Republic of Zambia

Ministry of Education

DESIGN AND TECHNOLOGY

TEACHING MODULE

FORM 1-TERM 1

Published by the Curriculum Development Centre

LUSAKA

2025

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VISION
Quality, lifelong education for all which is accessible, inclusive and relevant to individual, national and global needs and value systems

PREFACE

The **Design and Technology Teaching Module** for Form 1 has been developed following the introduction of the **Competence Based Curriculum** (CBC) which marks a transformative step in improving education quality and relevance. This Teaching Module has been designed to support teachers navigate as they effectively deliver Design and Technology lessons under the new curriculum. The module aims to bridge the gap created by the absence of approved textbooks and to equip educators with practical tools, activities, and assessments tailored to the learners' level and needs.

As a Ministry, we are mindful of the challenges that come with transitioning to the dictates of any new innovation. This module reflects our commitment to making this journey as smooth as possible for teachers, by providing structured guidance, suggested activities, and formative assessments that align with the CBC's objectives and the vision of the Government. However, we also encourage educators to supplement this module with their own research and innovations to address any gaps that may arise during implementation.

The suggested activities and assessments provided in this module are designed to foster the attainment of the desired competences enshrined in the 2023 Zambia Education Curriculum Framework while ensuring relevance and adaptability to different school environments. Thus, teachers are encouraged to tailor the suggestions to their unique classroom dynamics and to explore alternative but acceptable approaches when necessary.

We hope this module will serve as a valuable resource for teachers of Design and Technology as we implement the new curriculum, enhancing their ability to inspire and equip learners with the desired competences.

Joel Kamoko (Mr.)
Permanent Secretary- Educational Services
MINISTRY OF EDUCATION

ACKNOWLEDGEMENT

The **Design and Technology Teaching Module** for Form 1 has been developed through a consultative and participatory process. Many individuals, institutions and organisations were consulted and accorded an opportunity to take part in the development of the teaching module. We would, therefore, like to express our profound gratitude to individuals, institutions and organisations for their input that resulted in the successful development of this module. These include; teachers, lecturers from Colleges of Education and Universities, Subject Associations, and retired officers with vast experience as Curriculum Specialists.

We also extend our gratitude to the Zambia Education Enhancement Project (ZEEP) for the financial support and Zambia Educational Publishing House (ZEPH) for the technical support towards the development and finalization of the module.

Finally, we appreciate the commitment and hard work of the staff at the Directorate of Curriculum Development in ensuring the successful completion of the Teaching Module.

Charles Ndakala, (Dr.)
Director – Curriculum Development
MINISTRY OF EDUCATION

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Introduction

The Design and Technology Teaching Module for Form 1 has been developed to help teachers implement the 2023 revised Design and Technology syllabus. The subject first appeared in Zambian Curriculum in 2013 in place of the Industrial Arts subjects – Geometrical

and Mechanical Drawing, Woodwork and Metalwork. The 2013 Design and Technology was integrated with four TEVET courses i.e. Bricklaying, Carpentry, Electrical and Metal Fabrications. Learners taking Design and Technology were assessed and certified at Trade Test III Level by TEVETA in any of the trade courses of the candidate's choice. However, the 2023 Design and Technology syllabus does not include the TEVET content but contains the four components: *Materials and Manufacturing, Research and Entrepreneurship, Graphic Communication* and *Systems Technology.* In order to respond to national policies and aspirations on economic transformation and job creation as well as human and social development, the Vocation Education Training (VET) syllabuses that were initially integrated in the Design and Technology syllabus will now be obtained from TEVETA by individual schools.

The revised 2023 Design and Technology places more emphasis on STEM education which refers to the application of scientific and mathematical principles to design and develop technological solutions.

- **Science:** Understanding of materials, their properties and how they can be used in designs.
- **Technology:** Using software, tools and equipment to design, prototype and manufacture products.
- **Engineering:** Application of engineering principles when designing and developing solutions.
- **Mathematics:** Using mathematical concepts such as geometry, measurement and calculation to design and optimize solutions

Thus, in learning Design and Technology, STEM will help learners to:

- design and develop innovative products and solutions
- analyse and evaluate the effectiveness of designs
- optimize and improve existing designs
- develop problem-solving skills and critical thinking

In responding to the Curriculum Design of Competence Based, the module is based on the topics, specific competences and learning activities that have been anchored on the following Key Competences which learners should demonstrate at Ordinary level Secondary education:

- **Analytical Thinking:** Process of breaking down complex information into components and understanding how they are interconnected
- **Collaboration:** The act of working with others to achieve results as a team.

- **Communication:** The ability to share ideas, thoughts, information and messages concisely and precisely
- **Creativity and Innovation:** The ability to create new ideas and products by applying processes and introducing new techniques that can add value.
- **Critical Thinking:** The process of conceptualizing, applying, analysing, synthesizing, and evaluating information to form judgement or guide a belief or action
- **Digital:** Use of a broad range of Information and Communication Technologies such as a cell phone, computer, calculator in specific contexts.
- **Entrepreneurship:** The knowledge, skills and behaviour needed to identify, create, develop, manage, and grow a business venture.
- **Environmental Sustainability:** The appropriate use of natural resources and the preservation of the environment
- **Financial Education:** Ability to apply knowledge of key financial concepts, financial products and services to personal financial management.
- **Problem Solving:** The ability to identify, analyse and find solutions to challenging situations

About this module -

The content in this module has been presented in the following format:

◊ **Topic:** The topic is as it appears in the syllabus

◊ **Introduction**

- **Overview**: What the topic will cover and it's the importance in real life situations.
- **General Competence(s)**: Clearly defined general competence(s) to be acquired by learners.
- **Hook:** A thought-provoking question, statement, or real-life scenario related to the chapter topic to grab attention.
- **Problem posing scenario**

◊ **Key Terms:** A list of terms and concepts that will be introduced in the topic.

◊ **Sub-Topic 1- Subtopic Title** – as in the syllabus

a. Introduction: A brief overview of the subtopic

b. Specific Competence(s) – Learners to: Specific competences as they appear in the syllabus under the topic

c. Specific Competence 1- as it appears in the syllabus

a. Learning Activity 1- The learning activity is stated as it appears in the syllabus

b. Learning Environment setup: This is created to suit the lesson activity at hand. It is either **Natural**: or **Artificial**

Artificial: (i) Virtual

Technological: (i) Physical **(**ii) Virtual

c. **Suggested Teaching and Learning Material:** The materials are prepared to suit lesson activity at hand
d. **Suggested Teaching Methods:** These are carefully selected to facilitate effective learning in the Competence-Based-Curriculum
e. **Activity process:** Describes how the activity should be done
   -Exploration
   -Feedback and Consolidation Session

f. **Suggested Learning Points:** Brief note on lesson content
g. **Task:** To assess learners' acquisition of desired knowledge and competences. This is followed by well-crafted rubrics**.**

d. **Expected Standard: -** as it appears in the syllabus. The expected standard refers to how well the specific competence or learning activity has been done. This should be done against the rubrics that should be prepared beforehand.

e. **Assessment Guidelines:** Formative and Summative. Assessment can be done during or after the learning activity because a "competence" involves applied knowledge, skills and attitudes.

◊ **Summary: Key Points Recap:** A bullet-point list of the major ideas covered in the topic.

The Role of the teacher in a Competence Based Curriculum

The role of the teacher has changed from an information giver to a **facilitator**.

- Teachers should only provide a **democratic environment**, **materials** and **guidance**
- Teachers to give learners the opportunity to **learn** and **practice the skills** until they acquire them.
- Teachers to take into consideration personal differences of the learners and deal with **each learner** as an individual
- Teachers to devote large amounts of time to creating activities
- Teachers to employ various methods of **assessing** learners
- Teachers to encourage learners in active **inquiry** to make their findings explicit.

TOPIC: SAFETY

Introduction

"Imagine a place where precision meets power, a workshop bustling with activity, tools humming, and sparks flying. Now, picture the consequences if safety takes a backseat. One careless moment could turn progress into peril. Workshop safety isn't just a set of rules; it's the

shield that protects lives, preserves tools and ensures every project reaches its full potential without compromise."

Overview:

Safety in the workshop is the foundation of a productive, efficient, and hazard-free working environment. Workshops, whether they are used for industrial manufacturing, carpentry, engineering, or other hands-on tasks, are inherently dynamic spaces filled with tools, equipment, and materials that can pose risks. Proper safety practices ensure the well-being of workers and the integrity of tools and facilities. Creating a safety-first culture in the workshop not only prevents accidents but also fosters a sense of responsibility and professionalism among workers. Understanding and implementing safety protocols are essential to reducing risks, improving efficiency, and ensuring compliance with legal and regulatory requirements.

This topic aims to highlight the importance of workplace safety, the common hazards present, and the foundational principles required to create a secure environment for all. By prioritizing safety, workshops can operate effectively while protecting both personnel and resources. The topic on **safety** is broken down into four **subtopics** namely; personal safety, workplace safety, first aid and fire-fighting.

General Competences:

This topic is anchored on the following competences:

- **Collaboration:** learners will learn to work with others in order to create a safe working environment.
- **Communication:** Learners will share information, ideas and messages through creation of safety protocols for workplaces
- **Critical thinking:** Learners will be able to apply knowledge about classes of fires to make safe decisions about managing fires
- **Problem solving:** Learners will be able to conduct safety audits in a work station and develop appropriate safety plans

Key Terms

- **Eye Wash Station:** A unit to rinse eyes in case of chemical exposure.
- **Fire Extinguisher:** A tool for putting out small fires.

- ◊ **First Aid Kit:** A collection of medical supplies for treating injuries.
- ◊ **Hazard:** Anything that can cause harm, injury, or damage.
- ◊ **Incident Report:** Documentation of any accidents or near-misses in the workshop.
- ◊ **PPE (Personal Protective Equipment):** Equipment worn to minimize exposure to hazards (e.g., gloves, goggles, helmets and ear plugs).
- ◊ **Risk Assessment:** Identifying and evaluating potential hazards to reduce risks.
- ◊ Safety **Guard:** A protective device on machinery to prevent accidents.
- ◊ **Safety Protocols:** Established procedures to ensure a safe working environment.

Sub-topic: Personal Safety

Introduction
Personal safety is safeguarding oneself in the workshop and highlights how proactive measures not only protect individuals but also contribute to a productive and professional environment. Prioritizing personal safety is a responsibility shared by everyone in the workshop, fostering a culture of mindfulness, accountability, and respect.

Specific Competence(s): Apply personal safety precautions in a workplace

Specific competence: Apply personal safety precautions in a workplace

Leaning activity 1: Discussing safety precautions applied in a workplace (*wear correct safety attire, eat in designated areas, operate machinery that you are familiar with, lift objects carefully, use proper equipment…*)

Learning Environment Setup
Create a learning environment that will facilitate the exploration of safety in the workplace. This can include the following:

- ◊ **Natural –***Field trip to any organized factory/industry/company*
- ◊ **Artificial -***Workshops, work stations and laboratories*
  -Technological (videos, Personal Protective Equipment (PPEs) App., Simulated scenarios showing the
  Practising of safety rules, interactive platforms)

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Posters with safety rules,
- ◊ **Checklists:** Printable tasks on use of safety attire
- ◊ **Videos:** Instructional safety clips.
- ◊ **Worksheets:** Effects of good/poor personal safety on healthy and quality of work
- ◊ **Charts/Flashcards:** Posters on personal safety practices
- ◊ **Scenario Cards:** Appropriate personal safety practices in given scenarios
- ◊ **Power point presentations:** computer, projector, printed pictures

Suggested Teaching Methodologies

- ◊ **Inquiry-Based Learning:** Learners explore questions and problems through investigation and research.
- ◊ **Collaborative Learning:** Learners work in teams, developing communication, teamwork, and leadership skills.
- ◊ **Guest Lectures and Workshops:** Experts share real-world experiences and skills.

Scenario:

You are a safety officer at a manufacturing plant. During a routine inspection, you notice several potential hazards that could lead to accidents or injuries. These include:

- ◊ Workers not consistently wearing goggles, gloves or helmets in designated places
- ◊ Materials and equipment left in walk ways, creating a tripping hazard
- ◊ Some machines not properly maintained and warning signs are missing or unclear
- ◊ Blocked or not clearly marked emergency exits, and employees are unaware of evacuation procedures

Problem-Posing Questions

1. **Identifying hazards**: How can you systematically identify and document all potential safety hazards in the workplace?
2. **PPE Compliance:** What strategies can you use to ensure that all workers consistently wear the required PPE?

Activity process

Exploration

In groups, learners explore safety precautions to be applied in a workplace

Learners to participate in group research on the effects of poor/good personal safety on their health and quality of work

Learners to share information on personal safety precautions

Note:

- ◊ Ensure learners exhibit a good attitude towards personal safety
- ◊ Ensure learners have access to learning materials and are engaged in the learning environment.
- ◊ Monitor group interactions and encourage critical thinking.

Feedback and Consolidation Session

- ◊ Learners to make presentations of their findings/work done

Learners to discuss the effects of good/poor personal safety on health and quality of work

Note:

- ◊ *Facilitate the discussions*

- ◊ *Offer constructive feedback and acknowledge learners' achievements*
- ◊ *Correct the misconceptions*

Suggested Learning Points

Personal Safety Precautions

Safety is everyone's responsibility, while working in the workshop the following rules have been put in place to ensure the safety of all learners and staff:

- ◊ Learners with any health condition that may affect workplace safety must report these conditions to the workshop staff
- ◊ Wear correct protective equipment for the operation at hand.
- ◊ Notify the teacher of any faulty or broken equipment.
- ◊ When in doubt ask how to use tools and machinery safely.
- ◊ Make sure your work piece is secured before work commences.
- ◊ Wipe all spills off the floor.
- ◊ Keep clear of any person operating tools and machinery.
- ◊ Wash hands after using equipment and materials.
- ◊ Remove rings and loose jewellery before operating machinery.
- ◊ Fooling around and practical jokes in the workshop should not be allowed.

General Safety attire

- ◊ Safety glasses and hearing protection – Must be worn when drilling, grinding, welding etc.
- ◊ Learners who wear spectacles should differentiate them from safety glasses.
- ◊ All loose clothing (e.g. shirts hanging out) must be tucked in.
- ◊ Safety boots or closed leather shoes must be worn in the workshop.
- ◊ Long hair and fringes must be tied up.

Learning activity 2: Researching *on uses of various Personal Protective Equipment (PPEs)*

Learning Environment Setup

Create a learning environment to facilitate research on the uses of various Personal Protective Equipment (P**PEs).** It can be:

- ◊ **Natural –***Field trip to any organized factory/industry/company*
- ◊ **Artificial -** *Workshops, Work stations, assorted PPEs ...etc.*
  -Technological: Simulated PPE utilization scenarios, interactive platforms,

Teaching and Learning Materials

- ◊ **Visuals:** Posters with Personal Protective Equipment (PPE) (Gloves, Face shields, helmets, boots, respirators, work suits, and others)
- ◊ **Checklists:** Printable tasks on the use of safety attire
- ◊ **Videos:** Instructional video clips on uses of PPE
- ◊ **Worksheets:** Use of Personal Protective Equipment
- ◊ **Flashcards:** Posters on Personal Protective Equipment
- ◊ **Power point presentations:** computer, projector, printed pictures

Suggested Teaching Methodologies

- ◊ **Inquiry-Based Learning:** Learners explore questions and problems through investigation and research.
- ◊ **Collaborative Learning:** Learners work in teams, developing communication, teamwork, and leadership skills.
- ◊ **Guest Lectures and Workshops:** Industry experts share real-world experiences and skills.

Scenario:

You are a new apprentice in a woodworking shop. Your supervisor assigns you to work on a project that involves using a table saw to cut through a large piece of wood. As you begin to work, you notice that the saw is producing a lot of dust and debris.

Problem:

Your supervisor is not around, and you're not sure what personal protective equipment (PPE) you should wear to protect yourself from the hazards of the table saw. You know that you need to protect your eyes, ears, and lungs, but you're not sure what specific PPE to use.

Problem-Posing Questions

1. What are the potential hazards of using a table saw?
2. What types of PPE can you use to protect against these hazards?
3. How do you choose the right PPE for the task at hand?
4. What are the consequences of not wearing proper PPE when working with power tools?

Activity process

Exploration

Either

- ◊ *Take learners to an organized workshop/workstation (factory, industry, or construction company)*
- ◊ *In pairs, Learners to observe and record various workers' various attires and other safety equipment available*
- ◊ *Learners to share observations made on PPEs with peers.*

- ◊ *Learners to explore how various safety equipment is used at the workplace*
- ◊ *Learners to explore ways of maintaining PPEs*

Or

- ◊ *Display various safety attires or charts/posters of Personal Protective Equipment in a workroom*
- ◊ *In groups, learners to identify the different PPEs displayed.*
- ◊ *Learners to explore how each of the displayed safety attire or equipment is used*
- ◊ *Monitor group interactions as learners compile vital information on the use of PPEs*

Feedback and Consolidation Session

- ◊ *Learners to make presentations on observations and findings in groups/pairs.*

Learners to discuss the correct uses of various PPEs in the workplace

- ◊ *Learners to demonstrate correct usage of PPEs*

Note

- *Monitor group interactions and encourage reasoning and critical thinking*
- *Offer constructive feedback and acknowledge learners' achievements*
- *Correct learners' misconceptions*
- *Learners to store PPEs in designated places*
- *Ask learners to produce "**a user guide**" for each of the PPEs*

Learners reflect on key ideas learnt and document lesson takeaways

Suggested Learning Points

Uses of Personal Protective Equipment

Personal Protective Equipment (PPE) is any type of clothing or accessory worn by a worker to protect them from health, safety, and environmental hazards when on a worksite. PPE aims to reduce the workers' exposure to hazards and hazards to acceptable levels. Some of the general guidelines for dressing safely at work include:

- ◊ **Wear safety Boots**: Wearing boots will protect your feet from getting stepped on or crushed. Boots are important for preventing foot injuries such as punctures, sprains, crushing, and falls, especially steel-capped versions. They give the foot an extra protective, sturdy layer.
- ◊ **Specialist fabrics**: Such as breathable, flame-retardant fabrics, or fabrics that are tough but that do not restrict employee movement.
- ◊ **Wear the right gloves:** Depending on your work, you may need to wear gloves to protect your hands from chemicals, cuts, or other hazards. Make sure you're wearing the correct type of gloves for the job.

- ◊ **Wear protective eyewear**: If you work in a lab or around hazardous materials, you'll need to wear goggles or protective eyewear. This will protect your eyes from chemicals or flying debris.
- ◊ **Wear ear tugs**: your ears are one of the most delicate, sensitive areas of the body and as such they need protection with the use of noise-cancelling headphones/ear tugs. This will protect you from loud deafening noise.
- ◊ **Wear a dust mask**: If you work in an environment with the presence of debris, dust, particles, gases, and other things that can be damaging to the respiratory system, it is important to wear a dust mask or respirator to cover the nose and mouth to avoid breathing in too much dust. This can be especially harmful if you have asthma or another respiratory condition.
- ◊ **Wear a hard hat.** If you work in construction or around heavy machinery, you'll need to wear a hard hat to protect your head from falling objects or being struck by something.
- ◊ **Wear a reflective vest.** If you work outdoors or in a low-light environment, you should wear a reflective vest to make sure you're visible to other people. This can help prevent accidents.
- ◊ **Wear appropriate clothing.** In some workplaces, it's important to wear loose-fitting, breathable clothing. This is especially true if you work in a hot environment or around a fire.

Learning activity 3: *Demonstrating safe ways of handling tools and equipment*

Learning Environment Setup:

Create a learning environment which will demonstrate safe ways of handling tools and equipment. This environment learning environment can be:

- ◊ **Natural –** *Workshops, Outdoor workstations or open workplaces.*
- ◊ **Artificial -** *Workshops, Work stations,*

-Technological: Simulated scenarios and online interactive platforms, videos,

assorted tools and equipment (chisel, files, hammers, power tools…)

Teaching and Learning Materials

- ◊ **Real objects:** Assorted workshop hand tools and equipment (file, chisels, power saw, electrical hand tools etc.)
- ◊ **Visuals:** Posters with safe ways of handling tools and equipment
- ◊ **Videos:** Instructional video clips on safe use of tools and equipment.
- ◊ **Flashcards:** Posters on procedures for handling hand tools and equipment
- ◊ **PowerPoint presentations:** Tablets**,** computers, projector screens,
- ◊ **Tools**: Materials for demonstrations of safety

◊ **Simulations:** Virtual safety tools

Suggested Teaching Methodologies

◊ **Inquiry-Based Learning:** Learners explore questions and problems through investigation and research.
◊ **Collaborative Learning:** Learners work in teams, developing communication, teamwork, and leadership skills.
◊ **Guest Lectures and Workshops:** Industry experts share real-world experiences and skills.

Scenario

You are a skilled carpenter working on a construction site. Your supervisor has assigned you to train a new apprentice, John, on the safe use of power tools and equipment. John has never used power tools before and is eager to learn. As you begin the training session, you notice that John is wearing loose-fitting clothing and has long hair that is not tied back. He is also not wearing safety goggles or gloves.
You are about to demonstrate the safe use of a circular saw, but you realize that John's attire and lack of personal protective equipment (PPE) pose a significant risk to his safety.

Problem:
How would you handle this situation to ensure John's safety while demonstrating the safe use of the circular saw?

1. What are the potential hazards associated with using a circular saw?
2. What personal protective equipment (PPE) is required when using a circular saw?
3. How would you explain the importance of wearing proper attire and PPE to John?
4. What steps would you take to ensure John's safety while demonstrating the safe use of the circular saw?

Activity Process

Exploration

◊ Prepare a project task for learners. The project should have a variety of skills to be accomplished.
◊ Learners to identify the type of tools and equipment required to undertake the project (Tools: measuring, marking, cutting, testing, holding, driving tools…; Equipment: power drills, power saw…)

- ◊ Learners to inspect the condition of various tools and equipment to check their suitability for use. (Brocken tools should not be used)
- ◊ Learners to explore the correct maintenance procedures to be carried out on tools and equipment.
- ◊ Learners to explore the correct use of each tool and equipment.

Feedback and Consolidation Session

- ◊ Learners to make presentations on uses of tools
- ◊ Learners to share information on their findings
- ◊ Learners to demonstrate safe ways of handling the tools and equipment for the job at hand (select and use the right size and type of tool for the job).

Note to the teacher:

- ◊ Provide constructive feedback and correct the misconceptions
- ◊ Observe the usage of tools by learners and guide accordingly.
- ◊ Ask learners to store tools and equipment safely
- ◊ Task learners to formulate a checklist on Hand tools safety

Learners reflect on key ideas learnt and document lesson takeaways

Suggested Learning Points

The greatest hazards when using hand tools are using the tool improperly and lack of tool maintenance. Therefore, the majority of injuries can be prevented if you pay attention to these two areas by following these tips:

General Safety Tips for Handling tools

- ◊ Inspect tools prior to use and regularly following manufacturer specifications. Remove from service and tag out damaged tools.
- ◊ Select and use tools that are appropriate for the task. Never use tools for purposes other than what the manufacturer intended.
- ◊ Ensure tools meet all guarding and safety standards. Never bypass guards or use tools with broken or missing guards.
- ◊ Dress appropriately. Avoid wearing loose jewelry and clothing, including ties, scarves, and loose sleeves, which can get caught in moving parts. Wear closed-toe shoes and long pants. Long hair must be tied up and secured (not hanging).
- ◊ Wear appropriate personal protective equipment (PPE).
- ◊ Secure work pieces to prevent movement and to keep body parts away from the point of operation.
- ◊ Keep tools and the work area clean. Do not work with oily or greasy hands/tools. Ensure the walking-working surface is stable.

- ◊ Verify sufficient space is available for the task. Be aware of bystanders and make sure they stay clear of the operation. Use screens/barriers to protect bystanders, when necessary.
- ◊ Avoid leaving tools on elevated surfaces such as ladders and scaffolds where they could present a hazard to personnel below.
- ◊ Use a hoist or suitable tool bag to carry tools when ascending and descending ladders.
- ◊ Exercise care when handing tools to another worker. Never throw tools. Pointed tools should be passed in a protective carrier or with the handles towards the recipient.
- ◊ Avoid carrying pointed tools such as chisels, knives, and screwdrivers in clothing pockets. Acceptable ways to carry them include in a toolbox, pointed down in a tool belt or pocket tool pouch, or in the hand with the tip always held away from the body.
- ◊ Cut in a direction away from body parts when using chisels, knives and other edged tools.
- ◊ Store tools and equipment in a safe place. Never leave tools unattended. Leaving tools lying around, even for short periods of time, on an elevated structure poses a significant risk to workers below. This risk increases in areas with heavy vibration. Return tools to their designated storage location when done and/or at the end of the shift.
- ◊ Do not use electric tools in wet conditions unless they are approved for such use.

Learning activity 4: Developing safety plans

Learning Environment Setup

Create a learning environment which will enable learners to develop safety plans

- ◊ **Natural**: Real-life practice (e.g., field trips, outdoor safety drills,
- ◊ **Artificial** -*Workshops, Outdoor work stations, etc.*

-Technological: Simulated scenarios and online interactive platforms, videos and power point presentations on safety plans.

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Posters/charts showing the format of a safety plan
- ◊ **Videos:** Instructional safety clips on creating a safety plan.
- ◊ **Flashcards:** Posters on procedures of creating a safety plan.
- ◊ **Power point presentations**: computer, projector, printed pictures and templates for a variety of safety plans
- ◊ Scenario Cards
- ◊ **Tools**: Materials for demonstrations of safety

Suggested Teaching Methods

- ◊ Inquiry-Based Learning
- ◊ Collaborative Learning:
- ◊ Guest Lectures and Workshops**:**

Scenario

You are the manager of a small construction company that specializes in building residential homes. Your company has been hired to build a new home on a plot of land that is located near a busy highway. The construction site will have several hazards, including:

- ◊ Heavy machinery and equipment
- ◊ Falling objects and debris
- ◊ Electrical hazards from power tools and temporary lighting
- ◊ Slip, trip, and fall hazards from uneven terrain and construction materials

Problem:

As supervisor, it's your responsibility to create a safety plan that will protect your employees and subcontractors from the hazards on the construction site. Consider the following:

1. What are the potential hazards on the construction site?
2. Who is at risk of being injured by these hazards?
3. What safety measures can you put in place to mitigate these hazards?
4. How will you communicate the safety plan to your employees and subcontractors?
5. How will you monitor and enforce compliance with the safety plan?

Activity process

Exploration

- ◊ Divide learners into groups and let them to explore safety plans
- ◊ Learners to demonstrate an understanding of the importance of safety plans
- ◊ Learners to research on how to develop a safety
- ◊ Monitor individual learner's participation

Feedback and Consolidation Session

- ◊ Learners make presentations on how to develop a safety plan

Learners to discuss and share information researched on safety plans

- ◊ Supervise learners to outline the steps of developing a safety plan for a workplace

Note:

- ◊ In groups, learners develop safety plans for different work situations
- ◊ Monitor group interactions and application of problem-solving skills.
- ◊ Offer constructive feedback and acknowledge learners' achievements

◊ Correct the misconceptions

Learners reflect on key ideas learnt and apply them in rea-life situations

Suggested Learning Points

Most of us believe we know what we would do in a crisis, but when that time comes, we often find that we need more support than we originally anticipated. Planning ahead is always a good idea, especially when it comes to your well-being and safety.

What does a safety plan do?

1. Identifies warning signs
2. Develop internal coping strategies/skills to help you cope with stress.
3. Identifies people and social settings (distraction techniques) that provide distraction.
4. List the people in your support system who you can talk to
5. List professionals or agencies to contact during a crisis.
6. Suggests how you could make your environment safe/provide emergency crisis care solutions

Expected Standard: Personal safety precautions in a workplace applied correctly

Task

"Design a Safety Plan for a Community Event"

You are part of the team organizing a National Skills Competition to be held at your school. The event will take place in your school hall and is expected to attract over 500 participants. As part of the planning committee, you have been tasked with developing a comprehensive safety plan to ensure the well-being of pupils, staff, and volunteers.

Requirements

1. Identify potential safety hazards associated with the event (e.g., overcrowding, ventilation, lighting).
2. Research and incorporate school regulations and Health standards related to event safety.
3. Develop a detailed safety plan that includes:
4. Emergency safety protocols
5. Communication strategies for attendees, staff, and emergency responders
6. Risk mitigation measures (e.g., crowd control barriers, first aid stations)
7. Present your safety plan to the Skills organizing committee, justifying your decisions and recommendations.

Attributes

1. **Relevance**: The task is relevant to real-life scenarios, making it applicable and meaningful to learners.
2. **Higher-Order Thinking:** Learners must analyze potential hazards, evaluate risks, and develop a comprehensive safety plan, demonstrating critical thinking, problem-solving, and creativity.
3. **Authenticity**: The task simulates a real-world scenario, requiring learners to apply theoretical knowledge to practical problems.
4. **Complexity**: The task involves multiple components, requiring learners to consider various factors, prioritize risks, and develop a cohesive safety plan.

Assessment Guidelines: Provide an assessment that clearly reflects the specific or key competence(s) to be attained.

Formative: This form of assessment can be done using the following strategies:

- ◊ **Observation**: Monitor safety behaviour/attitudes towards use of PPEs
- ◊ C**hecklis**t: Assess learners on compliance to safe ways of handling of tools and equipment
- ◊ **Practical Demonstration**: Observe techniques of handling tools and equipment:
- ◊ **Class Discussions**: Evaluate understanding of safety plans through Q&A sessions

Summative: This is done at the end of the topic or when entering the next grade level

- ◊ **Written exercises on end of topic**: Assess knowledge on usage of hand tools.
- ◊ **Practical Demos:** Test skills on usage of hand tools/
- ◊ **Presentations**: Asses earners on their ability to appreciate and create workplace safety plans

Summary of Key points

By prioritising personal safety in the works room, individuals contribute not only to their protection but also to the overall success and efficiency of workshop operations. To effectively apply personal safety in the workplace, learners have to:

- ◊ Wear correct safety attire which is defined as, clothing that is clean, does not create a health hazard and is not distracting or demeaning to other learners. It mainly refers to personal protective equipment (PPEs)
- ◊ Demonstrate safe ways of handling tools and equipment.
- ◊ Appreciate and develop safety plans for the workplaces

Sub-Topic: - Workplace Safety

Introduction:

Safety in a workplace is a responsibility of everyone. Accidents usually occur when people are being careless. It is therefore important to follow recommended practices, procedures and

precautions in order to prevent injuries, illnesses, and damages to equipment and property. A safe working environment is important as it protects teachers, pupils and the surrounding rooms from potential hazards.

Specific Competence(s) Apply workplace safety practices

Specific competence: Apply workplace safety practices

Leaning activities 1, 2&3:

1. Exploring workplace safety practices (storing tools and equipment in the right places, keeping gangways clear, cleaning of the benches and the floors…)
2. Investigating adequate methods of providing lighting
3. Discussing methods of providing adequate ventilation in the work place

Learning Environment Setup

Create a learning environment suitable for the application of workplace safety practices. This can be:

- **Natural –***Field trip to any organized factory/industry/company*
- **Artificial -***Workshops, work stations and laboratories*
  interactive platforms (using video recording/audio to teach learners on workplace safety...)
  -*Technological (visual learning environment, simulated learning environment)*

Suggested Teaching and Learning Materials

- **Safety poster and signs:** Display safety posters and signs through the workplace
- **Workplace safety manuals:** Develop or obtain workplace safety manual
- **Safety data sheets:** Use safety data sheets to teach learners about chemical hazards.
- **Safety videos:** Use video that demonstrate safety procedures
- **Interactive software**: Use interactive safety software such as simulations and games to engage learners
- **Mobile safety application**: Use mobile safety application such as inspection checklists and emergency response guides.
- **Podcasts and audio files**: Create or obtain podcasts and audio files that discuss workplace safety topics.
- **Power point presentations:** computer, projector, printed pictures

Suggested Teaching Methods

- Hands on activities:
- Inquiry-Based Learning
- Collaborative Learning

- ◊ Modeling and Simulation
- ◊ Guest Lectures and Workshops

Scenario:

As a newly appointed prefect in charge of preventive maintenance, you have observed that various tools and equipment are not in good condition/stored properly hence posing a risk when accessing them for use. You have been tasked to identify potential hazards related to working in the storeroom.

Problem-Posing Questions

1. What are some of the potential safety hazards associated with working in the storeroom?
2. How will you communicate safety information and procedures to your fellow learners?
3. What measures will you take to ensure the storeroom is safe for users?

Activity process

Exploration

- ◊ In groups, ask learners to explore workplace safety practices
- ◊ Learners to discuss the effects of poor workplace safety practices

In groups, learners to discuss measures needed to ensure safety in the workplace**.**

- ◊ Learners to explore methods of providing adequate lighting and ventilation in a work place

Note:

- ◊ *Ensure learners exhibit good attitude towards workplace safety practices*
- ◊ *Ensure learners have access to learning materials as they engage in workplace safety practices*

Feedback and Consolidation Session

- ◊ Learners to make presentations of their findings on workplace safety practices.
- ◊ Learners to make presentations on the effects of poor/good safety practices in a workplace.

Learners to discuss methods of providing lighting and ventilation in a workplace

- ◊ Learners to explore the importance of good lighting system and ventilation in the workplace.
- ◊ Learners to demonstrate methods of providing adequate lighting and fresh air in a workplace

Note:

- ◊ *Facilitate the discussions*

- ◊ *Offer constructive feedback and acknowledge learners' achievements*
- ◊ *Correct the misconceptions from the learner's presentations.*
- ◊ *Ask learners to take note of the important points made during group presentations*

Learners to reflect on major ideas learnt and document lesson takeaway

Suggested learning points

Workplace Safety Practices

Workplace safety practices refers to the procedures and actions taken to prevent the risk of injury, illness or death in the workplace. These practices aim at protecting teachers, pupils and visitors to the workshops. They include the following:

- ◊ Tools not in use at a particular time should be stored properly.
- ◊ Always clean benches and floors after using the workplace.
- ◊ Keep the workplace and tools storage area clean and tidy
- ◊ Store tools in designated areas.
- ◊ Ensure tools are easily accessible and not obstructing walkways
- ◊ Provision of adequate lighting in a workplace
- ◊ Provision of adequate ventilation in a workplace

Learning activities 4: Creating safety protocols for workplaces

Learning Environment Setup

Create a learning environment suitable for teaching safety protocols for workplaces. This can be:

- ◊ **Natural –**Field trip to factory/industry/company
- ◊ **Artificial -**Workshops, work stations and laboratories interactive platforms (using VR experiences, simulations and models...)

-Technological (videos, PPE App., Simulated scenarios on safety protocols

Suggested Teaching and Learning Materials

- ◊ **Safety poster and signs**: A display of safety posters and signs in the workplace
- ◊ **Workplace safety manuals:** Develop or obtain workplace safety manual
- ◊ **Safety data sheets:** Use Safety data sheets to teach learners about chemical hazards and safe handling procedure
- ◊ **Safety videos:** Use video/audio that demonstrate safety procedures

- ◊ **Interactive software**: Use interactive safety software such as simulations and games to engage learners
- ◊ **Mobile safety application**: Use mobile safety applications such as, inspection checklists and emergency response guides
- ◊ **PowerPoint presentations:** Computer, projector, printed pictures

Suggested Teaching Methods

- ◊ *Hands on activities*
- ◊ *Inquiry-Based Learning*
- ◊ *Collaborative Learning*
- ◊ *Modeling and Simulation*
- ◊ *Guest Lectures and Workshops*

Scenario:

You are a newly appointed safety officer at a factory that produces metal parts. The factory has 100 employees working in various departments such as machining, welding and assembling. Lately, there has been several incidents, where:

- ◊ a machinist suffered a cut from a sharp object
- ◊ a welder experienced eye irritation from arc light and welding fumes

Your task is to develop and implement a comprehensive safety protocol to prevent similar incidents from occurring in future.

Problem-Posing Questions

1. What are the most common hazards in each department?
2. How can employees be trained to recognize and prevent hazards
3. What PPE is required for each task and how will it be maintained?

Activity process

Exploration

- ◊ Learners to explore workplace protocol.
- ◊ Learners to investigate about the key elements of safety protocols
- ◊ In groups, ask learners to write safety protocols of various workplaces.

Feedback and Consolidation Session

- ◊ Learners to make presentations on key elements of safety protocols
- ◊ Learners to present their written safety protocols to the class.

Learners to discuss steps/procedure of creating safety protocols

- ◊ Ensure that learners are provided with necessary teaching and learning materials

Note to the teacher:

- ◊ *Facilitate the discussions*
- ◊ *Assess collaboration, communication and problem-solving skills among learners*

- ◊ *Offer constructive feedback and acknowledge learners' achievements*
- ◊ *Correct the misconceptions from the learners' presentations.*
- ◊ *Ask learners to take note of additional points made during group presentations*

Suggested Learning Points

Safety protocols

Safety protocols are structured measures designed to safeguard individuals and equipment against potential risks in various settings, such as workplaces, schools, and public venues. They often include guidelines like emergency exit routes, fire drills, proper equipment usage, and adherence to health regulations to ensure everyone's well-being. They outline the steps to take in specific situations to protect people, equipment and the environment. Understanding and consistently following these protocols is crucial for preventing accidents and managing crises effectively. Robust safety protocols are crucial due to their multidimensional benefits. They serve to:

- **Prevent Accidents:** By addressing potential risks, safety protocols help reduce the possibility of accidents.
- **Ensure Legal Compliance:** Adhering to safety protocols means meeting legal and regulatory requirements, avoiding penalties.
- **Boost Efficiency:** By minimizing downtime caused by incidents, safety protocols can increase productivity.
- **Safeguard Resources:** They protect both human and material resources, minimizing losses.

Key elements of safety protocol

- ◊ **Clear Procedure**: step by step instructions for responding to specific situations.
- ◊ **Role and responsibilities**: define the roles and responsibilities of individuals involved in the protocol
- ◊ **Communication Procedures:** establish communication procedures, including alerting authorities, notifying individuals and reporting incidents.
- ◊ **Training**: ensure that people/workers are receive training on the protocol and their roles and responsibilities
- ◊

Example of a Workplace Safety Protocol

Consider an engineering workshop where machinery operations are standard. Safety protocols here would include:

- ◊ Mandatory safety goggles and gloves to protect against flying debris and sharp objects.
- ◊ Regular equipment maintenance schedules to prevent malfunction.

- ◊ A well-marked emergency exit and an accessible fire extinguisher.
- ◊ Personnel trained in first aid and emergency response procedures.

These steps ensure a safe working environment, highlighting the practical applications of safety protocols.

Learning activities 5: Conducting safety audits in a work station

Learning Environment Setup

Create a learning environment suitable for teaching safety protocols for workplaces. This can be:

- ◊ **Natural –***Field trip to factory/industry/company*
- ◊ **Artificial -***Workshops, work stations and laboratories interactive platforms (using VR experiences, simulations and models...)*

-*Technological (videos, PPE App., Simulated scenarios on safety audits)*

Suggested Teaching and Learning Materials

- ◊ **Safety poster and signs**: A display of safety posters and signs in the workplace
- ◊ **Workplace safety manuals:** Develop or obtain workplace safety manual
- ◊ **Safety data sheets:** Use Safety data sheets to teach learners about chemical hazards and safe handling procedure
- ◊ **Safety videos:** Use video/audio that demonstrate safety procedures
- ◊ **Interactive software**: Use interactive safety software such as simulations and games to engage learners
- ◊ **Mobile safety application**: Use mobile safety applications such as, inspection checklists and emergency response guides
- ◊ **PowerPoint presentations:** Computer, projector, printed pictures

Suggested Teaching Methods

- ◊ Hands on activities
- ◊ Inquiry-Based Learning
- ◊ Collaborative Learning
- ◊ Modeling and Simulation
- ◊ Guest Lectures and Workshops

Scenario:

Activity process

Exploration

- ◊ Learners to explore on workplace safety audits.
- ◊ Learners to investigate about the key components of safety audits
- ◊ In groups, ask learners to research on steps of conducting safety audits.

Feedback and Consolidation Session

- ◊ Learners to make presentations on workplace safety audits

Learners to discuss steps of creating safety audits

- ◊ Individual learners to make write-ups on steps for conducting safety audits
- ◊ Ensure that learners are provided with necessary teaching and learning materials

Note to the teacher:

- ◊ Facilitate the discussions
- ◊ Assess collaboration, communication and problem-solving skills among learners
- ◊ Offer constructive feedback and acknowledge learners' achievements
- ◊ Correct the misconceptions from the learners' presentations.
- ◊ Ask learners to take note of additional points made during group presentations

Suggested Learning Points

What is a Safety Audit?

A safety audit is a systematic and independent examination of an organization's safety policies, procedures, and practices to identify potential hazards, risks and areas for improvement. The goal of a safety audit is to ensure your work area is compliant with safety regulations and to see whether your workplace's safety program is working across departments. In other words, if you have a safety program, which you should, a safety audit will determine how well it is performing and whether it needs any adjustments. By this, we mean are individuals following safety protocols within your facility or are they engaging in at-risk behaviors. A well performed safety audit should reveal these types of unsafe acts or unsafe conditions.

It is preferable for multiple persons to be involved in a safety audit and may often be accomplished with the involvement of a third party. This is because audits need to be objective and without bias, so someone unfamiliar with the area but trained in conducting a proper safety audit should handle them. A proper safety audit seeks to uncover the following:

- ◊ Unsafe work conditions that endanger people's safety and health
- ◊ Areas of non-compliance with the safety and healthy regulation
- ◊ At-risk behaviors of workers/staff
- ◊ Opportunities to improve your workplace's safety program

Steps of conducting a safety audit for a workplace

1. Prepare for the Audit

2. Conduct the Audit

3. Review Your Findings

4. Take Corrective and Preventive Actions

5. Publish the Results

Summary: A safety audit is a systematic and independent examination of an organization's safety policies, procedures, and practices to identify potential hazards, risks and areas for improvement. The purpose of a safety audit is to evaluate the effectiveness of an organization's safety management system and to provide recommendations for improvement

Task: You are the newly appointed Design and Technology club president at your school. Your teacher has asked you to design a comprehensive workplace safety plan to prevent injuries and illnesses and to ensure compliance with relevant safety regulations.

1 Conduct a hazard assessment that would help to identify potential safety risks in each department
2 Develop safety procedures and protocols for each department
3 Designate personal protective equipment PPE for each task.
4 Suggest the strategies you would use to improve ventilation and lighting in workstations.

Expected standard: Workplace safety practices applied accordingly

Assessment Guidelines: Provide an assessment that clearly reflects the specific or key competences to be attained in the topic. Assessment shall be done using the following methods:

Formative assessment

Formative assessment refers to the process of collecting information about learners during the learning process. It is an own going process that takes place thought out the learning process.

1 Provide Quiz and classroom exercise to the learners to assess learner's understanding of work place safety practices.
2 Assign learners to write workplace protocol for the workplaces

Summative Assessment

Summative assessment refers to the evaluation of students learning at the end of the lesson, topic, term or end of academic year.

1 Give a comprehensive test to assess learners understanding of workplace safety.

Summary: Workplace safety covers practices, rules and procedures put in place at an institution to prevent injuries, illness and fatalities. It involves creating safety protocols, carryout safety audits and applying safety rules in workplaces. Workplace safety if adhered to can reduce costs of compensation which come a result of injuries. It also boosts morale, motivation and productivity among workers

Subtopic: - First Aid

Introduction

First aid is the immediate help given to a person who has been injured or suddenly taken ill before medical attention. This topic is aimed at equipping learners on how to apply first aid. The learning activities have been designed to help learners to practice first-aid techniques. It is hoped that after acquiring the skills, learners will be confident to provide first aid when required.

Specific Competence(s): Apply first aid techniques in the workplace

Learning activity 1: Identifying common accident scenarios (*suffocation, burns, cuts…*)

Learning Environment Setup

When teaching about accident scenarios in a First Aid, you can create a learning environment that is immersive, interactive, and realistic.

Natural: Real-life scenarios of accidents to help learners how to respond to different emergency situations

Artificial: Simulated Emergency Scenarios (Set up mock accident scenes, such as a car accident or a workplace injury, to simulate real-life emergency situations)

- Virtual reality to create immersive and interactive simulations of accident scenarios
- First Aid simulation stations (Set up simulation stations where learners can practice First Aid skills, such as CPR or wound dressing).

Technology-Enhanced Tools: - **First Aid apps** to provide learners with interactive and engaging learning experiences; **Online simulations**, such as virtual reality simulations, to provide different accident scenarios to help learners respond to them; **interactive quizzes and games** to teach learners First Aid skills.

Suggested Teaching and Learning Materials

- ◊ **Real-life materials**: First Aid Kits, Safety Equipment, Accident Reports: Use real-life accident reports to teach learners about the consequences of accidents and the importance of safety measures.
- ◊ **Visuals: Videos** of real-life accidents or simulations to illustrate the consequences of accidents and the importance of safety measures, **images** of accident scenarios to help learners visualise the risks; **infographics** to provide safety tips and emergency procedures.
- ◊ **Accident Scenario Cards**: Make cards that describe different accident scenarios.
- ◊ **Safety Guides**: Provide safety guides that outline emergency procedures and accident prevention tips.
- ◊ **Workbook:** Make workbook activities about first aid
- ◊ **Digital materials**: Online simulations, mobile apps, Virtual Reality experiences.

Suggested Teaching Methods

- ◊ **Inquiry-Based Learning:** Learners explore questions and problems through investigation and research.
- ◊ **Collaborative Learning:** Learners work in groups, to enhance communication, teamwork and leadership skills.
- ◊ **Guest Lectures and Workshops:** Experts share real-life experiences and skills.
- ◊ **Experiential Learning**: Hands-on: Conduct a school safety walk, practice fire drills, and participate in first aid demonstrations.
- ◊ **Interactive Learning:** Group Discussions: Discuss safety rules, analyze real-life safety scenarios, and brainstorm solutions

Scenario:

You are at a summer camp with a group of friends. One of your friends, Alex, is playing soccer when he trips and falls, hitting his head on a rock. Alex is now lying on the ground, unconscious and bleeding from a cut on his forehead.

Problem:

As the only person in the group with basic First Aid training, what would you do to help Alex? Consider the following:

1. How would you assess Alex's condition?
2. What would you do to stop the bleeding from the cut on his forehead?
3. What would you do if Alex were to regain consciousness?

Activity process

Exploration

- ◊ Learners to research on the importance of First aid
- ◊ In groups to explore common accident scenarios
- ◊ Learners to explore causes of workshop or workplace accident scenarios (for example poor safety standards, lack of communication, fatigue, stress…)
- ◊ Learners to explore emergency responses to common accident scenarios

- ◊ Learners to classify burns and injuries

Feedback and Consolidation Session

- ◊ Learners make presentations on common accident scenarios and the importance of First aid.
- ◊ Learners to share information on First aid responses for specific accident scenarios
- ◊ Learners to make presentations on First aid response for specific accident scenarios (cuts, burns, fracture, suffocation, stress…)

 Learners to discuss first aid techniques for common accident scenarios

Note:

- ◊ Monitor group interactions and application of collaboration, communication and problem-solving skills.
- ◊ Offer constructive feedback and acknowledge learners' achievements
- ◊ Monitor individual learner's participation

 Reflection and documentation

 **Suggested Learning Points**

Causes of workplace accidents

There are times when accidents happen in the workshops. The following are some of the causes of accidents.

Slip, Trip, and Fall Accidents: These accidents are very common. They can occur when a person slips on a wet floor, trips over an obstacle or falls due to an uneven surface. Poor lighting and clutter in the work environment can also contribute to these accidents. Slip, trip, and fall accidents can result in injuries such as bruises, sprains, fractures, head injuries and many others.

Equipment Accidents: These accidents occur when a person is injured by a machine, tools or other equipment. These accidents can be due to malfunctioning equipment, lack of proper training, or inadequate safety measures.

Fire and Explosions: Such accidents occur when a fire or explosion take place in the work environment. They are as a result of improper handling of flammable materials, faulty equipment, or inadequate safety measures.

Assaults: Assaults occur when a person is physically attacked while in the work environment. These attacks can be due to bullying, violence or harassment.

In order to prevent occurrence of accidents, there is need to adhere to good personal and workplace safety practices. These include wearing correct PPEs, correct utilisation of tools and equipment and improving workplace safety practices such as lighting and ventilation.

Learning activities 2 and 3

2. Role-playing the provision of first aid to injured persons
3. Demonstrating first aid to an injured person

Learning Environment Set-up

When role-playing and demonstrating first aid to an injured person, the following Learning Environments can be created:

- ◊ **Natural**: Real-life case studies of accidents to teach learners how to assess and respond to different emergency situation
- ◊ **Artificial:** Simulated Emergency Scenarios (Set up mock accident scenes, such as a car accident or a workplace injury, to simulate real-life emergency situations)

  Virtual reality to create interactive simulations of accident scenarios

  First Aid simulation stations (Set up simulation stations where learners can practice First Aid skills, such as CPR or wound dressing).

  Technology-Enhanced Tools: - **First Aid apps** to provide learners with interactive and engaging learning experiences; **Online simulations**, such as virtual reality

Suggested Teaching and Learning Materials

- ◊ **Real-Life Materials**: First Aid Kits, Safety Equipment, Accident Reports: Use real-life accident reports to teach learners about the consequences of accidents and the importance of safety measures.
- ◊ **Visuals**: Images of accident scenarios to help learners visualize and understand the risks; infographics to illustrate accident statistics, safety tips, and emergency procedures.
- ◊ **Accident Scenario Cards**: Create cards that describe different accident scenarios and ask learners to respond accordingly.
- ◊ **Safety Guides**: Provide learners with safety guides that outline emergency procedures and accident prevention tips.
- ◊ **Workbook Activities**: Create workbook activities that teach learners about accident response
- ◊ **Digital materials**: Online simulations, mobile apps, Virtual Reality experiences.

Suggested Teaching Methods

- ◊ **Collaborative Learning:** Learners work in teams, developing communication, teamwork, and leadership skills.

- ◊ **Hands-on Learning**: Conduct a school safety walk, practice fire drills,
- ◊ and participate in first aid demonstrations.
- ◊ **Guest Lectures and Workshops**: Industry experts share real-world experiences and
- ◊ skills.
- ◊ **Inquiry-Based Learning:** Learners explore questions and problems through investigation and research.
- ◊ **Interactive Learning:** Group Discussions: Discuss safety rules, analyse real-life safety scenarios, and brainstorm solutions

Scenarios: N/A

Activity process

Exploration

- ◊ Prepare accident scenarios cards for learners to role-play applying first aid to the casualty
- ◊ Learners to analyse simulated accident scenarios
- ◊ Distribute accident scenario cards to learners in small groups.
- ◊ Learners to respond to accident scenarios. (Leaners to refer to safety given guides)
- ◊ In groups, Learners to role-play first-aid in response to given accident scenarios

Feedback Session and Consolidation

- ◊ Individual leaners to record first aid skills observed during the role-play
- ◊ Learners to share information on what was more interesting/challenging during the
- ◊ role-play
- ◊ Learners to demonstrate application of First aid on an injured person.

Note:

- ◊ Assess first aid skills demonstrated by individual learners.
- ◊ Offer constructive feedback and acknowledge learners' contributions
- ◊ Assess collaboration, communication and problem-solving skills among learners

Reflection and documentation of key ideas learnt

Suggested Learning Points

First aid is the immediate help given to a person who has been injured or suddenly fallen ill. It includes home care if medical assistance is not available or delayed. The aims of first aid are highlighted below.

Preserve life

To sustain (preserve) life. For example, mouth-to-mouth respiration is done when breathing has stopped. In most cases, a helper puts oneself in danger *and* subsequently be another

casualty for the emergency services to deal with. Therefore, it is important to assess the situation, to make sure there are no threats before stepping in.

Prevent the situation from getting worse

If you are in no danger yourself, try to stop the situation from becoming worse by removing any obvious dangers (such as stopping traffic, clearing people away from the casualty, opening a window to clear any fumes, Immobilizing the fractured bone etc.). Also, act as quickly as you can to stop the casualty's condition from worsening.

Promote healing and recovery

Your role as a first aider is, after ensuring that the situation cannot get worse, to help the casualty recover from their injury or illness or stop their condition from getting worse. e.g., reassure the patient, relieve pain, protect from cold and arrange patient transfer. If the injury is severe, then the best you can do is try to keep them alive until the emergency services arrive.

Task: "Respond to a First Aid Scenario in the Design and Technology Workshop"

While working in the Design and Technology workshop your classmate accidentally cuts oneself on a band saw. The cut is deep and is bleeding heavily. As the first person to respond, you need to provide immediate first aid and ensure that your classmate receives proper medical attention.

1. **Relevance:** It is in the Design and Technology workshop, where learners may encounter similar accidents.
2. **Authenticity:** It is a real-life scenario, requiring learners to apply first aid in a practical context.
3. **Complexity:** It involves first aid response, workshop safety, emergency response planning, and reflection.
4. **Depth:** It requires learners to demonstrate masterly of skills knowledge, first aid procedures, thinking, and communication.

1. Demonstrate the correct first aid procedures for treating a deep cut, including:
   - ◊ Assessing the situation and calling for help
   - ◊ Applying pressure to control bleeding
   - ◊ Cleaning and dressing the wound
   - ◊ Providing comfort and reassurance
2. Develop a response plan
   - ◊ Communicating with emergency services
   - ◊ Providing first aid and support until medical help arrives

3. Reflect on your response to the scenario, evaluating your decision-making, first aid skills, and communication.

Assessment Criteria

1. **First Aid Procedure** (45%): including assessment, treatment, and communication.
2. **Response Plan** (25%): Quality of the emergency response plan, including activation, communication, and provision of first aid.
3. **Reflection and Evaluation** (30%): Reflection and evaluation, including decision-making, first aid skills, and communication.

Expected standard: First aid techniques in the workplace applied correctly

Assessment Guidelines*:* Provide an assessment that reflects the specific or key competence(s) to be attained.

- ◊ Knowledge of first aid techniques during accident scenarios
- ◊ Behaviour during accident situations
- ◊ Ability to demonstrate first aid techniques in accident situations

Formative: This form of assessment can be done using the following strategies:

- ◊ Observation: Assess learners' collaborative skills and behaviour towards accident
- ◊ victims
- ◊ Checklist: Asses learners' ability to report/communicate accidents
- ◊ Practical Demonstration: Test demonstration of first aid skills during accident
- ◊ scenarios
- ◊ Class Discussions: Assess knowledge of first aid techniques during accident situations
- ◊ Evaluate understanding of accident situations and first aid needed through question and-answer sessions

Summative: This is done at the end of the topic or when entering the next grade level

- ◊ Written exercises at the end of the topic: Assess knowledge of first aid techniques in given situations.
- ◊ Practical Demos: Test skills in first aid during accident situations
- ◊ Presentations: Asses learners on their ability to demonstrate first aid skills on an injured person.

Summary: In this topic, we have learnt about how to apply first aid during accident scenarios. The following below gives a general guideline on how to respond to accident scenarios.

- Assess the Situation
- Call for Help.
- Check the Casualty.
- Provide First Aid.
- Reassure the Casualty.
- Monitor the Casualty.
- Handover to Emergency Services.

Sub-Topic: Fire Fighting

Introduction

Firefighting is an essential aspect of safety. For Design and Technology learners, understanding the principals of firefighting can help you design and develop innovative solutions to prevent and combat fires. Firefighting involves the use of various techniques, equipment and strategies to extinguish or control fires. Fire fighters use a range of tools, including fire extinguishers, hoses and protective gear to respond to fires and minimize damage.

Specific Competence: Demonstrate firefighting techniques.

Learning Activity 1, 2 and 3

1. Classifying Fires
2. Utilising fire-fighting equipment
3. Demonstrating ways of fighting fire

Create a learning environment that will assist in classifying fires. It can be:

- ◊ **Natural:** Outdoor
- ◊ **Artificial:** Charts on classes of fire
- ◊ **Technology:** Television, projector.

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Fire classification chart, diagram showing different types of fire extinguishers,
- ◊ **Pictures** of firefighting equipment.
- ◊ Videos: Firefighting video tutorials
- ◊ **Worksheet**: Fire classification worksheet.
- ◊ **PowerPoint:** Computer

Teaching Methods

- ◊ Hands on learning
- ◊ Inquiry based learning
- ◊ Collaboration

Scenario

You are working in the Design and Technology workshop then a fire breaks out near the woodworking area. The fire is small but getting bigger.

Clues

1. The fire is near a pile of wood shaving.
2. A nearby machine is still plugged in.

Problem posing

Identify the type of fire and recommend how to extinguish it.

Activity process

Exploration

- ◊ Ask learners what they already know about fires and extinguishing agents.

Discuss the characteristics of each type of fire and the recommended extinguishing agents.

- ◊ Use visual aids, diagrams and examples to aid the discussion.
- ◊ Ask learners to work in groups to:
  (i) Identify the type of fire (Class A, B, C or D)
  (ii) Recommend the correct extinguishing agent.
  (iii)Explain their reason for the recommendation.
- ◊ Provide learners with a worksheet that describes different fire situations.
- ◊ Learners to work individually to:
  (i) Identify the type of fire.
  (ii) Recommend the correct extinguishing agent.
  (iii) Justify the selection of the extinguisher

Feedback and Consolidation Session

- ◊ Summarize the key learning points from the lesson.
- ◊ Emphasize the importance of fire safety and classification in Design and Technology.
- ◊ Provide opportunities for further learning and practice.

Reflection and documentation

Suggested Learning Points

Classes of fire and Suitable extinguishers.

Choosing the right fire extinguisher is very important. You cannot use water to put out an electrical fire. Fires are divided into classes based on the material that is burning, and each class requires the use of a suitable extinguisher. Fire extinguishers are well coloured and marked for easy identification.

Classes of Fires and Suitable Extinguishing Agent

Class	Material	Extinguisher
A	Wood, paper and cloth	Water
B	Flammable liquids	Carbon dioxide or Dry powder

C	Electrical wires	Carbon dioxide or Dry powder
D	Combustible metal fires	Dry powder agents

Identifying the type of fire

- ◊ Classes of fires (A, B, C, D, H, I)
- ◊ Characteristics of each type of fire

Choosing the correct Fire extinguisher

- ◊ Types of fire extinguishers (water, foam, dry powder, CO2, wet chemical)
- ◊ Choose the correct extinguisher for a specific type of fire.

How to use a fire extinguisher.

Follow these steps

1. Move to the proper distance.
2. Pull the pin
3. Aim the nose at the base of the fire.
4. Squeeze the handle
5. Sweep the hose from side to side.
6. Leave immediately if you are unable to control the fire.

Reflection and identification of areas of improvement

Learning Activity 4: Practicing methods of preventing fire

Create a learning environment that will facilitate a safe practice method of preventing fire. This can be:

- ◊ **Natural:** Outdoor
- ◊ **Artificial**: Workshop, dining hall

-Technology: Equipment

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Fire classification chart, Fire extinguisher guide, Firefighting procedures poster
- ◊ **Videos:** Firefighting video clips
- ◊ **Worksheet:** Fill in the blank spaces
- ◊ **PowerPoint:** Computer

Teaching Methods:

- ◊ Hands on learning
- ◊ Inquiry based learning
- ◊ Collaboration

Scenario

You are the newly appointed workshop supervisor at your school. During a recent safety audit, several fire hazards were identified in the workshop. Your task is to:

(i) Identify potential fire hazards in the workshop.
(ii) Develop a plan to prevent fires from occurring.
(iii)Implement safety measures to mitigate the risk of fire.

Problem posing questions

(i) What are the potential fire hazards in the workshop?
(ii) How can you prevent fires from occurring?
(iii)What safety measures can you implement to mitigate the risk of fire?

Activity process

Exploration

◊ Ask learners what they already know about fire safety and prevention.

Discuss potential fire hazards in the school workshop.

◊ Explain methods of preventing fires (Proper storage of flammable materials, regular maintenance of equipment, safe working practice)
◊ Ask learners to work in groups to:
  (i) Identify potential fire hazards in the workshop
  (ii) Develop a plan to prevent fires from occurring
  (iii)Present their findings and plan to the class.

Feedback and Consolidation Session

◊ Summarize the key learning points from the lesson
◊ Emphasize on the importance of practicing methods of preventing fire in the school workshop.
◊ Asses learners' collaboration and critical thinking during learning activities
Reflection and identification of areas of improvement

Suggested Learning Points
Fire hazards

◊ Potential fire hazards in the workshop (electrical, chemical, hot works)
◊ Risks associated with each hazard.

Preventing Fires

- ◊ Methods of preventing fires (proper storage of flammable materials, regular maintenance of equipment, safe working practices)
- ◊ Importance of housekeeping.

Safe working Practices

- ◊ Importance of following safe working practices (Using PPE, following safety procedures)
- ◊ Use equipment and tools properly to prevent accidents.

Fire safety procedure

- ◊ Fire safety procedures in the workshop (evacuation procedures, fire extinguisher locations)
- ◊ How to respond in case of a fire emergency.

Task: You are member of a firefighting team responding to an emergency call at a commercial building. Upon arrival, you notice that the building is on fire, with flames visible on the second floor. There are people trapped inside, and the fire is spreading quickly.

1. Assess the situation and conduct a rapid-fire assessment of the scene, identifying potential hazards, escape routes and the location of the trapped individuals.
2. Develop a rescue plan taking into account the layout of the building.
   Extinguish the fire by identifying the best course of action to extinguish the fire, considering the factors such as the type of fire, the materials involved and the availability of firefighting equipment

Reflection and identification of areas of improvement.

Expected standard: Fire-fighting techniques demonstrated correctly

Assessment Guidelines*:* Provide an assessment that clearly reflects the specific or key competence(s) to be attained. The assessment should be done using the following criteria.

- ◊ Knowledge on classes of fires
- ◊ Attitudes towards safety against fires
- ◊ Appreciating fire safety policies
- ◊ Skills in fire-fighting

Assessment can be in two forms namely, formative and summative.

Formative: This form of assessment can be done using the following strategies:

- ◊ **Observation:** Assess leaners' behaviour fires
- ◊ **Checklist:** Assess learners on knowledge on fire extinguishing agents
- ◊ **Practical Demonstration:** Assess demonstration of fire-fighting techniques

- ◊ **Class Discussions:** Evaluate understanding of fire safety through Question and Answer

Summative: This is done at the end of the topic or when entering the next grade level

- ◊ Written exercises at the end of the topic: Assess knowledge on classes of fires
- ◊ Practical Demos: Test skills on fire fighting
- ◊ Presentations: Asses learners' knowledge on fire extinguishing agents

Summary: In this topic, we have learnt about:

- ◊ Classes of fires (A, B, C, D, H, I)
- ◊ Characteristics of each type of fire
- ◊ Methods of preventing fires (proper storage of flammable materials, regular maintenance of equipment, safe working practices)
- ◊ Importance of following safe working practices (Using PPE, following safety procedures)
- ◊ Use equipment and tools properly to prevent accidents.
- ◊ Fire safety procedures to be followed in a workplace (evacuation procedures, fire extinguisher locations)

TOPIC: MATERIALS

Introduction

Materials are basic ingredients of technology. They make modern life possible, they range from a metal ballpoint you normally use to the wooden or plastic or metal chair you sit on and to mega structures around us, such as; bridges and buildings. The evolution of technology has largely been determined by the availability of materials. This has created new opportunities to continue to improve our quality of life.

Overview

Without knowledge of materials and how they can be machined, it will be very difficult to select the right material for project production. Materials are aimed to prepare learners for a future by providing the foundation for long-life learning about how materials are utilized during the development of products. This topic allows learners to explore and use various materials with the design and manufacture of products as the major focus. It enables learners to decide for themselves which materials best suit the type of product they want to design and manufacture. This topic will look at the production and utilization of wood, metals, plastics and other materials.

General competences

At the end of this topic, learners will acquire the following general competences:

- **Problem solving**: Learners will be able to analyse various materials before selecting the right material for their projects.
- **Environmental Sustainability**: Learners will act responsibly by practicing best practices of disposing waste materials to maintain our environment.
- **Collaboration**: Learners will learn to work with others in order to make products from the available materials.
- **Communicatio**n: Learners will share information, ideas and skills on how to use various tools on different materials.
- **Creativity and Innovation**: Learners will be able to design and make products that solve real and relevant problems within society using different materials by applying creativity and imagination.
- **Analytical thinking**: Learners will analyse different properties of materials and how the materials are affected by different weather conditions.
- **Environmental sustainability**: Learners will use materials responsibly to avoid a lot of waste and polluting the environment.

Key terms: As you explore materials, some terms you are likely to encounter are listed below:

- **Wood:** This is a porous and fibrous structural tissue found in the stems of trees.
- **Timbe**r. This is a natural product of solid wood obtained from a tree suitable for construction and building.
- **Manufactured board.** This is a man-made board made from wood chips, particles, fibers, veneers or wood strips that are bonded to form one material.

- ◊ **Metal**. This is a hard solid mined from the ground in the form of metallic ores.
- ◊ **Plastic.** This is to a polymer or polymeric material made from giant or large organic molecules (hydrocarbon chains).
- ◊ **Other Materials:** These are materials used in design and technology other than wood, metals and plastics. Examples include ceramics, leather, canvas, fabrics, grass, etc.

Subtopic: Materials – Wood

Introduction

Wood is one of the oldest materials used by humans to make products such as tools, utensils and weapons. Today, it is still being used in building, furniture and other products. Due to its fair properties (light in weight, good strength, easy to cut, shape and join), wood is widely used and is largely available as solid wood or manufactured boards.

Specific Competence: Use timber in different situations

Learning Activity 1 and 2

(i) Classifying types of wood (*softwood and hardwood*)
(ii) Analyzing properties of wood (physical and mechanical)

Learning Environment Setup

- ◊ **Natural: Physical –** Natural forest and Exotic forest, assorted solid timber pieces, Logs
- ◊ **Artificial: Physical –** Workshops, Classrooms
  Technology - Video conferencing, Computer, Projector

Suggested Teaching Methods

- ◊ ***Field trips***: a planned excursion or visit to a location outside a classroom
- ◊ ***Collaborative***: learners work in teams, developing communication, teamwork and leadership skills
- ◊ ***Inquiry-based learning***: learners explore questions and problems through investigation and research
- ◊ ***Guest lectures and workshops***: industry experts share real-world experiences and skills

Scenario:

You are a furniture maker who specializes in creating custom pieces for clients. A new client has approached you with a request to build a wooden cabinet using a specific type of wood. However, the client is unsure whether they want to use a hardwood or softwood for the project.

The client has provided you with a list of four different types of wood: Mukwa, Pine, Meligna, and Mubanga. They want you to classify each type of wood as either a hardwood or softwood and explain the characteristics that led you to that classification.

Problem:
Classify each of the four types of wood (Mukwa, Pine, Meligna and Mubanga) as either a hardwood or softwood. Provide evidence and explanations to support your classifications.

Requirements:
1. Research the characteristics of hardwoods and softwoods.
2. Examine the physical and mechanical properties of each type of wood.

Problem posing questions:

1. What are the main differences between hardwoods and softwoods?
2. How do the physical and botanical characteristics of each type of wood relate to its classification as a hardwood or softwood?
3. What are the implications of using a hardwood versus a softwood for the cabinet project?

Activity Process

Exploration

- ◊ Learners to investigate physical and mechanical properties of timber
- ◊ Learners to explore the two classes of timber
- ◊ Let learners identify examples of hardwood and softwood from a given worksheet.
- ◊ Analyzing physical and mechanical properties of wood

Feedback and Consolidation Session

- ◊ Learners to share information on the physical and mechanical properties of timber
- ◊ Learners to make presentations on the two classes of timber.
- ◊ Learners to state examples of hardwood and softwood

Note

- ◊ Assess collaboration, communication, analytical thinking among learners
- ◊ Offer constructive feedback and acknowledge learners' achievements

Reflection and identification of areas of improvement.

Suggested Learning Points

Classification of wood

Wood is divided into hardwood and softwood. The terms 'hardwood' and 'softwood' can be very misleading because some hardwoods are softer than many softwoods and vice versa. This grouping has nothing to do with the hardness or softness of the wood. It is based solely on the characteristics of wood.

Characteristics of Hardwood

- ◊ They have broad leaves
- ◊ They have umbrella-like crowns
- ◊ They are short and stout
- ◊ They shed leaves in winter
- ◊ They rough trunks

Characteristics of Softwood

- ◊ They have needle-like leaves
- ◊ They have cone-like crowns
- ◊ They are tall and slender
- ◊ They are ever-green
- ◊ They have smooth trunks

Mechanical properties

When selecting wood for a project, it is important to understand the mechanical properties of timber. Timber exhibits the following mechanical properties: timber has reasonable strength, hardness, density, and stiffness and has the ability to resist bending.

Physical properties

Learners should also be exposed to other physical properties of timber such as; colour, texture, grain structure, smell, toxicity, durability, moisture content, porosity, etc.

Familiarity with the physical and mechanical properties of timber is important because these properties can significantly influence the performance and strength of timber used in project making.

Task: Demonstrate ways of showing the stiffness and strength of a piece of timber and suggest the strong part (side) of timber.

Expected Standard: Timber used in different situations accordingly

Assessment guideline

The learners' understanding and skills will be evaluated through a combination of the following:

Formative

- ◊ Observation
- ◊ Checklist/worksheet
- ◊ Written tests
- ◊ Portfolio assessment
- ◊ Self-assessment and reflection

Summative

- ◊ Project-based assessment
- ◊ Written exams

 **Summary:** Timber is a natural material that is classified into different classes based on its characteristics, properties, and uses. The classification of timber is important for determining its suitability for various applications, such as project making.

Specific Competence: Utilise manufactured boards in different situations

 **Learning Activity 1 and 2**

(i) Identifying types of manufactured boards (*plywood, block board, fiberboard, chipboard, Medium Density Fibre (MDF)…*)
(ii) Discussing uses of manufactured boards

Learning Environment Setup

- ◊ **Natural:** Timber Processing Company, Timber Shops, and samples Manufactured Boards
- ◊ **Artificial:** Workshops, Classrooms

Technology - Video conferencing, Computer, Projector

Suggested Teaching Methods

- ◊ **Field trips***:* a planned excursion or visit to a location outside a classroom
- ◊ **Collaborative:** learners work in teams, developing communication, teamwork and leadership skills
- ◊ **Inquiry based learning:** learners explore question and problems through investigation and research
- ◊ **Guest lectures and workshops:** industry experts share real-world experiences and skills

 **Scenario:** You are a member of a school preventive maintenance club that promotes the use of eco-friendly materials. Your team has been tasked with designing and constructing a sustainable book storage device. The client has specified that the construction materials used must be environmentally friendly and cost-effective.

Problem posing Question

Your team needs to select a suitable manufactured board for the shelves of the book storage device. The board must meet the following criteria:

Sustainability: The board must be made from recycled or sustainably sourced materials.
Cost-effectiveness: The board must be affordable and provide good value for money.
Durability: The board must be able to withstand the elements and heavy foot traffic.
Aesthetics: The board must have an attractive appearance and be available in a range of colors and textures.

Questions to Consider

1. What types of manufactured boards are available, and how do they differ in terms of sustainability, cost, durability, and aesthetics?
2. How can you evaluate the sustainability of different manufactured boards, and what certifications or labels should you look for?
3. What are the advantages and disadvantages of using different types of manufactured boards, and how can you balance competing factors such as cost, durability, and aesthetics?
4. How can you ensure that the manufactured board you select meets the client's requirements and is compliant with relevant environmental regulations?

Activity Process

Exploration

◊ In groups, learners to identify different types of manufactured boards
◊ Learners to investigate characteristics of each manufactured boards
◊ Learners to explore the appropriate application of each manufactured board

Feedback and Consolidation Session

◊ Learners to make presentations on types of manufactured boards.
◊ Learners to share information on characteristics of manufactured boards.

Learners to discuss appropriate usage of manufactured boards.

Note:

◊ Assess learner participation, communication and collaboration among learners
◊ Offer constructive feedback and acknowledge learners' achievements

Reflection and identification of areas of improvement.

Suggested Learning Points

Manufactured Boards

Manufactured boards are most often referred to as artificial boards or man-made boards. They are made up of thin layers of wood, saw dust and other wood waste, which are glued together and compressed with a huge amount of heat and pressure.

Uses of manufactured boards

- ◊ They are used in making ceiling boards
- ◊ They are used for furniture construction
- ◊ They are used for cabinet making
- ◊ They are used for partitioning
- ◊ They are used in wall paneling

Advantages of Manufactured Boards

- ◊ They are available in wide sizes
- ◊ They have uniform strength across the boards
- ◊ They can be nailed or screwed at the edge without splitting
- ◊ They have generally few or no defects
- ◊ They help to reduce deforestation

Examples of Manufactured Boards

The following are some of the examples that can be discussed with the learners:

- ◊ **Plywood** is made from veneers (plies) of timber with each grain layer being at right angles to each other and bonded together by glue and pressure.
- ◊ **Chipboard** is made from wood chips that are pressed and bonded together using a synthetic resin adhesive.
- ◊ **Hard board** (fibreboard) is another manufactured board made from wood fibres that have been pulped. The pulp is put under pressure until the fibres bond to produce a tough board that is smooth on one side and rough on the other.
- ◊ **Lamin board** is a board made from glued strips not exceeding 12mm sandwiched between veneers.
- ◊ **Block board** a man-made board made from glued strips not exceeding 25mm sandwiched between veneers.
- ◊ **Batten board** is a board made from glued strips not exceeding 75mm sandwiched between veneers.

Task: Suggest the best ways of storing and caring for various products made from manufactured boards at your school.

Expected standard: Manufactured boards in different situations utilised appropriately

Assessment Guidelines*:* Provide an assessment that clearly reflects the specific or key competence(s) to be attained.

Formative: This form of assessment can be done using the following strategies:

- ◊ **Observation:** Observe manipulation of manufactured boards using assorted tools and equipment
- ◊ **Checklist:** Assess knowledge on uses of manufactured boards
- ◊ **Practical Demonstration:** Assess utilisation of manufactured boards in product making
- ◊ **Class Discussions:** Evaluate understanding of the use of manufactured boards
- ◊ through question and answer sessions

Summative: This is done at the end of the topic or when entering the next grade level

- ◊ **Written exercises** at the end of the topic: Assess knowledge on practical uses of manufactured boards
- ◊ **Practical Demos:** Assess critical thinking, creativity and innovation in utilisation of manufactured boards
- ◊ **Presentations**: Asses learners on their ability to share information on types and uses of manufactured boards
- ◊ **End of topic test:** (Assessment on knowledge, values and skills on usage of manufactured boards)

Summary: Manufactured boards offer a range of benefits and advantages over solid wood. It has been observed that these boards are versatile and cost-effective, and provide learners with a comprehensive understanding of appropriate boards to use during project design and prod

TOPIC: GRAPHICS

Introduction

Think of this; you have been given assorted parts for a chair or table to assemble and each part is unique. How easier would that be? Would you need something to use as a guide? Is it a worded or pictorial guide? It is clear that a pictorial guide with annotations would be appropriate in this case. It would help to communicate the steps needed when assembling the parts. Communication through pictures or symbols constitutes what we call graphics!

Overview

Graphics play a critical role in the communication world. They convey various ideas and concepts in the easiest and appropriate way. Usually, recognisable symbols and drawings are used. In order to effectively communicate through graphics, knowledge on drafting aids, lines, angles, triangles, quadrilaterals, and symbols is needed. This knowledge would help learners to acquire skills and concepts needed in designing and developing real world solutions to societal challenges.

General competences

The following general competences are expected to be acquired by the learners;

- **Communication:** Share ideas, thoughts, information and messages through graphics language.
- **Creativity and innovation:** Coming up with ideas of graphics and products that would solve a real-world problem.
- **Analytical thinking:** Understand the critical process needed when constructing lines, angles, triangles, quadrilaterals, and symbols. Such processes will help learners to understand how each plane figure is interconnected to the other.
- **Critical thinking:** Adopting the best graphical solution to a real-world challenge.
- **Digital literacy:** Gaining a skill of how to manipulate software tools when designing various artefacts or objects
- **Problem solving:** Acquire a step by step skill on how to identify, analyse, and find graphical solutions to challenging situations.

Key Terms

- **Graphics**: Visual elements used to communicate information, convey meaning, and enhance the aesthetic appeal of various media.
- **Drafting Aids:** Any device/instrument used to help in drawing something.
- **Plane Geometry:** Study of shapes, sizes and positions of objects on a flat surface.
- **Symbols:** Graphical representations used to convey meaning, concepts or ideas.
- **Computer Aided Design:** Use of computer software to create, modify, analyze, and optimize digital models of physical objects.

Subtopic: Drafting Aids

Introduction

Drafting aids are equipment or instruments used to come up with a drawing. They can be simple or complicated and made from any engineering material. When used correctly, they have a very good effect on drawings.

Specific Competence: Use drafting aids to create drawings

Learning activity 1: Using drafting Aids (pencils, drawing board, T ~ square, set squares, stencils, fillet, flex curves…)

Learning environment setup

- **Natural:** Well ventilated and lit area/space to avoid eye strain
- **Artificial:** Drawing room/classroom
  Technology – Computer

Suggested Teaching Methods

- **Inquiry based:** Allow learners to explore the questions and problems through investigation and research.
- **Hands on activities:** Allow leaners to demonstrate how to use the drafting aids
- **Project based**: Assign learners real world drafting projects that require application of learned skills
- **Collaborative learning method**: assign activities that require collaboration and communication among leaners

Scenario

Imagine you are staying in a two roomed house and the government wants to build you a house. You are then tasked to design your dream house and submit it to the government construction company.

Problem posing questions

- Generate a list of things you need to come up with your design.
- From the generated list above, organize items and discuss how each can be used.
- Using the organised items above, come up with the design of your dream house.

Activity process

Exploration

- In groups, learners to explore types of drafting aids.
- Learners to research on the uses of various drafting aids
- Let learners investigate the methods of caring for drafting aids

Feedback and consolidation

- Learners to make presentations on types of drafting aids
- Learners to discuss uses of various drafting aids

- ◊ Learners to share information on uses of various drafting aids
- ◊ Leaners to use various drafting aids

Note to the teacher

- ◊ Assess collaboration among learners
- ◊ Offer constructive feedback and acknowledge learners' achievements

Reflection and identification of areas of improvement.

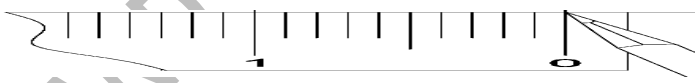
Suggest learning points

Drafting Aids

- ◊ These are devices or instruments used to come up with a drawing Paper
- ◊ They include drawing sheets (paper), pencils, ruler, set squares, and French curves…

Drafting aids and their uses

- ◊ **Paper**
  - A space where drawings are done or drawn and are of standard sizes thus **A0**, **A1**, **A2**, **A3**, & **A4.**
  - It comes in two formats; **Landscape** (when the longer side lies horizontally) and **Portrait** (when the longer side lies vertically)
- ◊ **Pencil**
  - An instrument used to leave a trace (mark) on a sheet of paper.
  - It has a **lead (**Drawing Tip**)** that ranges from hard to soft (…2H, 1H, HB, 1B, 2B…)
  - In Design and Technology, the **H types** are used.
- ◊ **Ruler**
  - An instrument used to obtain measurements and as a straight edge
  - Each space of the ruler marking represent a millimeter (mm) thus 10mm = 1cm



- ◊ **Eraser** - to help in erasing drawn objects
- ◊ **Set squares** - to help in drawing straight lines and those lines at an angle
- ◊ **Compass** - to help in constructing circles, & arcs of objects
- ◊ **Drawing board** - that where the drawing in done
- ◊ **T- square -** An instrument used to draw lines that are both perpendicular and parallel to the drawing paper
- ◊ **Protractor** - used to measure angles

Task
Using the drafting aids, design a layout for your school.

Expected Standard: Drafting Aids to create drawings used correctly

Assessment guideline

- ◊ **Formative:** Observation, checklist/worksheet, Q&A, Group discussion
- ◊ **Summative:** Project **Based** assessment and written exams

Summary: Drafting aids can be used to come-up with various designs in a real-world situation. Learners need to acquire relevant skills on how to use drafting aids. This is achieved through a continuous manipulation of these drafting aids. When good skills are gained, leaners will easily design the needed objects.

Learning activity 2: Applying varied effects to lettering work

Learning environment setup

- ◊ **Natural:** Well ventilated and lit area/space to avoid eye strain
- ◊ **Artificial:** Drawing room/classroom
  Technology – Computer

Suggested Teaching Methods

- ◊ **Inquiry-based Learning:** allow learners to explore the questions and problems through investigation and research.
- ◊ **Hands on** Learning: allow leaners to demonstrate how to print letters and numbers
- ◊ **Project based** Learning: assign learners a project on printing letters and numbers
- ◊ **Collaborative learning method**: Assign activities that require collaboration and communication among leaners

Scenario
When moving in the school environment, you notice the display of information on various surfaces. After a careful look, you observe that each information has a unique lettering and numbering style. You then decide to use those styles to develop an information sign for the school.

Problem-Posing question
Develop a poster which has printed information of the departments available in your school.

Activity process

Exploration

- ◊ Allow learners to explore on various ways in which information can be presented on various spaces such as; road signs, billboards, posters, newspapers ...
- ◊ Let learners research on various ways in which numbers and letters can be printed on road signs, billboards, posters ...
- ◊ In groups, let learners print any information on the surface of their choice

Feedback and consolidation

- ◊ Learners to make presentations on various ways in which information can be presented on surfaces/spaces.
- ◊ Learners to discuss uses of various ways in which numbers and letters can be printed on road signs, billboards, posters ...
- ◊ Learners to practices ways of printing information on various surfaces

Note to the teacher

- Assess collaboration, creativity and ability to share information among learners
- Offer constructive feedback and acknowledge learners' achievements

Suggested learning points

Lettering and numbering

Lettering

- ◊ Lettering is the use of letters to convey information.
- ◊ These letters are obtained from the English alphabet thus A to Z
- ◊ Specific styles of lettering are used thus **italics** – slanting **(*A, B, C, D, …, Z*)** and standard – upright **(A, B, C, D, …, Z)**
- ◊ A well lettered figure is very pleasing to look at on a drawing especially if the lettering styles are consistent and well-spaced.

Numbering

- ◊ Numbering is the use of numbers to convey a value or amount of something.
- ◊ Specific styles of numbering are used thus italics – slanting **(*0,1, 2, 3, 4, 5,6,7,8,9*)** and standard – upright **(0,1, 2, 3, 4, 5,6,7,8,9)**

Printing

- ◊ **Printing** is the process of pressing letters or numbers in an orderly/ organized way.
- ◊ Most letters on drawings are done in upper case (capital letters).
- ◊ Most draftspersons develop great skills in printing by hand.
- ◊ If you need to print, try both standard and italic and develop a style that suits you.
- ◊ **Always print between two construction** lines of about 3mm to 5mm

Task: Using a piece of paper, print the following information;
‘‘ The number 1,2,3,4 and 5 can be printed uprigthly or slantly whilst all letters of the alphabet must be printed in an upper case**.’’**

Expected Standard: Drafting Aids to create drawings used correctly

Assessment guideline

- ◊ **Formative:** Observation, Checklist/worksheet, Q&A, Group discussion
- ◊ **Summative:** Project Based Assessment and Written exams

Summary: Letters and numbers play critical roles in information displays. When well-spaced and written in consistent style, they make the information look orderly and appealing. There is need for learners to gain a skill of printing letters and numbers. Usually, this skill is gained through consistent practice. Hence, learners need to practices various ways of printing information to various surfaces

Sub-topic: 2 Plane Geometry

Introduction

Plane geometry is the study of shapes, sizes and positions of objects on a flat surface. It acts as a foundation for all drawings. Usually, all plane figures begin with a line. With lines, various objects can be designed, constructed and presented. When two lines in different orientations are joined end to end, they form an angle. Equally, when three lines are joined end to end to form an enclosed figure, a triangle is obtained. Conversely, four lines joined end to end form an enclosed figure called a quadrilateral. It is therefore important to understand how each of the figures mentioned above can be presented on plain paper.

Lines

Specific competence: Construct lines from the given data

Learning activity 1: Drawing border lines and title block

Learning environment setup

- ◊ **Natural:** Well-ventilated and lit area/space to avoid eye strain
- ◊ **Artificial:** Drawing room/classroom
  Technology **-**Computer
- ◊

Suggested Teaching Methods

- ◊ **Inquiry-based** Learning: Allow learners to explore the questions and problems through investigation and research.
- ◊ **Hands-on Learning**: Allow learners to demonstrate how to use the drafting aids

- ◊ **Project-based Learning**: Assign learners real-world drafting projects that require the application of learned skills
- ◊ **Collaborative learning method**: Assign activities that require collaboration and communication among learners.

Scenario

Your teacher has assigned you to draw an object on a manila paper. Before drawing the object, they want you to draw the borderline and title block.

Problem- posing question

Step by step demonstrate how to draw the borderline and title block on a piece of paper

Activity process

Exploration

- ◊ In groups, ask learners to research borderlines and titles block
- ◊ Ask learners to discuss ways of drawing borderlines and title blocks using a sheet of paper.

Feedback and consolidation

- ◊ Learners to make presentations on their findings on borderlines and titles block
- ◊ Learners to discuss ways to draw borderlines and titles block
- ◊ Let learners utilise the information gained to draw borderlines and title block on plain papers

Note to the teacher

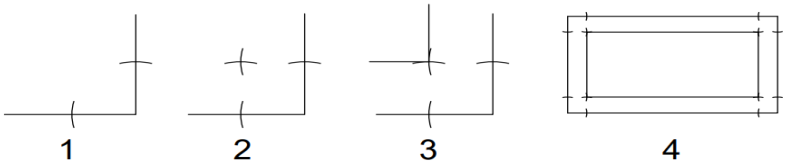
- ◊ Assess collaboration among learners
- ◊ Offer constructive feedback and acknowledge learners' achievements

Suggest learning points

Borderline

Construct the borderline as follows;

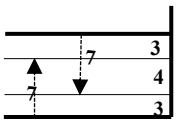
- ◊ **Stage 1 –** Construct the arc from each corner of the paper equal to 10 mm
- ◊ **Stage 2** – From the arcs obtained in Stage 1, draw other arcs to meet at a point inside the paper space
- ◊ **Stage 3** – Where the arcs meet, join the point to obtain the needed line
- ◊ **Stage 4** – Join all the points to obtain the borderline



Titles block

Construct the title block as follows;

- ◊ **Stage 1-**Using the borderline, mark a 10mm arc at the bottom of the border and outline
- ◊ **Stage 2** -Within 10mm outlined line, measure 7 mm on the compass and mark it both at the top and bottom of the line and then join the point in the constructed line



Task

Using the A4 paper, draw the borderline and title block. In the title block, print your name, school, form, date, title, scale, and checked by.

Assessment guideline

- ◊ **Formative:** Observation, checklist/worksheet, Q&A, Group discussion
- ◊ **Summative:** Project Based assessment and written exams

Summary: The borderline defines the workspace, while the title block contains information about the learners. These must be prepared each time drawings are created on paper.

Learning activities: 2,3 &4

2. Bisecting lines
3. Dividing lines into equal parts
4. Dividing lines into given ratios

Learning environment setup

- ◊ Natural: Well-ventilated and lit area/space to avoid eye strain
- ◊ Artificial: Drawing room/classroom

Technology – Computer

Suggested Teaching Methods

- ◊ **Inquiry-based** Learning: Allows learners to explore the questions and problems through investigation and research.
- ◊ **Hands-on Learning**: Allow learners to demonstrate how to use the drafting aids
- ◊ **Project-based Learning**: Assign learners real-world drafting projects that require the application of learned skills

- ◊ **Collaborative learning method**: Assign activities that require collaboration and communication among learners

Scenario

You have been given three metal bars that are 120 mm long. Each bar will be used to make a specific project, so it must be cut to the given specifications. The first bar is to be cut to 111mm, the second bar into five equal parts, and the third bar into a ratio of 2:3:4.

Problem Posing a question

Using a line as a bar, demonstrate graphically how each piece would be cut.

Activity process

Exploration

- ◊ Ask learners to define a line and its significance to drawings
- ◊ Let learners explore the types of lines commonly used on drawings.
- ◊ Ask learners to research on the steps followed when drawing a given line (e.g. 77mm, 82mm, . . .)
- ◊ Allow learners to research on the steps followed when bisecting a given line.
- ◊ Ask learners to research on the steps followed when dividing a given line into equal parts (e.g. 4 equal parts, 7 equal parts, ...)
- ◊ Ask learners to research the steps followed when dividing a given line into given ratios (e.g. 1:3, 2:5:7, ...)

Feedback and consolidation

- ◊ Learners to make presentations on their findings on lines, bisecting of lines, dividing of lines into equal parts and dividing of lines into given ratios
- ◊ Let learners utilise the information gained to divide real-world objects into equal parts and needed ratios

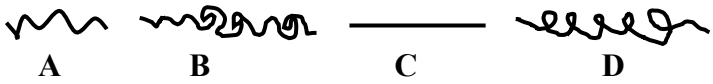
Note to the teacher

- ◊ Assess analytical thinking, collaboration, and problem solving among learners
- ◊ Offer constructive feedback and acknowledge learners' achievements
- ◊ Summarise key lesson points

Suggested learning points

<u>Lines</u>

- ◊ A line is a **trace** or **mark** made by a moving point.



◊ Figures **A**, **B**, **C**, and **D** are all lines as they are **traces** or **marks** made by the moving point.

Types of lines

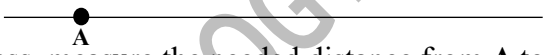
◊ There are different types of lines and each line on a drawing represents specific information regarding the component.
◊ Common lines include; **Outline**, **Construction** line, **Hidden detail** line, **Centre** line, **Cutting plane** line, and **phantom/folding** line.

Drawing a line

In order to draw the needed line, the following steps need to be followed.

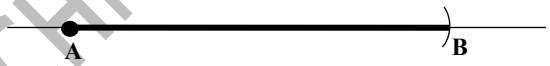
◊ Draw an arbitrary line in the construction line

◊ Identify a starting point and label it **e.g. A**



◊ Using the ruler and compass, measure the needed distance from **A** to the endpoint **B**

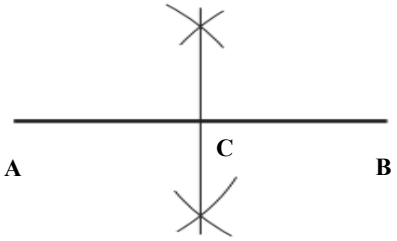
◊ Outline the distance AB as the needed line.



Bisection of lines

To bisect a line means to find the middle point of a given line. The following are the steps taken;

(i) Construct the given line AB
(ii) With center A and any convenient radius greater than half of line AB, construct arcs above and below the line
(iii) With centre B, construct arcs of the same radius to cut the previous ones



(iv) The line drawn through the intersections of the arcs will bisect the given line AB at C

Dividing a line into equal parts

Example: Divide a line into 9 equal parts

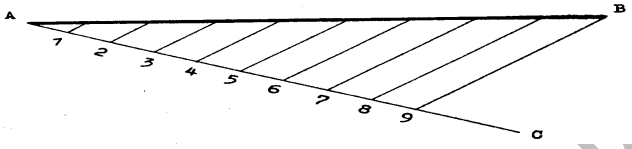
Divide the given line into 9 equal parts as follows;

(i) Construct the given line AB.

(ii) Draw a line AC at any convenient angle to line AB.

(iii) Step off along line AC the required number of divisions. These may be of any convenient length but equal. Number the divisions **1** to **9**

(iv) Join the last number to point B. Draw lines parallel to this line from the other numbers to meet/join line AB



AB is now divided into the required number of equal parts

Dividing a line into a given ratio

Example: Divide line AB into the Ratio 1:2:4

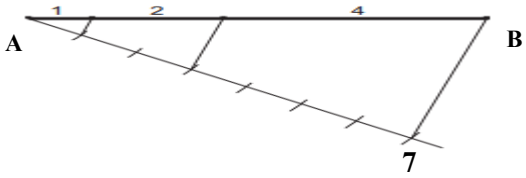
Divide the given line into the given ratio as follows;

(i) Construct the given line AB.

(ii) Draw a line AC at any convenient angle to line AB.

(iii) Step off along line AC the required number of divisions, the **sum** of the given proportions, that is, 1, 2, &4 (**1+2+4=7**). These may be of any convenient length but equal. Number the divisions **1** to **7**

(iv) Join the last number, **(7)** to point **B**. Draw lines parallel to line **7B** from points 1 and 3.



(v) Line AB is now divided into the required parts by ratio thus **1:2:4**

Task

- ◊ Draw the following lines; 67mm, 75mm, 97mm
- ◊ Divide the following into the stated parts
- ◊ 55 mm line into 6 equal parts
- ◊ 77 mm line into 11 equal parts
- ◊ 87 mm line into the ratio 3:7
- ◊ 122mm line into the ratio 2:5:8

Expected Standard: Lines from given data constructed correctly

 **Assessment guideline**

- ◊ Formative: Observation, checklist/worksheet, Q&A, Group discussion
- ◊ **Summative**: Project Based assessment and written exams

 **Summary:** Drawing objects starts with a line, making it essential to understand how to draw, bisect, and divide them into equal parts or a given ratio. This knowledge is crucial for developing the skills needed to draw other graphical figures or objects.

Subtopic: Angles

Specific competence: Construct angles from the given data

 **Learning activity 1:** Constructing angles from given data

Learning environment setup

- ◊ **Natural:** Well-ventilated and lit area/space to avoid eye strain
- ◊ **Artificial:** Drawing room/classroom
  Technology – Computer

Suggested Teaching Methods

- ◊ **Inquiry-based Learning:** allows learners to explore the questions and problems through investigation and research.
- ◊ **Hands-on Learning:** allow learners to demonstrate how to use the drafting aids
- ◊ **Project-based Learning:** assign learners real-world drafting projects that require the application of learned skills
- ◊ **Collaborative learning method**: Assign activities that require collaboration and communication among learners

Scenario

You have been given two chairs. The backrest of one chair is laying 60^0 to the ground whilst the other is at 90^0 to the ground.

Problem-Posing questions

(i) Which chair would you prefer to sit on? Provide reasons for your choice.

(ii) The concept of a chair's backrest being positioned at either 60° or 90° to the ground introduces the idea of angles in use. What is an angle? How are angles measured? Identify and explain the different types of angles.

Activity process

Exploration

- ◊ Ask learners to explore the term 'angle' and how it can be measured.
- ◊ Let learners research on the types of angles.
- ◊ In groups, assign learners to discuss ways of constructing the following angles; 600, 300,150, 900, 450, 22 ½ 0 and 1200
- ◊ In groups, ask learners to suggest and draw artefacts/products whose design has angles incorporated.
- ◊ After providing various drawings that depict real-world objects with angles incorporated (e.g. swimming pool layout), ask learners to draw these objects.

Feedback and consolidation

- ◊ Learners to make presentations on the term 'angle', and on how it can be measured.
- ◊ Learners to provide feedback on types of angles and on how the following angles can be constructed; 600, 300,150, 900, 450, and 1200
- ◊ Learners to draw artefacts/products whose design has angles incorporated

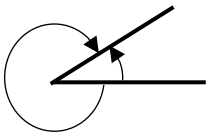
Note to the teacher

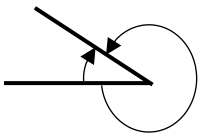
- ◊ Assess collaboration among learners
- ◊ Offer constructive feedback and acknowledge learners' achievements

Suggest Learning Points

Angle

- ◊ An angle is a space obtained between two straight lines when these lines meet.
- ◊ Angles can be measured in either a **clockwise** or **counterclockwise** direction.





Types of angles include;

- ◊ Acute angle – less than 90^0
- ◊ Obtuse angle – greater than 90^0 but less than 180^0
- ◊ Reflex angle – greater than 180^0
- ◊ Right angled - equal to 90^0

Constructing 60^0 angle

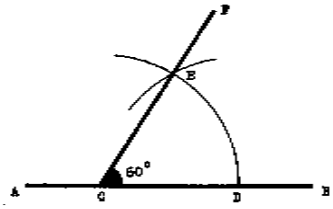
- ◊ Draw a line AB
- ◊ Indicate point C anywhere on AB

Constructing 120^0 angle

The arcs below indicate the process to follow;

◊ With center C and any convenient radius, draw an arc to cut AB at D

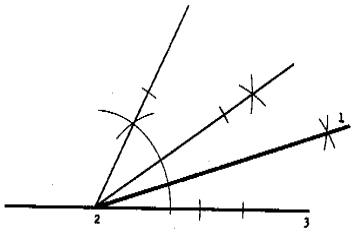
◊ With center D and the same radius, draw an arc to cut the previous one at E



◊ Draw the line from C through E (line **CF**). **FCB** is the required angle.

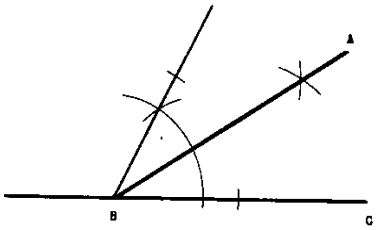
Constructing 15^0 angle

- Construct an angle of 30^0 as above
- Bisect the 30^0 angle
- Angle 1,2,3 is the required 15^0 angle



Constructing 30^0 angle

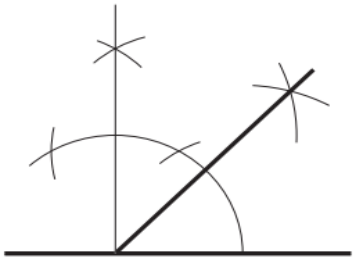
- Construct an angle of 60^0 as above
- Bisect the 60^0 angle



Angle ABC is the required 30^0 Angle

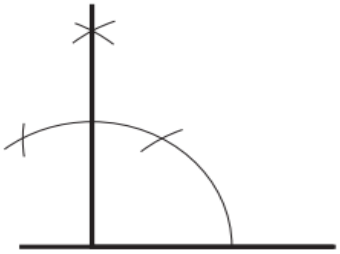
Constructing 45^0 angle

The arcs below indicate the process to follow;



Constructing 90^0 angle

Arcs below indicate the process to follow



Task
Construct the following angles: **135** ^{0}, **105** ^{0}, 97 ½ ^{0}, **82** ½ ^{0} **75** ^{0}, **67** ½ ^{0} , **52** ½ ^{0} , and **37** ½ ^{0}

Expected standard: Angles from given data constructed accurately

Assessment guideline

- ◊ **Formative:** Observation, checklist/worksheet, Q&A, Group discussion
- ◊ **Summative:** Project Based assessment and written exams

Summary: An understanding of angles and their respective construction methods helps one to create varied drawings in graphics.

TOPIC: ENERGY

Introduction

Human beings need energy to live, move and grow. Equally, machines need energy to perform work. "Energy is the ability to do work" and comes in different forms, where each has unique characteristics and application. Work involves the transfer of energy in which an object is moved to a certain distance. Example of work include; moving, lifting, jumping, warming or lighting. Energy cannot be destroyed but can be changed from one form ~~in~~ to another.

Overview

This topic focuses on forms of energy. It discusses various forms of energy used to power our daily activities such as those done in homes, workplaces and industries. These forms of energy come from different sources which are grouped into ***renewable*** and ***non-renewable*** sources. The forms of energy include; potential, kinetic, mechanical, heat, light among others.

General competences:

In this topic, learners are expected acquire the following competences;

- **Analytical thinking**: Learners to analyse the sources of energy, their forms and how they are interconnected
- **Communication:** Learners to share information, ideas and messages on the different forms and sources of energy
- **Creativity and Innovation**: Learners to apply their knowledge on forms of energy to create new solutions that meet the rising demand for sustainable energy
- **Critical Thinking**: Learners to select sustainable and eco-friendly sources of energy for use in different situations.

Key Terms

- **Energy**: Energy is the ability to do work.
- **Renewable energy Sources:** This refers to energy that comes from natural resources, can be replenished over time and are a sustainable way of generating energy.
- **Non-renewable energy Sources:** This is a form of energy that comes from natural resources that cannot be replenished or restored in a short period of time.
- **Potential energy**: Refers to stored energy or energy possessed by an object due to its position.
- **Kinetic Energy**: Refers to the energy an object possesses due to its motion.
- **Carbon print:** refers to the amount of greenhouse gasses particularly carbon dioxide that is released into the environment as a result of human activities

Sub-Topic: - Forms of Energy

Introduction
Energy comes in various forms and can be converted from one form to another. For example, electrical energy can be changed into light, heat or sound energy.

Specific Competence(s)
- **i.** Utilise forms of energy.
- **ii.** Utilise sources of energy

Specific competence 1: Utilise forms of energy

Learning activity 1: Researching forms of energy (*heat, light, sound, chemical, electrical, mechanical…)*

Learning Environment Setup
Create a learning environment that will facilitate the utilisation of different forms of energy. It can be:

- ◊ **Natural –**Field trip to any organized factory/industry dealing with energy
- ◊ **Artificial -**Workshops and laboratories for companies dealing in energy related activities
  -Technological (energy simulation models, videos and apps on energy)

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Posters on forms/sources energy
- ◊ **Checklists:** Printable tasks on forms of energy
- ◊ **Videos:** clips on the forms of energy.
- ◊ **Charts/Flashcards:** Posters on forms of energy
- ◊ **Power point presentations:** computer, projector, printed pictures

Suggested Teaching Methods

- ◊ Hands on activities
- ◊ Inquiry-Based Learning
- ◊ Collaborative Learning
- ◊ Modeling and Simulation
- ◊ Guest Lectures and Workshops

Scenario:

Image you and your friends are stranded on a deserted island after a boat developed a fault. The island has limited resources, and you need to survive for at least a week until help arrives. Your task is to design a sustainable energy system for your island survival camp. You have the following resources available.

(i) Solar panels

(ii) Wind turbines
(iii)A small stream with flowing water
(iv)A limited supply of batteries and electrical wiring
(v) Local materials like wood, leaves and rocks

Problem-Posing Questions

How will you design and implement an energy system that can provide;

1 lighting for your camp at night?
2 power for a water purification system?
3 energy for cooking and heating?
4 a means of communicating with the people home?

Activity process

Exploration

- ◊ In groups, ask learners to explore about forms of energy
- ◊ Learners to discuss the advantages and disadvantages of each form of energy explode
- ◊ Learners to investigate the interrelationship between various forms of energy
- ◊ Task learners to identify and cutout pictures that show different forms of energy. Allow them to glue those pictures in their exercise books

Feedback and Consolidation Session

- ◊ Each group to discuss and share their findings on the forms of energy with the class.
- ◊ Learners to present advantages and disadvantages of different forms of energy
- ◊ Learners to conduct experiments to show the different forms of energy

Note to the teacher*:*

- Facilitate the discussions
- Assess collaboration, communication and critical thinking as learners engage in experiments
- Offer constructive feedback and acknowledge learners' achievements
- Correct the misconceptions and consolidate on the exploded solutions.

Leaning activities 2 &3

2. Discussing uses of different forms of energy
3. Utilising various forms of energy in real life situations

Learning Environment Setup

Create a learning environment that will facilitate the utilisation of different forms of energy. It can be:

- ◊ **Natural –**Field trip to any organized factory/industry dealing with energy

- **Artificial -**Workshops and laboratories for companies dealing in energy related activities

  -Technological (energy simulation models, videos and apps on energy)

Suggested Teaching and Learning Materials

- **Visuals:** Posters on forms/sources energy
- **Checklists:** Printable tasks on forms of energy
- **Videos:** clips on the forms of energy.
- **Charts/Flashcards:** Posters on forms of energy
- **Power point presentations:** computer, projector, printed pictures

Suggested Teaching Methods

- **Inquiry-Based Learning**: Learners to conduct research on uses of various forms of energy
- **Collaborative Learning**: Assign learners group tasks to demonstrate the application of energy
- **Guest Lectures and Workshops:** Invite experts to make presentations on energy and its diverse applications

Scenario:

Anastasia wakes up early to get ready for work. She begins her morning routine which involves:

1. Taking a shower
2. Brushing her teeth
3. Making breakfast
4. Charging her phone
5. Getting dressed

Problem-Posing Questions

What forms of energy is being applied in each of the activities above.

Activity process

Exploration

- In groups, learners to explore the uses of various forms of energy
- Learners to explore the dangers associated with using various forms of energy
- Learners to make flashcards/posters/charts on applications of various sources of energy
- Learners to compile devices that utilise energy or processes that require the use of energy in their environment.

◊ Learners to analyse processes (at home/school) that use energy and determine the form of energy involved.
◊ Learners to discuss safety precautions to be taken when using various forms of energy.

Note:

- *Ensure learners are interacting and engaging as they explore forms of energy.*
- *Encourage critical thinking as the learners interact and engage on the use of forms of energy.*

Feedback and Consolidation Session

◊ Groups to present their findings on uses of various forms of energy
◊ Learners to make presentations on dangers associated with exposure to some forms of energy
◊ Learners to discuss and share information on uses of various forms of energy
◊ Learners to demonstrate the utilisation of various forms energy
◊ Learners to select appropriate forms of energy for use in real-life situations
◊ Learners to apply safety considerations when utilising different forms of energy

Note to the teacher:

◊ Assess individual learners' participation and critical thinking in group tasks
◊ Offer constructive feedback and acknowledge learners' achievements
◊ Correct the misconceptions and consolidate on the learners' presentations
◊ Create room for continuity and extension (*utilisation of forms of energy in real-life situations*)

Suggested Learning Points

◊ **Energy**: Energy occurs in two forms **Potential** and **Kinetic**. Potential energy is the stored energy or energy possessed by an object due to its position, whilst Kinetic energy is the energy an object has as it moves. **Kinetic energy** is used in the transportation systems such as cars, airplanes and bicycles while **Potential energy** is used in the storage systems, such as batteries and water tanks.
◊ **Heat Energy:** This form of energy results from the movement of tiny particles called atoms, molecules or ions in solids, liquids and gases. It can be released by burning substances such as wood, coal, paraffin or gas. Heat energy can be transferred from one object to another by conduction, radiation or convection. For instance, warming yourself using a heater or firewood. The transfer or flow due to the difference in temperature between the two objects is called heat

◊ **Light Energy:** Light energy is a form of electromagnetic radiation that is visible to the human eye. When you light a candle in the dark, the room becomes lit. Light energy is essential for many biological, chemical and physical processes.
◊ **Solar energy**: This is radiant light from the sunlight
◊ **Chemicals energy**: This is energy from substances such as foods and fuels

- ◊ **Mechanical energy**: This is energy from moving parts
- ◊ **Nuclear energy**: This is energy from nuclear reactions in the nucleus of atoms
- ◊ **Magnetic energy**: This is energy from dipole arrangements in substances
- ◊ **Sound energy**: This is energy produced by vibrating bodies
- ◊ **Electrical energy**: This is energy transferred from one point to another by moving charges
- ◊ **Light energy**: This is energy that is from electromagnetic waves,
- ◊ **Thermal energy**: Thermal energy is the energy possessed by an object/system by virtue of its temperature. When there is a temperature difference between two bodies, thermal energy flows from a higher temperature body to a lower temperature body.

Task: Design and make a simple solar powered fan that demonstrates the conversion of solar energy (light energy) into electrical energy and electrical into kinetic energy (motion energy)

(Materials: Small solar panel, DC motor, far blades, jumper wires, electrical tape, scissors)

Procedure

- ◊ Connect the solar panel to the DC motor using jumper wires
- ◊ Attach the fan blade to the motor shaft.
- ◊ Place the solar panel in the direction of sunlight.
- ◊ Observe the fan blades spinning, demonstrating the conversion of solar energy into kinetic energy.

Assessment questions

1. What type of energy is produced by the DC motor
2. Explain how the intensity of sunlight affect the speed of the fan blades?

Expected standard: Forms of energy utilised accordingly

Assessment Guidelines: Provide an assessment that clearly reflects the specific or key competences to be attained in this topic**.** Assessment shall be done using the following methods:

Formative assessment

- ◊ Observe learner's behavior and engagement as they discuss forms of energy.
- ◊ Provide Quiz and classroom work (exercise) to the learners to assess learner's understanding of forms of energy.
- ◊ Provide a worksheet where learners can practice converting between forms of energy
- ◊ Use peer assessment: allowing learners to review and provide feedback on each other's work on forms of energy
- ◊ Assign a group project where learners have to research and present on a specific form of energy

Summative Assessment

- ◊ Administer a comprehensive test to assess learners understanding of different forms of energy and their uses.
- ◊ Project: Learners to design a project that utilises a form of energy.
- ◊ Written tests.

Summary: Energy is an essential part of our daily lives and has numerous applications. Energy is used for lighting, heating, manufacturing and used in many sectors that support life.

TOPIC: ENTREPRENEURSHIP

Introduction

Entrepreneurship is the process of designing, launching, and running a business or enterprise, often with the goal of earning a profit. It involves taking calculated risks, innovating, and solving problems to create value for customers and stakeholders. For secondary school learners, exploring entrepreneurship opens doors to limitless opportunities, whether it is inventing new products or improving existing products or services. It fosters problem-solving skills, critical thinking, and resilience, essential attributes for the innovators of tomorrow. By learning how to turn concepts into marketable solutions, learners not only gain valuable entrepreneurial skills but also develop a mind-set that can lead to success in any career path.

Overview:

In this module, this topic covers only one subtopic (the entrepreneur). The topic focuses on identifying entrepreneurial opportunities in Design and Technology and generating a business idea. Further, the topic provides a way of thinking that transforms challenges into opportunities and ideas into impactful solutions. For learners, it serves as the perfect complement to their creativity, enabling them to cease every opportunity into ventures that address critical challenges, improve lives and shape the future.

General competences

This topic is anchored on the following competences:

- **Collaboration:** Learners work with others to explain qualities of a good entrepreneur.
- **Communication:** Learners to listen to customer needs.
- **Creativity and Innovation:** Learners to come up with business ideas and explain how to sustain them.
- **Financial Education:** Learners will learn how to cost a product, budget for a product and price a product.
- **Problem Solving:** Learners to understand customer needs and market gaps in creating valuable products.

Key Terms

- **Business:** This is a combination of factors of production to make products which satisfy peoples wants.
- **Capital:** This is the finance, machinery and equipment needed for the manufacture of products.
- **Entrepreneur:** A person who organizes, operates and takes a risk in order to start up a new business.
- **Enterprise:** This is the skill and risk-taking ability of a person who brings resources together to produce products.
-

Subtopic: The Entrepreneur

Introduction

Entrepreneurs are essential drivers of economic growth, job creation and societal innovation, shaping industries and transforming communities. They operate in various fields from technology to healthcare leaving a lasting mark through their determination. In many countries, small businesses produce a lot of goods and services and create a more jobs compared to big companies. In Zambia, we have more women entrepreneurs who fend for themselves.

Specific Competence(s)

- ◊ Identify entrepreneurial opportunities in Design and Technology.
- ◊ Generate a business idea.

Specific Competence 1: Identify entrepreneurial opportunities in Design and Technology.

Learning Activity 1: Discuss attributes of an entrepreneur

Learning Environment Setup

Create a learning environment that will facilitate a discussion on attributes of a good entrepreneur. This can be:

- ◊ **Natural-** Interview successful business people in the community.
- ◊ **Artificial-** Classroom, workshop
  -Technology: Videos, Simulated scenarios showing attributes of a good entrepreneur.

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Poster with attributes of a good entrepreneur.
- ◊ **Videos:** Clips on attributes of a good entrepreneur.
- ◊ **Worksheet:** Attributes of a good entrepreneur.
- ◊ **PowerPoint:** Computer, projector.

Suggested Teaching Methods

- ◊ Hands on learning
- ◊ Inquiry based learning
- ◊ Collaboration

Scenario:

You are a board member for a bank that gives loans to small companies. Your bank has received two business proposals from school leavers aspiring to be entrepreneurs, and you need to decide which one to fund.

Entrepreneur A;

- ◊ has a strong passion for the business idea.
- ◊ has conducted thorough market research and analysis.
- ◊ has a clear vision for the company's future.
- ◊ has a proven track record of leadership and management.

- ◊ is willing to take calculated risks.

Entrepreneur B

- ◊ has a unique and innovative business idea.
- ◊ has strong network contacts and partners in the industry.
- ◊ is highly adaptable and able to pivot when necessary.
- ◊ has a solid business plan and financial projections.
- ◊ is driven by a desire to make a profit quickly.

Problem posing:

1. Which entrepreneur would you fund and why?
2. What attributes do you think are most important for a successful entrepreneur to possess?

Activity process

Exploration

- ◊ Ask learners to share what they already know on entrepreneurship
- ◊ Using handouts present the attributes of an entrepreneur
- ◊ Assign each group a case study.
- ◊ Each group to analyse the case study and identifies the entrepreneurial attributes.
- ◊ Each learner to reflect on their own strength and weaknesses in relation to the entrepreneurial attributes.

Feedback and Consolidation Session

- ◊ Identify opportunities for further development.
- ◊ Document the good attributes of an entrepreneur.
- ◊ Share their documents.
- ◊ Reflect on learner's performance and understanding of the entrepreneurial attributes.
- ◊ Gather feedback from learners on the effectiveness of the lesson.
- ◊ Interpret the feedback from the learners to identify areas for improvement.

Suggested Learning Points

Attributes of a good entrepreneur

Successful entrepreneurs are believed to have certain key characteristics that make them successful. The characteristics of a good entrepreneur are as follows:

- ◊ **Open to criticism**: Listening to the comments of the customers and responding positively.
- ◊ **Creative and innovative**: Always thinking and doing things in new ways.
- ◊ **Hardworking**: Even willing to work long hours to ensure that their vision is realized.
- ◊ **Independent and Organised**: Being able to make own decisions and doing thing things in an orderly manner.
- ◊ **Responsive to feedback**: This means acting on customers' complaints, competition and the environment in order to improve on the goods and services being offered.

- ◊ **Risk taker**: Taking prudent risks is necessary for the business to progress.
- ◊ **Action oriented**: This means acting quickly to solve problems
- ◊ **Flexible**: Being able to adjust to fluctuating economic conditions
- ◊ **Persistent and determined**: Never giving up easily in developing strategies to change their vision into reality.
- ◊ **Positive thinker and highly optimistic**: Thinking and believing that the future will be favourable for business.
- ◊ **High achiever**: Having a strong desire to achieve high goals in any business undertaken.
- ◊ **Good organizer**: Bringing together all the required resources to produce goods and services.
- ◊ **Good foresight**: Being able to know and understand future market conditions, customer preferences and technological developments so as to make timely decisions and act accordingly.

Task
Learners to document attributes of a successful entrepreneur

Assessment Guidelines

- ◊ Learners to provide a list of entrepreneurial attributes.
- ◊ Assign a group task (e.g., designing flashcards attributes of an entrepreneur).
- ◊ Observe leadership, teamwork, and adaptability

Summary

Attributes of an entrepreneur

- ◊ Creative
- ◊ Risk taker
- ◊ Self-motivated
- ◊ Problem solver
- ◊ Good Communicator
- ◊ Adaptable
- ◊ Resilient
- ◊ Passionate
- ◊ Open minded
- ◊ Goal-Oriented

Learning Activity 2: Exploring ways of strengthening entrepreneurial abilities

Learning Environment Setup
Create a learning environment that will facilitate ways of strengthening entrepreneurial abilities in Design and Technology. These can be:

- ◊ **Natural-** Real World Business exposure.
- ◊ **Artificial-** Interactive classrooms.

  -Technology: Videos, Digital platforms.

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Poster on how to strengthen entrepreneurial abilities.
- ◊ **Videos:** Clips on entrepreneurship, business simulation games.
- ◊ **Worksheet:** How to strengthen entrepreneurial abilities.
- ◊ **PowerPoint:** Computer, projector.

Teaching Methods:

- ◊ Hands on learning
- ◊ Inquiry based learning
- ◊ Collaboration

Scenario:

You are a business consultant who specializes in helping entrepreneurs develop their skills. You have been approached by a struggling entrepreneur, who owns a small welding workshop. The entrepreneur has excellent welding skills, but is struggling to manage finances, market the business and manage the employees.

Problem posing questions

1. Develop a plan to help the entrepreneur strengthen entrepreneurial abilities.
2. What skills does the entrepreneur need to acquire?
3. What strategies can you recommend to overcome the challenges?

Activity process

Exploration

- ◊ Ask learners to share their understanding of entrepreneurship.
- ◊ Present strategies for strengthening entrepreneurial abilities.
- ◊ Put learners in groups and give them a challenge.
- ◊ Provide guidance and facilitate discussion.
- ◊ Each learner to reflect on their own entrepreneurial abilities.

Feedback and Consolidation Session

- ◊ Reflect on the learners' performance and understanding of the entrepreneurial abilities.
- ◊ Gather feedback from learners.
- ◊ Analyse the learners action plans.
- ◊ Interpret the feedback from learners
- ◊ Draw conclusions and make recommendations.

Suggested Learning Points

Ways of strengthening Entrepreneurial abilities

Entrepreneurs play various roles and it may not be possible for them to be good at all of them. There is, therefore, need to polish the areas in which they lack expertise or experience in order to strengthen their abilities. Entrepreneurs can strengthen their abilities through the following ways:

- ◊ Receiving help from people such as family members, friends and other business people.
- ◊ Observing successful entrepreneurs, talking to them and getting to understand what makes them successful.
- ◊ Training to improve one's skills and learn new ones.
- ◊ Reading books that are relevant to one's type of business and gathering more knowledge on entrepreneurial skills.
- ◊ Observing activities in the community to help the entrepreneur understand and get an insight on how to serve the needs of the community.

Assessment Guidelines

- ◊ Assess learners understanding of entrepreneurial concepts.
- ◊ Learners ability to apply entrepreneurial skills.
- ◊ Assess learners' competence in communicating their idea.

Formative

- ◊ Checklists
- ◊ Quizzes
- ◊ Discussions
- ◊ Presentations

Summative

- ◊ Assignments
- ◊ Projects
- ◊ Written tests

Learning Activity 3: Identifying entrepreneurial opportunities in Design and Technology.

Learning Environment Setup

Create a learning environment that will facilitate identification of entrepreneurial opportunities in Design and Technology. These can be:

- ◊ **Natural:** land
- ◊ **Artificial:** Workshop, workroom

-Technology: equipment, tools

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Posters with entrepreneurial opportunities.
- ◊ **Videos:** Instructional entrepreneurship opportunities.
- ◊ **Worksheet:** Entrepreneurial opportunities.
- ◊ **PowerPoint:** Computer, Projector.

Teaching Methods:

- ◊ Hands on learning
- ◊ Inquiry based learning
- ◊ Collaboration

Scenario:

Imagine you and your classmates are part of a community project aimed at promoting metal recycling. The local council has asked for ideas on how to encourage residents and businesses to recycle their metal waste effectively.

Problem posing questions

1. How could you turn this initiative into a small business? Consider aspects like collection, sorting and selling recycled metal.
2. What challenges might you face in starting this business and how could you overcome them.

Activity process

Exploration

- ◊ Provide real world examples of entrepreneurial opportunities in Design and Technology.
- ◊ Discuss the importance of problem identification in identifying entrepreneurial opportunities.
- ◊ In groups ask learners to brainstorm entrepreneurial opportunities in Design and Technology.
- ◊ Introduce SWOT analysis.

Feedback and Consolidation Session

- ◊ Review the key concepts of entrepreneurial opportunities.
- ◊ Provide real world examples of entrepreneurial opportunities in Design and Technology.
- ◊ Facilitate a group discussion on the key concepts, encouraging learners to reflect on their own experiences and ideas.
- ◊ Provide a design challenge that requires learners to identify entrepreneurial opportunities.
- ◊ Allow learners to develop their projects.

Suggested Learning Points

Entrepreneurial opportunities are chances to identify problems, create innovative solutions, and transform these ideas into products or services that address real world needs. Utilizing these opportunities especially in the field of Design and Technology involves combining creativity, technical skill and business ideas to develop marketable solutions.
Entrepreneurial opportunities often arise from unmet needs or gaps in existing products. To identify them:

- ◊ Observe Problems: Pay attention to every day challenges faced by the community.
- ◊ Analyse Trends: Look at emerging technologies, sustainable practices and popular demands.
- ◊ Evaluate ideas: Determine if the solution has practical and financial potential.
- ◊ Entrepreneurs use their skills and resources to develop solutions. In Design and Technology this could mean:
- ◊ Using technical skills like crafting to create products.
- ◊ Applying problem-solving and innovation to develop unique efficient products.

Task: Explore the ability of an entrepreneur to succeed in today's business in Zambia, considering the challenges of risks, being adaptable and decision-making. How can entrepreneurs balance the need to withstand the pressure to innovate and consider risks involved in the changing business environment?

Expected Standard: Entrepreneurial opportunities in Design and Technology identified accordingly

Assessment Criteria

- ◊ Understanding of entrepreneurial attributes
- ◊ Ability to analyse complex relationships between factors
- ◊ Critical thinking and evaluation skills
- ◊ Effective communication skills

Summary: At its core, entrepreneurship is about fostering a mind-set of initiative, problem solving and resilience. In the context of Design and Technology entrepreneurship involves teaching learners how to identify opportunities, analyse risks, develop prototypes and turn their ideas into tangible solutions. This encourages the learners to think beyond the classroom, considering the practical, economic and social impacts of their designs. Entrepreneurship creates jobs. A small firm can provide work for one or two people. As it grows more can be employed.

Specific Competence 2: Generate a business idea

Learning Activity 1: Brainstorming on business ideas

Learning Environment Setup

Create a learning environment that will facilitate critical thinking on business ideas. It can be:

- ◊ **Natural:** Outdoor
- ◊ **Artificial:** workroom, workshop.
  -Technology: Equipment

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Posters on a business idea
- ◊ **Videos:** Instructional clip
- ◊ **Worksheet:** Fill in the blank spaces
- ◊ **PowerPoint:** Computer, projector

Teaching Methods

- ◊ Hands on learning
- ◊ Inquiry based learning
- ◊ Collaboration

Scenario

Your community has many small businesses that sell hand made products such as spoons, cups and plates. However most of these products are packed in plastics, which contribute to environmental pollution. Some customers have also complained that the packaging is not attractive enough. As a prospective entrepreneur with a passion in business, you and your friends have been challenged to come up with a business idea that will help small businesses pack their products.

Problem posing Questions

- ◊ Brainstorm suggestions for a new enterprise.
- ◊ Suggest ways in which you can start your own small enterprise in product packaging.

Activity process

Exploration

- ◊ In groups learners brainstorm on suggestions for a new business.
- ◊ Sources of business ideas.
- ◊ Learners in groups discuss their business ideas.
- ◊ Research on their business ideas.
- ◊ Suggest a way of starting own enterprise.

Feedback and Consolidation Session

- ◊ Make conclusions on researched business ideas.
- ◊ Report to the class on the business chosen and give reasons.
- ◊ Consolidate the definition of an entrepreneur as a class.

Suggested Learning Points

Business Idea

A business idea is anything that you can think of doing to make money. It is in the mind of the entrepreneur and it can be turned into a prospective business. A business idea describes everything about the business to be formed such as location, products, market, type of business and its objectives.

Sources of business Ideas

- ◊ Newspapers, magazines and journals.
- ◊ Shows and trade fare exhibitions where entrepreneurs can get ideas from goods under display.
- ◊ Books and magazine articles with business information
- ◊ Vocational training and experience. For example, teachers can have ideas about opening and running a school from their training and experience as teachers.
- ◊ Observing existing business trends and watching out for weaknesses and strengths so as to see where one can come in to gap the bridge.
- ◊ Media like television, radio and the internet can have good business ideas.
- ◊ Friends and family may have ideas but may not be in a position to start their own business.
- ◊ Listening to customer complaints may provide ideas of new business to address their problems.
- ◊ Ideas can come from oneself through the process of creativity.
- ◊ A gap in the market can provide ideas which can be converted into a business to fill such a gap.

Learning Activity 2: Assessing a business idea using SWOT analysis and PMI methods

Learning Environment Setup

Create a learning environment that will facilitate critical thinking on business ideas. It can be:

- ◊ **Natural:** Real world business set up, conferences
- ◊ **Artificial:** Role play

-Technology: Games, machines, cloud based platforms

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Poster with business ideas
- ◊ **Videos:** Clip on a business conference
- ◊ **Worksheet:** Showing business ideas

- ◊ **PowerPoint:** Computer, Projector

Teaching Methods:

- ◊ Hands on learning
- ◊ Inquiry based learning
- ◊ Collaboration

Scenario

You are a student in a Design and Technology class, and you have designed and made a wooden pen holder in the school workshop. You think it's a great product and want to explore the possibility of making more to sell to your fellow students.

Problem posing

Using the SWOT analysis and PMI methods, assess the viability of producing and selling wooden pen holders in the school workshop.

Activity process

Exploration

- ◊ Brainstorm business ideas related to Design and Technology focusing on products that can be made in the school workshop.
- ◊ Design and plan their chosen product in the workshop.
- ◊ Introduce SWOT analysis method.
- ◊ Learners to conduct a SWOT analysis of their product.

Discuss findings in groups.

- ◊ Introduce the PMI method.
- ◊ Evaluate their product using PMI method.

Feedback and Consolidation Session

- ◊ Review of SWOT analysis. (Group discussion, Guiding the learners)
- ◊ Review of the PMI method. (Group discussion, Guiding the learners)
- ◊ Evaluation and Reflection
- ◊ Offer constructive feed and acknowledge learners' contributions

Suggested Learning Points

SWOT Analysis

The above acronyms are short for Strengths, Weaknesses, Opportunities and Threats. It is a marketing tool used to analyse the organization and its marketing environment. A business idea, whether for a new business or an old one, must be analysed using SWOT analysis.
Strengths and Weaknesses of a new idea
These are internal factors that an organization can easily control. Weaknesses can easily be turned into strengths.

Strengths could be:

- A new innovative product or service
- Good location for the business
- Quality goods and services
- Necessary skill, modern machinery and equipment to run the business
- A good name of the business (goodwill)

Weaknesses could be:

- Lack of needed skills to run the business.
- Damaged reputation.
- Inadequate capital
- Political instability
- Products not well known

Opportunities and Threats of a new idea

These are external factors which are not controllable. An opportunity is a favourable condition in the market environment that could benefit the business. On the other hand, a threat is a bad condition in the market that could lead to the failure of a business.

Opportunities could be:

- Poor facilities being offered to customers
- Poor quality products and unaffordable prices
- Insufficient quantities or unavailability of products
- A new market coming up, e.g. internet
- Market vacated by competitor gone bankrupt
- Little or no competition
- Demand for a new product

Threats could be:

- New competitor in your market
- Political change, i.e., change in government
- Tax introduced on your product or service
- Imported cheaper goods from other countries

Importance of SWOT Analysis

It is important for any business to conduct a SWOT analysis for their business ideas for the following reasons:

- To see if such ideas are feasible
- To ensure that weaknesses are turned into strengths
- For a business to be successful or profitable

PMI

PMI analysis is a decision-making tool used to evaluate ideas, options or solutions.

How to conduct a PMI analysis

- Define the problem or opportunity.
- Generate ideas.

- ◊ Evaluate each idea.
- ◊ Weigh the options.
- ◊ Make a decision.

Benefits of PMI

- ◊ Structured evaluation.
- ◊ Balanced perspective.
- ◊ Encourages creative thinking.

Learning Activity 3: Selecting a viable business opportunity.

Learning Environment Setup

Create a learning environment that facilitates the selection of a viable business opportunity. It can be:

- ◊ **Natural:** Outdoor
- ◊ **Artificial:** Marketplace, workshop, School tuck-shop
  -Technology: Online learning platforms.

Suggested Teaching and Learning Materials

- ◊ **Visuals:** Analysis templates, diagrams
- ◊ **Videos:** Clip on a Business.
- ◊ **Worksheet:** Selecting a viable business.
- ◊ **PowerPoint:** Computer, Projector.

Teaching Methods:

- ◊ Hands-on learning
- ◊ Inquiry-based learning
- ◊ Collaboration

Scenario:

Imagine you are a learner at one of the secondary schools in Zambia. You want to start a business to sell products made from the Design and Technology workshop to sell to the teachers at your school.

You have three business ideas:

1. **Stools**: Design and make customized stools using wood.
2. **Window frames**: Design and make window frames using metal.
3. **Test tube racks**: Design and make test tubes using plastic.

Problem posing

You need to choose one business idea that you think will be most viable.

Questions to Consider

1. Which product do you think teachers will buy the most?
2. Which product is the easiest to make?
3. Which product can you sell at a competitive price?

Activity process

Exploration

- ◊ Ask learners if they have ever thought of starting their own business.
- ◊ Present the scenario and ask learners to identify three business ideas.
- ◊ Learners in groups to evaluate the three business ideas using the following criteria:
  - (i) Market demand
  - (ii) Production cost
  - (iii) Competition
  - (iv) Profit potential
- ◊ Each group to present their decision and explain why they choose that business idea.
- ◊ Encourage other groups to ask questions

Feedback and Consolidation Session

- ◊ Summarize the key points from the lesson.
- ◊ Learners to reflect on what they learned.
- ◊ Provide feedback and guidance.

Suggested Learning Points

A Business idea is a new business enterprise that entrepreneurs undertake to make a profit. Business ideas involve developing a business model, acquiring human and other required resources and providing products or services to customers.

Steps to selecting a viable Business opportunity.

- ◊ Identify Business ideas
- ◊ Evaluate market demand
- ◊ Assess Financial viability
- ◊ Evaluate production costs and logistics
- ◊ Consider competitive advantage
- ◊ Evaluate risk and challenges
- ◊ Seek feedback and guidance
- ◊ Make a decision

Assessment Activities

1. Observe learner participation during group discussion and presentation.
2. Evaluate student understanding through a short class discussion.

Task: Generate a Business Idea in either Carpentry or Metal Fabrication

You are an entrepreneur with a passion for Carpentry or Metal Fabrication. Your goal is to generate a business idea taking advantage of your skills and expertise gained in Design and Technology in either.

Questions:

1. Develop a business idea that addresses the opportunity in the market.
2. Conduct a SWOT analysis to evaluate the potential success of your business idea.
3. Develop a business plan that outlines your business idea, target market, marketing and sales strategies, financial projections, and operational plan.
4. Prepare a presentation of your business idea to potential investors or stakeholders.

Assessment Criteria:

1. Business Idea Generation (30%): Originality, feasibility, and potential success of the business idea.
2. SWOT Analysis (20%): Thoroughness, accuracy, and relevance of the SWOT analysis.
3. Business Plan (30%): Completeness, coherence, and effectiveness of the business plan.
4. Presentation (20%): Persuasiveness, clarity, and confidence of the presentation.

Relevance: Design and Technology - Carpentry and Metal Fabrication - requires learners to apply their skills.

Authenticity: Real-life scenario, where entrepreneurs must generate business ideas, conduct market research, and develop business plans.

Complexity: It has components - business idea generation, SWOT analysis, business plan development, and presentation. Learners demonstrate creativity, critical thinking, problem-solving and communication.

Depth: It requires learners to demonstrate understanding of the business planning process, market research, and financial projections. Learners will also demonstrate the ability to analyse complex data, identify opportunities and threats, and develop effective marketing and sales strategies.

Expected standard: Business idea generated successfully

Assessment Guidelines

Formative

(i) **Presentations:** Assess communication and collaboration skills during presentations on importance of SWOT and PMI analysis tools when choosing a business

(ii) **Checklists:** use checklist to assess understanding of PMI and SWOT tools

(iii) **Quizzes:** Assess learners' mastery of content through question and answer

(iv) **Observatio**n: Observe student engagement during learning activities

Summative Assessment:

- ◊ Project: Conduct a SWOT analysis and PMI evaluation of a business idea.
- ◊ Written exercises**:** End of topic exercises

Summary: In this topic, you have learnt how to;

- ◊ assess a business idea using the SWOT analysis method
- ◊ assess a business idea using the PMI methods
- ◊ Selecting a viable business opportunity
- ◊ Generate a business idea.

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APPENDIX 1

Assessment of Tasks

In this module, the teacher will give the suggested **tasks** after a series of learning activities for each **Specific Competence**. Tasks are meant to help the teacher evaluate whether learners are meeting the **Expected Standards** as outlined in the Design and Technology syllabus. Therefore, tasks are designed to bring about acquisition of the expected specific competence.

All tasks, either in this module or those to be crafted by the teachers should meet the following criteria:

a) **Relevance**: the task should be in tandem with the specific competence
b) **Authenticity:** It should reflect a real-life situation that will require *application knowledge*
c) **Complexity**: It should require learners to demonstrate higher-order thinking and problem-solving.
d) **Depth**: It should provoke learners to explore the task in-depth and evoke their attitude or demonstrate mastery of knowledge or skill.

EXAMPLE OF A TASK:

DESIGN AND CONSTRUCT A PENCIL RACK

You have a lot of pens, pencils, crayons and markers in class while having Graphic Communication lessons and at times they drop on the floor; sometimes making it difficult to use them. Using available tools, design and make an item, that you will use to keep pens, pencils and markers preventing them from falling to the floor.

Question:

1. Design and make an item to keep pencils, pens and other items.
    a) Factors to consider - joint strength, durability, and aesthetic appeal
    b) Suitability of the material
    c) Hand tool skills: Demonstrate proficiency in using hand tools, including:
    d) Precision and accuracy: Achieve precise and accurate joints, demonstrating attention to detail and quality craftsmanship.
2. Drawing: design and construction process, including measurements, and notes on tool usage and techniques.

This task meets the criteria:

1. **Relevance:** Construction industry and traditional craftsmanship.
2. **Authenticity:** Real-life scenario, requiring learners to apply skills and knowledge in a practical
3. **Complexity:** involves design, material selection, hand tool skills and joint construction.
4. **Depth:** requires learners to demonstrate skills, precision, accuracy attention to detail and knowledge

Assessment Criteria:

1. **Design** (20%): Effectiveness of design, consideration of factors and quality of planning
2. **Use of hand tool skills** (40%): Proficiency in using hand tools, precision, and accuracy
3. **Product quality** (20%): Strength, durability, and aesthetic appeal of the joint
4. **Drawing of the Rack** (20%): Quality of drawing, clarity, and effectiveness of communication

Some assessments will focus on **attitudes** of the learners e.g. wearing of attire in the workshop, care for the environment and many other many others. Teachers are encouraged to pay particular attention to these details as the competence is made up of knowledge, skills and attitude.