	*Long-term (harvest cycles of years/ decades)*	*Short-term (often seasonal or annual harvests)*
Capital Requirements	*High (harvesting equipment, processing facilities)*	*Generally low (simple collection and processing tools)*
Market Development	*Requires 2-5 years to develop consumer acceptance*	*Many have existing traditional markets*
Employment Creation	*2-3 jobs per 100m³ harvested annually*	*4-8 seasonal jobs per hectare for collection/processing*
Value Addition	*5-10× multiplication through processing*	*Up to 500% for processed products (oils, medicines)*
Risk Profile	*Lower price volatility once established*	*More seasonal fluctuations but portfolio effect*
Accessibility	*Benefits those with harvesting rights/equipment*	*More accessible to marginalised groups including women*

Question 2

The increased use that could affect the timber industry in Ghana: **(2marks).**

a. Using LUS gives the industry more types of wood to work with, so they don't rely only on popular species like mahogany and odum.

b. Different LUS have different colours and grains. This can lead to new furniture or wood product designs.

c. When more types of wood are used, Ghana can sell timber to different markets and meet more customer needs.

d. Using LUS may require learning new skills or using better machines, which helps the timber industry grow stronger.

e. It shows the world that Ghana is using its forests wisely, which can attract buyers who care about the environment.

Question 3

Sketches: (5marks, 2marks for each sketch and 1mark for neat sketch)



SECTION 4: FINISHES IN BUILDING, MASS PRODUCTION ENVIRONMENTAL IMPART

The section covers building construction technology and woodwork technology unit (strands).

In this section, learners will acquire knowledge and understanding of finishes applied to buildings and finishes applied to floor. In the woodwork technology unit, learners are expected to gain the knowledge and understanding of basic techniques in mass production in the furniture industry and Impact of woodwork industry on the environment. All the above are treated from unit 13 to unit 16.

UNIT13

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of finishes applied to buildings.*

Learning Outcome: *Determine the basic finishes used for the different building Components of a simple three-bedroom self-contained house.*

INTRODUCTION AND SECTION SUMMARY

This unit introduces learners to Finishes, Functions of finishes and components of building they are applied to. Building Finishes can be referred to as the final surface of a building component which protects it from impact, water, frost, corrosion, abrasion, and so on, and as well provides it with acceptable aesthetic appearance. Finishes relate to both internal and external surfaces. They may also be applied to external component. They can be applied wet or dry. Some elements are self-finished, that the final surface finish is part of the material the element is formed from. The application of finishes may involve the build-up of more than one layer, which, whilst some of the layers will form the final exposed surface, they are nonetheless considered to be finishes. For example, an undercoat or primer might be applied to a wall before the final paint. The main categories of building finishes are those applied to; floors, walls, ceilings and roofs. The teacher will guide learners to understand the key concepts of finishes in building and Learners having understood finishes, will appreciate their importance and usefulness in buildings.

The unit covers only week 13: ***Explain finishes***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm the meaning and functions of finishes. Conducting experiential learning by organising field trips to construction sites where learners will observe finishes applied to building. Organise learners into mixed ability groups and assist them to explain finishes, functions of finishes in buildings and determine where they can be used. Help learners to develop a deeper understanding of the concept of finishes in buildings. Learners will be capacitated as they engage in critical thinking without any form of inhibition. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions which will in turn capture the diverse knowledge of all learners.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include homework, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment.

Indicators	DOK Level	Assessment Strategy and/ or Mode
Explain finishes	3 (strategic reasoning)	Homework

WEEK 13

Learning Indicator: *Discuss finishes*

FOCAL AREA 1: BUILDING FINISHES

Building Finishes are referred to as the final components applied on to surfaces of buildings, which protects the building part or component from impact, water, frost, corrosion, abrasion, and so on, and as well provides it with acceptable aesthetic appearance. One can also refer to finishes as the final touches applied to a building's interior and exterior surfaces to enhance its aesthetic appeal and provide protection. When it comes to considering the roof, the finishing is the material applied to the carcass of the roof to enhance its functions and aesthetic appearance. Finishes are generally applied onto Floor, wall, ceiling and roof carcass of buildings. Finishes, be they floor, wall, ceiling or roof carcass, generally have their functions as follows:

1. Finishes protect the building components and cause them to last long.
2. Finishes make cleaning of the building components easy.
3. Most Finishes are Fire Resistant.
4. Most finishes make less noise when in use.
5. Most finishes present pleasant aesthetic Appearances.
6. Finishes eliminate dampness and termites from the internal space.
7. Low Maintenance costs are incurred when good finishes are used to protect the building.
8. Finishes protect the building's surfaces from wear, tear, and environmental damage.
9. Properly applied finishes can reduce the need for frequent maintenance and repairs.
10. Certain finishes, like non-slip flooring enhance the comfort and safety of the building's occupants.
11. Finishes keep the interiors cool when it is hot and keep the rain and wind away.
12. The roof finishes keep the interiors warm when it is cold outside.
13. Suspended ceilings in tropical Africa serve as additional insulative barrier against solar heat.
14. Suspended ceilings incorporate services (air-conditioning ducts etc.) in multi-storey structures
15. Acoustic Ceiling Panels ensure maximum sound attenuation and provide a quieter and more peaceful space.

Figure.4.1 Shows finishes applied to building components such as floor, wall and ceiling, Figure 4.2 Shows roof carcass ready to receive roof finishes and Figure 4.3 Shows final finishes applied to roof carcass.

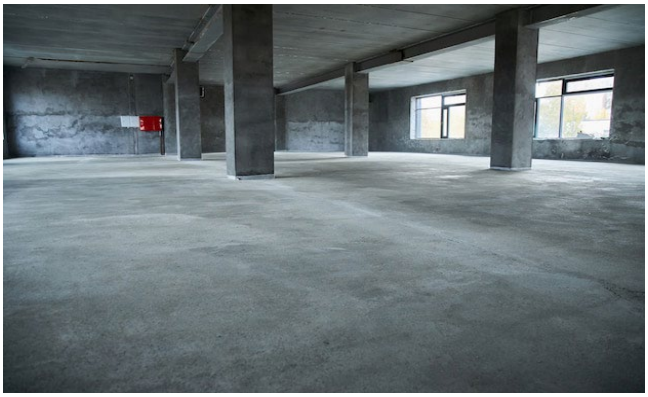


Figure 4.1 *Finishes applied to building*



Figure 4.2 *Roof carcass ready to receive roof finishes*



Figure 4.3 *Final finishes applied to roof carcass*

Learning Tasks

1. Explain Finishes.
2. Outline the functions of Finishes in Building.
3. Determine the various building components that receives final Finishes.

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and explain Finishes.

Group work/Collaborative Learning: Organise learners in mixed ability groups and assist them to outline the functions of finishes.

Critical thinking and Talk for Learning Approaches: Guide learners to brainstorm and determine the various Building Components that receives final finishes.

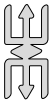
Key Assessment: Homework

1. A building requires finishes to address infection control, durability, acoustic performance, and aesthetic appeal. Analyse how these sometimes-competing requirements affect finish selection for different areas within the facility
2. Analyse how the functions of different finishes (floors, walls, ceilings) should be prioritised in the context of limited maintenance budget.

PLC Session 13

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



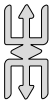
Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***homework***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the homework (NTS 3k-3q).

10 minutes | **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*

- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 13 Review

Unit 13 of week 13. This unit produces the learners with a deeper understanding of concept of Finishes. The pedagogical exemplars used in this section included group work/collaborative learning, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercise, practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, written presentations and using flip charts (Building Construction).

UNIT 14

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Materials and artefacts production in woodwork industry in Ghana

Content Standard: *Demonstrate knowledge and understanding of mass production, environmental impact and entrepreneurship of Timber Industry.*

Learning Outcome: *Demonstrate knowledge and understanding of mass production, environmental impact and entrepreneurship of Timber Industry.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners to understand basic techniques in mass production in the furniture industry. Mass production is a manufacturing method used to produce large quantities of standardised products quickly and efficiently. In the furniture industry, this technique allows factories and workshops to make items such as tables, chairs, cabinets, and beds at a faster rate and lower cost. Understanding these methods equips learners with the skills and knowledge needed to adapt to modern woodworking practices and prepares them for roles in industrial-scale production environments.

The unit covers only week 14: ***Basic techniques in mass production in furniture industry.***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in the discussion of basic techniques in mass production in the furniture industry. The teacher will employ pedagogies such as critical thinking and talk for learning, group work/collaborative learning and experiential learning. These strategies will be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities, should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts under this unit require learners to discuss the basic techniques in mass production in the furniture industry. The assessments should largely cover levels 1 and 2 of the DoK. Teachers will employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' progress and give prompt feedback. Teachers will administer assessments such as class exercises (including individual worksheets) after each lesson, homework, scores on basic techniques in mass production in the furniture industry and document learners' results in continuous assessment records. Teachers can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Basic techniques in mass production in furniture industry	3 (Strategic reasoning)	Questioning as an Assessment

WEEK 14

Learning Indicator: *Basic techniques in mass production in furniture industry*

FOCAL AREA 1: MASS PRODUCTION

Mass production in the woodwork industry is the process of large-scale manufacturing of large quantities of standardised products, using standardised processes and machinery to ensure uniformity, efficiency, and cost-effectiveness. Mass production facilitates the efficient production of a large number of similar products. Mass production is also referred to as flow production, repetitive flow production, series production or serial production.



Figure 4.4 *Mass production*

Mass Production Facilities

Mass production facilities in woodwork are designed to efficiently produce large quantities of wood products. These facilities often feature:

1. **Standardised Materials**: Wood is pre-processed into uniform sizes (e.g. boards, panels) to fit machine requirements.
2. **Mechanical Handling**: Large machines such as planers, moulders, and CNC routers handle surfacing, cutting, and shaping quickly and accurately.
3. **Automation**: Processes like measuring, marking, and feeding materials are often automated using conveyors and sensors.
4. **Jigs and Templates**: These are used extensively to ensure repeatability and reduce setup time.
5. **High Throughput**: Materials are prepared in bulk, enabling hundreds or thousands of identical parts to be produced quickly.
6. **Minimised Waste**: Efficient cutting plans (nesting software) reduce material wastage.

Mass Production Methods/Techniques in woodwork

1. **Assembly Line Production**: A method where furniture components move through a sequence of workstations, each performing a specific task, until the product is fully assembled. The parts move in a straight line until the final product is complete.

Key Features

a. Work is divided into simple, repetitive steps.

b. Each worker or machine performs only one task.

c. Materials move continuously on conveyors or rollers.

Example in the Furniture Industry: In a factory producing office desks, one station/person cuts parts, another drills holes, the next applies glue, another assembles the desk, another sands them and another applies the finish. The process flows without interruption.



Figure 4.5 *Mass production furniture industry*

2. **Batch Production**: A method where furniture is produced in groups or "batches," with each batch going through one production stage before moving to the next.

Key Features

a. Flexible—allows changes between batches.

b. Suitable for medium-scale production.

c. Machines may need resetting between batches.

Example in the Furniture Industry: A workshop produces 50 dining chairs, then switches to making 50 stools. Each batch follows the same steps: cutting, shaping, assembling, and finishing.

3. **Cellular Manufacturing:** A production method where workstations are grouped into cells, each responsible for a complete unit or component. The workshop is divided into small groups or "cells," and each cell is responsible for producing one complete part or unit. Workers in a cell do several tasks and work as a team.

Key Features

a. Combines flexibility of batch production with speed of mass production.

b. Cells are self-contained with tools and workers for a full process.

c. Promotes teamwork and ownership

Example in Furniture Industry: One cell builds complete cabinet doors, including cutting, profiling, and sanding. Another cell may handle drawers. Each team is responsible for a full component.

Advantages of Mass Production

1. If production is stringently monitored, mass production can result in a high level of precision because production line machines have preset parameters.

2. Mass production also results in lower costs because the automated assembly line production process requires fewer workers.
3. Mass production can create higher levels of efficiency because mass-produced items can be assembled at a quicker rate through automation.
4. Rapid assembly aids the prompt distribution and marketing of an organisation's products that, in turn, can create a competitive advantage and higher profits for a company.
5. It reduces labour costs.

Disadvantages of Mass Production

1. Establishing an automated assembly line is capital-intensive and requires a significant upfront investment of time and resources.
2. If the production design contains an error, extensive time and money may be required to redesign and rebuild mass production processes.
3. It involves high initial investment in machinery
4. There is the risk of overproduction of products.

Applications of Mass Production in Woodwork

1. Furniture Manufacturing (e.g., IKEA-style flat-pack furniture)
2. Cabinetry and Kitchen Units
3. Wooden Doors and Windows
4. Flooring and Wall Panelling
5. Pallet and Packaging Production

Learning Tasks

1. Explain the term mass production.
2. Explain the methods of woodwork mass production.
3. Describe the advantages and disadvantages of mass production.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners through a video demonstration on Basic techniques in mass production in the furniture industry, and brainstorm on the techniques in mass production with open-mindedness. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and collect relevant explanations from learners.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss and explain the methods of woodwork mass production. The teacher should circulate the classroom, ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Group work/Collaborative Learning: Guide learners in mixed ability groups to discuss and explain the advantages and disadvantages of mass production. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

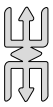
Key Assessment: Questioning

1. In a woodwork mass production facility, why are assembly lines typically arranged in a sequential order?
2. Describe how the preparation of wood materials differs between mass production facilities and traditional woodworking shops.
3. Summarise three each, advantages and disadvantages of mass production in woodwork industry.
4. Explain the following methods in woodwork mass production: assembly line production, batch production and cellular manufacturing.

PLC Session 14

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***questioning***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the questioning (NTS 3k-3q).

10 minutes | **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).

Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 14 REVIEW

Unit 14 of week 14 introduced learners to basic techniques in mass production in the furniture industry. The pedagogical exemplars used in this section included talk for learning, group work/collaborative learning, digital learning and experiential learning which helped to meet the varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/written presentation, class exercises, homework, practical group activities are structured to cater for all the varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Reflection: Are learners able to understand basic techniques in mass production in furniture industry.

UNIT 15

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of basic services*

Learning Outcome: *Determine the basic finishes used for the different building Components of a simple three-bedroom self-contained house.*

INTRODUCTION AND SECTION SUMMARY

This unit introduces learners to finishes applied to the floor. Floor finishing referred to as layers over or covering the structural floor. The functions of the floor finish include provision of high wearing resistance and long-life span of the floor. The finishes also make the floors safe, non-slip and easy-to-clean. The finishes also enhance the fire, termite and insect resistance of the floor. Floor finishes also reduce sound transmission, provide insulation as well as enhancing aesthetic appearance of the floors. Floor Finishes relate to both internal and external surfaces. They can be applied wet or dry. Some floor finishes such as screed are self-finished, that is the final surface is part of the material the floor is formed with. The teacher will guide learners to understand various types of floor finishes, the materials they are made of the construction technologies involved in applying them as well as bonding elements and tools used to apply them. They will also guide them to determine where in the building to apply the different types of finishes as well as how to maintain them. The Learners having understood the finishes, will appreciate how and where to apply them as well as maintain them.

The unit covers only week 14: ***Discuss finishes applied to floor***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm and explain floor Finishes, application of floor finishes and the various types of adhesives used in fixing the floor finishes. Conducting experiential learning by organising field trips to construction sites where learners will observe finishes applied to floors. Organise learners into mixed ability groups and assist them to explain floor finishes, types of finishes and the various types of adhesives used in fixing floor finishes. Help learners to develop a deeper understanding of the concept of floor finishes. Learners will be capacitated as they engage in critical thinking without any form of inhibition. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions which will in turn capture the diverse knowledge of all learners.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include discussion, homework, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the

concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment. Floor finishing referred to as layers over or covering the structural floor. The functions of the floor finish include provision of high wearing resistance and long-life span of the floor. The finishes also make the floors safe, non-slip and easy-to-clean. Choosing an appropriate floor finish depends upon; appearance, durability and lifespan of the floor finish.

Indicators	DOK Level	Assessment Strategy and/ or Mode
Discussion of finishes applied to floors	3 (strategic reasoning)	Discussion

WEEK 15

Learning Indicator: *Discuss finishes applied to floors*

FOCAL AREA 1: FINISHES APPLIED TO THE FLOOR

Finishes refer to the final layers or coverings to the structural floor it enhances its aesthetic appeal as well as serve as protection for it. Choosing an appropriate floor finish depends upon; appearance, durability, introduction of expansion joints and life span of the floor finish. The major categories of floor finish applied onto the oversite concrete or floor slab include the following;

1. **Hard monolithic floor finishes:** are basically a mixture of cement, sand and some fine or other aggregates well mixed with the help of a concrete mixer and cast as a continuous piece. They are usually cast upon cured or old monolithic concrete structural floors which themselves are continuous without any breaks nor joints. Hard monolithic floor finishes end up as hard and noisy surfaces. The most common examples of Hard monolithic floor finishes include Floor Screed when presented as a final finish, Granolithic screed and In-situ Terrazzo.
2. **Tiled Floor Finishes:** Tiled Floors include the use of all hard materials laid in separate pieces on a screed or mortar bed of cement and sand mixture with the ratio of 1:3 and thickness from 10 to 20mm. Such finishing materials include Concrete and Terrazzo Tiles, Ceramic Glazed Tiles, Mosaic, Quarry and Clay Tiles.
3. **Resilient Floor Finishes:** Resilient floor finish refers to any material covering the structural floor that is not wood, textile, stone, concrete nor ceramic and are described as comfortable underfoot due to the added cushion and flexibility of the materials. The sound produced by foot traffic is lessened, resulting in a quieter environment where they are in use and they also withstand wear and tear over time. Some resilient materials used as floor finishes include Linoleum, Cork and Flexible P.V.C. Sheets and Tiles.
4. **Wooden Floor Finishes:** Wood, being an organic material, makes a very beautiful floor surface and comes with some degree of resilience and good wearing resistance and insulating characteristics. There are two types of timber flooring in use. Boards and Strips is one option and the second type referred to as Block. In exception of the bathroom and other wet areas such as balconies Timber Floor finishing be it Boards and Strips or Blocks can be laid in any internal space of the house. Adhesive plays crucial role in fixing various floor finishes. They are; cement-based and epoxy adhesives, polyurethane adhesive, urethane adhesive and water-based adhesive. Figure 4.5 shows hard monolithic cement screed floor finishes, Figure 4.6 shows Hard Monolithic In-situ Terrazzo Floor finishes, Figure 4.7 shows the laying of floor tiled finishes, Figure 4.8 shows the laying of resilient floor finishes and Figure 4.9: wooden floor finishes.



Figure 4.5 *Hard Monolithic Cement Screed Floor Finishes*



Figure 4.6 *Hard Monolithic In-situ Terrazzo Floor finishes*



Figure 4.7 *Laying of Floor Tiled Finishes*



Figure 4.8 *Laying of Resilient Floor Finishes*



Figure 4.9 *Wooden Floor Finishes*

Learning Tasks

1. Explanation and appropriate selection of floors finishes
2. Outline types of floor finish with their functions.
3. Types of adhesives used in fixing floor finishes

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Guide learners to discussion floors finishes and their functions.

Group work/Collaborative Learning: Assist learners to outline types of finishes applied to floors.

Conducting experiential learning: Organise field trips to construction sites where learners will observe and discuss different types of finishes applied to floor surfaces, functions and methods of applying floor finishes and identify the types of adhesives used for fixing floor

finishes.

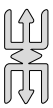
Key Assessment: Discussion

1. The function of floor finishes deteriorates at different rates depending on usage and maintenance practices. Analyse how the slip resistance, appearance, and wear resistance functions of three different floor finishes would change over a 10-year period in a school environment.
2. Analyse how the selection of floor finishes can enhance or limit a building's functional adaptability. Suggest a strategic approach for selecting floor finishes that allow for potential changes in the use of the space.

PLC Session 15

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
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Note

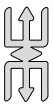
- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*

- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***discussion***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the discussion (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

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6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
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      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
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9. Remember to
   a. transfer your chats into your learning planner template.
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   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 15 Review

Unit 15 of week 15. This unit produces the learners with a deeper understanding of the concept of Floor Finishes. The pedagogical exemplars used in this section included group work/collaborative learning, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as discussion, oral/written presentation, class exercise, and practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, written presentations and using flip charts (Building Construction).

UNIT 16

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Materials and artefacts production in woodwork industry in Ghana.

Content Standard: *Demonstrate knowledge and understanding of mass production, environmental impact and entrepreneurship of Timber Industry.*

Learning Outcome: *Demonstrate knowledge and understanding of mass production, environmental impact and entrepreneurship of Timber Industry.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners explore the impact of the woodworking industry on the environment. Woodwork is an important industry that provides materials for furniture, buildings, and many useful items. However, the processes involved, such as cutting down trees, processing timber, and using chemicals, can affect the environment in many ways. Learners will understand how woodworking activities impact the natural world, both positively and negatively. It also highlights the importance of sustainable practices to reduce harm to the environment

The unit covers only week 16: ***Impact of wood woodwork industry on the environment.***

Recap weeks

Year 1	**Weeks 9 and 11:** Outline the processing phases of timber in the woodwork industry

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in the discussion of the impact of woodworking industry on the environment. The teacher will employ pedagogies such as critical thinking and talk for learning, group work/collaborative learning and experiential learning. These strategies will be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities, should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts under this unit require learners to discuss the impact of the woodworking industry on the environment. The assessments should largely cover levels 1, 2 and 3 of the DoK. Teachers will employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' progress and give prompt feedback. Teachers will administer assessments such as class exercises (including individual worksheets) after each lesson, homework, scores on basic techniques in mass production in the furniture industry and document learners' results in continuous assessment records. Teachers can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Impact of wood woodwork industry on the environment	3 (Strategic reasoning)	Essay

WEEK 16

Learning Indicator: *Impact of wood woodwork industry on the environment*

FOCAL AREA 1: ENVIRONMENTAL IMPACT OF WOOD INDUSTRY

The impact of the woodwork industry on the environment refers to the effects, both positive and negative, that woodworking activities have on nature. This includes how the industry influences forests, air, water, wildlife, and the climate through the cutting, processing, and use of wood and wood products. Figure 3.1 shows the impact of the woodwork industry on the environment.

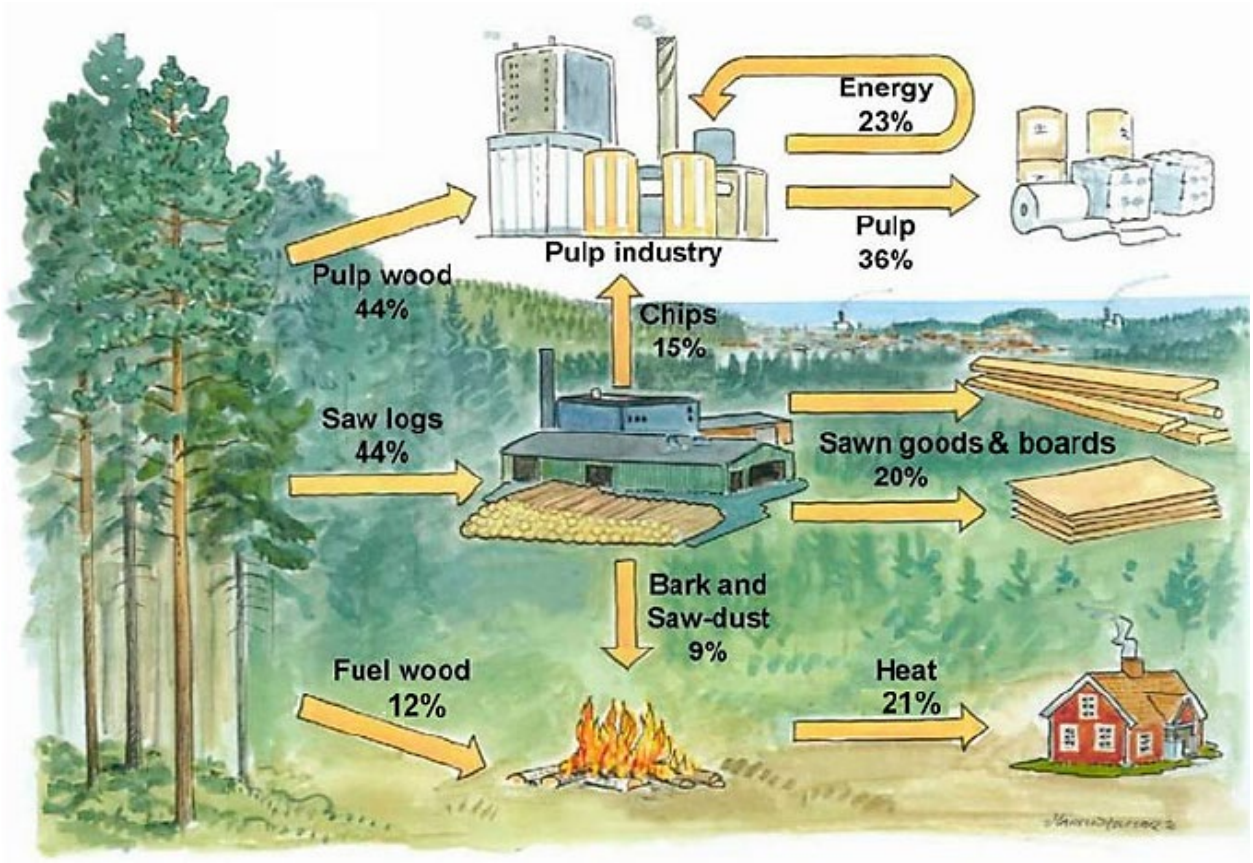


Figure 4.1*0 Impact of the woodwork industry on the environment*

Environmental Impacts in the Woodwork Industry

Environmental impacts in the woodwork industry refer to the various ways that woodworking operations, timber processing, and manufacturing activities affect the natural environment, ecosystems, and human health. These impacts occur throughout the entire lifecycle of wood products - from forest harvesting to manufacturing, usage, and disposal.

Positive impacts of the woodwork industry on the environment:

1. **Use of Renewable Resources**: Wood is a renewable material if harvested responsibly from managed forests.
2. **Carbon Sequestration**: Wood products store carbon throughout their lifetime, helping to reduce CO_2 levels in the atmosphere.

3. **Recycling and Reuse**: Wood can be recycled into particleboard, mulch, or reused for other construction or craft purposes.
4. **Promotion of Sustainable Forestry**: Certified woodwork industries often support reforestation and sustainable forest management.

Negative impacts of the woodwork industry on the environment:

1. **Deforestation**: Large-scale harvesting of trees for timber leads to the destruction of forests. This contributes to the loss of biodiversity and disruption of ecosystems.
2. **Air Pollution**: Woodworking machines and processes (like sanding, spraying and cutting) release dust and harmful fumes (e.g., from paints, adhesives, and finishes) into the air.
3. **Waste Generation**: Offcuts, sawdust, shavings, and rejected materials are often discarded as waste, contributing to landfills.
4. **Water Pollution**: Improper disposal of chemicals like varnishes, solvents, and glues can contaminate water sources.
5. **Carbon Emissions**: Processing and transportation of wood products consume fossil fuels, leading to greenhouse gas emissions.
6. **Soil Erosion:** When trees are removed without proper forest management, the soil becomes exposed. Without tree roots to hold it in place, the soil is easily washed away by rain. This leads to soil erosion, which reduces soil fertility and affects farming activities near forested areas.
7. **Health issues:** Health impacts on workers and surrounding communities. Workers may fall sick as a result of inhalation of chemicals used in preservation and finishing of artefacts.

Sustainable Practices to Reduce Environmental Impact

1. Use sustainably sourced or certified wood (e.g., FSC-certified).
2. Minimise waste through efficient cutting of trees.
3. Utilisation of Lesser-Known Timber Species to reduce pressure on popular species
4. Recycled and reclaimed wood usage
5. Increased use of manufactured boards from wood residues
6. Use of dust collection and filtration systems
7. Closed-loop water systems to minimise pollution
8. Use of Non-Timber Forest Products (NTFP)
9. Reforestation and afforestation initiatives
10. Development and usage of environmentally friendly adhesives and finishes
11. Use water-based or low-VOC finishes and adhesives.
12. Adopt cleaner technologies and dust collection systems.
13. Support reforestation and tree planting initiatives.

Impact of wooden furniture compared to plastic or metal furniture

Material comparison	Impact of wooden furniture
Wooden Furniture	Wood is a **natural and renewable** material. If the trees are harvested responsibly, wooden furniture is **environmentally friendly.** Trees can **store carbon,** which helps reduce climate change. Wood is **biodegradable** and can break down naturally when disposed of. If wood is taken without replanting trees, it can lead to **deforestation** and **loss of wildlife habitat.**
Plastic Furniture:	Plastic furniture requires petroleum extraction, this is a non-renewable resource. In the manufacturing and processing of plastics, CO_2 and other greenhouse gases are released into the environment to cause pollution Plastic furniture releases microplastics through wear and tear into the environment It has Lower durability and leads to frequent replacement, multiplying environmental impact Plastic furniture cannot decompose easily in the environment and leads to consuming more landfill space when disposed of.
Metal Furniture:	Making metal furniture involves **mining,** which damages the land. It also requires **high energy** to process the metal. If not recycled, metal waste can harm the environment. Metal can be **recycled many times,** which helps reduce pollution. It is **strong and long-lasting,** so it doesn't need to be replaced often.

Learning Tasks

1. Explain the impact of the woodwork industry on the environment.
2. Explain the **positive and negative impacts of the woodwork industry on the environment.**
3. Compare the impact of wooden furniture to plastic or metal furniture.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners through a video demonstration on the impact of the woodwork industry on the environment, and brainstorm on the impact of the woodwork industry on the environment with open-mindedness. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and collect relevant explanations from learners.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss and explain the positive and negative impacts of the woodwork

industry on the environment. The teacher should circulate the classroom, ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Group work/Collaborative Learning: Guide learners in mixed ability groups to discuss and compare the impact of wooden furniture to plastic or metal furniture. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

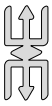
Key Assessment: Essay

1. Explain how using Lesser-Known Timber Species (LKS) could help reduce environmental damage while keeping the woodwork industry profitable in Ghana.
2. Analyse two negative environmental impacts of the woodwork industry in Ghana.
3. Explain one each of the environmental impacts of wooden furniture compared to plastic or metal furniture.

PLC Session 16

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
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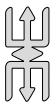
Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***essay***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the essay (NTS 3k-3q).

10 minutes | **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
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30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
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      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
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   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 16 REVIEW

Unit 16 of week 16 introduced learners to the impact of the woodwork industry on the environment. The pedagogical exemplars used in this section included talk for learning, group work/collaborative learning, digital learning, which helped to meet the varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/ written presentation, class exercises, homework, practical group activities are structured to cater for all the varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, real life impacts of woodwork industry on the environment

Reflection: Are learners able to understand the impact of the woodwork industry on the environment.

MARKING SCHEMES/RUBRICS FOR THE KEY ASSESSMENTS

UNIT 13

Question 1

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of Finish Requirements	*Explains all four requirements (infection control, durability, acoustics, and aesthetics) and why they matter in building finishes*	*Explains most requirements with some understanding of their importance*	*Shows limited understanding of the requirements with minimal explanation*	*Shows one understanding of the requirements without explanation*
Identification of Competing Factors	*Analyses specific conflicts between requirements (e.g., how infection control materials might limit aesthetic options) with clear examples*	*Identifies some conflicts between requirements with basic explanations*	*Mentions minimal conflicts with limited explanation*	*Mention one conflicts without explanation*
Area-Specific Analysis	*Analyses at least 3 different building areas and how their specific functions create different priorities for finish selection*	*Describes 2 building areas with some analysis of their finishing needs*	*Mentions 1-2 areas with minimal analysis of specific needs*	*Mention1area without analysis of specific needs*
Material Selection Analysis	*Analyses how specific materials can balance multiple requirements, with examples of appropriate compromises*	*Describes some materials that address multiple requirements with partial analysis*	*Lists few materials with minimal analysis of their suitability*	*Lists one material without analysis of their suitability*
Decision-Making Process	*Explains a logical decision-making approach for resolving competing requirements, with consideration of priorities for different situations*	*Describes a basic approach to decision-making with some consideration of priorities*	*Offers minimal guidance on how to make decisions when requirements compete*	*Offers a guidance on how to make decisions when requirements compete*

Question 2

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of Finish Functions	*Explains the multiple functions of building finishes (protection, aesthetics, safety, etc.) and how maintenance preserves these functions*	*Describes some functions of building finishes with partial explanation of maintenance needs*	*Shows limited understanding of finish functions with minimal connection to maintenance*	*Shows one understanding of finish functions without connection to maintenance*
Floor Finish Analysis	*Analyses floor finish priorities considering traffic patterns, safety requirements, and long-term damage risks*	*Identifies some important factors for floor maintenance with basic analysis*	*Lists minimal considerations for floor maintenance with little analysis*	*Lists one consideration for floor maintenance with little analysis*
Wall Finish Analysis	*Analyses wall finish priorities considering exposure to damage, visibility, and functional requirements (e.g., cleanliness in kitchens)*	*Identifies some important factors for wall maintenance with basic analysis*	*Lists minimal considerations for wall maintenance with little analysis*	*Lists one consideration for wall maintenance with little analysis*
Ceiling Finish Analysis	*Analyses ceiling finish priorities considering visibility of damage, accessibility for repairs, and consequences of neglect*	*Identifies some important factors for ceiling maintenance with basic analysis*	*Lists minimal considerations for ceiling maintenance with little analysis*	*Lists one consideration for ceiling maintenance with little analysis*
Budget Allocation Strategy	*Develops a strategic approach to prioritising maintenance spending with specific criteria for decision-making and consideration of long-term consequences*	*Describes a basic approach to budget allocation with some consideration of priorities*	*Offers minimal guidance on how to allocate a limited budget with little strategic thinking*	*Offers one guidance on how to allocate a budget with little strategic thinking*

UNIT 14

(20 marks)

Questions	Answer	Marks
1. *Why are assembly lines typically arranged in a sequential order?*	*Assembly lines are arranged in sequential order to allow specialised workers to focus on specific tasks.* *Mass Production Facilities:* 1. *Wood is pre-processed into uniform sizes (e.g. boards, panels) to fit machine requirements.* 2. *Large machines such as planers, moulders, and CNC routers handle surfacing, cutting, and shaping quickly and accurately.*	*(4 marks)* *(4 marks, 1 mark each)* *(6 marks, 1 mark each)*
2. *Differences*	*Traditional Woodworking Shops:* 1. *Wood is selected and assessed by hand for grain, knots, and defects.* 2. *Hand Tools and Basic Machines: Tools like hand planes, chisels, table saws, and jointers are used for shaping and surfacing.*	*(6 marks, 1 mark each)*
3. *Advantages and Disadvantages*	*Advantages:* 1. *Cost efficiency.* 2. *Standardisation and consistency.* 3. *Production speed and volume.* 4. *Economic benefits.* 5. *Resource utilisation* *Disadvantages:* 1. *Environmental Impact,* 2. *Quality and Craftsmanship* 3. *Labour Implications* 4. *Flexibility Limitations* 5. *Initial Investment and Risk.*	
4. *Methods*	*1. Assembly Line Production* a. *Sequential workstations performing specific operations* b. *Components move from station to station* c. *Specialised tooling at each workstation* d. *Paced workflow to ensure consistent output*	

	2. Batch Production • *Similar components processed together through each production stage* • *Set-up time distributed across multiple identical pieces* • *Efficient use of specialised machinery for each batch* • *Allows for some product variety while maintaining efficiency* *3. Cellular Manufacturing* • *Groups of machines arranged to produce families of similar components* • *Workers operate multiple machines within a cell* • *Reduces material handling and transportation* • *Allows more flexibility than rigid assembly lines*	

UNIT 15

Question 1

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2 mark)	Needs Improvement (1mark)
Understanding of Floor Finishes	*Identifies and explains three different floor finishes suitable for schools with specific technical properties*	*Identifies three floor finishes with some explanation of their properties*	*Lists three floor finishes with minimal description of their properties*	*Lists one floor finishes with description of their properties*
Slip Resistance Analysis	*Analyses how slip resistance would change over time for each finish, considering specific school areas (e.g., entrances, hallways) and maintenance needs*	*Describes some changes in slip resistance with partial consideration of school environment*	*Mentions minimal changes to slip resistance with limited connection to time period or location*	*Mentions one change to slip resistance without connection to time period or location*

Appearance Analysis	*Analyses appearance deterioration patterns for each finish, considering factors like staining, fading, and visual impact in an educational setting*	*Describes some appearance changes with partial consideration of educational setting*	*Mentions minimal appearance changes with limited analysis of deterioration patterns*	*Mention one appearance changes without analysis of deterioration patterns*
Wear Resistance Analysis	*Analyses wear patterns for each finish, identifying high-traffic areas in schools and explaining how each finish would respond differently over time*	*Describes some wear patterns with partial consideration of school traffic patterns*	*Mentions minimal wear considerations with limited connection to the 10-year timeframe*	*Mention one wear considerations without connection to time*
Comparative Evaluation	*Strategic comparison of all three finishes across all three properties, explaining which would perform best for specific school locations over the full 10-year period*	*Compares finishes with some strategic thinking about their relative performance*	*Offers minimal comparison between finishes with limited strategic analysis*	*Offers one comparison between finishes with a strategic analysis*

Question 2

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of Adaptability	*Explains what "functional adaptability" means in buildings and why it matters for floor finish selection*	*Provides a general understanding of adaptability with some connection to flooring*	*Shows limited understanding of adaptability with minimal connection to flooring*	*Shows one understanding of adaptability without connection to flooring*
Analysis of Limiting Factors	*Analyses how specific floor finishes can restrict future space use (e.g., permanent installations, specialised surfaces) with clear examples*	*Identifies some limitations with basic explanations*	*Mentions minimal limitations with little analysis*	*Mention one limitation with little analysis*

Analysis of Enhancing Factors	*Analyses how specific floor finishes can support multiple uses and future changes with relevant examples*	*Identifies some adaptability features with basic explanations*	*Mentions minimal adaptability features with little analysis*	*Mention one adaptability features without analysis*
Cost-Benefit Considerations	*Strategically analyses the relationship between initial costs and long-term adaptability benefits, with consideration of different scenarios*	*Describes some cost-benefit factors with partial analysis*	*Offers minimal consideration of costs versus adaptability benefits*	*Offers one consideration of costs versus adaptability benefits*
Strategic Selection Approach	*Develops a logical approach for selecting adaptable flooring with specific decision-making criteria and consideration of different space types*	*Suggests a basic approach with some strategic elements*	*Offers minimal guidance for selection with limited strategic thinking*	*Offers one guidance for selection with limited strategic thinking*

UNIT 16

Question 1

a. Most woodworkers use common trees like mahogany and odum, which are becoming scarce due to overuse. Using LKS such as ananta, esa, or niangon will reduce the pressure on popular species and allow forests to recover naturally.

(1mark)

b. When different tree species are used, logging becomes more balanced and less damaging. This prevents deforestation and helps maintain biodiversity in the forest.

(1mark)

c. Using LKS will help the industry make use of trees that would go to waste.

(1mark)

Question 2

a. The industry relies heavily on cutting down trees for timber. This leads to the clearing of large areas of forest land, which reduces forest cover. As a result, wildlife loses its habitat, rainfall patterns are affected, and the risk of desertification increases in some regions of Ghana.

(1mark)

b. When trees are removed without proper forest management, the soil becomes exposed. Without tree roots to hold it in place, the soil is easily washed away by rain. This leads to soil erosion, which reduces soil fertility and affects farming activities near forested areas.

(1mark)

c. The use of chemicals such as paints, varnishes, and adhesives in wood processing can contaminate water sources if not handled properly. Also, sawdust and fumes from burning wood or using outdated machines contribute to air pollution, which can harm human health and the atmosphere.

(1mark)

Question 3

(4 **marks,** 1 mark for each point)

Question	Answer
Wooden Furniture	*If the trees are harvested responsibly, wooden furniture is environmentally friendly.*
Plastic Furniture:	*In the manufacturing and processing of plastics, CO_2 and other greenhouse gases are released into the environment to cause pollution*
Metal Furniture:	*Making metal furniture involves mining, which damages the land.*

SECTION 5: FINISHES IN BUILDING AND ENTREPRENEURSHIP

The section covers building construction technology and woodwork technology unit (strands).

In this section, learners will acquire knowledge and understanding of finishes applied to walls, finishes applied to Ceiling joists and finishes applied to roof carcasses. In the woodwork technology unit, learners are expected to gain the knowledge and understanding of basic entrepreneurship in the woodwork industry. All the above are treated from unit 17 to unit 20.

UNIT17

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of basic services*

Learning Outcome: *Determine the basic finishes used for the different building Components of a simple three-bedroom self-contained house.*

INTRODUCTION AND SECTION SUMMARY

This unit introduces learners to Finishes applied to walls surfaces. Wall Finishes referred to final materials or treatments applied onto wall surfaces after the main structural construction is completed to provide acceptable aesthetic appearance or decoration and serve as protection to the structure or both. Finishes relate to both internal and external surfaces. Wall finishes can be applied wet or dry. The appropriate finishes applied to wall surfaces are Plaster, Paint, Tiles, Wallpaper and Cladding. Methods of applying wall finishes: Plaster; prepare the wall surface by sprinkling water and apply base coat of mortar by using trowel, use a straight edge to level the surface and apply finishing coat of mortar and use float or trowel to smooth the surface. Paint; prepare the surface of wall by cleaning, filling holes, and priming, using brushers rollers or spray equipment apply multiple coats of paints needed allowing drying time between the coats. Tiles; prepare the wall surface by sprinkling water and apply adhesive with notched trowel and place tiles with spacers. Wallpaper; prepare the wall surface by cleaning and sizing, cut wallpaper to the required lengths and applied adhesive at the back of the wallpaper or onto the wall surface hang paper and smooth out bubbles with brush, then trim excess at edges. Cladding; install the supporting frame and cut materials to size, attach using appropriate fasteners or adhesives and finish joints and edges as required. Adhesive plays crucial role in applying various finishes to walls. They are; Cement Based Adhesives, Mastic Adhesives, Wall paper Adhesives, PVA (polyvinyl Acetate) Adhesives, Construction Adhesive and Contact

Adhesive. The teacher will guide learners to understand the key concepts of wall finishes, application of wall finishes and the various types of adhesives and Learners having understood wall finishes, will appreciate their importance and usefulness in buildings.

The unit covers only week 16: ***Discuss finishes applied to walls***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm and explain Wall Finishes, application of wall finishes and the various types of adhesives used in fixing the finishes to walls. Conducting experiential learning by organising field trips to construction sites where learners will observe finishes applied to wall surfaces. Organise learners into mixed ability groups and assist them to explain wall finishes, types of finishes and the various types of adhesives used in fixing the finishes to wall surfaces. Help learners to develop a deeper understanding of the concept of wall finishes. Learners will be capacitated as they engage in critical thinking without any form of inhibition. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions which will in turn capture the diverse knowledge of all learners.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include discussion, homework, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment. Wall Finishes referred to final materials or treatments applied onto wall surfaces after the main structural construction is completed to provide acceptable aesthetic appearance or decoration and serve as protection to the structure or both. The appropriate finishes applied to wall surfaces are Plaster, Paint, Tiles, Wallpaper and Cladding. Types of adhesives used for wall finishes are; Cement Based Adhesives, Mastic Adhesives, Wall paper Adhesives, PVA (polyvinyl Acetate) Adhesives, Construction Adhesive and Contact Adhesive.

Indicators	DOK Level	Assessment Strategy and/ or Mode
Discussion of finishes applied to walls	3 (strategic reasoning)	Discussion

WEEK 17

Learning Indicator: *Discussion finishes applied to walls*

FOCAL AREA 1: FINISHES APPLIED TO WALLS

Discussion of finishes applied to walls surface. Wall Finishes referred to final materials or treatments applied onto wall surfaces after the main structural construction is completed to provide acceptable aesthetic appearance or decoration and serve as protection to the structure or both. The appropriate finishes applied to wall surfaces are Plaster, Paint, Tiles, Wallpaper and Cladding. Methods of applying wall finishes: Plaster; prepare the wall surface by sprinkling water and apply base coat of mortar by using trowel, use a straight edge to level the surface and apply finishing coat of mortar and use float or trowel to smooth the surface. Paint; prepare the surface of wall by cleaning, filling holes, and priming, using brushers rollers or spray equipment apply multiple coats of paints needed allowing drying time between the coats. Tiles; prepare the wall surface by sprinkling water and apply adhesive with notched trowel and place tiles with spacers. Wallpaper; prepare the wall surface by cleaning and sizing, cut wallpaper to the required lengths and applied adhesive at the back of the wallpaper or onto the wall surface hang paper and smooth out bubbles with brush, then trim excess at edges. Cladding; install the supporting frame and cut materials to size, attach using appropriate fasteners or adhesives and finish joints and edges as required. Types of adhesives used for wall finishes are; Cement Based Adhesives, Wall Putty Adhesive, Mastic Adhesives, Wall paper Adhesives, PVA (polyvinyl Acetate) Adhesives, Construction Adhesive and Contact Adhesive. Figure 5.1: shows Cement based adhesive wall finish applied to wall surface, Figure 5.2: Shows Paint finish applied to wall surface with wall putty-based adhesive, Figure 5.3: Shows tiles finish applied to wall surface with mastic adhesive based, Figure 5.4: Shows wall paper applied to wall surface with PVA (polyvinyl Acetate) Adhesives based and Figure 5.5: Shows sample of wall paper.



Figure 5.1 *Cement based adhesive wall finish applied to wall surface*



Figure 5.2 *Paint finish applied to wall surface with wall primers based adhesive*



Figure 5.3 *Tiles finish applied to wall surface with mastic adhesive based*



Figure 5.4 *Wall paper applied to wall surface with per-mixed past Adhesives based*



Figure 5.5 *Wall paper*



Figure 5.6 *Cladding finishes to a wall with install supporting frame based*

Learning Tasks

1. Discussion of finishes applied to walls surface and functions
2. Types of finishes applied to wall surfaces
3. Methods of applying wall finishes
4. Types of adhesives used for wall finishes

Pedagogical Exemplars

Critical thinking and Talk for Learning Approaches: Guide learners to discussion finishes applied to walls surface and functions

Group work/Collaborative Learning: Assist learners to outline types of finishes applied to wall surfaces.

Conducting experiential learning: Organise field trips to construction sites where learners will observe different types of finishes applied to wall surfaces, methods of applying finishes to wall surfaces and identify the types of adhesives used for wall finishes.

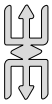
Key Assessment: Discussion

1. Modern building design requires finishes to serve multiple functions. Analyse how wall finishes could be strategically selected to integrate protective, aesthetic and durability functions in an office environment.
2. Different adhesives deteriorate at different rates depending on environmental conditions and the materials they're bonding. Analyse how the bond strength of three different wall finish adhesives would change over time in spaces with varying weather conditions.

PLC Session 17

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***discussion***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the discussion (NTS 3k-3q).

10 minutes | **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).

Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 17 Review

Unit 17 of week 17. This unit produces the learners with a deeper understanding of concept of wall Finishes. The pedagogical exemplars used in this section included group work/ collaborative learning, role-play, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies, such as discussion, oral/written presentation, class exercise, practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, written presentations and using flip charts (Building Construction).

UNIT 18

STRAND: WOODWORK TECHNOLOGY

Sub-Strand: Materials and artefacts production in woodwork industry in Ghana

Content Standard: *Demonstrate knowledge and understanding of mass production, environmental impact and entrepreneurship of Timber Industry*

Learning Outcome: *Demonstrate knowledge and understanding of mass production, environmental impact and entrepreneurship of Timber Industry.*

INTRODUCTION AND UNIT SUMMARY

This unit will help learners explore the basic entrepreneurship in woodwork industry. Entrepreneurship in the woodwork industry involves identifying opportunities, creating wood-based products or services, and managing a small business to meet customers' needs. As demand for custom furniture, home fittings, and wooden décor continues to grow, individuals with woodwork skills can turn their passion into a profitable business. It focuses on how to plan, produce, price, and promote woodwork products successfully in a competitive local market.

The unit covers only week 18: ***Basic entrepreneurship in woodwork industry.***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be accomplished, learners must participate in discussing of basic entrepreneurship in woodwork industry. The teacher will employ pedagogies such as critical thinking and talk for learning, group work/collaborative learning and experiential learning. These strategies will be used in mixed-ability and mixed-gender groupings, in pairs and individual learning. All learners, irrespective of their learning abilities, should be encouraged to participate fully in investigations as well as presentation of findings. The teacher should implement differentiation strategies to accommodate diverse learning needs.

ASSESSMENT SUMMARY

The concepts under this unit require learners to discuss basic entrepreneurship in woodwork industry. The assessments should largely cover levels 1, 2 and 3 of the DoK. Teachers will employ a variety of formative assessment strategies such as oral/written presentations, pair-tasks, reports, home tasks, etc. to collect information about learners' progress and give prompt feedback. Teachers will administer assessment such as class exercises (including individual worksheets) after each lesson, homework, scores on basic techniques in mass production in the furniture industry and document learners' results in continuous assessment records. Teacher can consult Teacher Assessment Manual and Toolkits (TAMTK) (NaCCA 2023) on how to use the assessment strategies effectively.

Indicators	DOK Level	Assessment Strategy and/or Mode
Basic entrepreneurship in woodwork industry	3 (Strategic reasoning)	Practice Paper 2 Peer Assessments

WEEK 18

Learning Indicator: *Basic entrepreneurship in woodwork industry*

FOCAL AREA 1: ENTREPRENEURSHIP

Entrepreneurship is the process of identifying, creating, and pursuing opportunities to develop new products, services, or businesses. It involves taking risks, innovating, and utilising resources to create value for customers and society

An **entrepreneur:** appears as a threat, an aggressive competitor, whereas to another businessman the same entrepreneur may be an ally, a source of supply, a customer or someone who creates wealth for others as well as finds better ways to utilise, resources, reduce waste, and produce jobs others are glad to get.

Entrepreneurship in the woodwork industry: involves identifying business opportunities, producing wooden items such as furniture making, cabinetry, carvings and selling them for profit. It requires a mix of technical skills, business knowledge, and creativity to succeed. Figure 5.7 shows entrepreneurship in the woodwork industry.



Figure 5.7 *Entrepreneurship in the woodwork industry*

Areas of basic entrepreneurship in woodwork

1. **Identifying Business Opportunities**
   a. Spotting what products are in demand (e.g., furniture, doors, crafts).
   b. Solving problems customers face with wooden products.
2. **Product Design and Development**
   a. Creating attractive, functional, and durable wooden items.
   b. Customising products to meet customer needs.
3. **Production and Quality Control**
   a. Using tools and machines efficiently to make high-quality products.
   b. Reducing waste and working safely.
4. **Marketing and Sales**
   a. Advertising products through social media, flyers, or local exhibitions.
   b. Building relationships with customers and meeting delivery deadlines.

5. **Financial Management**
    a. Setting prices that cover costs and make profit.
    b. Keeping records of expenses, sales, and profits.
6. **Customer Service**
    a. Listening to customer feedback.
    b. Providing after-sales service or repairs if needed.
7. **Legal & Safety Requirements**
    a. Registering of the business (if required locally)
    b. Following safety regulations and using protective equipment

Importance of Entrepreneurship in Woodwork

1. Creates jobs and income.
2. Promotes local craftsmanship.
3. Reduces import of furniture and wood products.
4. Encourages innovation and self-employment.

Factors that Make a Woodwork Business Successful

1. **Quality of Products**
    a. **Durable and well-finished items** attract customers.
    b. Use of good-quality wood and strong joints builds trust.
    c. Attention to details in design, sanding, and finishing makes products stand out.
2. **Meeting Local Needs**
    a. Products must suit the **tastes, income levels, and lifestyles** of the community.
    b. Making practical items like doors, chairs, shelves, and kitchen stools can ensure steady demand.
3. **Affordable Pricing**
    a. Prices should match what people in the area can afford.
    b. Offering value for money encourages local support.
4. **Skilled Labour**
    a. Employing or training skilled workers ensures consistency and speed in production.
    b. A well-trained team improves quality and reduces waste.
5. **Effective Marketing**
    a. Use word-of-mouth, posters, local radio, and social media to reach out to customers.
    b. Showing finished work at community events or fairs can attract attention.
6. **Reliable Supply of Materials**
    a. Having consistent access to quality wood, glue, screws, and finishes prevents delays.
    b. Building relationships with local suppliers helps reduce costs.

7. **Innovation and Variety**
    a. Creating new or unique items (e.g., foldable furniture, carved signs) attracts more buyers.
    b. Offering both traditional and modern designs gives customers more choices.

Challenges of Starting up a Woodwork Business

a. **Limited Start-Up Capital:** A beginner may not have enough money to buy machines, rent a workshop, or buy quality materials in bulk.
b. **Lack of Business Knowledge:** Many woodworkers are skilled in the craft but lack skills in pricing, marketing, and record-keeping.
c. **Inconsistent Supply of Materials**: Unreliable access to good-quality timber and materials can slow down production.
d. **Difficulty Attracting Customers**: New businesses often struggle to get noticed or gain trust in a competitive market.
e. **Lack of Workshop Space:** A beginner may not have a dedicated or well-equipped space for work.
f. **Competition from Established Businesses:** Bigger or older businesses may already dominate the local market.
g. **Lack of Confidence and Experience: New** entrepreneurs may doubt their skills or fear failure.

Learning Tasks

1. Explain the term entrepreneurship.
2. Discuss areas of basic entrepreneurship in woodwork**.**
3. Discuss the factors that make a woodwork business successful.

Pedagogical Exemplars: The teacher should consider the following activities:

Critical Thinking and Talk for Learning Approaches: Guide learners through a video demonstration on entrepreneurship in the woodwork industry and brainstorm on entrepreneurship in the woodwork industry with open-mindedness. To move thinking on, the teacher should target questions to learners as they discuss with one another. The teacher should bring all learners back in for whole-class feedback and collect relevant explanations from learners.

Group work/Collaborative Learning /Digital Literacy learning: Place learners into small mixed-ability groups. Ask learners to discuss areas of basic entrepreneurship in woodwork. The teacher should circulate the classroom, ensuring all learners are supported and participating in the discussion. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Group work/Collaborative Learning: Guide learners in mixed ability groups to discuss the factors that make a woodwork business successful. Highly Proficient learners can be assigned to assist groups in discussions with the teacher.

Key Assessment: Practice Paper 2

1. Explain three factors that would make a woodwork business successful in a local community.
2. Your friend wants to start a woodworking business making furniture. Analyse four key challenges your friend might face when starting a business.
3. Explain how poor quality of product affects customer satisfaction and long-term business success.

HINT

*Conduct **Practice Paper 2**. It should cover contents taught from Year 1 to 3. Refer to the **Table of Specification and Structure of the Paper** at the end of this section. Learners' papers should be marked immediately and scores entered into the SAP.*

PRACTICE PAPER 2 TABLE OF SPECIFICATION

PAPER 1 (Multiple Choice Questions)

STRAND	LEARNING INDICATORS	LEVEL OF ASSESSMENT				TOTAL
		1	2	3	4	
Building Construction Technology	Describe the roles of stakeholders in building construction project	1	2	2		
	Differentiate Clearly between site preparations and hoarding of Site to facilitate constructional works.		1	2		
	Identify the professionals involved in building construction project	2				
	Discuss the reasons for mobilisation	1				
	Discuss finishes applied to the floor		2	1		
	Discuss roofs		1			
	Explain load bearing and non-load bearing members of the superstructure			1		
Woodwork technology	Discuss the uses of Lesser-Known Timber Species (LKS), Lesser Used Timber Species (LUS)		2			2
	Discuss the impact of wood work industry on the environment	1		1		2
	Explain the types of manufactured boards made from Wood and non-wood residues		1			2
	Identify, classify, select and use appropriate joints for a specific woodwork operation	1	1	1		3

	Explain the uses and application of different types of finishes			1		1
	Classify Lesser-Known Timber Species (LKS), Lesser-Used Timber Species (LUS)	1				1
	Explain the uses of different types of adhesives			1		1
	Select and use appropriate machine for a specific woodwork operation.		1			1
	Select and use appropriate hand tools for a specific woodwork operation.	1				1
	Select an appropriate machine for a specific operation independently			1		1
	Select and use appropriate hand tools for a specific woodwork operation	1	1			1
Automotive technology	Demonstrate safety measures applied to servicing, repairs and maintenance of engine systems.		2			2
Metal technology	Explain health and safety related to workshop, tools, materials and machines		1			1
	Explain ferrous and non-ferrous metals with engineering applications and state the uses of non-metallic materials.		1			1
Electrical technology	Discuss safety in the use of electricity	2				
Electronics technology	Describe the principles and operation of the various Diodes	1				
	Apply the principles of Diodes in designing circuits		1			
Total		12	16	12		40
		30%	40%	30%		100%

PAPER 2 (Essay)

STRAND	LEARNING INDICATORS	LEVEL OF ASSESSMENT				TOTAL
		1	2	3	4	
Building Construction Technology	Identify the professionals involved in building construction project	3				3
	Describe the roles of Professionals in building Construction projects					
	Explain load bearing and non-load bearing members of the superstructure					

	Discuss the reasons for mobilisation					
	Explain how the locations of temporal structures are specified, as well locations of Services, welfare facilities and Equipment at the new construction Site to ensure order, safety, progress of work and Security					
Woodwork technology	Outline the processing phases of timber in the woodwork industry	3				3
	Explain how to care for and maintain hand tools.					
	Apply the appropriate safety measures in the woodwork shop					
	Discuss the impact of wood work industry on the environment					
	Select and use appropriate hand tools for a specific woodwork operation					
	Explain the uses of different types of adhesives					
	Identify, classify, select and use appropriate joints for a specific woodwork operation					
	Classify Non-Timber Forest Products (NTFPs)					
Total		6				6
						100%

PAPER 3 (Practical test)

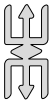
STRAND	LEARNING INDICATORS	LEVEL OF ASSESSMENT				TOTAL
		1	2	3	4	
Building Construction Technology (Alternative to practical)	Discuss finishes applied to the floor	6				6
	Explain load bearing and non-load bearing members of the superstructure					
	Differentiate Clearly between site preparations and hoarding of Site to facilitate constructional works.					
	Discuss ceilings					
	Discuss doors, windows and their frames.					
	Discuss Roofs					

Woodwork technology (Practical Test)	Apply Computer Aided Design [CAD] in designing and making of artefacts	1	1
	Produce working drawings from the final solution		
	Select the appropriate material suitable for producing the final solution		
	Produce an artefact from your working drawing		
Total		7	7
			100%

PLC Session 18

45 minutes **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous session, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand.
   b. identify three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q).
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



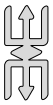
Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*
- *Use your app to plan and administer the mode of assessment for the Student Assessment Portal (SAP).*

   d. The key assessment for the week is ***Practice Paper 2***. Chat with your app to plan this assessment by reviewing or developing the assessment items/tasks and marking schemes/rubrics for the practice paper (NTS 3k-3q).

10 minutes **Content Exploration**

4. As a subject group, select one problem or topic/idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through the problem individually for 3–4 minutes
   c. the group then works through it together the problem, step by step
   d. highlight the most common errors made at each step (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

5. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

6. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
7. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
8. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

UNIT 18 REVIEW

Unit 18 of week 18 introduced learners to the basic entrepreneurship in woodwork industry. The pedagogical exemplars used in this section included talk for learning, group work/ collaborative learning, digital learning, which helped to meet the varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as oral/ written presentation, class exercises, homework, practical group activities are structured to cater for all the varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Reflection: Are learners able to understand the basic entrepreneurship in woodwork industry.

Resources:

Pictures, Videos, real object,

UNIT 19

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of finishes applied to buildings.*

Learning Outcome: *Determine the basic finishes used for the different building Components of a simple three-bedroom self-contained house.*

INTRODUCTION AND SECTION SUMMARY

This unit introduces learners to different types of roof finishes including Wood shingles, Concrete tiles and Corrugated roofing sheets. Concrete slab with solar slabs or Flat roof constitutes a roof structure and finish all in one. Roof Finishes refer to the materials or coatings applied to building carcasses to provide protection against weather and environmental conditions. These finishes enhance the aesthetic appearance of the roof as well as its functions. The functions of the roof include protection from environmental damage, keeping the interiors cool when it is hot outside or the interior warm when it is cold outside. The teacher will guide learners to understand how the choice of a roofing material enhances the performance of the roof while Learners also appreciate appropriate finishes that can be applied given the environmental conditions prevailing in the locality of the building.

The unit covers only week 19: ***Discuss finishes applied to roof carcasses.***

SUMMARY OF PEDAGOGICAL EXEMPLARS

To attain successful, Learners are expected to participate in pedagogical strategies such as Communication and Collaboration which will elicit Critical thinking about the finishes to use. Teachers will guide learners to brainstorm over roof finishes and conduct experiential learning by organising field trips to construction sites where learners will observe materials used as roof finishes. The teacher will organise learners into mixed ability groups and assist them, through debates, to determine the types of roofing materials to use given the building type and the prevailing environmental conditions.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include class exercise, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment.

Indicators	DOK Level	Assessment Strategy and/or Mode
Discuss finishes applied to Roof Carcasses.	3(strategic reasoning)	Discussion as an Assessment Strategy.

WEEK 19

Learning Indicator: *Discuss finishes applied to roof carcasses*

FOCAL AREA 1: FINISHES APPLIED TO ROOF CARCASSES

Roof Finishes refer to the materials or coatings applied to building carcasses to provide protection against weather and environmental conditions. These materials or coatings applied to building carcasses include Wood shingles, Concrete tiles and Corrugated roofing sheets. Flat Roofs constitute concrete slabs as the roof structures and at the same time the roof finish.

1. **Wood shingles** are thin, tapered pieces of wood used for roofing. They are made from wood such as cedar and Emeri (Terminalia tvorensis). Wood shingles are known for their ability to insulate, withstand wind and impact. Installing wood shingles involves laying them in a staggered pattern, ensuring proper overlap and secure fastening with corrosion-resistant nails. Shingles are ideal in areas of high humidity. Shingles are normally laid upon a rafter and purlin carcass with felt used as sheathing beneath the shingles as the final finish. Figure 5.8 shows a Wood Shingle Roof.



Figure 5.8 *Wood Shingle Roof*

2. **Concrete tiles:** produced as interlocking flat pan tiles to be supported on timber battens which in turn are fixed to rafters. Concrete tiles are produced from Portland cement and sand which has a high quartzite content. The roof finish needs to be laid on strong carcass, they are very durable with a very long life. If laid properly, they need little or no maintenance. They can withstand impact and turbulent wind. The sea breeze has no adverse effect on the finish. Figure 5.9 Shows Concrete Roofing tiles.



Figure 5.9 *Concrete Roofing tiles*

3. **Corrugated Aluminium:** if well insulated and ventilated, can be economic, light and durable roofing materials to use. It does not require a strong Carcass. Aluminium corrugated sheets are produced in an increasingly wide range of profiles and gauges which are used in residential, public and institutional buildings with different accessories such as bolts, self-tapping screws with washers. Corrugated sheets should be fixed with a side lap of not less than two full corrugations; troughed sheets should be fixed with one single side lap in tropical conditions. Similar to Corrugated Aluminium Sheets, galvanized steel sheets are used but if they are exposed in these areas to sea breeze, they should be covered with a zinc galvanised be painted with any oxide paint in order to avoid corrosion of the material. Figure 5.10 Shows Corrugated Aluminium Roofing Sheets.



Figure 5.1*0 Corrugated Aluminium Roofing Sheets*

4. **Flat roofs:** are in fact concrete slabs serving as final roof finishes. They are not completely flat; they have a minimal slope to help with drainage. Flat roofs are mostly used in places with arid climates where the roof space can be used for relaxation and other purposes. Flat roofs have a slope of 1 in 4 Commercial buildings and skyscrapers are mostly known for using the flat roofing system. EPDM, or Ethylene Propylene Diene Monomer is a synthetic rubber material that is widely used atop the Flat roof. It is a durable and flexible material that can withstand extreme temperatures, UV radiation, and weathering, making it ideal for waterproofing, and sealing applications.Top of FormBottom of Form Fig. 5.11 shows Concrete Flat Roof treated with water proofing chemical.



Figure 5.11 *Concrete Flat Roof treated with water proofing chemical*

Learning Tasks

1. Discussion on finishes applied to the Roof
2. Discussion on the appropriate finish to apply given the geographical location of the Roof.
3. Discussion on technology involved in roof finishing
4. Types of adhesives, accessories, tools and equipment

Pedagogical Exemplars

Communication/ brainstorming method/ critical thinking; Organise whole class to discuss finishes to apply to roof.

Collaboration: In mixed ability groups ask learners to discuss the construction technologies involved in the application of specific roof finishes.

Collaboration: In mixed ability groups ask learners to discuss the types of adhesives, accessories, tools and equipment to be used to enhance efficiency in the application of the finish.

Experiential Learning: Embark on field trips to Construction Sites or Sales Halls where Finishes are sold. Learners will observe, feel and learn about the appropriate finish to use.

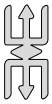
Key Assessment: Discussion

1. A client's building in a coastal area is experiencing premature deterioration of roof finishes. Analyse how you would adjust your specifications for roof finishes in such areas to address environmental factors while maintaining aesthetic appeal.
2. Analyse how the functional requirements for roof finishes differ across different climate zones. Suggest the appropriate roof finishes that address the primary environmental challenges in zones such as the coast and the tropical rain forest.

PLC Session 19

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).



Note

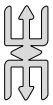
- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***discussion***. Chat with your app to plan this assessment,

indicating what you and your learners will do before, during and after the discussion (NTS 3k-3q).

10 minutes Content Exploration

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).



Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes Enactment

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes Reflection

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).
8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 19 Review

Unit 19 of week 19. This unit presents the learners with a deeper understanding of concept of Roof Finishes. The pedagogical exemplars used in this section included discussion/ collaborative learning, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as discussion and debates, oral/written presentation, class exercise, practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Additional Reading

Resources: Pictures, videos, written presentations and using flip charts (Building Construction).

UNIT 20

STRAND: BUILDING CONSTRUCTION TECHNOLOGY

Sub-Strand: Substructure and Superstructure

Content Standard: *Demonstrate Knowledge and understanding of finishes applied to buildings.*

Learning Outcome: *Determine the basic finishes used for the different building Components of a simple three-bedroom self-contained house.*

INTRODUCTION AND SECTION SUMMARY

This unit introduces learners to different types of finishes applied to the ceiling joists or various structural element of the Ceiling. Finishes refer to the materials and methods used to cover and decorate the upper surface of a room. Ceiling finishes tend to cover unsightly parts of the structure as well as contain the services it runs. Ceiling finishes keep the interiors cool when it is hot outside. Ceiling Finishes are Fire Resistant and in general provide glamour and pleasant aesthetic appearances inside the building. The teacher will guide learners to understand how the choice of a ceiling finish can affect the acoustics, lighting, and overall design of a space while Learners also appreciate appropriate ceiling finishes to apply given the function of the room.

The unit covers only week 20: ***Discuss finishes applied to Ceiling joists.***

SUMMARY OF PEDAGOGICAL EXEMPLARS

For this unit to be achieved, learners must fully participate in Critical thinking and Talk for Learning Approaches. Guide learners to brainstorm over finishes for the ceiling, conduct experiential learning by organising field trips to construction sites where learners will observe finishes applied to buildings. Organise learners into mixed ability groups and assist them to determine the types of ceiling finishes to use given the function of the space. The collaborative environment which will be made tolerant of GESI, SEL and National Values is expected to enhance the brainstorming sessions.

ASSESSMENT SUMMARY

The assessments to be used to monitor progress of learning during instruction should be formative and this should include class exercise, oral and written presentations and using flip charts. Teachers must keep track of performance of each learner given the different levels of performance of the learner in class and provide the relevant motivation or scaffolds to enhance understanding of the concept. The assessment will also serve as a tool to evaluate levels 1, 2 and 3 of the DoK amongst learners. In this way the pedagogical differentiation strategies adopted will also be complemented under the assessment.

Indicators	DOK Level	Assessment Strategy and/or Mode
Discuss Ceiling finishes applied to Ceiling joists	3 (Strategic reasoning)	Debate as Assessment Strategy

WEEK 20

Learning Indicator: *Discuss finishes applied to Ceiling joists*

FOCAL AREA 1: FINISHES APPLIED TO CEILING JOISTS

Finishes applied to Ceiling Joists. Ceiling Finishes refer to the materials and methods used to cover and decorate the upper surface of a room. Such ceiling finishes include gypsum boards, soft boards, hardwood strips, and plywood.

1. **Gypsum boards are used** in open and free flowing spaces like hallways. The seamless surface which features only ornamental light fittings makes the finish look elegant. **Methods and Tools**: A Framework of galvanized steel is required to be anchored onto the concrete slab or any ceiling carcass. Screw Gypsum boards onto these suspended frameworks. Platforms will be required to access the works given its height. Eye protection, gloves, and other safety equipment are essential for various tasks. Tools such as trowels, cutters, drills, heat guns and adhesives like acrylic stud will be required for profile attachment.
2. **The second type of suspended ceiling is soft boards** are used in studies and bedrooms where some quiet environment is desired. This is due to the ability of the material to absorb noise.

   Methods and Tools: A ceiling carcass is required to attach soft boards to it, using a strong adhesive for ceiling boards. Screws, nails, or clips, may be used. Cutouts for electrical fixtures and vents need to be made in the boards before installation. Tools like levels, saws, and knives are essential for precise cutting and placement. Adhesives such as PVA glue are required to secure the boards to the ceiling carcass. Equipment like nail guns, screw guns, and ladders are needed to facilitate the installation.
3. **Hardwood Strips** for a ceiling are very appropriate for a living room due to the ostentation the ceiling provides in the space.

   Methods and Tools: Apply adhesive to the back of the hardwood strip. Press the strip firmly against the ceiling carcass till the adhesive sets. If installing into drywall, use a stud finder to locate ceiling trusses and nail straight into them. The Key equipment will include saws, Hammer, screws, screwdriver, level, and nail gun. Eye glasses, gloves, dust mask will be required. Construction adhesive will have to be made available. Air compressor and hose, Ladder, Trowel for applying adhesive, and Power drill with bits have to be made available.
4. **Plywood** can be used either as a finished surface itself or as a sub-base for other finishes like paint to be applied. Plywood is chosen because it is less expensive and can be applied everywhere in the house.

   Methods and Tools: Securing plywood panels to ceiling joists or trusses using screws, glue, or a combination of both. ensure panels are centred on the wall and ceiling and use a level to verify the panels are straight. Tools will be needed for measuring, cutting, and fastening, as well as adhesives and potentially equipment like a saw and a drill. There will be the need for safety equipment like gloves and eye protection. Figure 5.12 Shows Gypsum Board being fixed as seamless ceiling, Figure 5.13 Shows Soft Board being used as a ceiling in a Classroom to absorb noise, Figure 5.14 Shows hardwood strips ceiling and Figure 5.15 Shows plywood ceiling.



Figure 5.12 *Gypsum Board being fixed as suspended ceiling carcass*



Figure 5.13 *Soft Board being used as a ceiling in a Classroom to absorb noise*



Figure 5.14 *Hardwood Strips ceiling*



Figure 5.15 *Plywood ceiling*

Learning Tasks

1. Discussion of finishes applied to Ceiling surface/Carcass given functions of space.
2. Methods of applying Ceiling Finishes
3. Types of Equipment/adhesives, etc used.

Pedagogical Exemplars

Communication/ brainstorming method/ critical thinking; Organise whole class to select finishes to apply given the specific space involved.

Collaboration: In mixed ability groups ask learners to debate the construction technologies involved in the application of specific finishes to be used.

Collaboration: In mixed ability groups ask learners to discuss the types of adhesives, accessories, tools and equipment to be used to enhance efficiency in the application of the finish.

Experiential Learning: Embark on field trips to Construction Sites or Sales Halls where Finishes are sold. Learners will observe, feel and learn about the appropriate finish.

Key Assessment: Debate

1. Compare three ceiling types (plywood, plaster of Paris and timber panels) in terms of their lifecycle functional performance in a school environment. Evaluate factors including initial cost, durability, maintenance requirements, ease of replacement and life span.
2. A building with exceptionally high ceilings requires extensive finish installation. Analyses the challenges this height creates for adhesive application, tool operation, and equipment deployment.

PLC Session 20

45 minutes | **Planning & Reviewing the Learning Plan**

1. Begin the session by recapping lessons from the previous year/session/week, focusing on how learning was applied.
2. Use your subject specific app to explore the content before planning. Ask the app to
   a. explain the week's concepts in a practical way that will make it easier for learners to understand
   b. identify two or three common misconceptions learners may have on the week's content and how to address them using contexts familiar to Ghanaian learners. (NTS 3a, 3g and 3m).
3. Use your subject specific app to plan your lesson. Ask the app to
   a. suggest the most effective method for teaching the week's concepts to learners with diverse backgrounds.
   b. suggest learning activities, differentiation and essential questions based on the method of teaching (NTS 3a-3q)
   c. review your prepared learning plan and address any challenging issues you may have identified in your subject area (NTS 3a-3c).

Note

- *Take note of the recap topics linked to Years 1 and 2 while preparing for your lesson.*
- *Refer to the Values Learning Community Handbook and link the values for the week in your lesson to ensure that learners are applying what they learn.*

4. Plan the week's key assessment with your app
   a. The key assessment for the week is ***debate***. Chat with your app to plan this assessment, indicating what you and your learners will do before, during and after the debate (NTS 3k-3q).

10 minutes **Content Exploration**

5. As a subject group, select one problem or idea/term in the week's content that is challenging (not a routine procedural question, but one that requires conceptual understanding) and then
   a. use the app, ask it to solve the problem step by step and explain the reasoning behind each step (you may be assisted by a teacher who is strong in the content area)
   b. all teachers in the group work through a similar problem individually for 3–4 minutes
   c. the group then works through the problem together step by step
   d. highlight the most common errors made at each step and discuss (NTS 1c, 1e, 2c, 2e, 3e-3j).

Note

- *This part is not just about 'How do I teach this?' but how do I teach it for learners to understand?*
- *If the group still shares the same content gap, use the app: ask it to solve the problem step by step and explain the reasoning behind each step.*
- *Problems/ideas discussed should be sourced from the Teacher Manual content, not invented separately. This keeps the content exploration directly connected to what teachers will deliver.*

30 minutes **Enactment**

6. Enact a teaching activity based on your learning plan (NTS la-1b, 1e-lg, 2c, 2e, 2f, 3c-3j and 3o).
   a. Colleagues observe with specific attention to clarity of concept explanation, use of familiar Ghanaian examples and how misconceptions are handled if they arise.
   b. After the enactment, ask for structured feedback from the group
      i. was the concept explained in a way that a learner with no prior knowledge could follow?
      ii. were the examples grounded in contexts familiar to Ghanaian learners?
      iii. did any misconceptions surface and if so, how were they addressed?

5 minutes **Reflection**

7. Reflect and share your views on the session. One thing that worked well, what did not work well and what you will do differently. (NTS 1a, 1b).

8. Identify a critical friend to observe and provide feedback on your lesson in relation to the PLC Session conducted (NTS 1f, 1g).
9. Remember to
   a. transfer your chats into your learning planner template.
   b. read your Teacher Manual and related Learner Material in preparation for the next session. Take note of the recap weeks, which are linked to Years 1 and 2 (NTS 3a).
   c. integrate National Values, GESI, SEL, and 21st century skills into your learning activities, assessment tasks, and rubrics/mark schemes.

Unit 20 Review

Unit 20 of week 20. This unit introduces learners with a deeper understanding of concept of Ceiling Finishes. The pedagogical exemplars used in this section included debates/ collaborative learning, digital learning and experiential learning which helped to meet varied needs of all learners. These strategies will enable learners to develop communication, collaboration, critical thinking and problem-solving skills. Various assessment strategies such as discussion and debates, oral/written presentation, class exercise, practical group activities were structured to cater for all varied activities of learning. These assessments were classified under the DoK level 1, 2 and 3.

Resources: Pictures, videos, written presentations and using flip charts (Building Construction).

MARKING SCHEMES/RUBRICS FOR THE KEY ASSESSMENTS

UNIT 17

Question 1

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of Wall Finish Functions	*Explains the protective, aesthetic, and durability functions of wall finishes with specific examples relevant to office environments*	*Describes the three functions with some understanding of their importance in offices*	*Shows limited understanding of wall finish functions with minimal explanation*	*Shows one understanding of wall finish functions with an explanation*
Analysis of Protective Functions	*Analyses how wall finishes protect underlying structures in an office setting, considering moisture resistance, impact resistance, and fire safety*	*Describes some protective aspects with partial analysis for office environments*	*Mentions minimal protective functions with limited analysis*	*Mentions one protective functions without analysis*
Analysis of Aesthetic Functions	*Analyses how wall finishes contribute to workplace atmosphere, productivity, branding, and visual comfort with specific examples*	*Describes some aesthetic considerations with basic analysis*	*Mentions minimal aesthetic functions with limited relevance to office settings*	*Mentions one aesthetic functions without relevance to office settings*
Analysis of Durability Functions	*Analyses how wall finishes maintain appearance and function over time in high-traffic office areas, considering cleaning requirements and wear patterns*	*Describes some durability factors with partial analysis*	*Mentions minimal durability considerations with limited analysis*	*Mentions one durability considerations with limited analysis*

Strategic Integration Approach	*Develops approach for selecting wall finishes that balance all three functions, with specific examples for different office areas (reception, workspaces, meeting rooms)*	*Suggests a basic approach for balancing functions with some consideration of different office needs*	*Offers minimal guidance for integration with limited strategic thinking*	*Offers one guidance for integration with limited strategic thinking*

Question 2

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2mark)	Needs Improvement (1mark)
Understanding of Wall Finish Functions	*Identifies and explains three different wall finish adhesives with their specific properties and typical applications*	*Identifies three adhesives with some explanation of their basic properties*	*Lists three adhesives with minimal description of their properties*	*Lists one adhesive with description of a properties*
Environmental factors analysis	*Analyses how specific environmental factors (humidity, temperature fluctuations, sunlight exposure) affect adhesive performance*	*Describes some environmental factors with partial analysis of their effects*	*Mentions minimal environmental factors with limited explanation*	*Mentions one environmental factor with an explanation*
First adhesives analysis	*Analyses how the first adhesive's bond strength changes over time under different weather conditions, with clear cause-effect relationships*	*Describes some changes to the first adhesive with basic analysis*	*Mentions minimal changes to the first adhesive with limited analysis*	*Mentions one change to the first adhesive without analysis*

Second adhesive analysis	*Analyses how the second adhesive's bond strength changes over time under different weather conditions, with clear cause–effect relationships*	*Describes some changes to the second adhesive with basic analysis*	*Mentions minimal changes to the second adhesive with limited analysis*	*Mentions one change to the second adhesive without analysis*
Third adhesive analysis	*Analyses how the third adhesive's bond strength changes over time under different weather conditions, with clear cause–effect relationships*	*Describes some changes to the third adhesive with basic analysis*	*Mentions minimal changes to the third adhesive with limited analysis*	*Mentions one changes to the third adhesive without analysis*

UNIT 18

Question 1

a. **Quality of Products:** Durable and well-finished items attract repeat customers.

(1mark)

b. **Meeting Local Needs:** Products must suit the tastes, income levels, and lifestyles of the community. **(1mark)**

c. **Affordable Pricing:** Prices should match what people in the area can afford.

(1mark)

Question 2

a. **Limited Start-Up Capital:** A beginner may not have enough money to buy machines, rent a workshop, or buy quality materials in bulk. **(1mark)**

b. **Lack of Business Knowledge**: Many woodworkers are skilled in the craft but lack skills in pricing, marketing, and record-keeping. **(1mark)**

c. **Inconsistent Supply of Materials:** Unreliable access to good-quality timber and materials can slow down production. **(1mark)**

d. **Difficulty Attracting Customers:** New businesses often struggle to get noticed or gain trust in a competitive market. **(1mark)**

Question 3

a. **Effect on Customer Satisfaction:** Customers expect value for their money. If a product breaks easily, does not meet its purpose, or looks unfinished, customers quickly lose trust in the business. Poorly made products often lead to **customer complaints,** returns, or demands for repairs, all of which cost the business time and money. **(2mark)**

b. **Effect on Long-Term Business Success: Reduced Profit Margins:** Frequent rework, repairs, or refunds due to poor quality increase production costs and reduce profits. Businesses spend more time fixing errors instead of growing. A business known for poor quality will struggle to attract new clients, win bulk orders, or grow its operations. Potential customers may choose competitors with better reputations. **(2mark)**

UNIT 19

Question 1

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2marks)	Needs Improvement (1mark)
Understanding of coastal challenges	*Clearly identifies and explains specific coastal environmental factors (salt spray, humidity, UV exposure, wind) that cause roof finish deterioration*	*Identifies some coastal factors with partial explanation of how they affect roofing*	*Lists minimal coastal factors with limited understanding of their effects*	*Lists one coastal factor with one understanding of their effects*
Analysis of deterioration patterns	*Thoroughly analyses how and why specific roof finishes deteriorate in coastal environments, with clear cause-effect relationships*	*Describes some deterioration patterns with basic analysis*	*Mentions minimal deterioration issues with limited analysis*	*Mentions one deterioration issues without analysis*
Materials selection strategy	*Thoroughly analyses specific alternative materials and coatings that would better withstand coastal conditions, with clear reasoning*	*Suggests some alternative materials with partial explanation of their benefits*	*Offers minimal material suggestions with limited justification*	*Offer one material suggestions with any one justification*
Installation specification adjustments	*Clearly explains specific changes to installation methods that would improve performance (e.g., fastener types, overlap requirements, sealants)*	*Describes some installation adjustments with basic explanation*	*Mentions minimal installation changes with limited detail*	*Mention one installation changes with any one detail*

Aesthetic consideration	*Strategically analyses how to maintain visual appeal while prioritising durability, with specific examples of compatible options for coastal settings*	*Addresses some aesthetic concerns with partial analysis of the balance with durability*	*Mentions aesthetics with minimal analysis of how to maintain appeal*	*Mention one aesthetics with any one analysis of how to maintain appeal*

Question 2

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2 mark)	Needs Improvement (1mark)
Understanding of Climate Zones	*Clearly explains the specific environmental conditions of coastal and rainforest zones (humidity levels, rainfall patterns, salt exposure, temperature variations)*	*Describes some key characteristics of coastal and rainforest zones with partial detail*	*Lists minimal characteristics of the climate zones with limited understanding*	*Lists one characteristics of the climate zones with one understanding*
Analysis of Coastal Challenges	*Thoroughly analyses specific coastal challenges (salt spray, high winds, UV exposure, moisture) and how they affect roof performance requirements*	*Identifies some coastal challenges with basic analysis of their effects on roofing*	*Mentions minimal coastal challenges with limited analysis*	*Mentions one coastal challenges with one analysis*
Analysis of Rainforest Challenges	*Thoroughly analyses specific rainforest challenges (heavy rainfall, high humidity, organic debris, fungal growth) and how they affect roof performance requirements*	*Identifies some rainforest challenges with basic analysis of their effects on roofing*	*Mentions minimal rainforest challenges with limited analysis*	*Mentions one rainforest challenges with one analysis*
Functional Requirements Comparison	*Clearly compares how specific roof functions (water shedding, durability, thermal performance) must differ between climate zones with detailed explanations*	*Makes some comparisons between functional requirements with partial explanation*	*Makes minimal comparisons with limited understanding of functional differences*	*Makes one comparisons with understanding of functional differences*

Appropriate Finish Recommendations	*Recommends highly appropriate roof finishes for each zone with strategic justification linking material properties to specific environmental challenges*	*Suggests some appropriate finishes with basic justification*	*Offers minimal recommendations with limited connection to climate conditions*	*Offers one recommendations without connection to climate conditions*

UNIT 20

Question 1

Criteria	Excellent (4marks)	Very Good (3marks)	Satisfactory (2marks)	Needs Improvement (1marks)
Understanding of ceiling types	*Explains the characteristics of all three ceiling types and their basic construction methods in school settings*	*Describes the general properties of the three ceiling types with some understanding*	*Shows limited understanding of the ceiling types with minimal explanation*	*Shows one understanding of the ceiling types with one explanation*
Initial cost analysis	*Thoroughly analyses the initial costs of all three ceiling types with specific price comparisons and installation considerations for school budgets*	*Provides some cost analysis with partial comparison between ceiling types*	*Mentions minimal cost factors with limited comparison*	*Mentions one cost factor with a comparison*
Durability and Lifespan Evaluation	*Thoroughly evaluates how each ceiling type performs over time in a school environment, considering specific school-related factors (classroom activity, moisture in certain areas)*	*Evaluates some durability aspects with basic consideration of the school environment*	*Provides minimal evaluation of durability with limited consideration of context*	*Provides one evaluation of durability with a consideration of context*
Maintenance requirements analysis	*Strategically analyses maintenance needs for each ceiling type, including frequency, complexity, and school-specific challenges (scheduling around school calendar)*	*Describes some maintenance requirements with partial analysis*	*Lists minimal maintenance factors with limited analysis*	*Lists one maintenance factors without analysis*

Replacement and lifecycle evaluation	*Comprehensively evaluates the overall lifecycle performance of all three options, with clear reasoning about which performs best for specific school areas*	*Provides some lifecycle evaluation with basic comparison*	*Offers minimal lifecycle perspective with limited strategic thinking*	*Offers one lifecycle perspective with one strategic thinking*

Question 2

Criteria	Excellent (8marks)	Very Good (6marks)	Satisfactory (4mark)	Needs Improvement (2mark)
Understanding of high ceiling challenges	*Explains why high ceilings create unique finishing challenges compared to standard heights, with specific reference to gravity, reach, and visibility issues*	*Describes some general challenges of high ceilings with partial explanation*	*Shows limited understanding of high ceiling challenges with minimal explanation*	*Shows one understanding of high ceiling challenges without explanation*
Adhesive Fixing Analysis	*Analyses specific adhesive challenges at height (dripping, uneven application, drying time changes, gravity effects) with clear cause-effect relationships*	*Identifies some adhesive challenges with basic analysis*	*Mentions minimal adhesive issues with limited analysis*	*Mentions one adhesive issues without analysis*
Tool operation analysis	*Analyses how tool effectiveness changes at height (reach limitations, precision difficulties, fatigue factors, safety concerns) with specific examples*	*Describes some tool operation challenges with partial analysis*	*Lists minimal tool challenges with limited explanation*	*Lists one tool challenges without explanation*
Equipment development analysis	*Analyses equipment options (scaffolding, lifts, ladders) including setup challenges, movement limitations, stability concerns and space requirements*	*Describes some equipment considerations with basic analysis*	*Mentions minimal equipment factors with limited analysis*	*Mentions one equipment factors with one analysis*
Safety and efficiency consideration	*Provides comprehensive analysis of how height affects worker safety and work efficiency, with specific strategies to address these concerns*	*Addresses some safety and efficiency issues with partial analysis*	*Mentions minimal safety or efficiency concerns with limited depth*	*Mentions one safety efficiency concerns with one depth*

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