Technology and Industrial Arts

Communication Technology

Junior High

Grade 9

Teacher Guide

Standards-Based

Department of Education

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Contents

Acronyms

AAL	Assessment as Learning
ARS	Audience Response System.
AFL	Assessment for Learning
AOL	Assessment of Learning
BoS	Board of Studies
CDD	Curriculum Development Division
CP	Curriculum Panel
DA	Diagnostic Assessment
IHD	Integral Human Development
GoPNG	Government of Papua New Guinea
KSVA	Knowledge Skills Values and Attitudes
MTDG	Medium Term Development Goals
NDoE	National Department of Education
OBC	Outcomes-Based Curriculum
OBE	Outcomes-Based Education
PNG	Papua New Guinea
SAC	Subject Advisory Committee
SBA	Standards-Based Assessment
SBC	Standards-Based Curriculum
SBE	Standards-Based Education
SCG	Subject Curriculum Group
STEAM	Science, Technology, Engineering, Arts and Mathematics
SRS	Student Response System
UOW	Unit of Work

Secretary's Message

The ultimate aim of Standards-Based Education in Papua New Guinea (PNG) is to prepare students for careers, higher education, and citizenship. This means that education should focus on developing and equipping students with essential knowledge, skills, values, and attitudes that they can use in all aspects of their lives. Education must also aim to motivate and prepare students to pursue Science, Technology, Engineering, Arts, and Mathematics (STEAM) courses in higher education institutions and pursue careers in STEAM related fields.

The Technology and Industrial Arts subject has 5 strands with their own teacher guides developed and this Communication Technology Teacher Guide is one of them. Communication Technology is a significant curriculum to develop proficiency and competency in students to be confident, efficient and effective users of technology in understanding software applications, networks and communication, security and safety protocols and the internet of things. However, it is equally important for students to understand technology, its impacts and implications and make decisive and collaborative decisions that will enable themselves to utilise technology more to their advantage.

Technology and Industrial Arts as a subject of which Communication Technology is a strand, is envisioned to benefit students in enabling them to utilise technology knowledge, skills, values and attitudes, and systems and processes to solve problems using the design process in a methodical and precise manner to innovate and invent design solutions. The integration of STEAM in the teaching and learning of Communication Technology will instill in students the abilities and capabilities to be highly proficient and competent end users and possibly creators of technology as STEAM is an integral component of the core curriculum.

Teachers are encouraged to read this teacher guide carefully to become familiar with the content so that they can be confident to use the new concepts and strategies as well as teach the content well. They can also adjust to suit the needs of the students.

I commend and approve this Grade 9 Technology and Industrial Arts: Communication Technology Teacher Guide to be used in all high schools throughout Papua New Guinea.

.....
UKE W. KOMBRA, PhD.

Secretary for Education

Introduction

The strand Communication Technology in the Technology and Industrial Arts subject aims to help students become competent and confident users of communication and technology, who can make efficient, effective and creative use of application software in their everyday activities. It further encourages them to individually and collaboratively apply systems thinking to monitor, analyse, predict and shape the interactions within and between information systems and the impact of these systems on individuals, societies, economies and environments. It embraces the development in technology and emerging technologies using software and applications, safely, ethically and with greater responsibility.

The study of Communication Technology will enhance the students‘ knowledge to recognize intellectual property, apply digital information, security practices, and personal security protocols and further identify the impacts of communication technology in society. It also aims to provide lifelong skills and opportunities for students to live a productive life as well as a career or pursuing further learning. In the 21st Century, it is important to recognise that technology has become part of the educational process for all age levels and should be viewed and taught as a tool for problem solving and decision-making. Students should be encouraged to analyse, synthesise and evaluate situations at home, and school, thereby, apply technology to complete tasks efficiently and effectively and be prepared for the future in the face of a constantly changing technology landscape.

Students‘ employability will be enhanced through the study and application of STEAM principles. STEAM is an integral component of the core curriculum. It is envisioned that the study of STEAM will motivate students to take up academic programs and careers in STEAM related fields. STEAM has been embedded in the Technology and Industrial Arts: Communication Technology curriculum.

Teachers of Communication and Computer Technology strands will plan and program the two strands for 13 weeks on a rotational basis with the other 3 strands as they are taught concurrently, hence the total coverage of learning Technology and Industrial Arts as a subject. The learning integration is more relevant including the STEAM approach to teach the essential knowledge, skills, values and attitudes, and processes. Technology and Industrial Arts: Communication Technology is to be timetabled for 200 minutes (5 periods) per week in junior high school.

Structure of the Teacher Guide

The Communication Technology Strand Teacher Guide comprises four main sections that provide essential information that all teachers should know and do to effectively implement the Communication Technology curriculum.

1. General Information of the Subject/Strand

The general information section of the Teacher Guide informs teachers on the Communication Technology Strand under the following headings below;

- Introduction of the Strand Teacher Guide
- Structure of the Strand Teacher Guide
- Purpose of the Strand Teacher Guide
- How to use the Strand Teacher Guide

2. Teaching and Learning Section

The teaching and learning section of the Teacher Guide informs and guides teachers to apply the teaching and learning theories, principles, pedagogies and practices in planning, programing, teaching and assessing students. They are outlined in the headings bulleted below;

- Syllabus and Teacher Guide Alignment
- Learning and Performance Standards
- Core Curriculum
- Science Technology Engineering Arts Mathematics (STEAM)
- Curriculum Integration
- Essential Knowledge, Skills, Values and Attitudes
- Teaching and Learning Strategies
- Strands, Units and Topics
- Sample SBC Lesson Plans

3. Assessment Section

The assessment section of the Teacher Guide informs and guides teachers to plan and program assessment activities, formulate assessment rubrics and apply assessment strategies to assess studies. This section also guides teachers to monitor and report students' progress of learning and performances of the attainment of standards.

4. Glossary, References and Appendices Sections

These sections guide teachers to refer to terms and definitions of the strand/subject content, references outlined to guide the development of this teacher guide. The appendices section provides essential information to guide teachers on the content and the delivery of this strand/subject.

Purpose of the Teacher Guide

This teacher guide describes what teachers should know and do to effectively plan, program, teach and assess Grade 10 Communication Technology content to enable all students to attain the required learning and proficiency standards.

Ample information with thorough guidelines is provided for the teacher to use to achieve the essential Knowledge, Skills, Attitudes and Values (KSAV) embedded in the set national content standards and grade level benchmarks.

The overarching purpose of this teacher guide is to assist teachers to;

- understand the significance of aligning all the elements of standards- based curriculum (SBC) as the basis of achieving the expected level of education quality;
- effectively align all the components of SBC when planning, programming, teaching, and assessing students learning and levels of proficiency;
- effectively translate and align the Technology and Industrial Arts Syllabi and Communication Technology Strand teacher guides to plan, program, teach and assess different Communication Technology Strand Teacher Guide units and topics, and the essential knowledge, skills, attitudes and values (KSAVs) described in the grade – level benchmarks;
- understand the Communication Technology Strand national content standards, grade-level benchmarks, and evidence outcomes;
- effectively make sense of the content (KSAVs) described in the Communication Technology Strand national content standards and the essential components of the content described in the grade – level benchmarks;
- effectively guide students to progressively learn and demonstrate proficiency on a range of Communication Technology Strand skills, processes, concepts, ideas, principles, practices, values and attitudes;
- confidently interpret, translate and use Communication Technology Strand content standards and benchmarks to determine the learning objectives and performance standards, plan and program appropriately to enable all students to achieve these standards;
- embed the core curriculum in the Communication Technology Strand lesson planning, programming, instruction, and assessment to permit all students to learn and master the core knowledge, skills, values and attitudes required of all students;

- provide opportunities for all students understand how STEAM has and continues to shape the social, political, economic, cultural, and environment contexts and the consequences, and use STEAM principles, skills, processes, ideas and concepts to inquire into and solve problems relating to both the natural and physical worlds (human–made) as well as problems created by STEAM;

- integrate cognitive skills (critical, creative, reasoning, decision-making, and problem solving skills), high level thinking skills (analysis, synthesis and evaluation skills), values (personal, social, work, health, peace, relationship, sustain values), and attitudes in lesson planning, programming, instruction and assessment;

- meaningfully connect what students learn in Communication Technology Strand with what is learnt in other subjects to add values and enhance students learning so they can integrate what they learn and develop in- depth vertical and horizontal understanding of subject content;

- formulate effective SBC lesson plans using learning objectives identified for each of the topics;

- employ SBC assessment approaches to develop performance assessments to assess students‘ proficiency on a content standard or a component of the content standard described in the grade – level benchmark;

- effectively score and evaluate students‘ performance in relation to a core set of learning standards or criteria, and make sense of the data to ascertain status of progress towards meeting grade-level and nationally expected proficiency standards,

- use evidence from the assessment of students‘ performance to develop effective evidence–based intervention strategies to help students making inadequate or slow progress towards meeting the grade-level and national expectations to improve their learning performances.

How to Use the Teacher Guide

The Grade 9 Communication Technology Strand Teacher Guide is an expansion of the content in the Technology and Industrial Art Syllabus. The Syllabus contains the content standards, benchmarks and evidence outcomes which are expanded into teaching and learning Activities in the Teacher Guide. The Teacher Guide provides essential information about what the teacher needs to know and do to effectively plan, teach and assess students' learning and proficiency on learning and performance standards. It should be read in conjunction with the syllabus in order to understand what is expected of teachers and students to achieve the envisaged quality of education outcomes.

The first thing teachers should do is to read and understand each of the sections of the Teacher Guide to help them understand the key SBC concepts and ideas. A thorough understanding of these components will help teachers meet the teacher expectations for implementing the SBC curriculum, and therefore the effective implementation of Grade 9 Communication Technology Strand in TIA Curriculum. Based on this understanding, teachers should be able to effectively use the teacher guide to do the following:

The scope of learning is translated and programmed according to the four terms. The suggested teaching and learning strategies and the key important instructions provided for teachers can be used to design and manage teaching and learning activities for the students in the classroom.

The assessment methods, assessment samples, reporting and recording strategies contained in this guide will assist teachers to plan assessment in Strands for the school year.

The strand teacher guide can be used for developing both classroom learning and professional development activities. The document is a useful resource for developing school and community based in-service programs.

Teachers must thoroughly read the contents of the documents in order to develop an understanding and do the following;

Determine Learning Objectives and Lesson Topics

- The teaching and learning Standards are derived from the Content Standards and Benchmarks in the Syllabus. The Learning Objectives are extracted from the grade-level benchmarks and are used for teaching topics. And lesson objectives are derived from learning objectives and are used for teaching Lessons.

Identify and Teach Grade Appropriate Content

- Grade appropriate content has been identified and scoped and sequenced using appropriate content organisation principles. The content is sequenced using the spiralling sequence principles. The strand, topics and lesson concepts in the Teacher Guide can be spiralled and taught by Strand, by Topics or by lessons using the Benchmarks. Using the Benchmarks, Content Mapping in Programing will enable teacher to see the content from what the

students have already learned in line with current to be taught and link to the next learning content.

Integrate the core curriculum in lesson planning, instruction and assessment

- This sequencing of content will enable students to progressively learn the essential knowledge, skills, values and attitudes as they progress further into their schooling.

Integrate cognitive, high level and 21st century skills in lesson planning, instruction and assessment

- Lesson titles in the teacher guide were drawn out from the benchmarks. From the lesson titles outlined in the planning and programming section, the values, the attitude, the skills and the knowledge is identified.

Integrate Technology and Industrial Arts: Communication Technology Values, and Attitudes in lesson planning, instruction and assessment

- When planning a lesson, it is important that, the values, attitudes, skills and knowledge of the lesson come out clearly in the teaching and learning activities as displayed in the sample guided lessons.

Identify and use grade and content appropriate, innovative, differentiated and creative teaching and learning methodologies

- At least one value, one attitude, one skill and one knowledge must be captured in a topic.

Integrate Science, Technology, Engineering, Arts and Mathematics (STEAM) principles and skills in lesson planning, instruction and assessment

- STEAM principles and skills must be effectively taught and learned by students. Teachers should use the teacher guide to help them make informed decisions when selecting the types of teaching and learning methodologies to use in their teaching of the subject content, including STEAM principles and skills.

Plan and address the principles of "Inclusive Teaching and Learning"

Teachers are obliged to create an inclusive learning environment to include students with special needs to promote learning for all. These special needs may include students who are gifted or disadvantaged physically, socially, emotionally and intellectually. Students may display combinations of any of these needs and therefore, the teaching and learning activities must have students with special needs to participate to their fullest abilities. The different types of needs in students include;

- Physical disabilities
- Intellectual disabilities
- Hearing impairment
- Sight-vision impairment
- Speech impairment
- Behavioural and emotional disorders

It is important that the learning activities for TIA: Communication Technology are inclusive and foster the learning needs of all students.

Syllabus and Teacher Guide Alignment

The Grade 9 Communication Technology Strand Teacher Guide are closely aligned and complementary to Technology and Industrial Art Syllabus.

They are the essential focus points for teaching and learning the essential knowledge, skills, values and attitudes.

Syllabus and Teacher Guide Alignment	
Syllabus Outlines the ultimate aim and goals, and what to teach and why teach it	**Teacher Guide** Describes how to plan, teach, and assess students‘ performance
• Overarching and SBC principles • Content overview • Core curriculum • Essential knowledge, skills, values and attitudes • Strands and units • Evidence outcomes • Content standards and grade-level benchmarks • Overview of assessment, evaluation, and Reporting	• Determine topics for lesson planning, instruction and assessment • Formulate learning objectives • Plan SBC lesson plans • Select teaching and learning strategies • Implement SBC assessment and evaluation • Implement SBC reporting and monitoring

The syllabus outlines the ultimate aim and goals of SBE and SBC, what is to be taught and why it should be learned by students, the underlying principles and articulates the learning and proficiency standards that all students are expected to attain. On the other hand, the teacher guide expands on what is outlined in the syllabus by describing the approaches or the how of planning, teaching, learning, and assessing the content so that the intended learning outcomes are achieved.

This teacher guide should be used in conjunction with the syllabus. Teachers should use these documents when planning, teaching and assessing Grade 9 Communication Technology Strand content.

Teachers will extract information from the syllabus (e.g., content standards and grade-level benchmarks) for lesson planning, instruction and is for measuring students‘attainment of a content standard as well as progress to the next grade of schooling.

Learning and Performance Standards Alignment

Content Standards, Benchmarks and Evidence Outcomes are linked to Learning Objectives, Lesson Objectives and Performance Standards in the Teacher Guide. (see table). There is a close linear relationship between these standards. Students‘ performance on a significant aspect of a benchmark (KSVA) is measured against a set of performance standards or criteria to determine their level of proficiency using performance assessment. Using the evidence from the performance assessment, individual student‘s proficiency on the aspect of the benchmark

assessed and progression towards meeting the benchmark and hence the content standard are then determined.

Standards Alignment	
Standards in Syllabus	**Standards in Teacher Guide**
• SBC Aims and Goals • Content Standard • Benchmarks • Evidence Outcomes	• Learning Objectives • Lesson Objectives • Essential Knowledge, Skills, Values and Attitude • Performance Standard

Standard Alignment

Standard Alignment shows the link between different standards in the Syllabus and Teacher Guide. It begins with SBC Aims and Goals which are National Standards in which the Syllabus Standard are derived from. The Content Standards or Subject Standards are expanded into Benchmarks which are Achievable Benchmarks for particular Grade Levels and are translated into the Teacher Guide as Teaching and Learning Standards and Assessment Standards. And they become the components of Unit of Work.

The Unit of Work (UOW) consists of the Achievable Standards for a particular Grade Level and is translated into Teaching and Learning Activities and Assessment Tasks.

It is essential that teachers know and can do standards alignment when planning, teaching, and assessing students‘ performance so that they can effectively guide their students towards meeting the grade-level benchmarks (grade expectations) and subsequently the content standards (national expectations).

Below is a diagram to show the relationship between Standards in the Syllabus and the Teacher Guide.

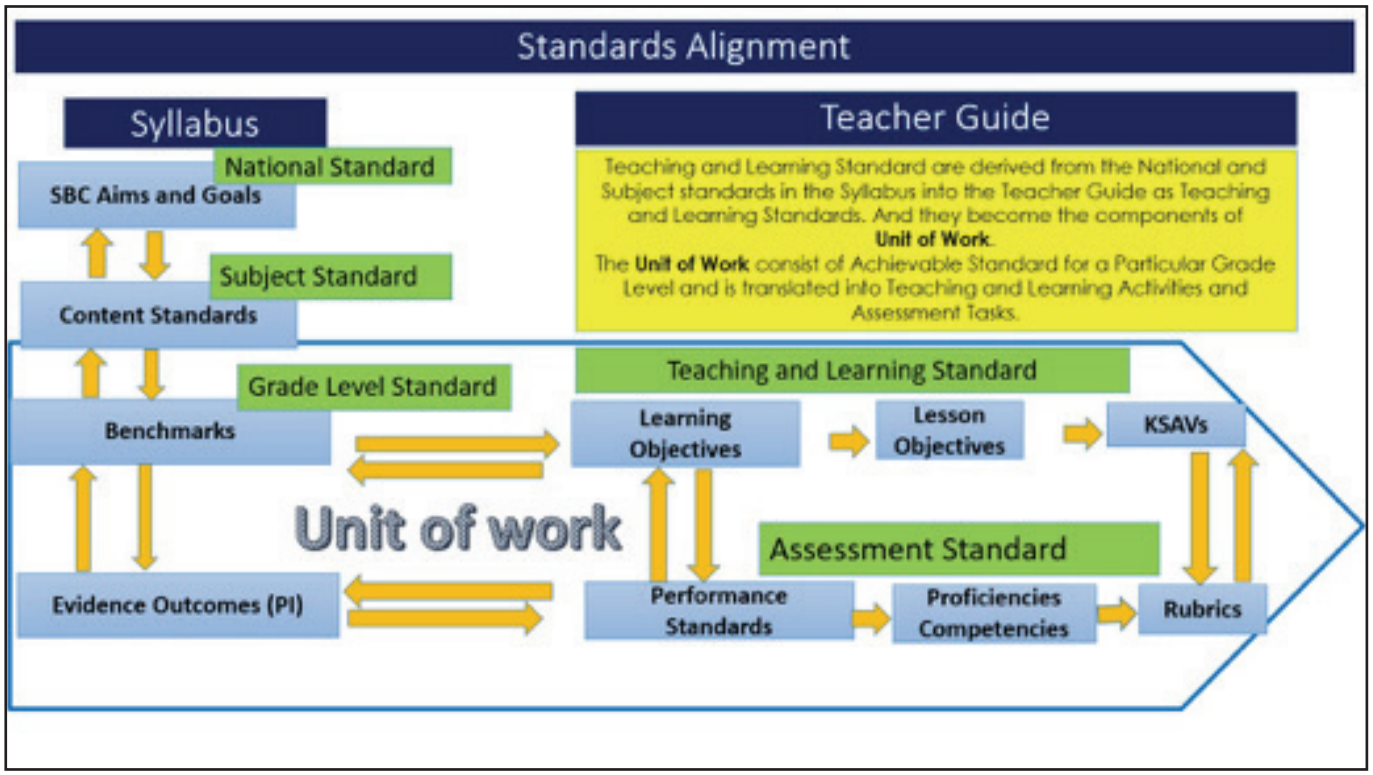


Figure 3: Standards Alignment that shows the alignment of standards in the syllabus and teacher guide

Learning and Performance Standards

Standards define the expected level of education quality that all students should achieve at a particular point in their schooling.

Content standards, benchmarks, and learning objectives are called learning standards while performance and proficiency standards (evidence outcomes) can be categorized as performance standards. These standards are used to measure students‘ performance, proficiency, progression and achievement of the desired level of education quality. Teachers are expected to understand and use these standards for programming, lesson planning, instruction and assessment.

Student‘s progression and achievement of education standard(s) are measured using performance standards or criteria to determine their demonstration or performance on significant aspects of the standards and therefore their levels of proficiency and competency. When they are judged to have attained a proficiency on a content standard or benchmark or components of these standards, they are then deemed to have met the standard(s) that is, achieve the intended level of education quality.

Content Standards

Content standards are evidence-based, rigorous and comparable regionally and globally. They have been formulated to target critical social, economic, political, cultural, environment, and employable skills gaps identified from a situational analysis. They were developed using examples and experiences from other countries and best practice, and contextualized to PNG contexts.

Content standards describe what **(content - knowledge, skills, values, and attitudes) all students are expected to know and do (how well students must learn and apply what is set out in the content standards)** at each grade-level before proceeding to the next grade. These standards are set at the national level and thus cannot be edited or changed.

Content Standards:

- are evidenced-based;
- are rigorous and comparable to regional and global standards;
- are set at the national level;
- state or describe the expected levels of quality or achievement;
- are clear, measurable and attainable;
- are linked to and aligned with the ultimate aim and goals of SBE and SBC and overarching and SBC principles;
- delineate what matters, provide clear expectations of what students should progressively learn and achieve in school, and guide lesson planning, instruction, assessment;
- comprise knowledge, skills, values, and attitudes that are the basis for quality education;

- provide teachers a clear basis for planning, teaching, and assessing lessons;
- provide provinces, districts, and schools with a clear focus on how to develop and organise their instruction and assessment programs as well as the content that they will include in their curriculum.

Benchmarks

Benchmarks are derived from the content standards and benchmarked at the grade-level. Benchmarks are specific statements of what students should know (i.e., essential knowledge, skills, values or attitudes) at a specific grade-level or school level. They provide the basis for measuring students‘ attainment of a content standard as well as progress to the next grade of schooling.

Grade-level benchmarks:

- are evidenced-based;
- are rigorous and comparable to regional and global standards;
- are set at the grade level;
- are linked to the national content standards;
- are clear, measurable, observable and attainable;
- articulate grade level expectations of what students are able to demonstrate to indicate that they are making progress towards attaining the national content standards;
- provide teachers a clear basis for planning, teaching, and assessing lessons;
- state clearly what students should do with what they have learned at the end of each school-level;
- enable students‘ progress towards the attainment of national content standards to be measured, and
- enable PNG students‘ performance to be compared with the performance of PNG students with students in other countries.

Learning Objectives

Learning or instructional Objectives are precise statements of educational intent. They are formulated using a significant aspect or a topic derived from the benchmark, and is aligned with the educational goals, content standards, benchmarks, and performance standards. Learning objectives are stated in outcomes language that describes the products or behaviours that will be provided by students. They are stated in terms of measurable and observable student behaviour. For example, students will be able to identify all the main towns of PNG using a map.

Performance Standards

Performance Standards are concrete statements of how well students must learn what is set out in the content standards, often called the **“be able to do”** of —what students should know and be able to do.

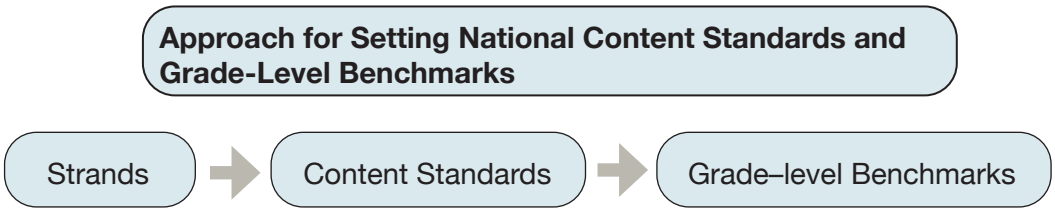
Performance standards are the indicators of quality that specify how competent a students' demonstration or performance must be. They are explicit definitions of what students **must do to demonstrate proficiency or competency at a specific level on the content standards.** Performance standards:

- measure students' performance and proficiency (using performance indicators) in the use of a specific knowledge, skill, value, or attitude in real life or related situations
- provide the basis (performance indicators) for evaluating, reporting and monitoring students' level of proficiency in use of a specific knowledge, skills, value, or attitude.
- are used to plan for individual instruction to help students not yet meeting expectations (desired level of mastery and proficiency) to make adequate progress towards the full attainment of benchmarks and content standards
- are used as the basis for measuring students' progress towards meeting grade- level benchmarks and content standards

Proficiency Standards

Proficiency standards describe what all students in a particular grade or school level can do at the end of a strand, or unit. These standards are sometimes called evidence outcomes because they indicate if students can actually apply or use what they have learnt in real life or similar situations. They are also categorized as benchmarks because that is what all students are expected to do before exiting a grade or are deemed ready for the next grade.

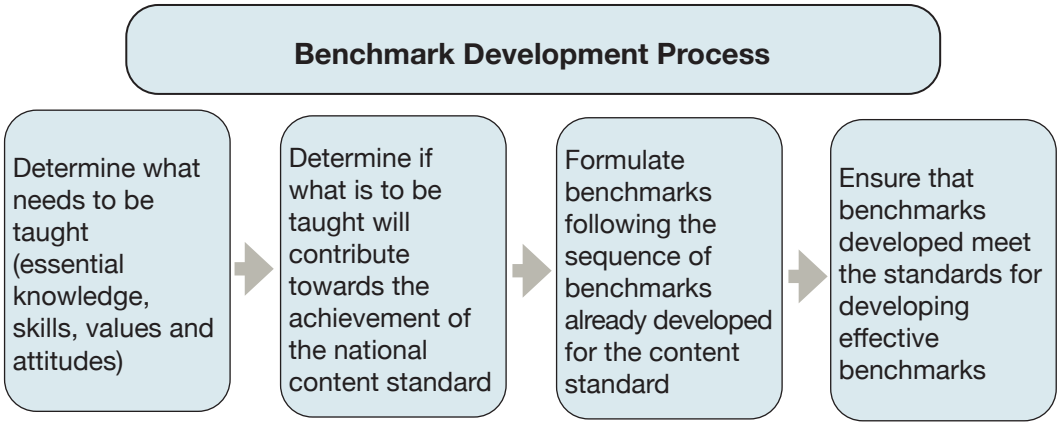
As per presented above, should teachers wish to develop additional benchmarks to cater for their students learning needs. You are encouraged to follow the process below to develop them.



Development of Additional Benchmarks

Teachers should develop additional benchmarks to meet the learning needs of their students. They should engage their students to learn about local, provincial, national and global issues that have not been catered for in the grade-level benchmarks but are important and can enhance students' understanding and application of the content. However, it is important to note that these benchmarks will not be nationally examined as they are not comparable. Only the benchmarks developed at the national level will be tested. This does not mean that teachers should not develop additional benchmarks. An innovative, reflect, creative and reflexive teacher will continuously reflect on his/her classroom practice

and use evidence to provide challenging, relevant, and enjoyable learning opportunities for his/her students to build on the national expectations for students. Teachers should follow the following process when developing additional grade-level benchmarks



Core Curriculum

Core curriculum refers to a core set of common learnings (knowledge, skills, values, and attitudes) that are integrated into the content standards and grade-level benchmarks for all subjects. The core curriculum includes:

- Cognitive skills (critical and creative thinking);
- Reasoning, problem-solving and decision-making skills;
- High level thinking skills (analysis, evaluation and synthesis);
- 21st century skills;
- STEAM principles and skills;
- Seven Principles for Teaching Procedural and Technical Skills (Plan ahead, Demonstration, Observation of learner in action, Provide specific feedback, Encourage self-evaluation, Allow learner practice, Prepare to modify approach)
- Working Diagrams (sketching and technical drawing)
- Reading, writing and communication skills, and
- Essential values and attitudes.

Technology and Industrial Arts: Communication Technology teachers are expected to include the core learning's in their lesson planning, teaching and assessment of students in all their lessons. In addition to these are the essential core curriculums; illustration, web design, animation, technical drafting, CAD software and computer programming, manual skill, mechanical tools and equipment and the manufacturing process in Communication Technology. Teachers may include other core curriculum concepts in relation to the subject to cater for students learning needs.

A practical example of integrating core curriculum in Teaching and Learning

Teachers can identify a set of core curriculum to teach in one lesson for example; in Technology and Industrial Arts: Communication Technology, students may be posed with an opportunity to find solutions on how technology can be used to utilise one of the core concepts of business studies in their area. The core concepts include; marketing, sales, design and manufacturing, technology, services, operations and financial intermediation.

Students will be required to use what they learnt in Communication Technology about designing, communication, the design process and how technology is engaging in people's livelihood in terms of designing and making products and marketing as a quicker and cheaper way of advertising and selling their products. They can use STEAM principles and skills in finding cause and solutions, use high level thinking skills to analyze and evaluate the effects and how to improve design products, use decision making and critical thinking skills to find the solutions for making and marketing a product.

They can be able to confidently and boldly communicate their findings and present intelligent and convincing arguments, which we can conclude that learning of the core curriculum is evident.

If students can be able to demonstrate mastery, proficiency and competency of core curriculum in such a manner, then the learning of core curriculum has been achieved.

Science, Technology, Engineering, Arts and Mathematics

STEAM education is an integrated, multidisciplinary approach to learning that uses science, technology. Engineering, arts and mathematics as the basis for inquiring about how STEAM has and continues to change and impact the social, political, economic, cultural and environments contexts and identifying and solving authentic (real life) natural and physical environment problems by nitrating STEAM- based principles, processes, skills, values and attitudes to prepare them for careers, higher education and citizenship.

Business Studies utilises both the goals of STEAM rather than just the goal of problem- solving. This is to ensure that all students are provided opportunities to learn, I integrate and demonstrate proficiency on all essential STEAM principles, processes, skills, values and attitudes to prepare them for careers, higher education and citizenship.

Objectives:

Students will be able to:

i. Examine and use evidence to draw conclusions about how STEAM has and continues to change the social, political, economic, cultural and environmental contexts.
ii. Investigate and draw conclusions on the impact of STEAM solutions to problems on the social, political, economic, cultural and environments contexts.
iii. Identify and solve problems using STEAM principles, skills, concepts, ideas and process.
iv. Identify, analyze and select the best solution to address a problem
v. Build prototypes or model of solutions to problems.
vi. Replicate a problem solution by building models and explaining how the problem was or could be solved.
vii. Test and reflect on the best solution chosen to solve a problem.
viii. Collaborate with others on a problem and provide a report on the process of problem solving used to solve the problem.
ix. Use skills and processes learnt from lessons to work on and complete STEAM related projects.
x. Demonstrate STEAM principles, skills, processes, concepts and ideas through simulation and modeling.
xi. Explain the significance of values and attitudes in problem solving.

STEAM Problem-Solving Methods and Approaches

Problem–solving involves the use of problem-solving methods and processes to identify and define a problem, gather information to understand its causes, draw conclusions, and use the evidence to design and implement solutions to address it. Even though, there are many different problems-solving methods and approaches; they share some of the steps of problem-solving, for example:

- Identifying the problem;
- Understanding the problem by collecting data;
- Analyze and interpret the data;
- Draw conclusions;
- Use data to consider possible solutions;
- Select the best solution;
- Test the effectiveness of the solution by trialing and evaluating it, and
- Review and improve the solution.

STEAM problem-solving processes go from simple and technical to advanced and knowledge-based processes. However, regardless of the type of process used students should be provided opportunities to learn the essential principles and processes of problem solving and more significantly, to design and create a product that addressed a real problem and meets a human need.

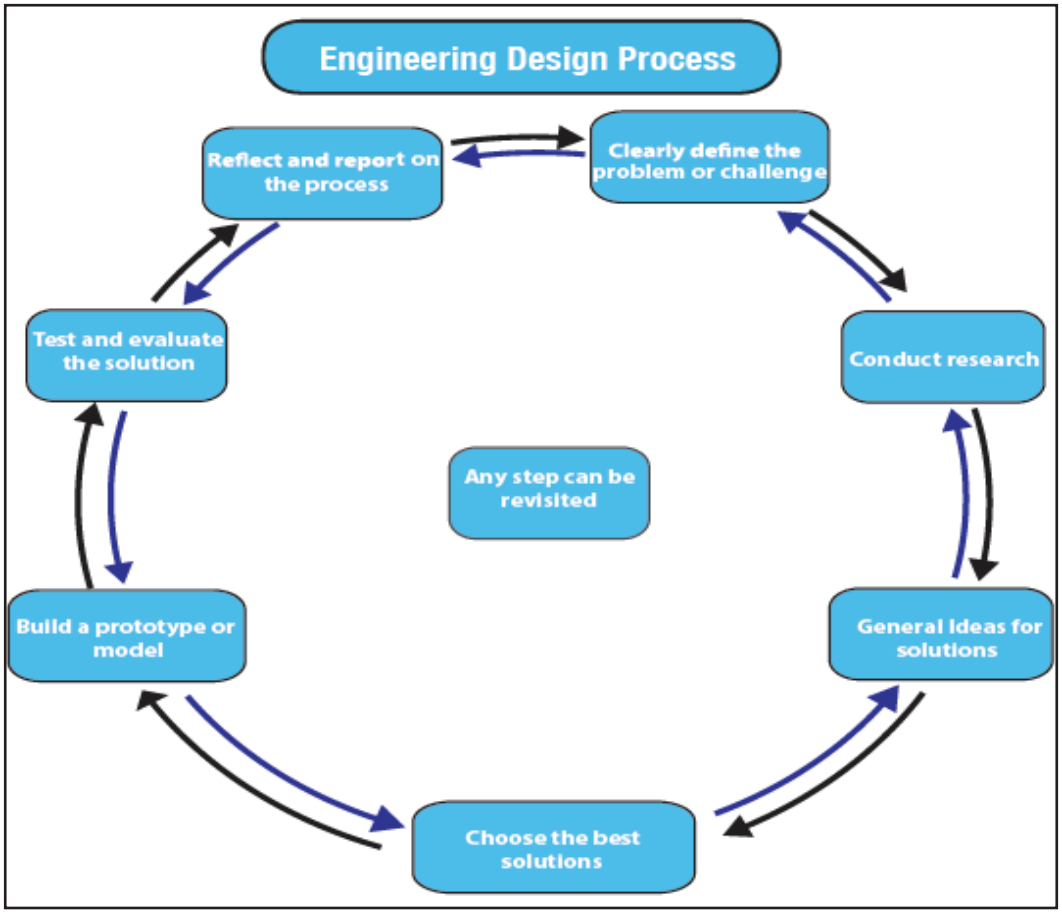
Engineering Design Process

Technological fields used the engineering design process to choose the best solution to solve the problem.

It is an open-ended problem solving process that involves the full planning and development of products or services to meet identified needs. It involves the following sequence of steps:

- Analyze the context and background, and clearly define the problem;
- Conduct research to determine design criteria, financial or other constraints, and availability of materials;
- Generate ideas for potential solutions, using processes such as brainstorming and sketching;
- Choose the best solution;
- Build a prototype or model
- Test and evaluate the solution;
- Repeat steps as necessary to modify the design or correct faults;
- Reflect and report on the process.

This sequential engineering design process steps described above are illustrated in the diagram below.



Students should be guided through every step of the process so that they can explain it and its importance, and use the steps and the whole process proficiently to identify, investigate and solve problems. They should be provided with opportunities to practice and reflect on each step until they demonstrate the expected level of proficiency before moving on to the next one.

It involves the following sequence of steps

Step 1: IDEA GENERATION

Step 2: RESEARCH

Step 3: PLANNING (DESIGN BRIEF)

Step 4: PROTOTYPING

Step 5: PRODUCTION

Step 6: COSTING

Step 7: MARKETING

Step 1: IDEA GENERATION

- Ideation, iteration, and brain storming new product ideas

  Students should be guided and provided opportunities to identify human made, natural and physical environment problems using their five senses and describe what the problem is and its likely causes.

  Example: Irregularity of keeping records of stocks of goods and materials

Step 2: RESEARCH

- Questionnaires Feedback from a substantial and unbiased audience for product validation

  After the problem is identified and described, several questions will be derived from a main issue question. The questionnaire will be formulated and then will be answered in the survey. This questionnaire will guide the researcher in conducting research and investigation for the appropriate solution to the problem.

  The questions will be targeted towards the usefulness of the product and the interests to purchase the finished product.

  Example: Main Question 'How can records of stocks be kept efficiently and managed effectively?'

Step 3: PLANNING (DESIGN BRIEF)

- Bring the product to life through sketching, illustrations and working diagrams

  Creating working sketches, illustrations and working diagrams helps the researcher to better understand his or her research problem, refine the research question and decide on investigation approach before the investigation is conducted.

  Example: Description of an Authentic Situation

  The researcher may look into the current practices of stock taking in schools, or other subject areas for tips or conduct online search on how to improve the records of stocks on relevant websites. The researchers may even analyse information and past practices or similar but better regarding the stock taking records keeping.

Step 4: PROTOTYPING

- Create a finished prototype product to use as a sample for production

  The researcher will make or develop a prototype of the solution and test how it would be used to solve the problem.

  Example: Prototype

The illustration of sketches in the planning stage can be created in the MS Excel and its functions can be identified as the basic solution for Stocking Records.

Step 5: PRODUCTION

- Gather materials and production

This step is the gathering of materials and producing of the product from the best prototype. This involves the identification of lists of materials, procedural steps with their respective tools or equipment to be used to produce the intended product.

It is obviously known during the production that certain procedural steps are needed to be done in certain order before the others because later steps depend on them being prioritized. In addition, concepts of other subjects needed for producing the product maybe gathered, integrated and utilised in the production of the product.

Example: Producing the product

Step 6: COSTING

- Total cost of product sold (COGS) to determine retail price and gross margin

This stage is known as product pricing which involves the calculation of the costs of materials used, labour cost, markup and selling price.

The selling price may be influenced by responses to the questions in the survey due to the interest of the buyers which will determine the cost of the product.

The cost for producing the item are:

1. Material unit cost: K_____
2. Labor costs (No of Hours Spent X Your Rate): 10 hrs x K___= K___
3. Selling/Marketing cost: K_____

A simple formula to calculate a good markup percentage for the project:

MARKUP PERCENTAGE = (SELLING PRICE – UNIT COST) / UNIT COST x 100%

Simply take the sales price minus the unit cost, and divide that umber by the unit cost. Then, multiply by 100 to determine the markup percentage.

For example, if the project costs K50 to make and the selling price is K75, then the markup percentage would be 50%: (K75 – K50) / K50 = 0.50 x 100 = 50%.

Example: Pricing the product

Step 7: MARKETING

- Launch product into market

  This stage involves the marketing of the finished product. The potential buyers of the product are the targeted audience that were used in the research.

  The finished product can be promoted using flyers, put out on public places and market page can be created on social media networks.

STEAM-Based Lesson Planning

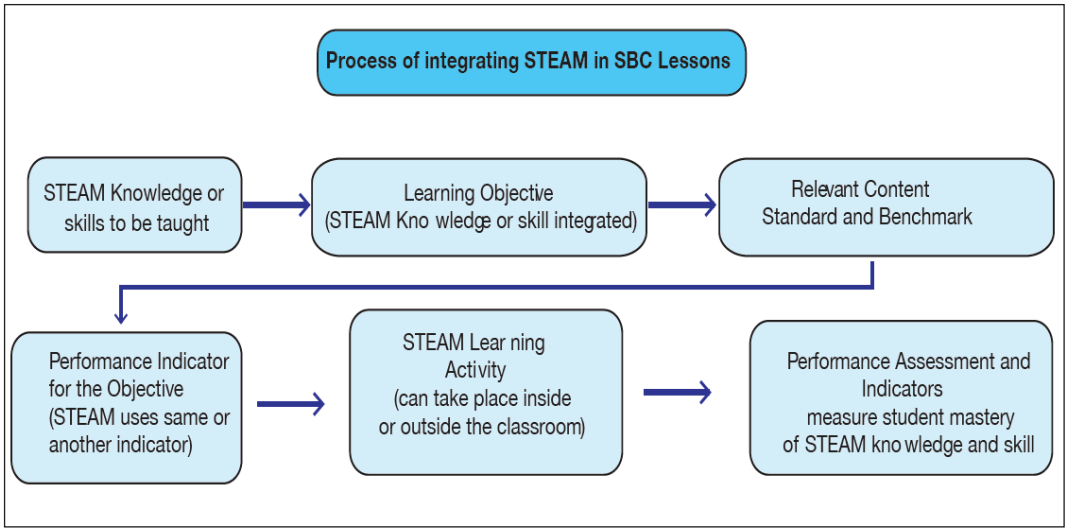
Effective STEAM lesson planning is the key to the achievement of the expected outcomes. STEAM Skills can be planned and taught using separate STEAM-based lesson plans or integrated into the standards-based lesson plans. To effectively do this, teachers should know how to write effective standards and STEAM-based lesson plans.

Developing STEAM-based Lesson Plans

An example of a standards-based lesson is provided below. Teachers should use this to guide them to integrate STEAM content and teaching, learning and assessment strategies into their standards-based lesson plans.

Integration of STEAM problem-solving skills into standards-based lesson plans

Process for Integrating STEAM Principles and Problem-Solving Skills into Standards-Based Lessons



Teachers should follow the steps given below when integrating STEAM problem-solving principles and skills into their standards-based lesson plans. (Refer to Appendices)

Step 1: Identify the STEAM knowledge or skill to be taught (From the table of KSAVs for each content standard and bench mark). This could be already being captured in the learning objective stated in the standards-based lesson plan.

Step 2: Develop and include a performance standard or indicator for measuring student mastery of the STEAM knowledge or skill (e.g. level of acceptable competency or proficiency) if this is different from the one already stated in the lesson plan.

Step 3: Develop student learning activity (An activity that will provide students the opportunity to apply STEAM knowledge or skill specified by the learning objective and appropriate statement of standards). Activity can take place inside or outside the classroom and during or after school hours.

Step 4: Develop and use performance descriptors (standards or indicators) to analyze student STEAM related behaviors or products (results or outcomes), which provide evidence that the student has acquired and mastered the knowledge or skill of the learning objective specified by the indicator(s) of the standard(s).

STEAM-Based Assessment

STEAM-based assessment is closely linked to standards-based assessment where assessment is used to assess student‘s level of proficiency or competency of a specific knowledge, skill, value or attitude taught using a set of performance standards (indicators or descriptors). The link also includes the main components such as the purpose, the assessment principles and assessment strategies and tools.

In STEAM-based assessment, assessment is designed for what the students should know and be able to do. In STEAM learning students are assessed in a variety of ways including portfolios, project/problem-based assessment, backward designs, authenticity assessment, or other students centered approaches. When planning and designing the assessment, teachers should consider the authenticity of the assessment by designing an assessment that relates to a real world task or discipline specific attributes (such as simulation, role play, placement assessment, live projects, debates) should make the activity meaningful to the student, and therefore be motivating as well as developing employability skills and discipline specific attributes.

Effective STEAM-Based Assessment strategies

The following six sections describe six assessment tools and strategies shown to impact teaching and learning as well as help teachers foster a 21st century learning environment in their classrooms.

1. Rubrics
2. Performance-based assessment (PBAs)
3. Portfolios
4. Student self-assessment
5. Peer-assessment
6. Students response system (SRS)

Although the list does not include all innovative assessment strategies, it includes what we think are the most common strategies, and ones that may be particularly relevant to the educational context of developing countries in this 21st century. Many of the assessment strategies currently use fit under one or more of the categories discussed. Furthermore, it is important to note that strategies also connect in a variety of ways.

1. Rubrics

Rubrics are both a tool to measure students‘ knowledge and ability as well as an assessment strategy. A rubric allows teachers to measure certain skills and abilities not measurable by standardised testing systems that assess direct knowledge at a fixed moment in time. Rubrics are also frequently used as part of other assessment strategies (portfolios, performances, projects, peer-review and self-assessment), they will be discussing in those sections as well.

2. Performance- Based Assessments

Performance- Based Assessments (PBA), also known as authentic assessment are generally used as a summative evaluation strategy to capture not only what students know about a topic, but if they have the skills to apply that knowledge in a; real-world‘ situation by asking them to create an end product. PBA pushes students to synthesize their knowledge and apply their skills to a potentially unfamiliar set of circumstances that is likely to occur beyond the confines of a controlled classroom setting. The implementation of performance-based assessment strategies can also impact other instructional strategies in the classroom.

3. Portfolio Assessment

Portfolios are a collection of student work gathered over time that is primary used as a summary evaluation method. The most salient characteristic of the portfolio assessment is that rather than being a snap shot of a student‘s knowledge at one point in time (like a single standardized test) it highlights student effort, development, and achievement over a period of time; portfolios measure as student‘s ability to apply knowledge rather than simply regurgitate. They are considered both student-centered and authentic assessment of learning.

4. Self-Assessment

Its main purpose is for students to identify their own strengths and weakness and to work to make improvements to meet specific criteria. Self-assessment occurs when students judge their own work to improve performance as they identify discrepancies between current and desired performance. In this way, self-assessment aligns well with standards-based education because it provides clear targets and specific criteria against which students or teachers can measure learning.

Self-assessment is used to promote self-regulation to help students reflect on their progress and to inform revisions and improvements on a project or paper in order for self-assessment to be truly effective, four conditions must be in place, the self-assessment criteria, criteria is

negotiated between the teachers and students, students are taught how to apply the criteria, students receive feedback on their self-assessments and teachers help students use assessment data to develop an action plan.

5. Peer Assessment

Peer assessment, much like self-assessment, is a formative assessment strategy that gives students a key role in evaluating learning. Peer assessment approaches can vary greatly but, essentially it is a process for learners to consider and give feedback to other learners about the quality or value of their work. Peer assessments can be used for a variety of products like papers, presentations, projects and or other skills behaviors. Peers assessment is understood as more than only a grading procedure and is also envisioned as teaching strategy since engaging in the process develops both the assessor and the assesses skills and knowledge. The primary goal for using peer assessment is to provide feedback to the learners. This strategy may be particularly relevant in the classrooms with many students per teacher since student time will be more plentiful than teacher time, although any single student‘s feedback may not be rich or in-depth as teachers feedback, the research suggests that peer assessment can improve learning.

6. Students Response system

Students response system (SRS), also known as classroom response (CRS), audience response system (ARS) is general term that refers to a variety of technology-based formative assessment tools that can be used to gather student- level data instantly in the classroom. Through the combination of hardware, (voice recorders, PC, internet connection, projector and screen) and software.

Teachers can ask students a wide range of questions (both closed and open ended), where students can respond quickly and anonymously, and the teacher can display the data immediately and graphically. The use of technology also includes a use of video which examines how a range of strategies can be used to assess students understanding. The value of SRS comes from the teachers analyzing information quickly and then devising real-time instructional solutions to maximize students learning. This includes a suggested approach to help teachers and trainers assess learning.

Essential Knowledge, Skills, Values, and Attitudes

Students‘ level of proficiency and progression towards the attainment of content standards for Technology and Industrial Arts subject will depend on their mastery and application of essential knowledge, skills, values, and attitudes in real life or related learning experiences and situations across the secondary curriculum.

Examples of the different types of knowledge, skills, values and attitudes, including processes, that all students are expected to learn and master as they progress through the grades are provided in;

- Technology and Industrial Arts syllabuses for grades 9 & 10 page 24-27. These knowledge, skills, values and attitudes have been integrated into the content standards, benchmarks and performance standards developed for Technology and Industrial Arts subject Teachers are expected to plan and teach these in their lessons, and assess students‘ performance and proficiency, and progression towards the attainment of content standards.

Technology and Industrial Arts

Technology and Industrial Arts provides and instills in students the confidence to use a range of specific knowledge, skills, values and attitudes in various technologies. These are scoped and embedded within the strands curriculum content in the subject, with the intension to create related career pathways. The content in each strand encourage students to be proactive, competent, creative, responsible and reflective learners, enabling them to pursue career opportunities in respective fields of technology studied in this subject.

Provided herein are recognised knowledge for the subject which are applicable across the strands.

Types of common knowledge for Technology and Industrial Arts

These are specific content knowledge for the subject. They include;	
• Creativity • Branding • Communication skills • Technical expertise • Industry expertise • Critical thinking • Information Technology skills • Innovation	• Building and Engineering Knowledge. • Physical Strength and Stamina. • Mathematical formulas in technology • Technical language • Language Coordination. • Technology Skills. • Problem-Solving Skills. • Prototype • Digital Literacy

Technology and Industrial Arts is a skills oriented subject, therefore embraces all the commonly recognised skills which can be used across the strands scoped in the content. Listed here for teacher‘s convenience are commonly recognised skills across the strands.

Types of Skills for Technology and Industrial Arts

These are specific content Skills for the subject, They include;	
• Creativity • Critical thinking • Technical knowledge • Commercial awareness of textile industry • Research and data handling capacity • Critical analysis and interpretation of materials • Management skills • Organisational Skills. • Problem solving skills • Mathematical skills • Language Literacy skills • Leadership • Innovative skills • Transformational skills • Technical drawing • Layout and Print reading • Materials specification • Project specification • Attention to detail skills (multitasking approachability,	• Food Catering Skills • Food service • Food processing skills • Nutritional studies • Food and kitchen hygiene • Fabric identification tests • Textiles design and construction skills • Design influencers • Focus Communication skills (approachability, circumstantial awareness, diligence, efficiency, thoroughness • Multitasking skills • Attention to detail skills (multitasking , approachability, • Technical Skills • Decision making skills • Coding • Information technology soft skills • Logical thinking • Collaboration • Teamwork • Software engineering • Software quality assurance (qa) • Customer Service • Modelling

Types of Values

Personal engagement and civic engagement strategies help young to acquire and apply skills and dispositions that will prepare them to become competent and responsible citizens.

1. Personal Values (importance, worth, usefulness, etc.)

Core values	Sustaining values
• Sanctity of life • Truth • Aesthetics • Honesty • Human • Dignity • Rationality • Creativity • Courage • Liberty • Affectivity • Individuality	• Self-esteem • Self-reflection • Self-discipline • Self-cultivation • Principal morality • Self-determination • Openness • Independence • Simplicity • Integrity • Enterprise • Sensitivity • Modesty • Perseverance

2. Social Values

Core Values	Sustaining Values
• Equality • Kindness • Benevolence • Love • Freedom • Common good • Mutuality • Justice • Trust • Interdependence • Sustainability • Betterment of human kind • Empowerment • Solidarity • Peace and harmony	• Plurality • Due process of law • Democracy • Freedom and liberty • Common will • Patriotism • Tolerance • Gender equity and social inclusion • Equal opportunities • Culture and civilisation • Heritage • Human rights and responsibilities • Rationality • Sense of belonging • Safe and peaceful communities

3. Types of Attitude

Attitudes - Ways of thinking and behaving, points of view	
• Optimistic • Participatory • Critical • Creative • Appreciative • Empathetic • Caring and concern • Positive • Confident • Cooperative	• Responsible • Adaptable to change • Open-minded • Diligent • With a desire to learn • With respect for self, life, equality and excellence, evidence, fair play, rule of law, different ways of life, beliefs and opinions, and the environment.

Communication Technology strand

The communication technology strand encourages students to —think out of the box. This simply means to think openly and freely beyond the learning situation to bring about fresh creative ideas into the classroom lessons. This gives opportunity to the students to apply creativity and critical thinking to participate .Teachers must ensure that even students with rudimentary creativity skills end up improvising their learning.

These are specific content knowledge for the strand. They include;	
• CAD • Multimedia programs and its products • Computer awareness • Computer safety and responsibility • Computer ethics	• Manufacturing of technological products • Algorithms • Programming language • Software and hardware • Computer Peripherals • Computer applications • Communication skills • Internet of things • Virtual learning

Processes in Technology & Industrial Arts

Technology and Industrial Arts expounds on the classroom practices using processes for effective and evidence based lesson deliveries. The commended/suggested processes are for teachers to use as the starting points planning skills or practice based lessons in any of the strands as presented in the subject syllabus.

Types of Processes - Inquiry processes for Technology & Industrial Arts subject

Technology & Industrial Arts Inquiry processes include:

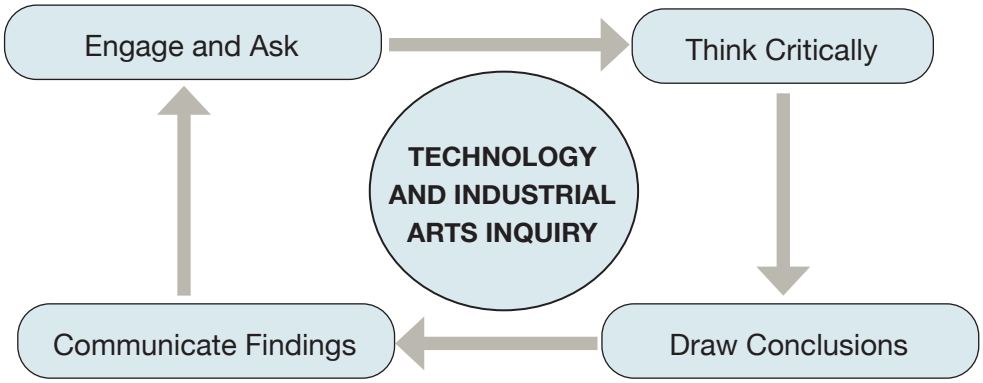
- Gathering information
- Analysing information
- Evaluating information
- Making judgments
- Taking actions
- Instructional technology
- Integration process
- Project planning process
- Organization of learning experiences

Technology & Industrial Arts Inquiry Processes

Engage and Ask	How will I engage my students in the topic and prompt them to ask questions? • Determine the enduring understandings about the topic being studied. • Engage your students with the topic by grabbing their interest with a hook connected to the enduring understandings. • Allow students to generate questions based upon the topic and hook. • Determine what questions will be essential to achieving the enduring understandings. (Student generated or teacher determined. • With students, determine what other information is needed in order to fully answer the questions.
Think Critically	How will students access and analyse information about this topic? • Have students think about where they can find answers to the questions posed about the topic. • Gather and organise multiple primary and secondary sources. • Ensure that sources used expose students to different perspectives and viewpoints about the topic. • Students should use sources to collect, analyse, and interpret data. • Ensure students are analysing sources for credibility, bias, and perspective in order to identify gaps in the research.

Draw Conclusion	How will students synthesise ideas to answer the questions posed based on sources used? • Students should engage in civic discussion to answer the questions posed while respecting diverse opinions. • Engage students in evaluating possible courses of action and their consequences. • Students should make and justify an informed decision or choice and/or design an action plan supported by evidence from sources. • Have students evaluate the consequences of a decision or choice. • Allow students to make revisions based on feedback and further study.
Communicate Findings	How will students demonstrate what they have learned and take action on that learning? • Determine how students will apply what they have learned and share their findings with others. • Explore appropriate audiences for students to present conclusions. • Determine if there is an opportunity for students to take action and influence others to make more informed decisions. • Have students develop strategies to persuade others, including policy makers when applicable. • Prepare students to defend their analysis against alternative.

Below is how the Technology & Industrial Arts Inquiry Process will be taught in the classroom. Be specific as you make notes of the activities or prompts you will use to ensure students will have the opportunity to practice these skills as a requirement in the Grade 9 content standards.



Technology & Industrial Arts Enquiry
1. Developing Questions and Planning Inquiries a. Constructing Essential Questions – Address essential questions that reflect an enduring issue in the field b. Constructing Supporting Questions – Explain how supporting questions contribute to an enquiry. c. Determining Helpful Sources – Develop new supporting and essential questions through investigations, collaboration and using diverse sources.

2. Evaluating Sources and Using Evidence

a. Gathering and Evaluating Sources
- – Gather and evaluate information from multiple sources while considering the origin, credibility, point of view, authority, structure, context and corroborative value of the sources.

b. Developing Claims and Using Evidence
Identify evidence that draws information from multiple sources to revise or strengthen claims.
- – Communicating Conclusions and Taking Informed Action

c. Communicating Conclusions
- – Construct and evaluate explanations and arguments using multiple sources and relevant, verified information.

d. Critiquing Conclusions
- – Articulate explanations and arguments to a targeted audience in diverse setting.

e. Taking Informed Action
- – Use interdisciplinary lenses to analyse the causes and effects of and identify solutions to local, regional or global concerns.
- – Use deliberative processes and apply democratic strategies and procedures to address local, regional or concerns and take action in or out of school.

4. Literacy Skills

A strong emphasis must be placed on various types of literacy, from financial to technological, from media to mathematical, from content to cultural. Literacy may be defined as the ability of an individual to use information to function in society, to achieve goals and to develop her or his knowledge and potential. Teachers emphasize certain aspects of literacy over others, depending on the nature of the content and skills they want students to learn.

Types of Literacy Skills – Skills in basic literacy, digital literacy and financial literacy
• Define and apply discipline-based conceptual vocabulary • Describe people, places, and events, and the connections between and among them • Arrange events in chronological sequence • Differentiate fact from opinion • Determine an author's purpose • Determine and analyse similarities and differences • Analyse cause and effect relationships • Explore complex patterns, interactions and relationships • Differentiate between and among various options • The ability to locate, evaluate and use digital information. • The ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills • The ability to effectively and critically navigate, evaluate and create information using a range of digital technologies. • Making choices about personal finances and having the skills to make decisions that will have positive outcomes. • Effectively use financial skills • Improves personal financial management skills • Improves budgeting and investing skills • Creates a savvy relationship with money application skills • Creates a lifelong journey of learning for education is the key to success when it comes to money • Effective use financial skills • Improves personal financial management skills • Improves budgeting and investing skills • Creates a savvy relationship with money application skills • Creates a lifelong journey of learning for education is the key to success when it comes to money

5. Numeracy Skills

Numeracy skills refer to the ability to use, interpret and communicate mathematical information to solve real-world problems. These include the ability to understand basic math like addition, subtraction, division and multiplication. More advanced numeracy skills incorporate the use of graphical, spatial, statistical and algebraic concepts and the ability to interpret that data and apply it to real-world situations.

Types of Numeracy Skills – skills that are driven by the basic mathematical aspects
• Basic knowledge of numbers • Calculation skills • Budgeting • Interpreting mathematical information • Understanding the relationships between numbers • Understanding trends • Measurement and data analysis

6. High Level Thinking Skills

These skills include analysis, synthesis, and evaluation skills.

i. *Analysis Skills* – Analysis skills involve examining in detail and breaking information into parts by identifying motives or causes,

underlying assumptions, hidden messages; making inferences and finding evidence to support generalisations, claims, and conclusions.

ii. *Synthesis Skills* – Synthesis skills involve changing or creating something new, compiling information together in a different way by combining elements in a new pattern proposing alternative solutions.

iii. *Evaluation Skills* – Evaluation skills involve justifying and presenting and defending opinions by making judgments about information, validity of ideas or quality of work based on set criteria.

Key Words				
Analyse	Differences	Find	Reproduce	Similar to
Appraise	Discover	Focus	Motivate	Simplify
Arrange	Discriminate	Function	Omit	Take part in
Assumption	Discussion	Group	Order	Test for
Breakdown	Distinction	Highlight	Organise	Theme webbing
Categorise	Distinguish	In-depth	Point out	Create
Cause & effect	Dissect	Inference	Research	Innovate
Choose	Divide	Inspect	See	Design
Classify	Establish	Isolate	Select	Collaborate
Comparing	Examine	Investigate	Separate	Recreate
				Networking

Curriculum Integration

An integrated curriculum is described as one that connects different areas of study by cutting across subject-matter lines and emphasising unifying concepts. Integration focuses on making connections and linkages in content for students, allowing them to see the importance of all subjects in the curriculum. When students are able to see and understand the linkages between different subject matter, they engage in relevant, meaningful activities that can be connected to real life.

Curriculum integration is a holistic approach to learning thus curriculum integration in SBC will equip students with the essential 21st Century knowledge, skills, values and attitudes. Teachers must develop intriguing curriculum by going beyond the traditional teaching of content based or fragmented teaching to the teacher who is knowledge based and who should be perceived as a 21st Century innovative educator.

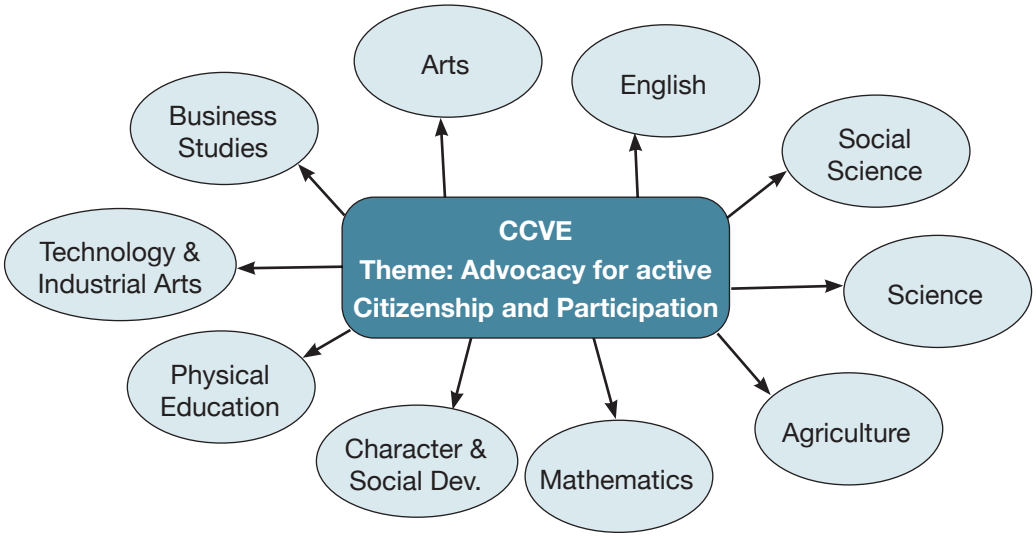
There are three approaches that SBC will engage to foster conducive learning for all children whereby they all can demonstrate proficiency at any point of exit. Adapting these approaches will have an immense impact on the lives of these children as they will not only see themselves as catalyst of change for a competitive PNG but also, comparable to the world standards as global citizens.

Engaging these three approaches in our curriculum will surely sharpen the knowledge and ability of each child, allowing them to see themselves as assets through their achievements and as agents of change contributing meaningfully to their country.

Integrated learning will bear a generation of knowledge-based populace who can solve problems and make proper decisions based on evidence. Thus, PNG can achieve its goals like the Medium Term Development Goals (MTDG) and aims such as the Vision 2050 for a happy, healthy and wealthy society whereby, all its citizens should have access and fair distribution to income, shelter, health, education and general good and services improving the general standard of living for PNG in the long run.

(i) Multidisciplinary Approach

In this approach, learning involves a theme or concept that will be taught right across all subject area of study by students. For instance, if the theme is —Advocacy for active Citizenship and Participationǁ, all subject areas create lessons or project-based learning and assessment as per their subjects around this theme. The content of the theme —Advocacy for active Citizenship and Participation will be taught right across all the different subjects through the different Benchmarks as shown in the diagram and table below.



Sample Curriculum Integration Outline of Linkages

THEME: "ADVOCACY FOR ACTIVE CITIZENSHIP AND PARTICIPATION"		
SUBJECT: CHRISTIAN AND CITIZENSHIP VALUES EDUCATION GRADE: 12		
STRAND 3: CHRISTIAN CITIZENSHIP AND SOCIETY		
UNIT 1: Christian Civics Systems		
TOPIC: Christian civic organizations use technology to advocate for good health, better education and for protection of the natural environment and its sustainability.		
Subject	**Benchmark**	**Concept of focus to learn and assessed for the Theme**
CCVE	**12.3.1.4:** Inquire and discuss how Christian civic Organizations use technology to advocate for good health, better education and for protection of the natural environment and its sustainability.	How Civic Organisations use technology to advocate for protection of the natural environment and its sustainability
Agriculture	**12.3.1.4.3:** Suggest ways for improving problems that affect conservation in Papua New Guinea	Improving Conservation problems in PNG as Citizens
Arts	**12.3.3.2:** Conduct research and create artworks to advocate for social change. **12.1.2.2:** Use a range of techniques and technological tools in a variety of applications relating to music to communicate a theme.	Use data from research to create artwork to advocate for active Citizenship Use Music Technological Tools to communicate active Citizenship
Business Studies	**12.4.2.9:** Establish the e-business by creating a website or using a mobile application (apps) using the Apple operating system (App Store) or Google Android operating system (Google Play).	Create a website or a mobile application to as a platform to advocate for active Citizenship

Character and Social Development		
English	**12.2.6.2:** Take advantage of technology's capacity to link to other information and to display information flexibly and dynamically. **12.5.4.2:** Give a clearly articulated, well-structured presentation on a complex topic.	How to display Citizenship information flexibly and dynamically with use of technology. Do a clearly articulated, well-structured presentation on active Citizenship
Mathematics	**12.4.4.3:** Use appropriate technology to aid concept development as a tool for problem solving. (General Maths) **12.1.1.5:** Apply quadratic equations to solve real-world situations and complex number problems. (Advance Math)	Application of quadratic equations to solve real-world situations as part of active citizenship Use appropriate technology as a tool for problem solving when they engage as active citizens in real life situations
Physical Education	**12.2.2.2:** Distinguish and illustrate sporting greats of PNG in respect to their contribution in the country	How they can actively participate as sporting greats to model active citizenship participation
Science	**12.2.1.6:** Investigate human population growth by comparing recent and future population growth in developed and developing countries (Biology)	Use of data from investigations to compare human population growth and use the information to participate in informed decision making
Social Science	**12.1.4.6:** Critique various national and global strategies, agenda, and actions for addressing climate change. (Geography) **12.2.4.2:** Examine the different ways the United Nations promote change and maintain stability in different regions of the world. (Political Science) **12.3.3.1:** Identify and appraise the different ways people from different cultures, religions, and ethnic and ideological backgrounds relate to each other (History)	Use of strategies to actively participate in addressing climate change Understanding of how UN maintains stability to be able to actively advocate for understanding of world peace Learn how common grounds of understanding and relationships minimizes differences in cultures, religions, and ethnic and ideological backgrounds and advocate for tolerance
TIA	**12.5.2.4:** Describe the characteristics of client site scripting and creating interactive menus (Computer Tech)	The use of site scripting to create interactive menus for advocacy on issues of national and global interest as part of active citizenship participation

Note: Assessment Project Planning for the theme

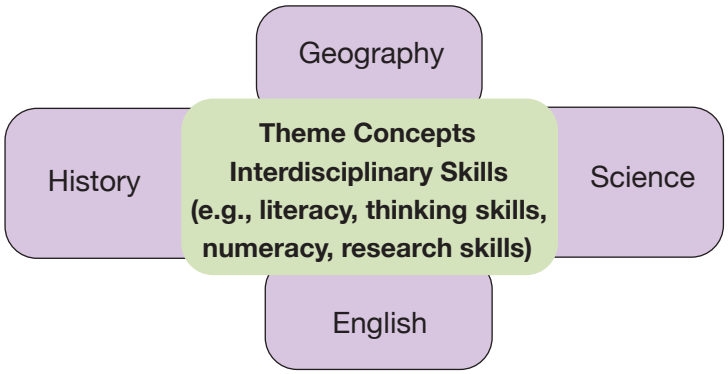
Planning for assessment will be a collaborative effort of all the subject teachers who wish their students to be part of the project with the CCVE subject Teacher as the overall coordinator of the Project and leading the Team.

See the process of this assessment in the Assessment Section.

(ii) Interdisciplinary Approach

This approach addresses learning similarly to the multidisciplinary approach of integrated learning whereby learning takes place within the subject area. It is termed interdisciplinary as the core curriculum of learning is interwoven into each subject under study by the students. For instance; in CCVE, under the strand —Governance and Leadership students will learn the different types of leadership and common governance principles cut across the different leadership styles they will learn. Apart from learning these, students learning in CCVE are expected to use the application of writing, speaking and communication presentation skills in writing text types in their essay, such as argumentative essay, informative, explanatory, descriptive, expository and narrative essay, oral presentations and speech delivery in debates, advocacies and awareness campaigns. They must be able to capture the mechanics of English skills such as grammar, punctuation etc... Though these skills are studied under English, they are considered as core skills that cut across all subjects under study.

Therefore, essential knowledge, skills, values and attitudes comprising the core curriculum are interwoven and provide an essential and holistic framework for preparing all students for careers, higher education and citizenship in this learning.



(iii) Intra-disciplinary approach

This approach involves teachers integrating sub-disciplines within a subject area. For instance, within the subject CCVE, the four different strands will all be captured studying a particular content for CCVE. For example, under the Civic Systems and Principles, students will learn about civic different identities of different contexts and their participation likewise in the other 3 strands. Thus, children are well aware of their responsibility in active civic participation.

(iv) Trans-disciplinary Approach

In this approach learning goes beyond the subject area of study. Learning is organized around students‘ questions and concerns. That is, where there is a need for change to improve lives, students develop their own curriculum to effect these needs. The Trans-disciplinary approach addresses real-life situations thus gives the opportunity to students to attain real life skills. This learning approach is more to do with Project–Based Learning also referred to as problem-based learning or place-based learning.

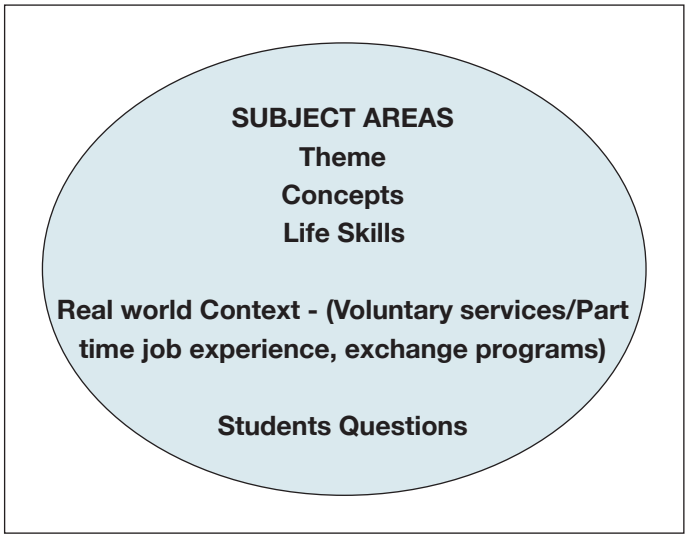
The three steps to planning project-based curriculum (Chard 1998).

1. Teachers and students select a topic of study based on student interests, curriculum standards, and local resources.
2. The teacher finds out what the students already know and helps them generate questions to explore. The teachers will also provide resources for students and opportunities to work in the field.
3. Students share their work with others in a culminating activity. Students display the results of their exploration and review and evaluate the project.

For instance; students may come up with slogans for school programs such as 'Our culture – clean city for a healthier PNG‘. The main aim could be to curb betel nut chewing in public areas especially around bus stops and local markets. Here, students draw up their own instructions and criteria for assessment which is they have to clean the nearest bus stop or local market once a week throughout the year. They also design and create posters to educate the general public as their program continues. They can also involve the town council and media to assist them especially to carry out awareness.

Studies (Susan M. Drake and Rebecca C. Burns) have proven that Project based-programs achievements have led to the following:

- Students go far beyond the minimum effort.
- Make connections among different subject areas to answer open-ended questions.
- Retain what they have learnt.
- Apply learning to real-life problems.
- Have fewer discipline problems.
- Lower absenteeism (Curtis, 2002).



These integrated learning approaches will demand for teaches to be more proactive in order to improve students learning and achievements. In order for SBC to serve its purpose fully, these three approaches must be engaged for better learning for the children of Papua New Guinea now and in the future

Teaching and Learning Strategies

Technology and Industrial Arts emphasizes and embraces the use of cognitive, reasoning, decision-making, problem solving and higher level thinking skills to teach to enhance students‘ understanding of inter-disciplinary concepts and issues in relation to environment, geography, history, politics and economic within PNG and globally.

It aims to provide a meaningful pedagogical framework for teaching and learning essential and in demand knowledge, skills, values, and attitudes that are required for the preparation of students for careers, higher education and citizenship in the 21st century.

Students must be prepared to gather and understand information, analyse issues critically, learn independently or collaboratively, organise and communicate information, draw and justify conclusions, create new knowledge, and act ethically.

Teaching and learning is a two-way interactive interaction between teacher and a student, a student to a student/students and occurs in any learning environment in or outdoors depending on the nature of teaching strategies learning activities and performance assessments teachers plan to use in the delivering of the lesson.

Technology and Industrial Arts teaching and learning takes on a **blended perception and practices** of its content delivering with envisioning intentions to reinforce evidence based learning. It embraces these in the classrooms whereby each technology strand content in the form of content standards, benchmarks and performance standards direct or determine the planning of the types of learning situations and activities, assessments throughout the school year.

These standards, including the specific knowledge skills and attitudes ,how they are planned for students learning and performance attainment purposes in the respective grade levels are through highly commended teaching, learning and assessing strategies. For example; using blended learning strategies. This is where/when the traditionally recognised strategies(teacher centred) is blended with using e-teaching/ learning strategies (online using smart phones) to learn about multi-media, in a Communication Technology strand lesson.

Teaching Strategies

Find listed for your convenience are identified teaching strategies commended for TIA subject lesson deliveries lessons However teachers can blend these in with the existing or current teaching practices using technology;

- use of multimedia for content research
- utilization of social media for fact finding on particular technology
- using variety of resources for meaningful teaching
- making most of games in electronic devices for learning
- use technology to empower students and reach out.

Learning Strategies

These are suggested learning strategies that can be used across the learning of all the five content strands in TIA subject.

1. Using multiple types of instructional materials for learning
2. Incorporate technology for reinforcement and motivation for learning
3. Try new learning techniques for
4. Keep your traditional methods
5. Vary your assessments
6. Mix up group work styles
7. Try a digital curriculum

Classroom assessment strategies

Find for your convenience suggested assessment strategies to assess technology curriculum content.

- Clarifying learning intentions and criteria for success.
- Engineer effective classroom-based questioning and discussions on performance tasks that provoke or draw out evidence of learning.
- Constantly provide feedback that move learners forward.
- Present or address students as instructional resources for each other,
- Computer assisted video-based test

All Teachers teaching TIA from grades 9-12 are encouraged to also add to this list for the good of their student‘s learning are.

TIA Classroom

This classroom will be a learning environment prepared especially for the teaching and learning of TIA subject. As we are moving through the 21st century technology era TIA classrooms must reflect shadow image to encourage the teaching and learning of all the strands in the subject content.

It is suggested that teachers and students could work together to ensure that this technology classroom tips could be accommodated. These are

- Regularly keep updates on new advancements in technology
- Ongoing Effective Evaluate ness on an Ongoing Basis
- Make Technology a Treat & Not an Expectation
- Monitor closely usage of electronic devices
- Set ground rules for all
- Share knowledge on how to get technical support
- Communicate with Parents
- Familiarise yourself with the Technology First aid
- Use of Technology by Students

These teaching and learning strategies will help teachers to;

- familiarise themselves with different methods of teaching in the classroom
- develop an understanding of the role of a teacher for application of various methods in the classroom

Successful teachers always keep in view that teaching must —be dynamic, challenging and in accordance with the learner‘s comprehension. He/she does not depend on any single method for making his/her teaching interesting, inspirational and effective.

Please find a list of the different teaching and learning strategies in the Appendix.

These strategies;

- make learning more engaging
- make learning more effective
- make learning fun
- encourage higher motivational level
- improve attention spans
- develop higher order thinking and reflective skills
- improve communication skills
- develop the spirit of teamwork/collaboration
- develop leadership skills and qualities
- encourage discovery learning

Therefore, teachers are encouraged to utilise the suggested strategies as well as others.

Strands, Units and Topics

This section of the teacher guide contains the Technology and Industrial Arts: Communication Technology content to be taught in grade 9. It consists of;

- a brief explanation of how the topics, learning objectives and lesson topics are derived.
- an overview of the content distributed according to the four terms in an academic year;
- the unit of work per strand

Technology and Industrial Arts is organized around five main strands – Textiles, Food, Construction, Communication, and Computer of which Communication Technology is one strand. These strands embed the content that students are expected to learn and master at each grade and school level. National content standards are benchmarked at each grade level, which allows for essential KSAVs to be reinforced and expanded throughout the grades.

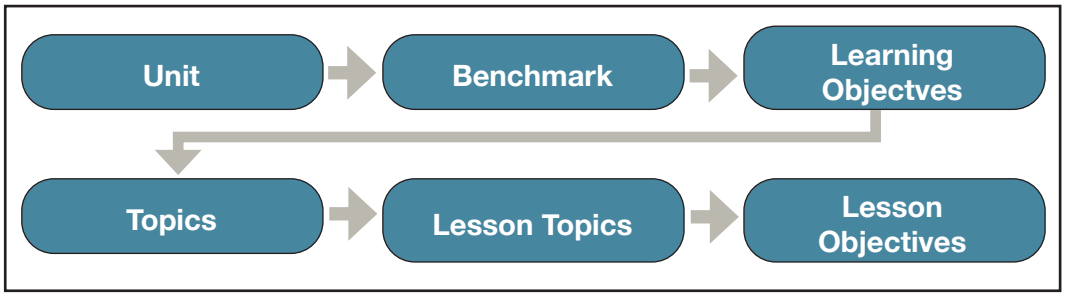
Benchmarks show grade level expectations of what students are able do to demonstrate that they are making progress towards attaining the content standard.

These grade-level benchmarks were then unpacked to identify the topics, learning objectives and the lesson topics. Below is a description of how topics were derived from the grade-level benchmarks.

Identifying topics from benchmarks

In order to identify the topic from the benchmark, we need to unpack the benchmark. When we unpack a benchmark, we are identifying what students will know and be able to do when they have mastered the benchmark.

1. Write out the benchmark that you want to unpack.
2. Write the verbs (skills/actions) – Higher order thinking skills
3. Underline or highlight the big idea (content) in the benchmark. The big idea (content) is the topic derived from the benchmark.
4. Write essential questions that would be engaging for students
5. Develop sub-topics from the big idea (topic)
6. Write learning objectives according to the sub-topics
7. Write lesson topics from the learning objectives



Content Overview

The teaching and learning of Communication Technology as a strand in Grades 9 will follow the outline of content for the four terms in a year as a strand within the Technology and Industrial Arts.

This is only a sample to guide teachers as to how they are going to plan and teach the five strands in Technology and Industrial Arts in a school year.

TERM	STRAND	UNIT	CONTENT STANDARD
1	**Textiles Technology**	Fibres and Fabrics	**CS1.1** Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing.
		Textiles and Clothing	**CS1.2** Integrate and apply principles and techniques in presenting fashion ideas and illustrations in pattern making and garment construction for a variety of needs and occasions
	Food Technology	Food and Nutrition	**CS2.1** Examine and analyse the characteristics and properties of different types of food and the social, economic, political, cultural and technological influences on their production and compliance with ethical principles and standards.
		Food Science	**CS2.2** Investigate and analyse the cultural, physical, chemical, nutritional, biological and sensory characteristics of food and how they influence the development and production of food to meet different demands (eg, health, occasions, lifestyle, business)
2	**Construction Technology**	Building Technology	**CS3.1** Investigate the history and theory of buildings and analyse the components and systems of buildings, occupational health and safety procedures, the properties of building materials and the processes in which those materials and equipment are used according to industry standards.
		Electrical Technology	**CS3.2** Analyse and apply the technological processes, concepts, principles and practices related to Electrical Technology and its social contribution with regard to economic growth, entrepreneurship, sustainability and as a tool for change, improving the quality of life responsive to individual, community and industrial needs.
		Plumbing Technology	**CS3.3** Investigate and analyse fundamental concepts of plumbing and theories, Occupational Health and Safety Regulations and standards, trade drawing, demonstrations and applications of tools and materials specifications, installation of plumbing fittings and accessories in Drain, waste, vent system, and water (DWV) distribution system.
		Welding Technology	**CS3.4** Investigate and analyse safety procedures, print reading, measurement and layout, identify properties of metals, the welding techniques, cutting processes according to welding codes, inspections, testing principles and apply fundamentals of fabrication.
		Engineering Technology	**CS3.5** Investigate and analyse the historical and societal influences in Engineering by understanding the engineering principles, practices, the design process, the management, problem-solving and communication skills appropriate to any engineering field.

TERM	STRAND	UNIT	CONTENT STANDARD
3	**Communication Technology**	Data Communication and Network	**CS4.1** Investigate and analyse communication technology utilising multi-media and the practices and systems in designing, installing, configuring and managing networks.
		Computer Security and Safety	**CS4.2** Investigate and analyse the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.
4	**Computer Technology**	Computer Architecture	**CS5.1** Explore and analyse computer fundamentals, the skills to manage and maintain; diagnose, troubleshoot and solve issues that encompass computer systems, networking, interfacing and programming as well as electronics and robotics and be aware of related environmental and societal issues.
		Computer Software	**CS5.2** Investigate and analyse computer system and application software, programming, algorithm, web design and databases, and develop and apply the skills and knowledge in the various software.

Strand 4: Communication Technology

This strand consists of two (2) units. They are;

1. Data and Communication Network
2. Computer Security and Safety

UNITS	TOPICS	LESSON TITLES
1. Data Communicaion and Network	1. Data Communication Systems	1. Introduction to Data Communication Systems 2. Elements of Data Communication systems
	2. Computer Networks	1. Introduction to Computer Networks 2. Functions of Computer Network Components
	3. OSI Model	1. Introduction OSI Model 2. Functions of the OSI Model
	4. Communication Technology Terminologies	1. Communication Technology Terminologies 2. Application of Terminologies 3. Media Products
	5. Media Communication	1. Introduction to Media Communication 2. Techniques and Skills for application purposes
	6. The Design Brief –A simple network	1. Introduction to Design Brief 2. Research and apply Design Brief in simple Networking
	7. Authoring software-Multimedia	1. Introduction to Multimedia, Authoring Software 2. Categories of Authoring Software 3. Features of Multimedia, Authoring Software
2. Computer Security and Safety	1. Postures in Computer Equipment Usage	1. Introduction to Ergonomics 2. Correct Posture or Positions 3. Case Study - Posture
	2. Health and Safety in ICT	1. Types Health Hazards associated with use of ICT 2. Good ergonomics practices to minimise Health hazards associated in ICT usage
	3. Effects of Computer Usage	1. Introduction to computer technology 2. Effects of Computer Technology Usage on society
	4. Emerging Technological Impact	1. The evolution of emerging technologies 2. Impact of emerging technologies on society and environment 3. Case-Study (Music)
	5. Safe Working Practices/Habits	1. Introduction to Work Place Safety 2. Safe Work Practices

Unit 1: Data Communication And Network

UNITS	BENCHMARK	TOPICS	LESSON TITLES
1. Data Communicaion and Network	**9.4.1.1**	1. Data Communication Systems	1. Introduction to Data Communication Systems 2. Elements of Data Communication systems
	9.4.1.2	2. Computer Networks	1. Introduction to Computer Networks 2. Functions of Computer Network Components
	9.4.1.3	3. OSI Model	1. Introduction OSI Model 2. Functions of the OSI Model
	9.4.1.4	4. Communication Technology Terminologies Basic Scientific and Mathematical Concepts in creating media products	1. Communication Technology Terminologies 2. Application of Terminologies 3. Media Products
	9.4.1.5	5. Media Communication	1. Introduction to Media Communication 2. Techniques and Skills for application purposes
	9.4.1.6	6. The Design Brief – A simple network	1. Introduction to Design Brief 2. Research and apply Design Brief in simple Networking
	9.4.1.7	7. Authoring software-Multimedia	1. Introduction to Multimedia, Authoring Software 2. Categories of Authoring Software 3. Features of Multimedia, Authoring Software

UNIT 1. Data Communication and Network

Content Standard .4.1 Investigate and analyse communication technology utilising multi-media and the practices and systems in designing, installing, configuring and managing networks.
Benchmark 9.4.1.1 Define the elements of data communication system

Topic 1: Data Communication Systems

Learning Objectives
By the end of this topic, the students will be able to;
1. Define Data Communication System (data, information and communication systems)
2. Identify, define and describe the elements of data communication systems.
3. Define the elements of data communication systems.
4. Research and identify the important of data communication in the global society today.

Essential Questions:
1. What are the elements of data communication?
2. How are they organised for communication in a network?
3. Why data communication?

Essential Knowledge, Skills Values and Attitudes

Knowledge	Skill:	Values:	Attitudes
• Data Communication	• Define, Discuss, Explain	• Rationality	• Be appreciative of the use of data communication system.

Technology in Industrial Arts Application: Communication Technology

Content Background

Introduction to Data Communication and Network (Communication Technology)

Data Communication and Network refers to the communication between digital computers, facilitated by computer networks. It is the process of using computing and communication technologies to transfer data from one point (communication device) to another and/ or vice versa. It is made up of hardware and software components. The hardware components of a data communication system involves the devices that sends, transmits and receives the information , while the software components of a communication system involves the guidelines, rules and/or the protocols used in sending and receiving data and/or information on a computer network.. Transmission mediums are the physical pathway of transferring data or information from one point to another.

Important Terminology for the topics include;
- **Data**
- **Communication**
- **Data Communication**
- **Transmission mediums**
- **Network**

The effectiveness of a data communication system is influence by four (4) fundamental feature and they are;

***1. Delivery* – data should be delivered to the correct destination and correct user.**

***2. Accuracy* –** the communication system should deliver the data correctly, without introducing any errors. The data may get corrupted during transmission affecting the accuracy of delivered data.

3. Timeless - Audio and Video data has to be delivered in a timely manner without any delays; such data delivery is called real time transmission of data.

***4. Jitter* –** is the variation in the packet arrival time or in other words the amount of time that elapses after the receipt of a packet data or information until the next packet of data or information. Uneven Jitter may affect the timeliness of data being transmitted.

Components of Data Communication System.

The data communication system has five (5) elements which transmits digital data/ information from one point or communication device to another.

Basic Components of digital data communication system are:

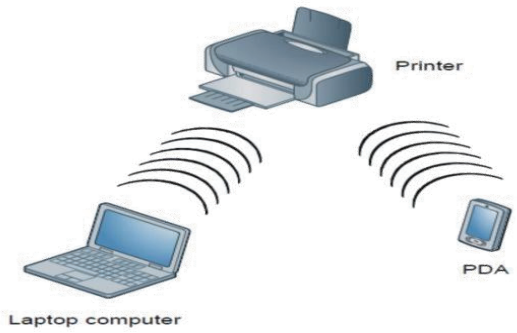
1. **Source and/ or Sender:**
2. **Transmitter and Protocols (encoder/decoder)**
3. **Transmission Medium**
4. **Messages**
5. **Receiver or Destination**

Types of Network

All computer networks are categorised into six types.

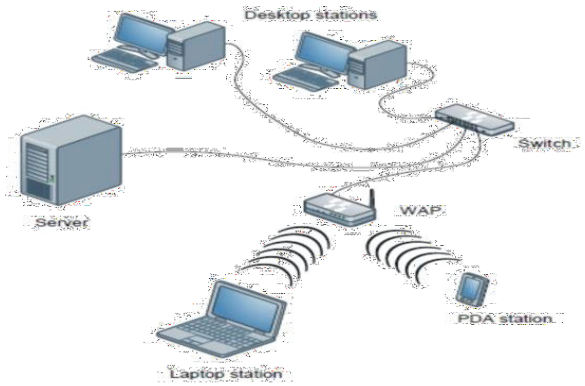
a) Personal Area Network (PAN)

Is the interconnection of information technology ices of an individual computer. For instance, computer, printer, scanner, speakers and etc.



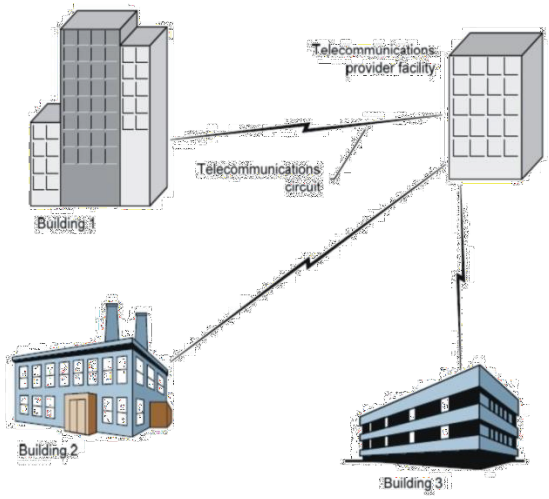
b) Local Area Network (LAN))

Privately owned and links provide devices in a single office, building or institutions.



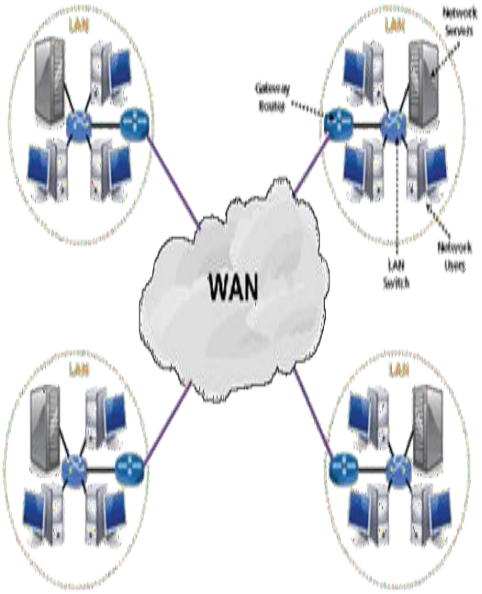
c) Metropolitan Area Network (MAN)

Is a network size between LAN and WAN, that is medium. It normally covers an area within a town or city.



d) Wide Area Network (WAN)

Is a network system that covers long distance transmission of data.



e) Wireless

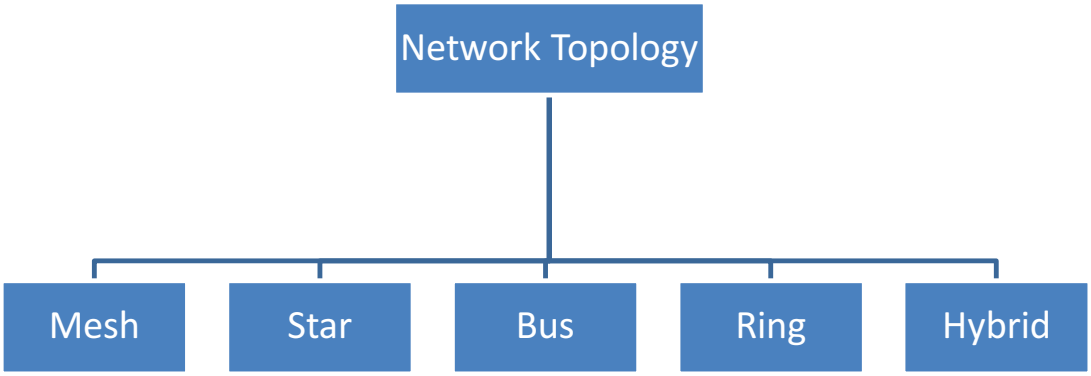
Wireless connections occur when two devices connect through settle light connections.

f) Inter Network (Internet)

On the internet, data and information are transferred worldwide by the servers and clients which are computers connect to the internet.

Network Topologies

Network Topology refers to the way in which a network is laid out physically. That is two or more devices connected to a node or data link; and two or more links form a topology.



Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore, students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Lesson 1: Introduction to Data Communication Systems
Lesson Objectives: effectively plan research activity
Competently conduct research and present research findings.

Teacher	Students
Introduction	
i. Ask the Essential Question	1. Ponder the essential questions as guide to the lesson.
Body	
Activity 1 (Engage) Brainstorming activity on how computer network and data communication are set up. Divide students into groups and design guiding questions for their research. **Activity 2 (Explore)** In groups; conduct research on computer networks and the components of data communication. **Activity 3 (Explain)** Presentations of research findings on data communication and computer networks.	**Activity 1. [Engage**] Work in groups to look at the guiding questions that will lead to the research to be conducted. **Activity 2. [Explore]** Conduct the research on computer networks and the components of data communication **Activity 3 [Explain]** Present research findings.
Conclusion	
Ask students to summarise their research findings	Discussion on the summary of research findings.
Assessment	
The main purpose of assessment is to find out if students comprehend what a computer Information Processing Cycle is. Assessment should be linked to the performance indicator indicated in the lesson plan and the lesson objective.	**Assessment Rubric descriptors** 1. Detailed explanation of computer network with clear illustrations 2. Define data communication 3. detailed explanation of the components of data communication

Resource

1. Online search engine – www.tipsand artiles.com
2. Online E-book – Data Communication for High schools..

Lesson 2: Elements of Data Communication systems

Teaching Strategies
Students engaged in exploring data communication and network setups in their learning environment especially the setup of the computer laboratories.

Learning Strategies

1. What are the elements of data communication?
2. How are they organised for communication in a network
3. Why data communication?

Activity 1

Explore and identify how the idea of data communication works within a computer network.
Discuss how the computer lab network system was setup.
Discuss and explain the importance of data communication.

Activity 2

Define and explain the functions of each element in the data communication and network setup.
Identify, define and explain the functions of the element of data communication and network setup.

Activity 3

Discuss and explain the importance of data communication.
Students are engaged in investigating and analyzing elements of the computer network system of the school

Resources

1. Online e-book – Elements of Data Communication Systems

UNIT 1. Data Communication and Network

Content Standard: 4.1 Investigate and analyse communication technology utilising multi-media and the practices and systems in designing, installing, configuring and managing networks.

Benchmark: 9.4.1.2 Describe the functions of the different components of a computer network

Topic 2: Computer Network

Learning Objectives

By the end of this topic, the students will be able to;

1. Define and describe computer system?
2. Define and describe computer networking system?
3. Identify, define and describe the components of a computer network system?

Essential Questions:

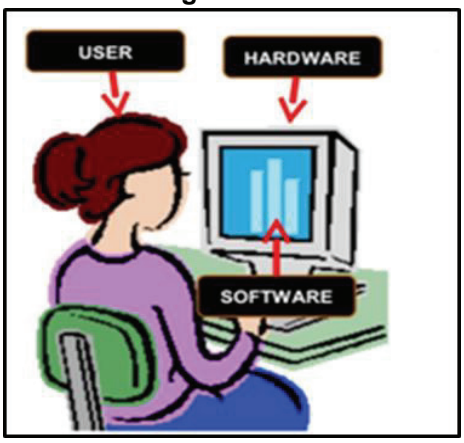
3. What is a computer system?
4. What is computer network system?
5. What are the functions of the computer network components?

Essential Knowledge, Skill, Values and Attitudes

Knowledge	Skill	Value	Attitudes
Computer Networks	Describe	Rationality	Appreciative

Technology and Industrial Arts Application: Communication Technology

Content Background



What is a computer system?

A computer system is defined as a combination of components designed to enter data, process data, store data and give feedback or produce results for the data. A computer system requires **hardware, software and a user** to fully function.

What is a computer networking system?

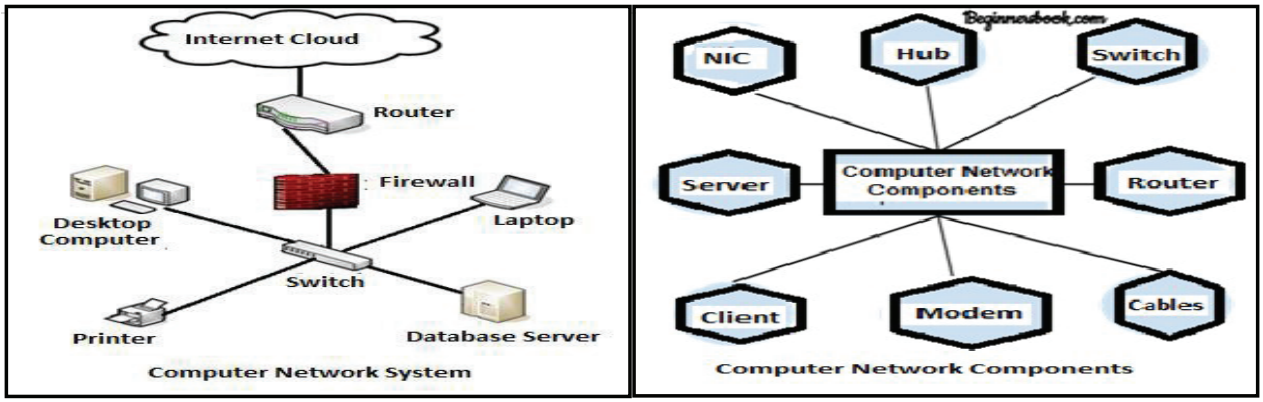
A Computer Network System

What is a computer networking system?

A **computer network system** is group more than one computer systems and other computing hardware devices that are linked together through communication channels to facilitate communication and resource-sharing among a wide range of users. It is a **digital telecommunications network system** which allows nodes to share resources. In computer networks, computing devices exchange data with each other using connections (data links) between nodes. These data links are established over cable media such as twisted pair or fiber-optic cables, and wireless media such as any device in a computer that handles the intermediate stage of processing the incoming data

Components of a Computer Network System

Computer networks share common devices, functions, and features including servers, clients, transmission media, shared data, shared printers and other hardware and software resources, network interface card(NIC), local operating system (LOS), and the network operating system (NOS). Following are common network components.



Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Lesson 1: Introduction to Computer Networks

Teaching Strategies

Activity 1. Engage students by writing motivational questions on the board to be answered by individual students on the following contents:
- i. computer systems
- ii. Network systems
- iii. and components of a network system

Activity 2 Engage students to investigate the computer systems they are working on.

Activity 3 Engage students to investigate the network components of the schools network system.

Learning Strategies

Activity 1 Students are engaged in investigating and analyzing questions on;
- i. Computer system of the individual computers they are using
- ii. Network system of the computer network system of the school
- iii. Components of a network system of the computer network system of the school.

Activity 2 i. Investigate and identify how a computer works.
- ii. Identify and name the physical components.
- iii. Investigate and identify how hardware and peripherals components are connected.

Activity 3 Investigate the network component of the school and write a report on your findings.

Resources

1. Online search engine – www.tipsandarticles.com
2. Online E-book – Data Communication for High schools..
3. Data Communication (e-book) Yekini,.
4. Wikiversity.

Lesson 2: Functions of Computer Network Components

Teaching Strategy

- Engage students by accessing prior knowledge through connecting with past knowledge:

i. Components of a network system
ii. Functions of a computer network components.

- Engage students to explore and investigate the functions of the components of computer network systems of the school laboratory.
- Engage students to explore, explain, extend and elaborate on the network components of the school computer network system.

Learning Strategy

Activity 1 Students are engaged in investigating and analyzing questions on;
i. Components of a network system of the school.
ii. Functions of the Components of a network system of the school.

Activity 2 Discuss and define the components of the computer network system.
Activity 3 Investigate the network component of the school and explain the functions in their own words.

UNIT1. Data Communication and Network

Content Standard: 4.1 Investigate and analyse communication technology utilising multi-media and the practices and systems in designing, installing, configuring and managing networks.

Benchmark: 9.4.1.3 Define the OSI (Open Systems Interconnect) model and how it functions.

Topic 3: OSI Model

Learning Objectives:

By the end of this topic, the students will be able to;

1. Define OSI Model and describe the Function of an OSI Model.
2. Identify and explain the function of an OSI network model.
3. Explore and explain the concept of OSI model layers/sessions.
4. Understand and explain the communication concepts between layers/sessions of an OSI model.

Essential Questions:

1. What is a computer network model?
2. What is an OSI network model?
3. How does an OSI Network model function?
4. What are the seven (7) OSI Model layers/sessions?
5. How does communication takes places between the layers/sessions of an OSI model?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
OSI model	Define ,Identify, Explain	Importance	Appreciative

Technology and Industrial Arts Application: Communication Technology

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Content Background

What is a computer network model?

A computer network model is a digital telecommunications network model which allows nodes to share resources or exchange data/ information between two parties. In computer networks, computing devices exchange data with each other using connections (data links) between nodes. A ***data link*** is an electronic connection for the exchange of information. A ***node*** is a point at which lines or pathways intersect or branch. It is the central or connecting point. These data links are established over cable media such as twisted pair or fiber-optic cables, and wireless media such as Wi-Fi.

The (OSI) Open Systems Interconnection Model (connecting with each other) is a conceptual and logical layout that defines network communication used by systems open to interconnection and communication between computer systems.

The Seven (7) Open Systems Interconnection (OSI) Model layers/sessions.

Network engineering is a complicated task, which involves software, firmware, chip level engineering, hardware, and electric pulses. To ease network engineering, the whole networking concept is divided into seven (7) layers and each layer is involved in some particular task and is independent of all other layers. But as a whole, almost all networking tasks depend on all of these layers. Layers share data between them and they depend on each other only to take input and send output. Following are the seven (7) OSI model layers or sessions.

1. ***Physical Layer -*** This layer defines the hardware, cabling, wiring, power output, pulse rate etc.

2. ***Data Link Layer -*** This layer is responsible for reading and writing data from and onto the line. Link errors are detected at this layer.

3. ***Network Layer -*** This layer is responsible for address assignment and uniquely addressing hosts in a network.

4. ***Transport Layer -*** This layer is responsible for end-to-end delivery between hosts.

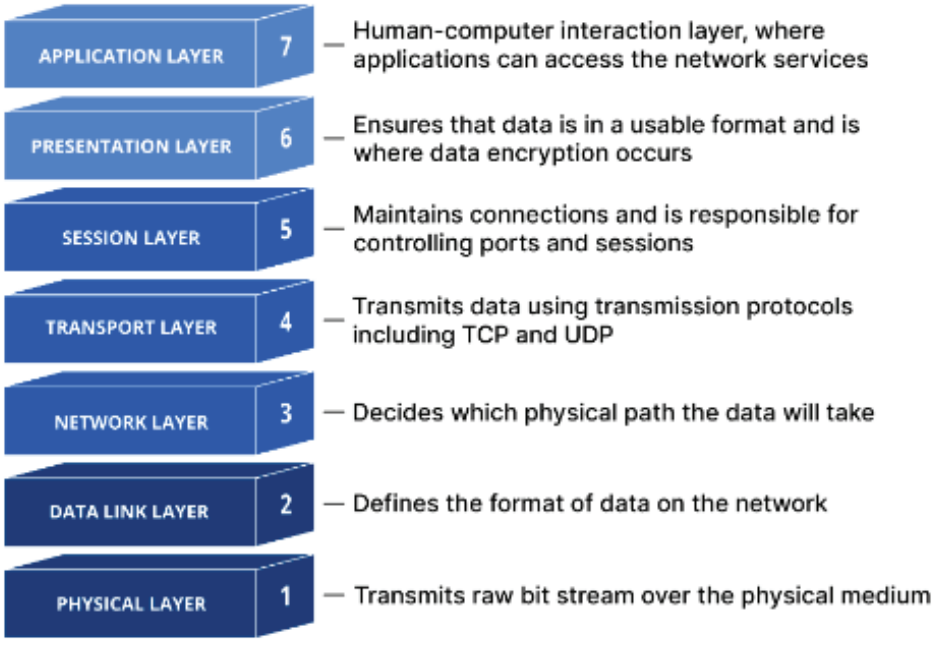
5. ***Session Layer -*** This layer maintains sessions between remote hosts. For example, once user/password authentication is done, the remote host maintains this session for a while and does not ask for authentication again in that time span.

6. ***Presentation Layer -*** This layer defines how data in the native format of remote host should be presented in the native format of host.

7. ***Application Layer -*** This layer is responsible for providing interface to the application user. This layer encompasses protocols which directly interact with the user.

Conceptual and logical layout that defines interconnection and communication between computer systems.

9. In layered architecture of Network Model, one whole network process is divided into small tasks. Each small task is then assigned to a particular layer which works dedicatedly to process the task only. Every layer does only specific work.
10. In layered communication system, one layer of a host deals with the task done by or to be done by its peer layer at the same level on the remote host. The task is either initiated by layer at the lowest level or at the top most level. If the task is initiated by the topmost layer, it is passed on to the layer below it for further processing. The lower layer does the same thing; it processes the task and passes on to lower layer. If the task is initiated by lowermost layer, then the reverse path is taken. Every layer clubs together all procedures, protocols, and methods which it requires to execute its piece of task. All layers identify their counterparts by means of encapsulation header and tail.



Functions of an OSI Model

Data Communication System is complex with millions of people communicating with mobile phones, computers etc...in real time around the world at the same time. It is most likely that communication problems will occur. To make communication easier, the OSI (Open System Interconnection) model was created by the ISO (International Standards Organisation) in 1977 to help control communication between computer systems.

The OSI model breaks down the problems involved in moving data from one computer to another computer or network device by categorising these hundreds of problems to Seven Layers, which are used to categorise specific problems.

All the problems which are related to the communications are answered by specific protocols operating at different layers. The following image shows the seven layers of Open Systems Interconnection (OSI) model, their functions and examples.

Reference

Briscoe, N. (2000). Understanding the OSI 7-layer model. *PC Network Advisor*, *120*(2), 13-15.

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Lesson 1: Introduction to OSI Model

Teaching Strategy

- Engage students by accessing prior knowledge through connecting with past knowledge:

i. Network systems
ii. Network model
iii. the OSI systems

- Engage students to explore and investigate the OSI systems of the schools data communication and network system.
- Engage students to explore, explain, extend and elaborate how the OSI system works for the schools computer Laboratory.

Learning Strategy

Activity 1 Students are engaged in investigating and analyzing questions on;

i. The Network systems
ii. Network models
iii. The OSI system
iv. How the OSI system works.

Activity 2 In groups students are engaged to explore and investigate the schools;

i. Network Model.
ii. OSI system.
iii. Explain as group presentation how they work.

Activity 3 Record and report their finding on the schools OSI mode.

UNIT 1. Data Communication and Network

Content Standard: 4.1 Investigate and analyse communication technology utilising multi-media and the practices and systems in designing, installing, configuring and managing networks.

Benchmark: 9.4.1.4 Explore the use of technical terminology, basic scientific concepts, and mathematical concepts used in communications technology and apply them to the creation of media products.

Topic 4: Basic Scientific and Mathematical Concepts in communication technology

Learning Objectives:

By the end of this topic, the students will be able to;

1. Define basic scientific and mathematical terminologies and concepts used in communication technology.
2. Define binary systems and explain how it functions.
3. Define light waves, space, relativity and etc. in communication technology.
4. Explain the concept of light waves used in the binary system in communication technology.

Essential Questions:

1. What are the basic scientific concepts used in communication technology?
2. What are the basic mathematical concepts used in communication technology?
3. How does the Binary System works in communication technology?
4. How does the scientific concepts of light waves, space and relativity used in communication technology?
5. What is the main scientific and mathematical concepts used in creating media products?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
Scientific and mathematical concepts in communication technology	Explore and Apply	Affectivity and openness	Open- minded and optimistic to use the concept of STEAM in communication technology.

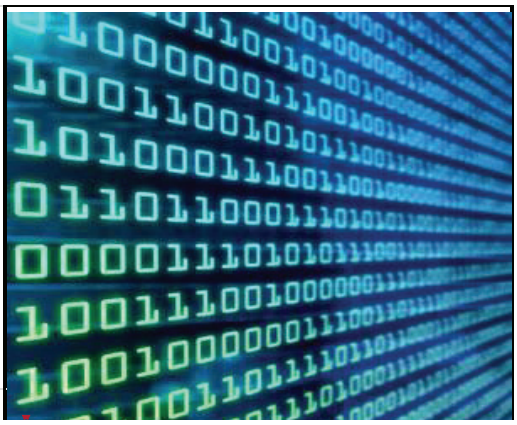
Technology and Industrial Arts Application: Communication Technology

Content Background

Binary

Binary may refer to any of the following:

1. **Binary** is a **base 2** number system invented by Gottfried Leibniz that is made up of only two numbers: 0 and 1. This number system is the basis for all **binary code**, which is used to write data such as the computer processor instructions used every day.



How does binary work?

The 0s and 1s in binary represent **OFF or ON** respectively. In a transistor, a "0" represents no flow of electricity, and "1" represents electricity being allowed to flow. In this way, numbers are represented physically inside the computing device, permitting calculation.

Why do computers use binary?

Binary is still the primary language for computers for the following reasons.

- It is a simple and elegant design.
- Binary's 0 and 1 method is quick to detect an electrical signal's off or on state.
- The positive and negative poles of magnetic media are quickly translated into binary.
- Binary is the most efficient way to control logic circuits.

How to read binary numbers

The following chart illustrates the binary number 01101000.

Each column represents the number two raised to an exponent, with that exponent's value increasing by one as you move through each of the eight positions. In this example, we get the total value by reading the chart from right to left and adding each column's value to that of the previous column: (8+32+64) = 104. As you can see, we do not count the bits with a) because they're "turned off".

:

Exponent:	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Value:	128	64	32	16	8	4	2	0
ON/OFF:	0	1	1	0	1	0	0	0

The next example is 11111111 in binary, the maximum 8-bit value of 255. Again, reading right to left we have 1 + 2 + 4 + 8 + 16 + 32 + 64 + 128 = 255.

Value:	128	64	32	16	8	4	2	1
ON/OFF:	1	1	1	1	1	1	1	1

Counting on a computer normally starts with 0 instead of 1. Therefore, counting all the bits does equal 255, but if you start at 0, it is really 256.

If you took the binary code from the first example (which totaled 104) and put it into ASCII, it would produce a lowercase *h*. To spell the word *hi*, you would need to add the binary for the letter *i*, which is 01101001. Putting these two codes together, we have 0110100001101001 or 104 and 105, which represents *hi*.

Note: ASCII means American Standard Code for Information Interchange.

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Lesson 1: STEAM Concept

Teaching Strategy

- Engage students in discussion about the Basic Science Technology Engineering Arts and Mathematics or STEAM Concept in Communication Technology.
- Allow students to investigate the binary system and how it works.
- Ask students to evaluate the light waves, space and relativity in communication technology.

Learning Strategy

Activity 1 Explore and investigate basic concept of STEAM in communication.

Activity 2 Explore and investigate binary system and its function

Activity 3 Explore and investigate light waves used in binary system in communication

UNIT1. Data Communication and Network

Content Standard: 4.1 Investigate and analyse communication technology utilising multi- media and the practices and systems in designing, installing, configuring and managing networks.
Benchmark: 9.4.1.5 Explore and articulate the core concepts, techniques, and skills required to produce a range of communications media products or services.

Learning Objectives:
By the end of this topic, the students will be able to;

1. Define media communication.
2. Explore and articulate core concepts and skills required to create media products or services.
3. Explore and articulate the techniques required to create media products or services.

Essential Questions:

1. What is communication media?
2. How media does helps in communication today?
3. What are the core concepts and skills needed in creating media communication products?
4. What are the techniques used in creating media communication products and services?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
Media Communication	Explore, Articulate	Liberty and Creativity	Appreciative of knowledge and skills of communication media products and services.

Technology and Industrial Arts Application: Communication Technology

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Content Background
What is Media Communications?
In the simplest form, **Media** is the plural of **"medium". Medium** is a channel of communication**.**
It is one of the means or channels of communication in society**. Communication** is a way to relay message, information and data from one person to another or in technology terms it is a way to inter- connect, join, link or transfer data or information from one device to another.

Therefore, **media communication** refers to multiple communication channels to relay messages, data or information. It is the means of delivering and receiving data or information. In telecommunication, these means are transmission and storage tools or channels for data storage. Different media are employed for transmitting data from one computer terminal to the central computer or to other computer systems inside some kind of network.
There are two forms of communication media:

- Analog: Includes conventional radio, telephonic and television transmissions.

Digital: Computer-mediated communication, computer networking and telegraphy.

The most commonly used data communication media include:

- Wire pairs
- Coaxial cable
- Microwave transmission
- Communication satellites
- Fiber optics

Examples of media communication service products include;

- Television broadcasting service
- On-demand media services
- Commercial communication
- Radio broadcasting services

Communication Media Products

- Books, magazine, publications
- Sound recording
- Video recording
- Software product
- Computer game
- Video game

Roles of Media in Communication today. Importance of Media in communication today.

Media plays a very significant role in keeping everyone updated about the various events around the world. With the help of various media like electronic media, print media and web media, the mass communication method is accomplished in a suitable way. A vast majority of people, all across the world, rely upon various sources of media for keeping themselves updated on various ongoing issues around the world. Media plays an important role for the whole society.

Let us know and understand the significance of media through the following important points:

1. Gives us immense knowledge & transmits information
2. Raises our consciousness
3. Raises voice against issues in societies
4. Provides true pictures and live telecast for various events
5. Educates the society

The five points just mentioned tell us the important role of media in spreading any message across the world in today‘s society.

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching

what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Resources

https://www.techopedia.com/definition/14462/communication-media https://www.managementstudyguide.com/importance-of-communication.htm https://www.govloop.com/community/blog/the-role-of-communication-technology-in-todays- society/

Teaching Strategies

Engaged students in exploring and investigating media communication.

Ask students to discuss and list core concepts and skills required to create media products and services.

Ask students to describe techniques used to create media products and services.

Learning Strategies

Activity 1 Engaged in exploring and investigating media communication.

Activity 2 Discuss and list core concepts and skills required to create media products and services.

Activity 3 Describe techniques used to create media products and services.

UNIT1. Data Communication and Network

Content Standard: 4.1 Investigate and analyse communication technology utilising multi- media and the practices and systems in designing, installing, configuring and managing networks.
Benchmark: 9.4.1.6 Research and apply the design brief to design, configure and manage simple network.

Topic 6: Design Brief- Simple Network

Learning Objectives:
By the end of this topic, the students will be able to;
1. Research and evaluate the evaluation of emerging technologies in the society and the environment.
2. Research and evaluate the impacts of emerging technologies in the society and the environment.
3. Creatively, research, design and apply design brief in a simple network using design brief concepts.

Essential Questions:
1. What is a Design Brief?
2 .How did data communication and network evolve in the 21st Century?
3. What are simple design brief in a networking?
4. What are the impacts of emerging technologies on society and environment?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
Design Brief	Research , apply	Rationality	Open-Minded and Appreciative

Technology and Industrial Arts Application: Communication Technology

Content Background

1. What is a Design Brief?

A ***design brief*** is the plan of creating something. By this, the designer outlines his or her idea or though into pen and paper and produces it in the physical reality. This journey can take many paths, which are known as the ‐design process‖.

Design Process – the design process is the step by step procedure taken in the production or creation of a product. The design processes responds to the needs and opportunities in designing a product. By this the designer works out factors that influence design and defines his/her work as a designer and identifies his/her role and contributions in in improving the quality of the product.

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Lesson 1: ntroduction to Design Brief

Teaching Strategy

- Engage students by accessing prior knowledge through connecting with past knowledge of a design brief with illustrative examples in the class.
- Engage students to explore and investigate simple design brief.
- Divide students into groups or teams of five and allow them to write up a simple network design brief.

Learning Strategy

Activity 1 Students are engaged in investigating and analysing questions on a simple design brief and the processes of a design brief.

Activity 2 As a class student will discuss, explore, investigate, explain and identify a simple design brief of a simple product.

Activity 3 Develop interpersonal and interpersonal skill and team spirit to work together to design a product.

Resources Hi Tech- Media Technologies Stage 4, pg. 1-15

UNIT1. Data Communication and Network

Content Standard: 4.1 Investigate and analyse communication technology utilising multi-media and the practices and systems in designing, installing, configuring and managing networks.

Benchmark: 9.4.1.7 Explore the Authoring Software or Multimedia associate Software

Topic 7: Authoring Software Multimedia

Learning Objectives:

By the end of this topic, the students will be able to;

1. Define and explain multi-media and authoring software.
2. Identify and analyze the categories of authoring software.
3. Identify and explain the features of multimedia and authoring software.
4. Explain the operational concept of authoring software in multimedia.

Essential Questions:

- What is Multimedia?
- What is authoring software?
- What are the categories of authoring software?
- What are the features of multimedia and authoring software?
- How does authoring software operate in multimedia?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
Authoring Software	Explore	Importance	Be Appreciative of the different features of multimedia.

Technology and Industrial Arts Application: Communication Technology

Content Background

What is Multimedia?

In the simplest form, Multi stands for “many" and Media is the plural of "medium". Medium is a channel of communication.

Therefore, Multimedia is "a means of communicating information using multiple channels or is a means of communicating involving or covering several media”.

Multimedia can be as simple as speaking and using your hands at the same time for emphasis. It doesn't have to involve computers. It just has to involve more than one channel of communicating your intent. The Internet is multimedia. Movies are multimedia. Books can be multimedia if they contain text and pictures.

The combined use of several media -- such as text, graphics, audio, video, and animation -- in a single application for educational or entertainment purposes. Multimedia describes an integrated presentation which combines at least three different elements in a single integrated delivery system.

Components of Multimedia

There are five components of multimedia and they are;

i. Text

ii. Graphics

iii. Sound

iv. Video

v. Animation

Use of Multimedia
Multimedia is used by all organisation for education, advertisement, arts, entertainment, engineering, business research and etc.

Features of Multimedia
- Integration
- Interactivity
- Compression
- Very high processing power
- File system
- Synchronisation
- Input/output
- Editing
- Security
- Operating system
- Network support
- Software tools

What is authoring Software?

Authoring is the writing of an electronic document or software program, especially a hypertext or multimedia application (often used attributively).

Authoring software is software that helps a user create their own media content. For example, a DVD authoring program would enable the user to create a DVD or a multimedia **authoring program** that would allow the user to create a movie or another visual presentation. This could be as simple as creating a Microsoft Word document, or as complex as a graphic design tool. A piece of **authoring software** allows the user to generate and manipulate multimedia objects for the content's intended purpose.

Multimedia authoring is a process of assembling different types of media contents like text, audio, image, animations and video as a single stream of information with the help of various software tools available in the market. Multimedia authoring tools give an integrated environment for joining together the different elements of a multimedia production. It gives the framework for organising and editing the components of a multimedia project. It enables the developer to create interactive presentation by combining text, audio, video, graphics and animation.

Four main categories of multimedia authoring software

- Hypercard (Mac)
- Toolbook (window)
- Power Point (windows)
- Supercard (Mac)

Features of Authoring Software

- Content authoring
- Interactivity
- Template and theme
- Content management
- Collaboration
- Assessment
- Accessibility publishing

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Resources

- Clark R.C, & Mayer, E.R., (2008). *E-learning and the Science of Instruction: Proven guidelines for consumers and designers of multimedia learning.* San Francisco: Pfeiffer
- Moreno R., & Mayer E.R., (2000), *A learner-centered approach to multimedia explanations: Deriving instructional design principles from cognitive theory,* Interactive Multimedia Electronic Journal of Computer-Enhanced Learning, 2000, 2(2): E-pub
- Dictionary.com
- https://www.google.com/search?rlz=1C1GCEU_enPG894PG894&ei=HaThXqnxMMCY4-EPxtuokAI&q=How+does+authoring+software+operates+in+multimedia%3F&oq=How+does+auth oring+software+operates+in+multimedia%3F&gs_lcp=CgZwc3ktYWIQAzIFCCEQoAE6BAgAEE c6CAghEBYQHRAeOgUIABCRAjoECAAQQzoCCAA6BQgAELEDOgUIABCDAToHCAAQsQ MQQzoICAAQFhAKEB46BggAEBYQHjoICAAQCBANEB46BAghEBU6BwghEAoQoAFQ_fY OWJWREWDvlRFoA3ABeAWAAdgCiAGxbZIBCTAuMTAuNDAuOJgBAKABAaoBB2d3cy13a XqwAQA&sclient=psy-ab&ved=0ahUKEwjp896T6PjpAhVAzDgGHcYtCiIQ4dUDCAw&uact=5
- en.wikibooks.org/Introduction_to_Computer_Systems/Multimedia#The_Five_Multimedia_Elements
- https://sites.google.com/site/edst441mutimediaauthoring/What-is-Multimedia

Teaching Strategies

- Ask students to differentiate multimedia and authoring software.
- Allow students to investigate categories of authoring software and features of multimedia and authoring software.
- Engage students in a project to investigate the operational concept of authoring in multimedia.

Learning Strategies

Activity 1 Differentiate multimedia and authoring software.
Activity 2 Investigate categories of authoring software and features of multimedia and authoring software.
Activity 3 Engage students in a project to investigate the operational concept of authoring in multimedia.

Unit 2: Computer Security And Safety

Unit	Benchmark	Topics	Lesson Titles
2.Computer Security and Safety	9.4.2.1	Postures in Computer Equipment Usage	1. Introduction to Ergonomics 2. Correct Posture or Positions 3.Case Study - Posture
	9.4.2.2	Health and Safety in ICT	1. Types Health Hazards associated with use of ICT 2. Good ergonomics practices to minimize Health hazards associated in ICT usage
	9.4.2.3	Effects of Computer Usage	1. Introduction to computer technology 2. Effects of Computer Technology Usage on society
	9.4.2.4	Emerging Technological Impact Impacts of Emerging Technology	1. The evolution of emerging technologies 2. Impact of emerging technologies on society and environment 3. Case-Study (Music)
	9.4.2.5	Safe Working Practices/Habits	1. Introduction to Work Place Safety 2. Safe Work Practices

UNIT 2. Computer Security and Safety

Content Standard: 4.2 Investigate and analyses the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.
Benchmark: 9.4.2.1 Investigate and demonstrate appropriate posture in using computer equipment.

Topic 1: Postures in Using Computer Equipment

Learning Objectives
By the end of this topic, the students will be able to;
1. Define Computer Ergonomics and Posture.
2. Investigate and identify the importance of posture in computer usage.
3. Demonstrate appropriate postures of computer equipment usage.

Essential Questions:
- Why is Health and Safety Important in using data communication data and networking?
- What is Computer Ergonomics?
- What is the definition of Posture in computer ergonomics?
- Why is posture important in computer usage?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
Postures in Using Computer Equipment (Computer Ergonomics)	Investigate, Demonstrate	Sustainability and mutuality	Care and responsibility of posture when using computer.

Technology and Industrial Arts Application: Communication Technology

Content Background
The Science Computer Ergonomics

Computer ergonomics is the study of how we interact with our computers. The study of computer ergonomics, attempt to find solutions to strain, fatigue, and injuries caused by poor product design or workplace arrangement. The goal is to create an overall comfortable and relaxed workplace environment.

Setting Up Your Workstation
According to the ergonomic experts, your workstation should
- Be adjusted to allow your arms to rest at a 90-degree angle to the keyboard
- Allow for the monitor and keyboard to be separated
- Have a chair that supports your back in an upright seated position with a slight arch that may or may not contain a lumbar roll for the lower back
- Position the monitor to be directly in front of you (at least 18 inches) and at eye level
- Keep feet flat on the floor with the legs in a parallel position, and for the vertically challenged, a footrest may be needed
- If using a hard-copy document, use a document holder to keep it at eye level

Since laptops are not designed for use over long periods of time, if possible, separate the monitor and keyboard. Place the laptop on top of books or some other device to raise it to eye level. Then, use an external keyboard that allows the elbows to retain their 90-degree angle while typing.

Other Factors to Consider
Other factors such as body position, working for shorter periods of time before moving around, and moving every 10 minutes, will help keep your back and neck from becoming stiff and sore.

One study reported that workers who moved every seven minutes avoided computer-related pain, even with extended computer use. Every 30 minutes to an hour, take a short break to get up out of your chair and stretch or walk around.

Keeping physically fit can also help to avoid, and even treat, problems and pains related to extended computer use. Build up core muscles to support the lower back while seated.

If you have constant pain, numbness, or any other symptoms that are persistent and do not go away, seek medical care immediately. A delay in seeking care may cause the problems to develop into serious medical conditions related to the back and joints.

Ergonomics - Posture

Posture is the position or carriage of the body in a sitting or standing position. It is very easy to have a bad posture when sitting at a computer workstation. Even good posture when held for a long time can lead to fatigue or discomfort.

The position of workstation equipment has to be taken into consideration when initially designing a new workstation to prevent future problems. A good looking workstation should not be the primary design criterion. The effects of postural discomfort should be considered in the design - a person may be able to tolerate an uncomfortable posture for a limited amount of time but over a long period this will cause problems.

Office seating has to support the body. If the body is expected to sit in the same, uncomfortable position for periods of time the body experiences a number of reactions, including:

- increased compressive load on the spine
- reduced blood flow to muscles resulting in compression of soft tissue and associated numbness and pain
- increased pooling of blood in the legs and feet which further reduces blood flow
- holding the body in one position means that muscles have to contract leading to tiredness and fatigue.

The chair is an important ergonomic tool. The body conforms to the curves of the seat pan and back. Not only is the chair design important the rest of the workstation is too. The height of the work surface, keyboard, mouse and monitor all play an important role in posture. The position of the telephone, lighting and documents may affect how you have to sit at the workstation. No item should be considered in isolation when achieving an ergonomic workstation.

In order to accommodate as many people in the population as possible furniture tends to be adjustable. By being adjustable all but the smallest and largest 5% of the population can be accommodated. The wider the range of adjustment available the more people it will fit. If there are multiple users at a workstation who carry out a variety of tasks at the workstation, then the more adjustable the workstation needs to be to accommodate everyone using it.

Workstation dimensions and adjustment ranges

The computer workstation should allow you to sit with:

- your head should be held upright to follow the curve of the spine
- your arms held horizontally with an approximately 90
- your wrists in neutral positio
- your thighs parallel to the floor so that the hip angle is 90
- your feet should be supported by a foot rest or the floor so that there is a 90

- the lumbar support of your chair fitting into the small of your ba

- shoulder discomfort
- elbow discomfort
- wrist
- hand/finger discomfort

When sitting at your computer your forearms should be parallel to the floor, with your elbow creating a right angle (90 to 110 degrees) between the upper and forearms. Your shoulders and upper arms should be relaxed.
The wrists should be in a neutral position (flat over the keyboard).
Wrists should not be resting against a hard and/or sharp surface. Wrist rests can provide a soft, padded surface for the palm of the hand. The wrist rest should only be used when not typing

Why is posture important?
The following is some of the more important reasons to focus on your posture while using the computer.

- Not keeping a proper posture can lead to pain in your back, elbow, neck, shoulder, or wrist.
- Repetitive improper posture at a computer can cause carpal tunnel that may require surgery.
- Having a proper posture can increase your typing speed.

Reference:

The Science Computer Ergonomics
By Debra Rodzinak

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore, students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Lesson 1: Introduction to Ergonomics
Lesson Objectives;

Students should be able to research and define ergonomics and computer ergonomics and state their importance to health.

Teacher	Students
Introduction	
i. Ask the Essential Question. Ask students to picture the classroom setting and consider the points to answer what is ergonomics. Study the classroom setting, and discuss arrangement of items in the classroom, seating arrangement access and ease of movement. Teacher leads students to activities on defining ergonomics and computer ergonomics.	**1.** Students respond to activity to define ergonomics. Students respond with interest on defining ergonomics and computer ergonomics through organised activities.
Body	
Activity 1 (Engage) Brainstorming activity on ergonomics and computer ergonomics Divide students into groups and design guiding **questions for their research.** **Activity 2** (Explore) In groups; conduct research on ergonomics and computer ergonomics **Activity 3** (Explain) Presentations of research findings on ergonomics and computer ergonomics	Brainstorming activity on the definition of ergonomics and computer ergonomics. In groups devise, research questions before conducting research. Group leaders to involve all group members in the research activity. Conduct research activity. Presentation of research findings on ergonomics and computer ergonomics.
Conclusion	
Teacher to use illustrations to reiterate the importance of ergonomics in designing and computer ergonomics in the usage of computers.	Students take note of different groups presentations and teachers summary notes.
Assessment	
The main purpose of assessment is to find out if students comprehend ergonomics and computer ergonomics are and their importance to health. Assessment should be linked to the performance indicator indicated in the lesson plan and the lesson objective.	**Assessment Rubric** Teacher can devise a grading scale to assess students understanding of concepts.

UNIT 2. Computer Security and Safety

Content Standard: 4.2 Investigate and analyses the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.

Benchmark: 9.4.1.2 Describe the functions of the different components of a computer network

Topic 2: Health and Safety in ICT

Learning Objectives

By the end of this topic, the students will be able to;

1. Identify and define the health hazards associated with the use of the modern emerging technologies.
2. Identify and demonstrate good ergonomics practices to prevent health hazards associated with modern emerging technologies.

Essential Questions:

1. What is health hazard?
2. Why is health and safety important in the use of data communication and networks?
3. How are health hazards associated with technologies prevented?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
Health Hazards in ICT usage	Identify	Modesty in computer usage	Caring and concern for health whist being a Responsible user of ICT.

Technology Application: Communication Technology

Content Background

Health and Safety

Negative effects of technology can be Psychological and physical.
Psychological effect include isolation, depression and anxiety and physical effect may include;
Eye strain, poor posture, sleep problem, reduced physical activity.

Ergonomics

The term ‗ergonomics ‘is derived from two Greek words: ‗ergon‘, meaning work and ‗nomoi‘, meaning natural laws. Ergonomists study human capabilities in relationship to work demands. --

What is Ergonomics?

Ergonomics is the study of how working conditions, machines and equipment can be arranged in order that people can work with them more efficiently. As computers are probably the most ubiquitous type of machine in today‘s work and learning environments, the issue of ergonomically sound interaction with them has come to the fore. In general, computers are clean, quiet and safe to use. However, poor interaction with and positioning of computer equipment can lead to health problems such as eyestrain, swollen wrists and backache. Problems can be avoided by good workplace design and by good working practices. Prevention is easiest if action is taken early through effective analysis of each workstation.

There are a number of practical steps that can be taken to achieve an ergonomically positive environment and, furthermore, to promote a safer learning environment. These are:

- Positioning of the person and equipment
- Arranging a safe learning environment
- Taking regular breaks

For students with disabilities, it is advisable to consult with an occupational therapist in relation to ergonomics.

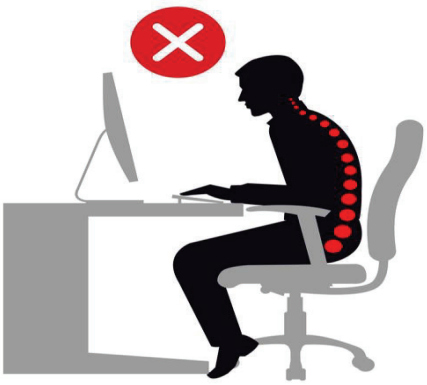
Positioning

Body positioning and the positioning of equipment are fundamental to ensuring a comfortable and healthy interaction with computers. The following recommendations can help to reduce the risk of health problems:

- Sit up straight rather than slouch forward
- Use supports such as foot rests, wrist rests and adjustable chairs
- Adjust equipment to the correct height, distance and angle

The diagrams below highlight some positive and negative body and workstation positioning.

Recommended Positioning



Inadvisable Positioning

Arranging a Safe Learning Environment The term ‗workstation' refers collectively to the computer, the monitor, the keyboard, the desk, the chair and the space provided for doing work. Workstations should be comfortable and have sufficient space to allow for freedom of movement. A minimum of 4.65 square metres of floor space for adults is recommended for office or similar environments. Adequate space between workstations should be provided for students both in a classroom and computer suite context. This should exclude space taken up by fixtures such as presses and filing cabinets. As computers can generate heat, a well-ventilated room is an important consideration. Coiled cables also give off heat and may need to be rerouted. In addition, securing and covering trailing cables is necessary if hazards are to be avoided.

The following table identifies how specific aspects of our environment can be organised to create the right ergonomic conditions for a safer learning environment.

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore, students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of

analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Teaching Strategies

- Discuss with students the health hazards associated with the use of modern emerging tech.
- Demonstrate to students the good posture and allow them to evaluate ergonomics practices that can prevent health hazard that is associated with emerging technology.

Learning Strategies

Activity 1 Engaged in discussion about health hazards associated with the use of modern emerging tech.

Activity 2 Demonstrate good posture and evaluate ergonomics practices that can prevent health hazard associated with emerging technology.

UNIT 2. Computer Security and Safety

Content Standard: 4.2 Investigate and analyses the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.

Benchmark: 9.4.2.3 Identify effects of the widespread use of computers and associated technologies on society.

Topic 3: Effects of Computer Usage

Learning Objectives

By the end of this topic, the students will be able to;

1. identify effects of widespread computer technology usage in the society

Essential Questions:

1. What does the word effects means in relations to data communication and technologies?
2. How does data communication and technologies affect society?
3. What are the positive and the negative effects of computers and technologies in the society?
4. What responsibilities should data communication and technology users take?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
• Effects of computer usage	• Identify	• Sustainability	Appreciative of the impacts of computer on society.

Technology and Industrial Arts Application: Communication Technology

Content Background

Effects of widespread use of computers and related technologies on society

The extreme increase in the use of computers has drastically changed the lives of many people. Computers initially were used as simple calculators, but through the years they have come to be valued as more than simple machines. "The computer has gained new qualities, it is not only used as a calculator, but now it entails simulation, navigation, and interaction". With the increase in computer usage, comes new software that attracts people's attention even more. Adults, adolescents and even children find themselves "losing track of time" when they sit down and play on the computer for half an hour and suddenly realize that thirty minutes has turned into a couple of hours. As changes occur in technology, we must also contemplate the effect these changes will have on individuals. We must realise that individuals are vulnerable to the virtual world and that they can get lost. "Our need for a practical philosophy of self-knowledge has never been greater as we struggle to make meaning from our lives on the screen"

The computer can serve many purposes, such as an aid for research, finishing homework and even as a means for keeping in touch with loved ones, but it can also cause an individual to get lost in the "virtual world.

At what point does using the computer become unhealthy?

In this day and age, one can get lost without a computer, when it is used on a daily basis for email, research, shopping online, but there is a limit. When an individual loses track of time and does nothing else but use the computer, than this can be seen as a problem. Some of the impacts computers have on people can be negative. When an individual becomes lost in the "virtual world", it can cause them to lose their identity and connection with the real world,

"individuals are vulnerable to the virtual world and we must learn to take responsibility for their actions"

"individuals are vulnerable to the virtual world and we must learn to take responsibility for their actions"

The internet plays an important role in today's information age and has become extremely powerful in our communications, work life and people's daily activities. Even though computers have positively contributed to our technology standards, society has to realise that computers can have a negative effect on people's identity. The different impacts the computer and the internet have had in the lives of people and how that has affected their lives and relationships they hold with others. "Society is becoming more and more computer dependent not only for information, but for fun and entertainment."
Computers and the Internet have been responsible for many positive changes that have taken place within society. The increase in computer usage has made life easier for individuals in a wide range of activities that include: schools, the work place and even at home.

Technology has gone through many changes throughout these past couple of years. Suddenly, it has become very important to be computer literate and to know how to use the internet. With the rapid increase in the use of computers, new dilemmas begin to develop. Such as the time an individual spends on the computer and how that can affect an individual's life. Americans underestimate the power the computer and the internet have on people. Even though society and our use of technology is much more advanced due to the use of computers and the internet, dependency on these two things can cause an individual to lose his/her identity.

The computer and the internet are valuable and indispensable tools for society. The impact that these tools have had on our lives is immense and to this day it continues to grow. On a scholastic basis, the amount of information and data that one can obtain through the internet is immense. On the other hand, it is also important that we, as individuals, take responsibility for our actions. It has to be understood that at some point the dependency on the computer can become unhealthy for people. Moderating the time one spends on the computer is crucial in order keep the use of computers enjoyable and healthy. It is easy for individuals to get lost in the "virtual world" with the immense amount of resources the net has to offer, but with moderation, this does not have to occur. It is imperative for society to take precautions and look at the entire picture. Despite the fact that computers have greatly improved our lives and society we must also become aware of the negative impact it can have on individuals if not used responsibly.

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore, students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

UNIT 2. Computer Security and Safety

Content Standard: 4.2 Investigate and analyses the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.

Benchmark: 9.4.2.4 Evaluate the impact of past, current and emerging technologies on the individual, society and environment

Topic 4: Emerging Technological Impact

Learning Objectives

By the end of this topic, the students will be able to;

1. evaluate the emerging technologies on society and environment

Essential Questions:

1. What does the word impact means in relations to data communication and technology?
2. What are the positive and negative impacts of the emerging technology on individuals?
3. What are the positive and negative impacts of the emerging technology on the society?
4. What are the positive and negative impacts of the emerging technology on the environment?
5. What responsibilities should be taken to minimize negative impacts on individuals, society and the environment?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
• Emerging Technological Impact	• Evaluate	• Enterprise, • Liberty, • empowerment • and self-cultivation	• Be positive adaptable to emerging technology impact on change.

Technology and Industrial Arts Application: Communication Technology

Content Background

Technology innovation is critical to all kinds of businesses around the world and greatly impacts our society. In fact, we are living in one of the most disruptive periods of tech evolution since the Internet first entered the scene decades ago.

https://www.winston.com/en/legal-glossary/emerging-technology.html

What is an emerging technology?

Emerging technology is a term generally used to describe a new technology, but it may also refer to the continuing development of an existing technology; it can have slightly different meaning when used in different areas, such as media, business, science, or education. The term commonly refers to technologies that are currently developing, or that are expected to be available within the next five to ten years, and is usually reserved for technologies that are creating, or are expected to create, significant social or economic effects.

Five societal questions we can't avoid when we think about emerging technologies

1. Will perfection "on demand" turn us off?

2. Will we all be the same?

3. Will we give up our bodies as our last private space?

4. Will computers replace our brains, hearts and souls?

5. Who will write the code?

Types of emerging technologies
a. Artificial Intelligence
b. Nanotechnology
c. internet of things
d. robotics
e. quantum computing
f. printing f. cognitive science

Their impacts
Emerging technologies have enabled the development of new products, services and business models that were hardly conceivable just a few years ago. Their pace and scope continue to have an astonishing impact on markets and societies (OECD, 2019[1]) (OECD, 2020[2]). At the same time, emerging technologies can bring with them adverse effects, for instance by significantly disrupting labour in traditional markets or by marginalising fragile populations. They also raise profound challenges in terms of data governance - for instance regarding data privacy, discrimination, or the ethical use of data
Regulation is essential to lessen the risks of emerging technologies, while promoting innovation and maximising benefits for all.

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore, students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Teaching Strategies
- Ask students to evaluate positive and negative impacts of emerging technology on individuals, society and environment.
- Ask students to share their findings on how to minimize negative impacts on individual, society and environment.

Learning Strategies
Activity 1 Evaluate positive and negative impacts of emerging technology on individuals, society and environment.
Activity 2 Share findings on how to minimise negative impacts on individual, society and environment.

2. Computer Security and Safety

Content Standard: 4.2 Investigate and analyses the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.
Benchmark: 9.4.2.5 Demonstrate an understanding of and apply safe work practices in communications technology activities.

Topic 5: Safe working practices

Learning Objectives

By the end of this topic, the students will be able to;
1. demonstrate and apply safe working practices in communication technology activities

Essential Questions:
1. What is Safe Working Practices in Communication Technology?
2. Why are safety requirements important in communication technology activities?

Essential Knowledge, Skills, Values and Attitudes

Knowledge	Skill	Values	Attitudes
• safe working practices	• Demonstrate, apply	• Sense of belonging, • betterment of human, • empowerment	Care and Concern on safety use of communication technology

Technology and Industrial Arts Application:

Content Background
Computer Safety
Many schools and colleges have dedicated ICT suites, while others locate all or some of their computers in ordinary classrooms. Whatever the ICT strategy, the equipment should be safe and comfortable for both staff and pupils to use.
This gives guidance on health and safety precautions for staff and pupils working with information & communications technology (ICT) equipment, including computers, keyboards, display screens, laptops, tablets and smartphones.

1. What the Law says about the use of ICT equipment
2. Staff duties and responsibilities
3. What the regulations define the user as,
4. Health tests and assessments
5. Risk Assessments
6. Good work station ergonomics for teachers and students
7. Keyboard, mouse, chair, display screens, document holders, desks, students with special needs
8. Safety Issues in ICT suites: lighting, reflection and glare, temperature and humidity, seating, flooring, space between workstations, cabling, fire exits
9. Safety issues in the general classroom: Siting of Equipment, Laptop computer charging trolleys,
10. Health and safety hazards; Pregnancy and display screen work, Repetitive Strain Injury (RSI), RSI due to Mouse Use, Epilepsy, Skin Rashes, Stress, Risks due to use of laptops, Smartphones and tablets, Electrical hazards, Asbestos, Wireless networks, Data projectors,

Teaching and learning ICT in the 21st Century is seen as an essential resource to support learning and teaching, as well as playing an important role in the everyday lives of pupils and adults. Schools have a duty to make use of these technologies in order to provide pupils with the skills they will need to access life-long learning and employment. Information and Communications Technology covers a wide range of resources, used both inside and outside of the classroom. These include:

- Websites
- Learning Platforms
- Email and Instant Messaging
- Chat Rooms and Social Networking
- Blogs and Wikis
- Podcasting
- Video Broadcasting
- Music Downloading
- Gaming
- Mobile/ Smart phones with text, video and/ or web functionality
- Other mobile devices with web functionality

Whilst exciting and often beneficial, all users need to be aware of the range of risks associated with the use of these Internet technologies. Understanding the responsibility to educate students and teachers on e- safety issues, appropriate behaviours and critical thinking skills must be taught to enable them to remain both safe and legal when using the internet and related technologies an and beyond the classroom context.

Measures can include;

- Managing internet access
- Identifying key roles and responsibilities and,
- Acceptable use

You wouldn't imagine that using computers could be dangerous, but there are a few situations that can result in accidents...

Trailing Cables
Computer equipment is often connected to lots of cables: power, network, etc.

If these cables are laying on the floor, they can cause people to trip over them

Solution: Place cables inside cable ducts, or under the carpet / flooring

Spilt Drinks or Food
If any liquids are spilt on electrical equipment, such as a computer, it can result in damage to the equipment, or an electric shock to the user.

*Solution: Keep drinks and food **away** from computers*

Overloaded Power Sockets
Plugging **too many power cables** into a socket can result in the socket being **overloaded**, overheating, and a **fire starting**.

*Solution: Never plug **too many cables** into a socket. Always make sure there are **fire extinguishers** nearby*

Heavy Objects Falling
Many items of computer equipment are very **heavy**: CRT monitors, laser printers, etc. Heavy items can cause serious injury if they fall on people.

*Solution: Make sure equipment is placed on **strong tables** / shelves*

Ref: https://www.igcseict.info/theory/6/safe/index.html

Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations to better understand the concepts taught. Therefore, students will learn effectively and master the knowledge prescribed in each topic. Whilst introducing the topic, guided discovery and research will enable students to get a picture of data communication and network. The knowledge prescribed must be taught. It is not only about teaching what students should know but also to interpret that knowledge for students in a way that makes it relevant to them, and enables them to begin to acquire skills of analysis and problem solving, which will support teaching and learning. Students must be given opportunities to apply their knowledge, to be creative and to solve problems.

Teaching Strategies

- Discuss safe working practices in communication technology
- Allow students in small groups to do research on the importance of safety requirements in communication technology activities.

Learning Strategies

Activity 1 Explore safe working practices in communication technology
Activity 2 In small groups research on the importance of safety requirements in communication technology activities

Programming And Planning

The 8 steps in Planning and Programming Process

1. Identify the number of Strands and Units in the subject Syllabus
2. Identify the total number of Content Standards, Benchmarks and Number of Topics (Syllabus and Teacher Guide)
3. Consider the Facts and Considerations in the Planning and Programming Process (subject related)
4. Distribute the Content evenly across the 4 school terms in a Matrix (Proposed Template)
5. Expand and plot the distributed content into the complete Yearly Content Overview for the subject for the grade (Proposed Template)
6. Develop the Termly Programs (Proposed Template)
7. Develop the Weekly Teaching Program (Proposed Template) Daily Lesson Plan (SBC Template
8. Review, Evaluate and Re-plan the yearly, termly, weekly Programs

Planning and Programming Process

The Planning and Programming Process used by the Business and Technology Subjects is a 8 step process. This process begins from Unpacking the Content Standards and Benchmarks and ends with planning a daily lesson plan.

Step 1:	Identify the number of Strands and Units in the subject Syllabus
Step 2:	Identify the total number of Content Standards, Benchmarks and Number of Topics (Syllabus and Teacher Guide)
Step 3:	Consider the Facts and Considerations in the Planning and Programming Process (subject related)
Step 4:	Distribute the Content evenly across the 4 school terms in a Matrix (Proposed Template)
Step 5:	Expand and plot the distributed content into the complete Yearly Content Overview for the subject for the grade (Proposed Template)
Step 6:	Develop the Termly Programs (Proposed Template – 3 part programme)
Step 7:	Develop the Weekly Teaching Program (Proposed Template) Daily Lesson Plan (SBC Template)
Step 8:	Review, Evaluate and Re-plan the yearly, termly, weekly Programs

TECHNOLOGY AND INDUSTRIAL ARTS PLANNING AND PROGRAMMING PROCESS

Planning and Programming Process involves 8 steps. The steps are outlined and described with samples provided to assist and guide you.

Step 1: Identify the number of Strands and Units in the subject Syllabus (Grade 9 & 10 TIA Syllabus Page 31)

It is important to first identify the strand and unit names for familiarisation and also the number of strands and units in the Grade 9 Technology and Industrial Arts subject.

Technology and Industrial Arts has 5 strands and 13 Units

Table of Strands and Units

The table below outlines the strands and units for grade 9 Technology and Industrial Arts subject. This helps teachers understand how to deal with units per strand when they are expanded into evidence outcomes and benchmarks at each grade.

The strands and units of content standards explain the progression from Grade 9 to Grade 10, linking to senior high school Technology and Industrial Arts content. The order and linkage of units signifies what the students will achieve from one grade to the next.

Technology and Industrial Arts is organised around five strands – Textile Technology, Food Technology, Construction Technology, Communication Technology and Computer Technology. These strands are comparable with the strands used internationally. The Content Standard of each Strand is based on units. The Strands, Units and Content Standards are outlined in the table below:

Step 1: Identify the number of Strands and Units in the subject Syllabus (Grade 9 & 10 TIA Syllabus Page 31)

STRANDS	UNITS
Textiles Technology	Fibres and Fabrics
	Textiles and Clothing
Food Technology	Food and Nutrition
	Food Science
Construction Technology	Building Technology
	Electrical Technology
	Plumbing Technology
	Welding Technology
	Engineering Technology
Communication Technology	Data Communication and Network
	Computer Security and Safety
Computer Technology	Computer Architecture
	Computer Software

Step 2: Identify the total number of Content Standards, Benchmarks and Number of Topics (Syllabus and Teacher Guide)

- Use the Syllabus to derive the total number of Content Standards and total number of Benchmarks
- Use the unpacking tool to derive your topics and the total number of topics
- Place or slot them in a matrix as in the sample shown below so you are knowledgeable and made aware of the total number of content standards, benchmarks and topics that you will be working with in the planning and programming of teaching and learning for the subject in a school year for that grade.

Grade 9 Technology and Industrial Arts Content Matrix

Consult the Grade 9 Technology and Industrial Arts Content Matrix showing the total number of strands, units, content standards, Benchmarks and topics to be covered in Grade 9. Note that this would be in the teacher Guide but because the teacher guides are not available, we have provided this matrix for you to use to program.

Total Number Of Strands	Total Number Of Units	Total Number of Content Standards	Total Number Of Benchmarks	Total Number Of Topics
1	2	2	11	11
2	2	2	13	13
3	5	5	29	29
4	2	2	12	12
5	2	2	11	11
Totals	**13**	**13**	**77**	**77**

Step 3: Consider the Facts and Considerations in the Planning and Programming Process (subject related)

It is important to consider and analyse facts that are worth considering if these facts will help or if these facts will pause a challenge to the planning and programming process.

Facts and Considerations about the Grade 9

Technology and Industrial Arts

1. As per the Matrix, there are a total of 77 Benchmarks and Topics which must be programmed and taught in a school year.
2. TIA is now a subject which requires all students to take all 5 strands in the subject unlike the OBC practice.
3. There are no specialist teachers who are trained to teach all the specialist content in the TIA subject.
4. Current practice has one teacher who can teach Food and Textile (Currently Home Economics), one teacher who can teach Construction Technology (currently Practical Skills) and one teacher who can teach Communication and computer Technology (currently Computer Studies and ICT).

5. With consideration #4, there are 3 personnel who will be required to teach TIA together to deliver the subject. Thus, this fact is considered to propose the Planning and Programming Process for TIA subject into a 3-part Teaching and Learning Planning and Programming Process. Which means TIA Subject Program is made up of 3 sub-programs
6. Time Allocation for Grade 9 Technology and Industrial Arts is 240 minutes per week which means it has 6 periods/6 lessons a week: 1 block of 80 minutes (2periods) periods and 1 x 160 minutes (4 periods blocked).
7. There is a total of 40 teaching weeks in a school year (4 Terms x 10 Weeks each)
8. In a term, there are about 8 weeks of actual teaching weeks which gives us 48 periods/48 lessons of actual teaching in a term (6 periods a week x 8 actual teaching weeks in a term).
9. Using these facts and considerations, we can Plan and Program the TIA according to this understanding

Understanding 1:
There are 3 x Teachers who are required to teach the TIA subjects in 40 weeks. Therefore teaching and learning must be programmed using the 3 parts (40/3 = 13.3 weeks per part).

Understanding 2:
There are 77 Benchmarks for TIA that must be planned and programed for 40 weeks but distributed equally according to the 3-parts: Textile & Food =34 BMs; Construction = 33 BMs; Communication &Computer = 33. (use the strand with the highest BMS to determine the number of BMS per week = 34 /16 = 2.1 BMS week)

Understanding 3:
The 3-factor plan and program for TIA becomes the Yearly plan and Program (meaning to say, the plan and program will be utilised by the teacher for 3 lots of students taking TIA in a rotation approach for a year. The TIA Content distribution will be determined by the 3 parts (3 available personnel) and therefore the content will be distributed.

Understanding 4:
In the instance where the school decides to deliver the Food Technology, Textile Technology, Communication Technology and Computer Technology from term 1-3, then the Construction Technology gets to be taught in Term 4. This allows for the school to acquired or make available the necessary requirements for the construction technology strand. Otherwise, it becomes school-based and students are awarded an attainment certificate - for the strands they have learnt and NOT TIA. TIA is externally examined and certified.

Step 4: Distribute the Content evenly across the 3-Parts (Proposed Template)

The teaching content outweighs the teaching weeks and therefore considerations must be made on teaching and learning approaches for example; integration, project-based learning, etc. we have provided some information to help you distribute the Technology and Industrial Arts subject content to be programmed fairly across the 3-parts. The tables include:

Grade 9 Technology and Industrial Arts Content distribution for the Teaching Year

The Grade 9 TIA has been distributed according to the 3-parts in a 13 week rotation program. *The content standards and Benchmarks according to the Distribution are also written and provided for you in a table (4a).*

Week	Textile Technology and Food Technology	Construction Technology	Communication and Computer Technology
1	**Textile Technology: Fibres and Fabrics:** CS: 9.11 BMs: 9.1.1.1 and 9.1.1.2	**Building Technology** CS: 9.3.1 BMS: 9.3.1.1. 9.3.1.2, 9.3.1.3,	**Communication Technology Data Communication and Network** CS: 9.4.2 BMs: 9.4.1.1, 9.4.1.2, ,
2	**Textile Technology: Fibres and Fabrics:** CS: 9.11 BMs: 9.1.1.3, .1.1.4,	**Building Technology** CS: 9.3.1 BMs: 9.3.1.4, 9.3.1.5, 9.3.1.6,	**Communication Technology Data Communication and Network** CS: 9.4.1 BMs: 9.1.4.3, 9.1.4.4, 9.1.4 .5
3	**Textile Technology: Textile and Clothing:** CS: 9.1.2 BMs:9.1.2.1, 9.1.2.2,	**Electrical Technology** CS: 9.3.1 BMs: 9.3.2.1, 9.3.2.2, 9.3.2.3,	**Communication Technology Computer Security and Safety** CS: 9.4.2 BMs: 9.4.2.1, 9.4.2.2,
	Assessment	**Assessment**	**Assessment**
4	**Textile Technology: Textile and Clothing:** CS: 9.1.2 BMs: 9.1.2.3, 9.1.2.4,	**Electrical Technology** CS: 9.3.2 BMs: 9.3.2.4, 9.3.2.5,	**Communication Technology Computer Security and Safety** CS: 9.4.2 BMs: 9.4.2.3, 9.4.2.4
5	**Textile Technology: Textile and Clothing:** CS: 9.1.2 BMs: 9.1.2.5, 9.1.2.6,	**Electrical Technology** CS: 9.3.2 BMs: 9.3.2.6, 9.3.2.7	**Communication Technology Computer Security and Safety** CS: 9.4.2 BMs: 9.4.2.5, 9.4.2.6,
6	**Food Technology: Food and Nutrition:** CS: 9.2.1 BMs: 9.2.1.1. 9.2.1.2	**Plumbing Technology** CS: 9.3.3 BMs: 9.3.3.1, 9.3.3.2	**Computer Technology Computer Architecture** CS: 9.5.1 BMs: 9.5.1.1, 9.5.1.2
	Assessment	**Assessment**	**Assessment**
7	**Food Technology: Food and Nutrition**: CS: 9.2.1 BMs: 9.2.1.3, 9.2.1.4	**Plumbing Technology** CS: 9.3.3 BMs: 9.3.3.3, 9.3.3.4,	

8	**Food Technology:** **Food and Nutrition:** CS: 9.2.1 BMs: 9.2.1.5, 9.2.1.6,	**Welding Technology** CS: 9.3.4 BMs: 9.3.4.1, 9.3.4.2,	**Computer Technology** **Computer Architecture** CS: 9.5.1 BMs: 9.1.5.3, 9.1.5.4
9	**Food Technology:** **Food and Nutrition**: CS: 9.2.1 BMs: 9.2.1.7	**Welding Technology** CS: 9.3.4 BMs: 9.3.4.3, 9.3.4.4, 9.3.4.	**Computer Technology** **Computer Architecture** CS: 9.5.1 BMs: 9.1.5.5
	Assessment	**Assessment**	**Assessment**
10	**Food Technology:** **Food Science**: CS: 9.2.1 BMs: 9.2.2.1, 9.2.2.2	**Engineering Technology** CS: 9.3.5 BMs: 9.3.5.1, 9.3.5.2,	**Computer Technology** **Computer Software** CS: 9.5.2 BMs: 9.5.2.1, 9.5.2.2
11	**Food Technology:** Food Science: CS: 9.2.1 BMs: 9.2.2.3, 9.2.2.4,	**Engineering Technology** CS: 9.3.5 BMs: 9.3.5.3, 9.3.5.4,	**Computer Technology** **Computer Software** CS: 9.5.2 BMs: 9.5.2.3, 9.5.2.4
12	Food Technology: Food Science: CS: 9.2.1 BMs: 9.2.2.5	Engineering Technology CS: 9.3.5 BMs: 9.3.5.5, 9.3.5.6, 9.3.5.7	Computer Technology Computer Software CS: 9.5.2 BMs: 9.5.2.5,
13	**Summative Assessment**		

Grade 9 Technology and Industrial Arts Content Standards and Benchmarks Overview as per Strands and Units

The five strands – Textile Technology, Food Technology, Construction Technology, Communication Technology and Computer Technology are unpacked into units to Benchmarks as outlined in the table below:

STRAND 1: TEXTILE TECHNOLOGY	
UNIT 1: FIBRES AND FABRICS	
Content Standard	**Benchmarks**
CS1.1 Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing.	**9.1.1.1 – 9.1.1.6**
	9.1.1.1 Compare and contrast social, economic, cultural and technological changes to textiles, fashion and clothing
	9.1.1.2 Distinguish the properties and characteristics of fibres and fabrics
	9.1.1.3 Explore the elements of design and the design and construction of fashion ideas
	9.1.1.4 Describe the functions of tools and equipment and their safe usage
	9.1.1.5 Explore the range of textile construction techniques
	9.1.1.6 Apply appropriate safety practices in fashion design and construction
STRAND 1: TEXTILE TECHNOLOGY	
UNIT 2: TEXTILE AND CLOTHING	
CS1.2 Integrate and apply principles and techniques in presenting fashion ideas and illustrations in pattern making and garment construction for a variety of needs and occasions	**9.1.2.1 – 9.1.2.6**
	9.1.2.1 Describe historical influences, technological progression and emerging trends as inspirational sources of design
	9.1.2.2. Demonstrate an awareness of the fundamentals of the design process through various artistic versions
	9.1.2.3 Apply a broad range of contemporary and appropriate tools and techniques with competence and in the development of design projects
	9.1.2.4 Describe how the properties of textile fibres affect textile wear and care

	9.1.2.5 Apply the design process to respond to needs and opportunities in textile design projects
	9.1.2.6 Select and use appropriate technology to creatively document, communicate and present design and project work
STRAND 2: FOOD TECHNOLOGY	
UNIT 1: FOOD AND NUTRITION	
CS 2.1 Students will be able to examine and analyze the characteristics and properties of difference types of food and the social, economic, political, cultural and technological influences on the production and compliance with ethical principles and standards	**9.2.1.1 – 9.2.1.7**
	9.2.1.1 Compare and contrast the nature and properties of food
	9.2.1.2 Practice safety and hygiene procedures in tool and equipment, food handling, meal preparation and food development
	9.2.1.3 Examine the nutritional components of food and food development and the impact of food consumption on nutrition.
	9.2.1.4 Explore nutrition as integral to making food choices
	9.2.1.5 Discuss economic, social and technological influences of food, food product and food sciences
	9.2.1.6 Explore ways of meeting nutritional requirements to maintain optimum nutrition or manage nutritional issues
	9.2.1.7 Apply the design process to create food items using combinations of basic ingredients with variations using a selection of techniques and food preparation equipment
STRAND 2: FOOD TECHNOLOGY	
UNIT 2: FOOD SCIENCE	
CS 2.2 Students will be	**9.2.2.1 – 9.2.2.6**
able to investigate and analyse the cultural, physical, chemical, nutritional, biological and sensory characteristics of food and how they influence the development and production of food to meet different demands (e.g., health, occasions, lifestyle, business)	**9.2.2.1** Identify and describe the cultural, physical, biological and nutritional characteristics of food that influence food development
	9.2.2.2 Describe the nutritional and sensory characteristics of food to meet the needs, health and occasions.
	9.2.2.3 Apply management strategies in food selection, meal preparation, product development, storage and preservation
	9.2.2.4 Explore safety and hygiene practices relating to food, and changes that occur in the functional properties of food.
	9.2.2.5 Examine the social, economic and environmental impact of food processing technology, and the role packaging plays in the distribution of food from the point of production to consumption
	9.2.2.6 Apply the design process to create food solutions.
STRAND 3: CONSTRUCTION TECHNOLOGY	
UNIT 1: BUILDING TECHNOLOGY	
CS 3.1 Investigate the history and theory of buildings and analyse the components and systems of buildings, occupational health and safety procedures, the properties of building materials and the processes in which those materials and equipment are used according to industry standards.	**9.3.1.1 – 9.3.1.6**
	9.3.1.1 Investigate the history and theory of buildings
	9.3.1.2 Identify and describe a variety of construction materials, components, and processes
	9.3.1.3 Describe the elements of drawings, and their application in technical drawings.
	9.3.1.4 Identify and describe the elements of safety
	9.3.1.5 Describe the scope and purpose of building codes, and identify other regulations and standards that apply to construction projects
	9.3.1.6 Apply mathematical skills and scientific concepts in the planning and building of a variety of construction projects

STRAND 3: CONSTRUCTION TECHNOLOGY	
UNIT 2: ELECTRICAL TECHNOLOGY	
CS 3.2 Analyse and apply the technological processes, concepts, principles and practices related to Electrical Technology and its social contribution with regard to economic growth, entrepreneurship, sustainability and as a tool for change, improving the quality of life responsive to individual, community and industrial needs.	**9.3.2.1 – 9.3.2.7**
	9.3.2.1 Describe the historical development of electricity
	9.3.2.2 Investigate and communicate OHS legislation and regulation and assess and employ emergency procedures whilst observing safety
	9.3.2.3 Identify, design, develop and evaluate processes and products related to electrical technology and communicate the findings through the use of appropriate electrical and electronic terminology.
	9.3.2.4 Define electricity and conductivity and differentiate insulators from conductors
	9.3.2.5 Identify symbols used and explain the functions of components and devices in electrical circuit diagrams
	9.3.2.6 Identify the different types of circuits and explain the parts and operation of a simple practical circuit.
	9.3.2.7 Investigate the concepts, principles and practices related to electrical
STRAND 3: CONSTRUCTION TECHNOLOGY	
UNIT 3: PLUMBING TECHNOLOGY	
CS 3.3 Investigate and analyse fundamental concepts of plumbing and theories, OHS, Occupational Health and safety Regulations and standards ,trade drawing, demonstrations and applications of tools and materials	**9.3.3.1 – 9.3.3.4**
	9.3.3.1 Describe and explain the fundamentals, concepts, and their relevance in the plumbing trade
	9.3.3.2 Analyse and describe OHS Regulations and standards in the plumbing trade and work places.
specifications, installation of plumbing fittings and accessories in (DWV) Drain, waste, vent system, and water distribution system.	**9.3.3.3** Demonstrate and apply basic plumbing tools and equipment and their specifications and practice in trade math.
	9.3.3.4 Explore and apply basic concepts of trade drawings in plumbing.
STRAND 3: CONSTRUCTION TECHNOLOGY	
UNIT 4: WELDING TECHNOLOGY	
CS 3.4 Investigate and analyse safety procedures, print reading, measurement and layout, identify properties of metals, the welding techniques, cutting processes according to welding codes, inspections, testing principles and apply fundamentals of fabrication.	**9.3.4.1 – 9.3.4.5**
	9.3.4.1 Investigate safe workshop setup and safety procedures in welding
	9.3.4.2 Explore and interpret welding principles, codes and standards
	9.3.4.3 Demonstrate knowledge in fundamental print reading, measurement and layout or fi t-up techniques
	9.3.4.4 Investigate and analyse the properties of metals
	9.3.4.5 Investigate the various welding techniques and cutting processes

STRAND 3: CONSTRUCTION TECHNOLOGY	
UNIT 5: ENGINEERING TECHNOLOGY	
CS 3.5 Investigate and analyse the historical and societal influences in Engineering by understanding the engineering principles, practices, the design process, the management, problem-solving and communication skills appropriate to any engineering field.	**9.3.5.1 – 9.3.5.7**
	9.3.5.1 Describe how history and society has influenced the engineering field and critically analyse innovations.
	9.3.5.2 Investigate the scope of engineering, roles and responsibilities of an engineer and recognise current innovations
	9.3.5.3 Explore and distinguish the different types of the Engineering fields.
	9.3.5.4 Explore and discuss engineering principles and practices and the appropriate materials in engineering.
	9.3.5.5 Explore and analyse the general safety practices in engineering.
	9.3.5.6 Outline management and problem solving skills using the engineering design process.
	9.3.5.7. Explore and utilise communication practices appropriate to engineering.
STRAND 4: COMMUNICATION TECHNOLOGY	
UNIT 1: DATA COMMUNICATION AND NETWORK	
CS 4.1 Investigate and analyse communication technology utilising multimedia and the practices and systems in designing, installing, configuring and managing networks.	**9.4.1.1 – 9.4.1.7**
	9.4.1.1 Define the elements of data communication system.
	9.4.1.2 Describe the functions of the different components of a computer network.
	9.4.1.3 Define the OSI (Open Systems Interconnect) model and how it functions.
	9.4.1.4 Explore the use of technical terminology, basic scientific concepts, and mathematical concepts used in communications technology and apply them to the creation of media products.
	9.4.1.5 Explore and articulate the core concepts, techniques, and skills required to produce a range of communications media products or services.
	9.4.1.6 Research and apply the design brief to design, configure and manage simple network.
	9.4.1.7 Explore the Authoring Software or Multimedia associate software

STRAND 4: COMMUNICATION TECHNOLOGY	
UNIT 2: COMPUTER SECURITY AND SAFETY	
CS 4.2 Investigate and analyse the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.	**9.4.2.1 – 9.4.2.5**
	9.4.2.1 Investigate and demonstrate appropriate posture in using computer equipment
	9.4.2.2 Identify health hazards associated with the use of ICT and propose good ergonomic practices
	9.4.2.3 Identify effects of the widespread use of computers and associated technologies on society
	9.4.2.4 Evaluate the impact of past, current and emerging technologies on the Individual, society and environments.
	9.4.2.5 Demonstrate an understanding of and apply safe work practices in communications technology activities
STRAND 5: COMPUTER TECHNOLOGY	
UNIT 1: COMPUTER ARCHITECTURE	
CS 5.1 Explore and analyse computer fundamentals, the skills to manage and maintain; diagnose, troubleshoot and solve issues that encompass computer systems, networking, interfacing and programming as well as electronics and robotics and be aware of related environmental and societal issues.	**9.5.1.1 – 9.5.1.6**
	9.5.1.1 Comprehend and explain the Computer System and types of computer.
	9.5.1.2 Explore generations of computer
	9.5.1.3 Investigate and describe the design brief of solving problems.
	9.5.1.4 Identify and describe the functions of, as well as important advances related to, electronic and computer components;
	9.5.1.5 Demonstrate a basic understanding of binary numbers and digital logic
	9.5.1.6 Explore and describe hardware and software troubleshooting principles
STRAND 5: COMPUTER TECHNOLOGY	
UNIT 2: COMPUTER SOFTWARE	
CS 5.2 Investigate and analyse computer system and application software, programming, algorithm, web design and databases, and develop and apply the skills and knowledge in the various software.	**9.5.2.1 – 9.5.2.5**
	9.5.2.1 Explore programming software and applications
	9.5.2.2 Demonstrate the understanding of Operating Systems/ Software and File Management
	9.5.2.3 Apply typing skills with speed (20wpm) and accuracy (80%)
	9.5.2.4 Create documents using Microsoft Office
	9.5.2.5 Explore the Authoring Software or Multimedia associate software

Grade 9 Technology and Industrial Arts Content Standards, Benchmarks and Topics Overview as per the Strands and Units

STRAND 1: FOOD TECHNOLOGY UNIT 1: FIBRES AND FABRICS		
Content Standard	**Benchmark**	**Topic**
CS1.1 Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction,	**9.1.1.1** Compare and contrast social, economic, cultural and technological changes to textiles, fashion and clothing	Impact of changes on textiles, fashion and clothing
	9.1.1.2 Distinguish the properties and characteristics of fibres and fabrics	Introduction to fibres and fabrics
	9.1.1.3 Explore the elements of design and the design and construction of fashion ideas	Designing and Construction
production, representation, regulation and marketing.	**9.1.1.4** Describe the functions of tools and equipment and their safe usage	Functions and safe usage of tools and equipment
	9.1.1.5 Explore the range of textile construction techniques	Techniques in textile construction
	9.1.1.6 Apply appropriate safety practices in fashion design and construction	Safety practices in fashion designing and construction
STRAND 1: TEXTILE TECHNOLOGY UNIT 2: TEXTILE AND CLOTHING		
Content Standard	**Benchmark**	**Topic**
CS1.2 Integrate and apply principles and techniques in presenting fashion ideas and illustrations in pattern making and garment construction for a variety of needs and occasions	**9.1.2.1** Describe historical influences, technological progression and emerging trends as inspirational sources of design	Sources of Design
	9.1.2.2. Demonstrate an awareness of the fundamentals of the design process through various artistic versions	Fundamentals of design process
	9.1.2.3 Apply a broad range of contemporary and appropriate tools and techniques with competence and in the development of design projects	Tools and techniques in project designs
	9.1.2.4 Describe how the properties of textile fibres affect textile wear and care	Textiles wear and care
	9.1.2.5 Apply the design process to respond to needs and opportunities in textile design projects	Designing a textile project
	9.1.2.6 Select and use appropriate technology to creatively document, communicate and present design and project work	Documenting a project portfolio

STRAND 2: FOOD TECHNOLOGY UNIT 1: FOOD AND NUTRITION		
Content Standard	**Benchmark**	**Topic**
CS 2.1 Students will be able to examine and analyze the characteristics and properties of difference types of food and the social, economic, political, cultural and technological influences on the production and compliance with ethical principles and standards	**9.2.1.1** Compare and contrast the nature and properties of food	Nature and properties of food
	9.2.1.2 Practice safety and hygiene procedures in tool and equipment, food handling, meal preparation and food development	Safety and hygienic practices in food product development
	9.2.1.3 Examine the nutritional components of food and food development and the impact of food consumption on nutrition.	Food and nutrients
	9.2.1.4 Explore nutrition as integral to making food choices	Food metabolism
	9.2.1.5 Discuss economic, social and technological influences of food, food product and food sciences	Influences on food product development
	9.2.1.6 Explore ways of meeting nutritional requirements to maintain optimum nutrition or manage nutritional issues	Food composition and energy metabolism
	9.2.1.7 Apply the design process to create food items using combinations of basic ingredients with variations using a selection of techniques and food preparation equipment	Food product development

STRAND 2: FOOD TECHNOLOGY UNIT 2: FOOD SCIENCE		
Content Standard	**Benchmark**	**Topic**
CS 2.2 Students will be able to investigate and analyse the cultural, physical, chemical, nutritional, biological and sensory characteristics of food and how they influence the development and production of food to meet different demands (e.g., health, occasions, lifestyle, business)	**9.2.2.1 – 9.2.2.6**	
	9.2.2.1 Identify and describe the cultural, physical, biological and nutritional characteristics of food that influence food development	Characteristics and properties of cereals, vegetables, fruits, legumes, fats and oils
	9.2.2.2 Describe the nutritional and sensory characteristics of food to meet the needs, health and occasions.	Sensory characteristics of food
	9.2.2.3 Apply management strategies in food selection, meal preparation, product development, storage and preservation	Food management
	9.2.2.4 Explore safety and hygiene practices relating to food, and changes that occur in the functional properties of food.	Food safety and hygienic practices
	9.2.2.5 Examine the social, economic and environmental impact of food processing technology, and the role packaging plays in the distribution of food from the point of production to consumption	Factors influencing food processing and packaging
	9.2.2.6 Apply the design process to create food solutions	The technology design

STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 1: BUILDING TECHNOLOGY		
Content Standard	**Benchmark**	**Topic**
CS 3.1 Investigate the history and theory of buildings and analyse the components and systems of buildings, occupational health and safety procedures, the properties of building materials and the processes in which those materials and equipment are used according to industry standards.	**9.3.1.1** Investigate the history and theory of buildings	The history and theory of buildings
	9.3.1.2 Identify and describe a variety of construction materials, components, and processes	Building construction materials
	9.3.1.3 Describe the elements of drawings, and their application in technical drawings.	Trade drawing
	9.3.1.4 Identify and describe the elements of safety	The Elements Occupational Health and Safety
	9.3.1.5 Describe the scope and purpose of building codes, and identify other regulations and standards that apply to construction projects	Building Codes, Standards and regulations
	9.3.1.6 Apply mathematical skills and scientific concepts in the planning and building of a variety of construction projects	Trade Maths

STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 2: ELECTRICAL TECHNOLOGY		
Content Standard	**Benchmark**	**Topic**
CS 3.2 Analyse and apply the technological processes, concepts, principles and practices related to Electrical Technology and its social contribution with regard to economic growth, entrepreneurship, sustainability and as a tool for change, improving the quality of life responsive to individual, community and industrial needs.	**9.3.2.1 – 9.3.2.7**	
	9.3.2.1 Describe the historical development of electricity	History of Electricity
	9.3.2.2 Investigate and communicate OHS legislation and regulation and assess and employ emergency procedures whilst observing safety	Workplace and Electrical safety
	9.3.2.3 Identify, design, develop and evaluate processes and products related to electrical technology and communicate the findings through the use of appropriate electrical and electronic terminology.	Electrical or Electronic processes and products
	9.3.2.4 Define electricity and conductivity and differentiate insulators from conductors	Fundamentals of electricity
	9.3.2.5 Identify symbols used and explain the functions of components and devices in electrical circuit diagrams	Components and devices used on circuit diagrams
	9.3.2.6 Identify the different types of circuits and explain the parts and operation of a simple practical circuit.	Circuits
	9.3.2.7 Investigate the concepts, principles and practices related to electrical	Electrical Fundamentals

STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 3: PLUMBING TECHNOLOGY		
Content Standard	**Benchmark**	**Topic**
CS 3.3 Investigate and analyse fundamental concepts of plumbing and theories, OHS, Occupational Health and safety Regulations and standards ,trade drawing, demonstrations and applications of tools and materials specifications, installation of plumbing fittings and accessories in (DWV) Drain, waste, vent system, and water distribution system.	**9.3.3.1 – 9.3.3.4**	
	9.3.3.1 Describe and explain the fundamentals, concepts, and their relevance in the plumbing trade	Fundamental concept and relevance of plumbing trade
	9.3.3.2 Analyse and describe OHS Regulations and standards in the plumbing trade and work places.	Topic 2: Occupational Health and Safety regulations and standard
	9.3.3.3 Demonstrate and apply basic plumbing tools and equipment and their specifications and practice in trade math.	Plumbing tool and equipment
	9.3.3.4 Explore and apply basic concepts of trade drawings in plumbing.	Trade Drawing

STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 4: WELDING TECHNOLOGY		
Content Standard	**Benchmark**	**Topic**
CS 3.4 Investigate and analyse safety procedures, print reading, measurement and layout, identify	**9.3.4.1 – 9.3.4.5**	
	9.3.4.1 Investigate safe workshop setup and safety procedures in welding	Workshop Organisation
	9.3.4.2 Explore and interpret welding principles, codes and standards	Welding Standards
properties of metals, the welding techniques, cutting processes according to welding codes, inspections, testing principles and apply fundamentals of fabrication.	**9.3.4.3** Demonstrate knowledge in fundamental print reading, measurement and layout or fi t-up techniques	Measurement Techniques
	9.3.4.4 Investigate and analyse the properties of metals	Metals
	9.3.4.5 Investigate the various welding techniques and cutting processes	Cutting and Welding

STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 5: ENGINEERING TECHNOLOGY		
Content Standard	**Benchmark**	**Topic**
CS 3.5 Investigate and analyse the historical and societal influences in Engineering by understanding the engineering principles, practices, the design process, the management, problem-solving and communication skills appropriate to any engineering field.	**9.3.5.1 – 9.3.5.7**	
	9.3.5.1 Describe how history and society has influenced the engineering field and critically analyse innovations.	Historical aspects of Engineering Design Process
	9.3.5.2 Investigate the scope of engineering, roles and responsibilities of an engineer and recognise current innovations	Introduction to Engineering
	9.3.5.3 Explore and distinguish the different types of the Engineering fields.	Engineering Fields
	9.3.5.4 Explore and discuss engineering principles and practices and the appropriate materials in engineering.	Engineering Principles and practices
	9.3.5.5 Explore and analyse the general safety practices in engineering.	Occupational Health & safety
	9.3.5.6 Outline management and problem solving skills using the engineering design process.	Engineering Design Process
	9.3.5.7. Explore and utilise communication practices appropriate to engineering.	Engineering Communication

STRAND 4: COMMUNICATION TECHNOLOGY UNIT 1: DATA COMMUNICATION AND NETWORK		
Content Standard	**Benchmark**	**Topic**
CS 4.1 Investigate and analyse communication technology utilising multimedia and the practices and systems in designing, installing, configuring and managing networks.	**9.4.1.1** Define the elements of data communication system.	Data Communication Systems
	9.4.1.2 Describe the functions of the different components of a computer network.	Computer Networks
	9.4.1.3 Define the OSI (Open Systems Interconnect) model and how it functions.	OSI Model
	9.4.1.4 Explore the use of technical terminology, basic scientific concepts, and mathematical concepts used in communications technology and apply them to the creation of media products.	Communication Technology Terminologies Basic Scientific and Mathematical Concepts in creating media products
	9.4.1.5 Explore and articulate the core concepts, techniques, and skills required to produce a range of communications media products or services.	Media Communication
	9.4.1.6 Research and apply the design brief to design, configure and manage simple network.	Design Brief-Simple Network
	9.4.1.7 Explore the Authoring Software or Multimedia associate software	Authoring Software Multimedia

STRAND 4: COMMUNICATION TECHNOLOGY UNIT 2: COMPUTER SECURITY AND SAFETY		
Content Standard	**Benchmark**	**Topic**
CS 4.2 Investigate and analyse the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.	**9.4.2.1 – 9.4.2.6**	**9.4.2.1 – 9.4.2.6**
	9.4.2.1 Investigate and demonstrate appropriate posture in using computer equipment	Postures in Computer Equipment Usage
	9.4.2.2 Identify health hazards associated with the use of ICT and propose good ergonomic practices	Health and Safety in ICT
	9.4.2.3 Identify effects of the widespread use of computers and associated technologies on society	Effects of Computer Usage
	9.4.2.4 Evaluate the impact of past, current and emerging technologies on the Individual, society and environments.	Emerging Technological Impact
	9.4.2.5 Demonstrate an understanding of and apply safe work practices in communications technology activities	Safe Working Practices/Habits

STRAND 5: COMPUTER TECHNOLOGY UNIT 1: COMPUTER ARCHITECTURE		
Content Standard	**Benchmark**	**Topic**
CS 5.1 Explore and analyse computer fundamentals, the skills to manage and maintain; diagnose, troubleshoot and solve issues that encompass computer systems, networking, interfacing and programming as well as electronics and robotics and be aware of related environmental and societal issues.	**9.5.1.1** Comprehend and explain the Computer System and types of computer.	Computer System
	9.5.1.2 Explore generations of computer	History of Computers
	9.5.1.3 Investigate and describe the design brief of solving problems.	Design Brief
	9.5.1.4 Identify and describe the functions of, as well as important advances related to, electronic and computer components;	Computer Electronics
	9.5.1.5 Demonstrate a basic understanding of binary numbers and digital logic	Binary
	9.5.1.6 Explore and describe hardware and software troubleshooting principles	Troubleshooting
STRAND 5 COMPUTER TECHNOLOGY **UNIT 2: COMPUTER SOFTWARE**		
Content Standard	**Benchmark**	**Topic**
CS 5.2 Investigate and analyse computer system and application software, programming,	**9.5.2.1** Explore programming software and applications	Software Programming
	9.5.2.2 Demonstrate the understanding of Operating Systems/ Software and File Management	Operating System
algorithm, web design and databases, and develop and apply the skills and knowledge in the various software.	**9.5.2.3** Apply typing skills with speed (20wpm) and accuracy (80%)	Keyboarding
	9.5.2.4 Create documents using Microsoft Office	Microsoft Office
	9.5.2.5 Explore the Authoring Software or Multimedia associate software	Authoring Software/ Multimedia

Grade 9 Technology and Industrial Arts Topics and Lesson Titles as per Strands and Units

The strand, Units and Benchmarks are further unpacked into Topics and Lesson Titles in the Teacher Guides. These are outlined in the table below:

STRAND 1: TEXTILE TECHNOLOGY **UNIT 1: FIBRES AND FABRICS**	
Topics	**Lesson Titles**
Benchmarks	**9.1.1.1 – 9.1.1.6**
Topic 1: Impact of changes on textiles, fashion and clothing	**Lesson 1**: Exploring Textiles? **Lesson 2:** Origins of textiles, fashion and clothing **Lesson3:** Factors affecting changes in textile, fashions and clothing
Topic2: Introduction to fibres and fabrics	**Lesson 1:** What are fibres and fabrics? **Lesson 2:** Characteristics and properties of fibres and fabrics **Lesson 3:** From fibres to fabrics.
Topic 3: Designing and Construction	**Lesson 1:** Elements of design and design types. **Lesson 2:** Sources of fashion ideas. **Lesson 3:** Basic construction processes.
Topic 4: Functions and safe usage of tools and equipment	**Lesson 1:** Textile Construction methods tools and their functions. **Lesson 2:** Safety when using textile tools and equipment. **Lesson 3:** Care and maintenance of textile products.
Topic 5: Techniques in textile construction	**Lesson 1:** Textile construction methods **Lesson 2:** Colouring and decorating methods **Lesson 3:** Fabric finishes
Topic 6: Safety practices in fashion designing and construction	**Lesson 1:** Differentiating between textile designing and construction processes **Lesson 2:** Safety practices in textile.
STRAND 1: TEXTILE TECHNOLOGY **UNIT 2: TEXTILE AND CLOTHING**	
Benchmarks	**9.1.2.1 – 9.1.2.6**
Topic 1: Sources of Design	**Lesson 1:** Sources of design **Lesson 2:** Technological progression **Lesson 3:** Emerging trends
Topic 2: Fundamentals of design process	**Lesson 1:** Importance of design process **Lesson 2:** Skills in the design process **Lesson 3:** Various artistic version
Topic 3: Tools and techniques in project designs	**Lesson 1:** Fashion and types of garments **Lesson 2:** Transferring patterns from garment to garment **Lesson 3:** Patterning techniques
Topic 4: Textiles wear and care	**Lesson** Types of tools for textile projects **Lesson** Safe uses of special tools **Lesson** Care for tools
Topic 5: Designing a textile project	**Lesson** What is design process **Lesson** Phases in Textile Project development **Lesson** Textile Projects
Topic Documenting a project portfolio	**Lesson** People and textile industry **Lesson** Textile technology equipment **Lesson** Textile Project exhibit

STRAND 2: FOOD TECHNOLOGY UNIT 1: FOOD AND NUTRITION	
Benchmarks	**9.2.1.1 – 9.2.1.7**
Topic 1: Nature and properties of food	**Lesson 1:** Introduction to food –(Nature and sources of food) **Lesson 2:** Food groups and dietary guidelines **Lesson 3:** Properties of starch, carbohydrates, fats and oil **Lesson 4:** Introduction to food product development
Topic 2: Safety and hygienic practices in food product development	**Lesson 1:** Personal hygiene and safety practices **Lesson 2:** Kitchen hygiene **Lesson 3:** Hygiene practices and safety in food development (preparation etc.)
Topic 3: Food and nutrients	**Lesson 1:** Functions of nutrients and food sources **Lesson 2:** Eating practices **Lesson 3:** Meal planning
Topic 4: Food metabolism	**Lesson 1:** Digestion and absorption of food **Lesson 2:** Functions of food and nutrients in human body **Lesson 3:** Over nutrition and malnutrition (anorexia, bulimia, obesity, hypertension etc.)
Topic 5: Influences on food product development	**Lesson 1:** Food ingredients **Lesson 2:** Principles of cooking methods **Lesson 3:** Food management **Lesson 4:** Economic, Social and technological influences on food product development
Topic 6: Food composition and energy metabolism	**Lesson 1:** Food composition **Lesson 2:** Food labelling **Lesson 3:** Energy metabolism **Lesson 4:** Meals for special needs
Topic 7: Food product development	**Lesson 1:** Introduction to food product development **Lesson 2:** Design process **Lesson 3:** Design Brief **Lesson 4:** Sensory analysis
STRAND 2: FOOD TECHNOLOGY UNIT 2: FOOD SCEINECE	
Benchmarks	**9.2.2.1 – 9.2.2.6**
Topic 1: Characteristics and properties of cereals, vegetables, fruits, legumes, fats and oils	**Lesson 1** Cooking methods in food product development **Lesson 2** Physical and biological properties of cereals, vegetables and fruits **Lesson 3** Physical and biological properties of fruits, legumes, fats and oils
Topic 2: Sensory characteristics of food	**Lesson 1** Sensory analyses of food **Lesson 2** Nutritional functions of food **Lesson 3** Functional foods
Topic 3: Food management	**Lesson 1** Food management **Lesson 2** Trends, fashion and food **Lesson 3** Seasons and food
Topic 4: Food safety and hygienic practices	**Lesson 1** Food borne diseases **Lesson 2** Contamination **Lesson 3** First Aid
Topic 5: Factors influencing food processing and packaging	**Lesson 1** Factors that influence food processing **Lesson 2** The role of food packaging **Lesson 3** Developments in packaging and distribution **Lesson 4** Techniques to evaluate products and processes
Topic 6: The technology design	**Lesson 1** Design brief and the technological process **Lesson 3** Evaluate the new product **Lesson 2** Using a design product to create a new product

STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 1: BUILDING TECHNOLOGY	
Benchmarks	**9.3.1.1 – 9.3.1.6**
Topic 1: The history and theory of buildings	**Lesson 1:** Introduction to Building **Lesson 2:** Definition of Building **Lesson 3:** Different Types of Building **Lesson 4:** Types of material used **Lesson 5:** Importance of building and career paths.
Topic 2: Building construction materials	**Lesson 1:** Define Building materials **Lesson 2:** Timber Building Materials **Lesson 3:** Bricks and Concrete materials **Lesson 4:** Metal and steel materials
Topic 3: Trade drawing	**Lesson 1:** Define trade drawing **Lesson 2:** Types of trade drawing **Lesson 3:** Isometric drawing **Lesson 4:** Pictorial drawing **Lesson 5:** Orthographic drawing **Lesson 6:** Types of lines use
Topic 4: The Elements Occupational Health and Safety	**Lesson 1:** Define occupational Health and safety **Lesson 2:** The regulations of OHS **Lesson 3:** The standards of OHS
Topic 5: Building Codes, Standards and regulations	**Lesson 1:** Define Building legislations and regulations **Lesson 2:** Types of building codes **Lesson 3:** Types of building regulations
Topic 6: Trade Maths	**Lesson 1:** Define Applied maths **Lesson 2:** Formulae to calculate substructure **Lesson 3:** Define sub- structure member (footings, post, bearers) **Lesson 4:** Define super -structure members (Floor joist, studs, roofing frame) **Lesson 5:** Types of building defect
STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 2: ELECTRICAL TECHNOLOGY	
Benchmarks	**9.3.2.1 – 9.3.2.7**
Topic 1: History of Electricity	**Lesson 1:** Electrical Energy Production & Supply **Lesson 2:** Modern Power Generation methods **Lesson 3:** Renewable and sustainable energy practices.
Topic 2: Workplace and Electrical safety	**Lesson 1:** Electrical Energy Production & Supply **Lesson 2:** Renewable and sustainable energy practices. **Lesson 3:** Career Pathway in Electrical Technology
Topic 3: Electrical or Electronic processes and products	**Lesson 1:** OHS legislation & Regulation **Lesson 2:** Personal Safety **Lesson 3:** Emergency procedures.
Topic 4: Fundamentals of electricity	**Lesson 1:** Electrical or Electronic processes **Lesson 2:** Electrical or Electronic products
Topic 5: Components and devices used on circuit diagrams	**Lesson 1:** Electricity **Lesson 2:** Conductivity **Lesson 3**: Conductors and Insulators
Topic 6: Circuits	**Lesson 1**: Electrical components & devices **Lesson 2:** Electrical symbols used in circuit diagrams
Topic 7: Electrical Fundamentals	**Lesson 1:** OHMs LAW **Lesson 2**: Kirchhoff's Law **Lesson 3:** Circuit Calculations

STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 3: PLUMBING TECHNOLOGY	
Benchmarks	**9.3.3.1 – 9.3.3.4**
Topic 1: Fundamental concept and relevance of plumbing trade	**Lesson 1:** Introduction to plumbing trade. **Lesson 2:** Importance of plumbing trade. **Lesson 3:** Career pathways of plumbing trade.
Topic 2: Occupational Health and Safety regulations and standard	**Lesson 1:** Define Occupational Health Safety regulations and standards. **Lesson 2:** Types of regulations and standards.
Topic 3: Plumbing tool and equipment	**Lesson 1:** Define plumbing tools and equipment. **Lesson 2:** Types of manual tools and equipment. **Lesson 3:** Types of plumbing materials and specifications.
Topic 4: Trade Drawing	**Lesson 1:** Define trade drawing. **Lesson 2:** Methods of Isometric drawing. **Lesson 3:** Methods of Pictorial drawing. **Lesson4:** Types of lines used.
STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 4: WELDING TECHNOLOGY	
Benchmarks	**9.3.4.1 – 9.3.4.5**
Topic 1: Workshop Organisation	**Lesson 1:** Workshop Set-up **Lesson 2:** Workshop safety procedures
Topic 2: Welding Standards	**Lesson 1:** Welding Principles **Lesson 2:** Welding Codes **Lesson 3:** Welding Standards
Topic 3: Measurement Techniques	**Lesson 1:** Measurement **Lesson 2:** Print reading **Lesson 3:** Layout/ fit-up Techniques
Topic 4: Metals	**Lesson 1:** Types of metals **Lesson 2:** Metal Properties
Topic 5: Cutting and Welding	**Lesson 1:** Types of Welding **Lesson 2:** Thermal cutting, heating and gouging **Lesson 3:** Brazing **Lesson 4:** Welding processes
STRAND 3: CONSTRUCTION TECHNOLOGY UNIT 5: ENGINEERING TECHNOLOGY	
Benchmarks	**9.3.5.1 – 9.3.5.7**
Topic 1: Historical aspects of Engineering Design Process	**Lesson 1:** Engineering, past, present & Future **Lesson 2:** Engineering Innovations **Lesson 3:** Influence of Engineering in the society.
Topic 2: Introduction to Engineering	**Lesson 1:** Introduction to Engineering **Lesson 2:** Scope of Engineering **Lesson 3:** Roles and responsibilities of Engineers
Topic 3: Engineering Fields	**Lesson 1:** Types of engineering fields **Lesson 2:** Specific terminologies for the different types of engineering. **Lesson 3:** Processes of manufacturing materials in various engineering discipline
Topic 4: Engineering Principles and practices	**Lesson 1:** Engineering principles **Lesson 2:** Engineering practices **Lesson 3:** Engineering materials
Topic 5: Occupational Health & safety	**Lesson 1:** OHS legislations and regulations for Engineers **Lesson 2:** Hazards & Risk Control Measures **Lesson 3:** Risk Assessment & Management **Lesson 4:** Basic First –Aid and CPR
Topic 6: Engineering Design Process	**Lesson 1:** Steps of Engineering Design **Lesson 2:** Management skills **Lesson 3:** Problem-solving skills

Topic 7: Engineering Communication	**Lesson 1:** Effective communication **Lesson 2:** Interpersonal and intrapersonal communication skills **Lesson 3:** Telephones, emails, directories **Lesson 4:** Report writing, **Lesson 5:** Memorandums **Lesson 6:** Incident reports

STRAND 4: COMMUNICATION TECHNOLOGY **UNIT 1: DATA COMMUNICATION AND NETWORK**	
Benchmarks	**9.4.1.1 – 9.4.1.7**
Topic 1: Data Communication Systems	**Lesson 1:** Introduction to Data Communication Systems **Lesson 2:** Elements of Data Communication systems
Topic 2: Computer Networks	**Lesson 1:** Introduction to Computer Networks **Lesson 2:** Functions of Computer Network Components
Topic 3: OSI Model	**Lesson 1:** Introduction OSI Model **Lesson 2:** Functions of the OSI Model
Topic 4: Communication Technology Terminologies Basic Scientific and Mathematical Concepts in creating media products	**Lesson 1:** Communication Technology Terminologies **Lesson 2:** Application of Terminologies **Lesson 3:** Media Products.
Topic 5: Media Communication	**Lesson 1:** Introduction to Media Communication **Lesson 2:** Techniques and Skills for application purposes
Topic 6: Design Brief-Simple Network	**Lesson 1:** Introduction to Design Brief **Lesson 2:** Research and apply Design **Lesson 3:** Brief in simple Networking
Topic 7: Authoring Software Multimedia	**Lesson 1:** Introduction to Multimedia, Authoring Software **Lesson 2:** Categories of Authoring Software **Lesson 3:** Features of Multimedia, Authoring Software
STRAND 4: COMMUNICATION TECHNOLOGY **UNIT 2: COMPUTER SECURITY AND SAFETY**	
Benchmarks	**9.4.2.1 – 9.4.2.6**
Topic 1: Postures in Computer Equipment Usage	**Lesson 1:** Introduction to Ergonomics **Lesson 2:** Correct Posture or Positions **Lesson 3:** Case Study - Posture
Topic 2: Health and Safety in ICT	**Lesson 1:** Types Health Hazards associated with use of ICT **Lesson 2:** Good ergonomics practices to minimise Health hazards associated in ICT usage
Topic 3: Effects of Computer Usage	**Lesson 1:** Introduction to computer technology **Lesson 2:** Effects of Computer Technology Usage on society
Topic 4: Emerging Technological Impact	**Lesson 1:** The evolution of emerging technologies **Lesson 2:** Impact of emerging technologies on society and environment **Lesson 3:** Case-Study (Music)
Topic 5: Safe Working Practices/ Habits	**Lesson 1:** Introduction to Work Place Safety **Lesson 2:** Safe Work Practices

STRAND 5: COMPUTER TECHNOLOGY UNIT 1: COMPUTER ARCHITECTURE	
Benchmarks	**9.5.1.1 – 9.5.1.5**
Topic 1: Computer System	**Lesson 1:** Information-Processing- Cycle **Lesson 2:** Computer Hardware and Software **Lesson 3:** Types of Computer
Topic 2: History of Computers	**Lesson 1:** History of Computers **Lesson 2:** Generation of Computers **Lesson 3:** Classification of Computers
Topic 3: Design Brief	**Lesson 1:** Introduction to Design Brief **Lesson 2:** Stage Design Brief **Lesson 3:** Case Study of Design Brief
Topic 4: Computer Electronics	**Lesson 1:** Fundamentals of Computer Electronics **Lesson 2:** Functions of computer electronic components
Topic 5: Binary	**Lesson 1:** Introduction to Binary Numbers
	Lesson 2: Binary Numbers **Lesson 3:** Digital Logic Circuitry
Topic 6: Troubleshooting	**Lesson 1:** Introduction to Computer Troubleshooting Lesson **Lesson 2:** Troubleshooting **Lesson 3:** Case Study of Troubleshooting
STRAND 5: COMPUTER TECHNOLOGY UNIT 2: COMPUTER SOFTWARE	
Benchmarks	**9.5.2.1 – 9.5.2.5**
Topic 1: Software Programming	**Lesson 1:** Introduction to Programming. **Lesson 2:** Types of Programming software and applications **Lesson 3:** Example of Software Programs and associated programming languages
Topic 2: Operating System	**Lesson 1:** Introduction to Operating System **Lesson 2:** Categories of Operating Systems Software **Lesson 3:** File Management
Topic 3: Keyboarding	**Lesson 1:** Introduction to Keyboard **Lesson 2:** Keyboard Techniques **Lesson 3:** Hands on Typing
Topic 4: Microsoft Office	**Lesson 1:** Introduction to Microsoft Word **Lesson 2:** Introduction to Microsoft Excel **Lesson 3:** Introduction to Microsoft PowerPoint/Publisher
Topic 5: Authoring Software/ Multimedia	See **Strand 4**, Benchmark **9.4.1.7**

Step 5: Expand and plot the distributed content into the complete 16 Week 3-Part Yearly Content Overview for the grade

The strand, Units and Benchmarks are further unpacked into Topics and Lesson Titles in the Teacher Guides.Because the Teacher Guide is not available now, the Grade 9 content overview has been adopted and expanded in this facilitators and in-service guide in the absence of the Grade 9 teacher guides to help you plan a Grade 9 Technology and industrial Art Teaching Program

- The Yearly Content Overview for the Technology and Industrial Arts is a 16 week 3-part Content Overview which is Yearly Content Overview for the Technology and Industrial Arts Subject. .
- It outlines the Strands, Units, Content Standards, Benchmarks, Topics and Lessons to be taught in 16 weeks for each part. Teachers

have the option of outlining the their Yearly Content Overview in a template that can be easily read and understood by all who will be using the Yearly Overview to derive their Termly teaching programs. (a sample template is provided below)

- In the sample below, the Strands, Units, Content Standards, Benchmarks, Topics and Lesson Titles are distributed evenly across the 16 weeks for each part that must be programmed
- A sample is given below for your convenience to help you plan for your termly program.

Grade 9 Textile And Food Technology Yearly Content Overview

Week	Textile Technology and Food Technology	Content Standard	Benchmark	Topic	Lesson Title
1	Textile Technology: Fibres and Fabrics: CS: 9.11 BMs: 9.1.1.1 and 9.1.1.2, 9.1.1.3,	**CS1.1** Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing.	**9.1.1.1** Compare and contrast social, economic, cultural and technological changes to textiles, fashion and clothing	Impact of changes on textiles, fashion and clothing	**Lesson 1**: Exploring Textiles? **Lesson 2:** Origins of textiles, fashion and clothing **Lesson3:** Factors affecting changes in textile, fashions and clothing
			9.1.1.2 Distinguish the properties and characteristics of fibres and fabrics	Introduction to fibres and fabrics	**Lesson 1:** What are fibres and fabrics? **Lesson 2:** Characteristics and properties of fibres and fabrics **Lesson 3:** From fibres to fabrics.
			9.1.1.3 Explore the elements of design and the design and construction of fashion ideas	Designing and Construction	**Lesson 1:** Elements of design and design types. **Lesson 2:** Sources of fashion ideas. **Lesson 3:** Basic construction processes
2	Textile Technology: Fibres and Fabrics: CS: 9.11 BMs: 9.1.1.4, 9.1.1.5, 9.1.1.6	**CS1.1** Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing.	**9.1.1.4** Describe the functions of tools and equipment and their safe usage	Functions and safe usage of tools and equipment	**Lesson 1:** Textile Construction methods tools and their functions. **Lesson 2:** Safety when using textile tools and equipment. **Lesson 3:** Care and maintenance of textile products.
			9.1.1.5 Explore the range of textile construction techniques	Techniques in textile construction	**Lesson 1:** Textile construction methods **Lesson 2:** Colouring and decorating methods **Lesson 3:** Fabric finishes
			9.1.1.6 Apply appropriate safety practices in fashion design and construction	Safety practices in fashion designing and construction	**Lesson 1:** Differentiating between textile designing and construction processes **Lesson 2:** Safety practices in textile.
3	Textile Technology: Textile and Clothing: CS: 9.1.2 BMs:9.1.2.1, 9.1.2.2,	**CS1.2** Integrate and apply principles and techniques in presenting fashion ideas and illustrations in pattern making and garment construction	**9.1.2.1** Describe historical influences, technological progression and emerging trends as inspirational sources of design	Sources of Design	**Lesson 1:** Sources of design **Lesson 2:** Technological progression **Lesson 3:** Emerging trends
			9.1.2.2. Demonstrate an awareness of the fundamentals of the	Fundamentals of design process	**Lesson 1:** Importance of design process **Lesson 2:** Skills in the design process
		for a variety of needs and occasions	design process through various artistic versions		**Lesson 3:** Various artistic version

4	Textile Technology: Textile and Clothing: CS: 9.1.2 BMs: 9.1.2.3, 9.1.2.4,	**CS1.2** Integrate and apply principles and techniques in presenting fashion ideas and illustrations in pattern making and garment construction for a variety of needs and occasions	**9.1.2.3** Apply a broad range of contemporary and appropriate tools and techniques with competence and in the development of design projects	Tools and techniques in project designs	**Lesson 1:** Fashion and types of garments **Lesson 2:** Transferring patterns from garment to garment **Lesson 3:** Patterning techniques
			9.1.2.4 Describe how the properties of textile fibres affect textile wear and care	Textiles wear and care	**Lesson** Types of tools for textile projects **Lesson** Safe uses of special tools **Lesson** Care for tools
5	Textile Technology: Textile and Clothing: CS: 9.1.2 BMs: 9.1.2.5, 9.1.2.6,	**CS1.2** Integrate and apply principles and techniques in presenting fashion ideas and illustrations in pattern making and garment construction for a variety of needs and occasions	**9.1.2.5** Apply the design process to respond to needs and opportunities in textile design projects	Designing a textile project	**Lesson** What is design process **Lesson** Phases in Textile Project development **Lesson** Textile Projects
			9.1.2.6 Select and use appropriate technology to creatively document, communicate and present design and project work	Documenting a project portfolio	**Lesson** People and textile industry **Lesson** Textile technology equipment **Lesson** Textile Project exhibit
6	Food Technology: Food and Nutrition: CS: 9.2.1 BMs: 9.2.1.1. 9.2.1.2	**CS 2.1** Students will be able to examine and analyze the characteristics and properties of difference types of food and the social, economic, political, cultural and technological influences on the production and compliance with ethical principles and standards	**9.2.1.1** Compare and contrast the nature and properties of food	Nature and properties of food	**Lesson 1:** Introduction to food –(Nature and sources of food) **Lesson 2:** Food groups and dietary guidelines **Lesson 3:** Properties of starch, carbohydrates, fats and oil **Lesson 4:** Introduction to food product development
			9.2.1.2 Practice safety and hygiene procedures in tool and equipment, food handling, meal preparation and food development	Safety and hygienic practices in food product development	**Lesson 1:** Personal hygiene and safety practices **Lesson 2:** Kitchen hygiene **Lesson 3:** Hygiene practices and safety in food development (preparation etc.)

7	Food Technology:	**CS 2.1** Students will	**9.2.1.3** Examine the nutritional	Food and nutrients	**Lesson 1:** Functions of nutrients and food sources
	Food and Nutrition: CS: 9.2.1 BMs: 9.2.1.3, 9.2.1.4	be able to examine and analysze the characteristics and properties of difference types of food and the social, economic, political, cultural and technological influences on the production and compliance with ethical principles and standards	components of food and food development and the impact of food consumption on nutrition.		**Lesson 2:** Eating practices **Lesson 3:** Meal planning
			9.2.1.4 Explore nutrition as integral to making food choices	Food metabolism	**Lesson 1:** Digestion and absorption of food **Lesson 2:** Functions of food and nutrients in human body **Lesson 3:** Over nutrition and malnutrition (anorexia, bulimia, obesity, hypertension etc.)
8	Food Technology: Food and Nutrition: CS: 9.2.1 BMs: 9.2.1.5, 9.2.1.6,	**CS 2.1** Students will be able to examine and analyse the characteristics and properties of difference types of food and the social, economic, political, cultural and technological influences on the production and compliance with ethical principles and standards	**9.2.1.5** Discuss economic, social and technological influences of food, food product and food sciences	Influences on food product development	**Lesson 1:** Food ingredients **Lesson 2:** Principles of cooking methods **Lesson 3:** Food management **Lesson 4:** Economic, Social and technological influences on food product development
			9.2.1.6 Explore ways of meeting nutritional requirements to maintain optimum nutrition or manage nutritional issues	Food composition and energy metabolism	**Lesson 1:** Food composition **Lesson 2:** Food labelling **Lesson 3:** Energy metabolism **Lesson 4:** Meals for special needs
9	Food Technology: Food and Nutrition: CS: 9.2.1 BMs: 9.2.1.7	**CS 2.1** Students will be able to examine and analyse the characteristics and properties of difference types of food and the social, economic, political, cultural and technological influences on the production and compliance	**9.2.1.7** Apply the design process to create food items using combinations of basic ingredients with variations using a selection of techniques and food preparation equipment	Food product development	**Lesson 1:** Introduction to food product development **Lesson 2:** Design process **Lesson 3:** Design Brief **Lesson 4:** Sensory analysis
		with ethical principles and standards			

10	Food Technology: Food Science: CS: 9.2.2 BMs: 9.2.2.1, 9.2.2.2	**CS 2.2** Students will be able to investigate and analyse the cultural, physical, chemical, nutritional, biological and sensory characteristics of food and how they influence the development and production of food to meet different demands (e.g., health, occasions,	**9.2.2.1** Identify and describe the cultural, physical, biological and nutritional characteristics of food that influence food development	Characteristics and properties of cereals, vegetables, fruits, legumes, fats and oils	**Lesson 1** Cooking methods in food product development **Lesson 2** Physical and biological properties of cereals, vegetables and fruits **Lesson 3** Physical and biological properties of fruits, legumes, fats and oils
			9.2.2.2 Describe the nutritional and sensory characteristics of food to meet the needs, health and occasions.	Sensory characteristics of food	**Lesson 1** Sensory analyses of food **Lesson 2** Nutritional functions of food **Lesson 3** Functional foods
11	Food Technology: Food Science: CS: 9.2.2 BMs: 9.2.2.3, 9.2.2.4,	**CS 2.2** Students will be able to investigate and analyse the cultural, physical, chemical, nutritional, biological and sensory characteristics of food and how they influence the development and production of food to meet different demands (e.g., health, occasions,	**9.2.2.3** Apply management strategies in food selection, meal preparation, product development, storage and preservation	Food management	**Lesson 1** Food management **Lesson 2** Trends, fashion and food **Lesson 3** Seasons and food
			9.2.2.4 Explore safety and hygiene practices relating to food, and changes that occur in the functional properties of food	Food safety and hygienic practices	**Lesson 1** Food borne diseases **Lesson 2** Contamination **Lesson 3** First Aid
12	Food Technology: Food Science: CS: 9.2.1 BMs: 9.2.2.5 9.2.2.6	**CS 2.2** Students will be able to investigate and analyse the cultural, physical, chemical, nutritional,	**9.2.2.5** Examine the social, economic and environmental impact of food processing technology, and the role packaging plays in the	Factors influencing food processing and packaging	**Lesson 1** Factors that influence food processing **Lesson 2** The role of food packaging **Lesson 3** Developments in packaging and distribution **Lesson 4** Techniques to evaluate products and processes

		biological and sensory characteristics of food and how they influence the development and production of food to meet different demands (e.g., health, occasions,	distribution of food from the point of production to consumption		
			9.2.2.6 Apply the design process to create food solutions.	The technology design	**Lesson 1** Design brief and the technological process **Lesson 3** Evaluate the new product **Lesson 2** Using a design product to create a new product
13	Textile and Food Summative Assessment				

Grade 9 Construction Technology Yearly Content Overview

Week	Construction Technology	Content Standard	Benchmark	Topic	Lesson Title
1	Building Technology CS: 9.3.1 BMS: 9.3.1.1. 9.3.1.2, 9.3.1.3,	**CS 3.1** Investigate the history and theory of buildings and analyse the components and systems of buildings, occupational health and safety procedures, the properties of building materials and the processes in which those materials and equipment are used according to industry standards.	**9.3.1.1** Investigate the history and theory of buildings	The history and theory of buildings	**Lesson 1:** Introduction to Building **Lesson 2:** Definition of Building **Lesson 3:** Different Types of Building **Lesson 4:** Types of material used **Lesson 5:** Importance of building and career paths.
			9.3.1.2 Identify and describe a variety of construction materials, components, and processes	Building construction materials	**Lesson 1:** Define Building materials **Lesson 2:** Timber Building Materials **Lesson 3:** Bricks and Concrete materials **Lesson 4:** Metal and steel materials
			9.3.1.3 Describe the elements of drawings, and their application in technical drawings.	Trade drawing	**Lesson 1:** Define trade drawing **Lesson 2:** Types of trade drawing **Lesson 3:** Isometric drawing **Lesson 4:** Pictorial drawing **Lesson 5:** Orthographic drawing **Lesson 6:** Types of lines use
2	Building Technology CS: 9.3.1 BMs: 9.3.1.4, 9.3.1.5, 9.3.1.6,	**CS 3.1** Investigate the history and theory of buildings and analyse the components and systems of buildings, occupational health and safety procedures, the properties of building materials and the processes in which those materials and equipment are used according to industry standards.	**9.3.1.4** Identify and describe the elements of safety	The Elements Occupational Health and Safety	**Lesson 1:** Define occupational Health and safety **Lesson 2:** The regulations of OHS **Lesson 3:** The standards of OHS
			9.3.1.5 Describe the scope and purpose of building codes, and identify other regulations and standards that apply to construction projects	Building Codes, Standards and regulations	**Lesson 1:** Define Building legislations and regulations **Lesson 2:** Types of building codes **Lesson 3:** Types of building regulations
			9.3.1.6 Apply mathematical skills and scientific concepts in the	Trade Maths	**Lesson 1:** Define Applied maths **Lesson 2:** Formulae to calculate substructure

			planning and building of a variety of construction projects		**Lesson 3:** Define sub-structure member (footings, post, bearers) **Lesson 4:** Define super -structure members (Floor joist, studs, roofing frame) **Lesson 5:** Types of building defect
3	Electrical Technology CS: 9.3.2 BMs: 9.3.2.1, 9.3.2.2, 9.3.2.3,	**CS 3.2** Analyse and apply the technological processes, concepts, principles and practices related to Electrical Technology and its social contribution with regard to economic growth, entrepreneurship, sustainability and as a tool for change, improving the quality of life responsive to individual, community and industrial needs.	**9.3.2.1** Describe the historical development of electricity	History of Electricity	**Lesson 1:** Electrical Energy Production & Supply **Lesson 2:** Modern Power Generation methods **Lesson 3:** Renewable and sustainable energy practices.
			9.3.2.2 Investigate and communicate OHS legislation and regulation and assess and employ emergency procedures whilst observing safety	Workplace and Electrical safety	**Lesson 1:** Electrical Energy Production & Supply **Lesson 2:** Renewable and sustainable energy practices. **Lesson 3:** Career Pathway in Electrical Technology
			9.3.2.3 Identify, design, develop and evaluate processes and products related to electrical technology and communicate the findings through the use of appropriate electrical and electronic terminology.	Electrical or Electronic processes and products	**Lesson 1:** OHS legislation & Regulation **Lesson 2:** Personal Safety **Lesson 3:** Emergency procedures.
4	Electrical Technology CS: 9.3.2 BMs: 9.3.2.4, 9.3.2.5,	**CS 3.2** Analyse and apply the technological processes, concepts, principles and practices related to Electrical Technology and its social contribution with regard to economic growth, entrepreneurship, sustainability and	**9.3.2.4** Define electricity and conductivity and differentiate insulators from conductors	Fundamentals of electricity	**Lesson 1:** Electrical or Electronic processes **Lesson 2:** Electrical or Electronic products
			9.3.2.5 Identify symbols used and explain the functions of components and devices in electrical circuit diagrams	Components and devices used on circuit diagrams	**Lesson 1:** Electricity **Lesson 2:** Conductivity **Lesson 3**: Conductors and Insulators

		as a tool for change, improving the quality of life responsive to individual, community and industrial needs.			
5	Electrical Technology CS: 9.3.2 BMs: 9.3.2.6, 9.3.2.7	**CS 3.2** Analyse and apply the technological processes, concepts, principles and practices related to Electrical Technology and its social contribution with regard to economic growth, entrepreneurship, sustainability and as a tool for change, improving the quality of life responsive to individual, community and industrial needs.	**9.3.2.6** Identify the different types of circuits and explain the parts and operation of a simple practical circuit.	Circuits	**Lesson 1**: Electrical components & devices **Lesson 2:** Electrical symbols used in circuit diagrams
			9.3.2.7 Investigate the concepts, principles and practices related to electrical	Electrical Fundamentals	**Lesson 1:** OHMs LAW **Lesson 2**: Kirchhoff's Law **Lesson 3:** Circuit Calculations
6	Plumbing Technology CS: 9.3.3 BMs: 9.3.3.1, 9.3.3.2	**CS 3.3** Investigate and analyse fundamental concepts of plumbing and theories, OHS, Occupational Health and safety Regulations and standards ,trade drawing, demonstrations and applications of tools and materials specifications, installation of plumbing fittings and accessories in (DWV) Drain, waste, vent system, and water distribution	**9.3.3.1** Describe and explain the fundamentals, concepts, and their relevance in the plumbing trade	Fundamental concept and relevance of plumbing trade	**Lesson 1:** Introduction to plumbing trade. **Lesson 2:** Importance of plumbing trade. **Lesson 3:** Career pathways of plumbing trade.
			9.3.3.2 Analyse and describe OHS Regulations and standards in the plumbing trade and work places.	Topic 2: Occupational Health and Safety regulations and standard	**Lesson 1:** Define Occupational Health Safety regulations and standards. **Lesson 2:** Types of regulations and standards.
		system.			

7	Plumbing Technology CS: 9.3.3 BMs: 9.3.3.3, 9.3.3.4,	**CS 3.3** Investigate and analyse fundamental concepts of plumbing and theories, OHS, Occupational Health and safety Regulations and standards ,trade drawing, demonstrations and applications of tools and materials specifications, installation of plumbing fittings and accessories in (DWV) Drain, waste, vent system, and water distribution system.	**9.3.3.3** Demonstrate and apply basic plumbing tools and equipment and their specifications and practice in trade math.	Plumbing tool and equipment	**Lesson 1:** Define plumbing tools and equipment. **Lesson 2:** Types of manual tools and equipment. **Lesson 3:** Types of plumbing materials and specifications.
			9.3.3.4 Explore and apply basic concepts of trade drawings in plumbing.	Trade Drawing	**Lesson 1:** Define trade drawing. **Lesson 2:** Methods of Isometric drawing. **Lesson 3:** Methods of Pictorial drawing. **Lesson4:** Types of lines used.
8	Welding Technology CS: 9.3.4 BMs: 9.3.4.1, 9.3.4.2,	**CS 3.4** Investigate and analyse safety procedures, print reading, measurement and layout, identify properties of metals, the welding techniques, cutting processes according to welding codes, inspections, testing principles and apply fundamentals of fabrication.	**9.3.4.1** Investigate safe workshop setup and safety procedures in welding	Workshop Organisation	**Lesson 1:** Workshop Set-up **Lesson 2:** Workshop safety procedures
			9.3.4.2 Explore and interpret welding principles, codes and standards	Welding Standards	**Lesson 1:** Welding Principles **Lesson 2:** Welding Codes **Lesson 3:** Welding Standards
9	Welding Technology CS: 9.3.4 BMs: 9.3.4.3, 9.3.4.4, 9.3.4.5	**CS 3.4** Investigate and analyse safety procedures, print reading, measurement and layout, identify properties	**9.3.4.3** Demonstrate knowledge in fundamental print reading, measurement and layout or fi t-up techniques	Measurement Techniques	**Lesson 1:** Measurement **Lesson 2:** Print reading **Lesson 3:** Layout/ fit-up Techniques

		of metals, the welding techniques, cutting processes according to welding codes, inspections, testing principles and apply fundamentals of fabrication.			
			9.3.4.4 Investigate and analyse the properties of metals	Metals	**Lesson 1:** Types of metals **Lesson 2:** Metal Properties
			9.3.4.5 Investigate the various welding techniques and cutting processes	Cutting and Welding	**Lesson 1:** Types of Welding **Lesson 2:** Thermal cutting, heating and gouging **Lesson 3:** Brazing **Lesson 4:** Welding processes
10	Engineering Technology CS: 9.3.5 BMs: 9.3.5.1, 9.3.5.2,	**CS 3.5** Investigate and analyse the historical and societal influences in Engineering by understanding the engineering principles, practices, the design process, the management, problem-solving and communication skills appropriate to any engineering field.	**9.3.5.1** Describe how history and society has influenced the engineering field and critically analyse innovations.	Historical aspects of Engineering Design Process	**Lesson 1:** Engineering, past, present & Future **Lesson 2:** Engineering Innovations **Lesson 3:** Influence of Engineering in the society.
			9.3.5.2 Investigate the scope of engineering, roles and responsibilities of an engineer and recognise current innovations	Introduction to Engineering	**Lesson 1:** Introduction to Engineering **Lesson 2:** Scope of Engineering **Lesson 3:** Roles and responsibilities of Engineers
11	Engineering Technology CS: 9.3.5 BMs: 9.3.5.3, 9.3.5.4,	**CS 3.5** Investigate and analyse the historical and societal influences in Engineering by understanding the engineering principles, practices, the design process, the management, problem-solving and communication skills appropriate to any engineering field.	**9.3.5.3** Explore and distinguish the different types of the Engineering fields.	Engineering Fields	**Lesson 1:** Types of engineering fields **Lesson 2:** Specific terminologies for the different types of engineering. **Lesson 3:** Processes of manufacturing materials in various engineering discipline
			9.3.5.4 Explore and discuss engineering principles and practices and the appropriate materials in engineering.	Engineering Principles and practices	**Lesson 1:** Engineering principles **Lesson 2:** Engineering practices **Lesson 3:** Engineering materials

12	Engineering Technology CS: 9.3.5 BMs: 9.3.5.5,	**CS 3.5** Investigate and analyse the historical and societal	**9.3.5.5** Explore and analyse the general safety practices in engineering.	Occupational Health & safety	**Lesson 1:** OHS legislations and regulations for Engineers **Lesson 2:** Hazards &
	9.3.5.6, 9.3.5.7	influences in Engineering by understanding the engineering principles, practices, the design process, the management, problem-solving and communication skills appropriate to any engineering field.			Risk Control Measures **Lesson 3:** Risk Assessment & Management **Lesson 4:** Basic First –Aid and CPR
			9.3.5.6 Outline management and problem solving skills using the engineering design process.	Engineering Design Process	**Lesson 1:** Steps of Engineering Design **Lesson 2:** Management skills **Lesson 3:** Problem-solving skills
			9.3.5.7. Explore and utilise communication practices appropriate to engineering.	Engineering Communication	**Lesson 1:** Effective communication **Lesson 2:** Interpersonal and intrapersonal communication skills **Lesson 3:** Telephones, emails, directories **Lesson 4:** Report writing, **Lesson 5:** Memorandums **Lesson 6:** Incident reports
13	**SUMMATIVE ASSESSMENT**				

GRADE 9 COMMUNICATION AND COMPUTER TECHNOLOGY YEARLY CONTENT OVERVIEW

Week	Communication and Computer Technology	Content Standard	Benchmark	Topic	Lesson Title
1	Communication Technology Data Communication and Network CS: 9.4.2 BMs: 9.4.1.1, 9.4.1.2, ,	**CS 4.1** Investigate and analyse communication technology utilising multimedia and the practices and systems in designing, installing, configuring and managing networks.	**9.4.1.1** Define the elements of data communication system.	Data Communication Systems	**Lesson 1:** Introduction to Data Communication Systems **Lesson 2:** Elements of Data Communication systems
			9.4.1.2 Describe the functions of the different components of a computer network.	Computer Networks	**Lesson 1:** Introduction to Computer Networks **Lesson 2:** Functions of Computer Network Components
2	Communication Technology Data Communication and Network CS: 9.4.1 BMs: 9.4.1.3, 9.4.1.4,	**CS 4.1** Investigate and analyse communication technology utilising multimedia and the practices and systems in designing, installing, configuring and managing networks.	**9.4.1.3** Define the OSI (Open Systems Interconnect) model and how it functions.	OSI Model	**Lesson 1:** Introduction OSI Model **Lesson 2:** Functions of the OSI Model
			9.4.1.4 Explore the use of technical terminology, basic scientific concepts, and mathematical concepts used in communications technology and apply them to the creation of media products.	Communication Technology Terminologies Basic Scientific and Mathematical Concepts in creating media products	**Lesson 1:** Communication Technology Terminologies **Lesson 2:** Application of Terminologies **Lesson 3:** Media Products.
3	Communication Technology Data Communication and Network CS: 9.4.1 BMs: 9.1.4 .5, 9.1.4 .6, 9.1.4 .7	**CS 4.1** Investigate and analyse communication technology utilising multimedia and the practices and	**9.4.1.5** Explore and articulate the core concepts, techniques, and skills required to produce a	Media Communication	**Lesson 1:** Introduction to Media Communication **Lesson 2:** Techniques and Skills for application purposes

		systems in designing, installing, configuring and managing networks.	range of communications media products or services.		
			9.4.1.6 Research and apply the design brief to design, configure and manage simple network.	Design Brief- Simple Network	**Lesson 1:** Introduction to Design Brief **Lesson 2:** Research and apply Design **Lesson 3:** Brief in simple Networking
			9.4.1.7 Explore the Authoring Software or Multimedia associate software	Authoring Software Multimedia	**Lesson 1:** Introduction to Multimedia, Authoring Software **Lesson 2:** Categories of Authoring Software **Lesson 3:** Features of Multimedia, Authoring Software
4	Communication Technology Computer Security and Safety CS: 9.4.2 BMs: 9.4.2.1, 9.4.2.2,	**CS 4.2** Investigate and analyse the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society.	**9.4.2.1** Investigate and demonstrate appropriate posture in using computer equipment	Postures in Computer Equipment Usage	**Lesson 1:** Introduction to Ergonomics **Lesson 2:** Correct Posture or Positions **Lesson 3:** Case Study - Posture
			9.4.2.2 Identify health hazards associated with the use of ICT and propose good ergonomic practices	Health and Safety in ICT	**Lesson 1:** Types Health Hazards associated with use of ICT **Lesson 2:** Good ergonomics practices to minimise Health hazards associated in ICT usage
5	Communication Technology Computer Security and Safety CS: 9.4.2 BMs: 9.4.2.3, 9.4.2.4,	**CS 4.2** Investigate and analyse the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society	**9.4.2.3** Identify effects of the widespread use of computers and associated technologies on society	Effects of Computer Usage	**Lesson 1:** Introduction to computer technology **Lesson 2:** Effects of Computer Technology Usage on society
			9.4.2.4 Evaluate the impact of past, current and emerging technologies on the Individual, society and environments.	Emerging Technological Impact	**Lesson 1:** The evolution of emerging technologies **Lesson 2:** Impact of emerging technologies on society and environment **Lesson 3:** Case-Study (Music)

6	Communication Technology Computer Security and Safety CS: 9.4.2 BMs: 9.4.2.5,	**CS 4.2** Investigate and analyse the ergonomics, social and ethical issues and the development of a monitoring and control system for both hardware, software and information security in society	**9.4.2.5** Demonstrate an understanding of and apply safe work practices in communications technology activities	Safe Working Practices/Habits	**Lesson 1:** Introduction to Work Place Safety **Lesson 2:** Safe Work Practices
7	Computer Technology Computer Architecture CS: 9.5.1 BMs: 9.5.1.1, 9.5.1.2	**CS 5.1** Explore and analyse computer fundamentals, the skills to manage and maintain; diagnose, troubleshoot and solve issues that encompass computer systems, networking, interfacing and programming as well as electronics and robotics and be aware of related environmental and societal issues.	**9.5.1.1** Comprehend and explain the Computer System and types of computer.	Computer System	**Lesson 1:** Information-Processing- Cycle **Lesson 2:** Computer Hardware and Software **Lesson 3:** Types of Computer
			9.5.1.2 Explore generations of computer	History of Computers	**Lesson 1:** History of Computers **Lesson 2:** Generation of Computers **Lesson 3:** Classification of Computers
8	Computer Technology Computer Architecture CS: 9.5.1 BMs: 9.5.1.3, 9.5.1.4		**9.5.1.3** Investigate and describe the design brief of solving problems.	Design Brief	**Lesson 1:** Introduction to Design Brief **Lesson 2:** Stage Design Brief **Lesson 3:** Case Study of Design Brief
			9.5.1.4 Identify and describe the functions of, as well as important advances related to, electronic and computer components;	Computer Electronics	**Lesson 1:** Fundamentals of Computer Electronics **Lesson 2:** Functions of computer electronic components
		aware of related environmental and societal issues.			

9	Computer Technology Computer Architecture CS: 9.5.1 BMs: 9.5.1.5, 9.5.1.6	**CS 5.1** Explore and analyse computer fundamentals, the skills to manage and maintain; diagnose, troubleshoot and solve issues that encompass computer systems, networking, interfacing and programming as well as electronics and robotics and be aware of related environmental and societal issues.	**9.5.1.5** Demonstrate a basic understanding of binary numbers and digital logic	Binary	**Lesson 1:** Introduction to Binary Numbers **Lesson 2:** Binary Numbers **Lesson 3:** Digital Logic Circuitry
			9.5.1.6 Explore and describe hardware and software troubleshooting principles	Troubleshooting	**Lesson 1:** Introduction to Computer Troubleshooting Lesson **Lesson 2:** Troubleshooting **Lesson 3:** Case Study of Troubleshooting
10	Computer Technology Computer Software CS: 9.5.2 BMs: 9.5.2.1, 9.5.2.2	**CS 5.2** Investigate and analyse computer system and application software, programming, algorithm, web design and databases, and develop and apply the skills and knowledge in the various software.	**9.5.2.1** Explore programming software and applications	Software Programming	**Lesson 1:** Introduction to Programming. **Lesson 2:** Types of Programming software and applications **Lesson 3:** Example of Software Programs and associated programming languages
			9.5.2.2 Demonstrate the understanding of Operating Systems/ Software and File Management	Operating System	**Lesson 1:** Introduction to Operating System **Lesson 2:** Categories of Operating Systems Software **Lesson 3:** File Management
11	Computer Technology Computer Software CS: 9.5.2 BMs: 9.5.2.3, 9.5.2.4	**CS 5.2** Investigate and analyse computer system and application software, programming, algorithm, web design and databases, and develop and apply the skills and knowledge in the various software.	**9.5.2.3** Apply typing skills with speed (20wpm) and accuracy (80%)	Keyboarding	
			9.5.2.4 Create documents using Microsoft Office	Microsoft Office	**Lesson 1:** Introduction to Keyboard **Lesson 2:** Keyboard Techniques **Lesson 3:** Hands on Typing

12	Computer Technology Computer Software CS: 9.5.2 BMs: 9.5.2.5,	**CS 5.2** Investigate and analyse computer system and application software, programming, algorithm, web design and databases, and develop and apply the skills and knowledge in the various software.	**9.5.2.5** Explore the Authoring Software or Multimedia associate software	Authoring Software/ Multimedia	**Lesson 1:** Introduction to Microsoft Word **Lesson 2:** Introduction to Microsoft Excel **Lesson 3:** Introduction to Microsoft PowerPoint/Publisher
13	**SUMMATIVE ASSESSMENT**				

Step 6: Develop the Termly Programs

- Extract the terms content from the Yearly Overview to expand the content into the termly teaching program.
- Note that the TIA program is developed in 3-parts and 1 of the 3 parts is the program to be used all year around for the different lots of students rotating to take all 5 strand s of TIA. Below is a proposed Template to develop a Teaching Program for a Term.(13 weeks)

Subject: _____Grade _____Term:____ Year: _____

Week	Content Standards	Benchmark	Unit	Topic	Learning Objective	Knowledge	Skill	Attitude/ Values	Performance Standard
Write the week number	Write the Coding only	Write the Coding only	Write the Unit number and Name	Write the Topic number and Name	By the end of this Topic, Students will be able to: Write the learning Objectives for the Topic	Write the essential knowledge to be learnt in this topic	Write the essential skill to be learnt in this topic	Write the essential attitude and values to be learnt in this topic	By the end of this Topic, students will be able to; Write the Performance Standard (if the Benchmark carries one)

Note: A Performance Standard will only be included if the Benchmark has been nominated to carry a Performance Standard (Assessment). Otherwise, it is not very necessary for all Benchmarks to have a Performance Standard.

Step 7: Develop the Weekly Teaching Program (Proposed Template) and Daily Lesson Plan (SBC Template)

Template 1: Using Topics to develop Weekly Teaching Program

- You can use the Topics to develop the weekly teaching program
- Below is a proposed Template to develop a Teaching Program for a week

Subject: _____Grade _____Term:____ Year: _____

Week	Content Standards	Benchmark	Unit	Topic	Learning Objective	Knowledge	Skill	Attitude/ Values	Performance Standard
Write the week number	Write the Coding only	Write the Coding only	Write the Unit number and Name	Write the Topic number and Name	By the end of this Topic, Students will be able to: Write the learning Objectives for the Topic	Write the essential knowledge to be learnt in this topic	Write the essential skill to be learnt in this topic	Write the essential attitude and values to be learnt in this topic	By the end of this Topic, students will be able to; Write the Performance Standard (if the Benchmark carries one)

Template 2: Using Lesson Titles to develop Weekly Teaching Program

- Use the unpacking process to derive lesson titles and lesson objectives to be able to expand your weekly teaching program.
- Below is a proposed Template to develop a Teaching Program for a week

Subject: _____Grade _____Term:____ Year: _____

Week	Content Standards	Benchmark	Unit	Topic	Learning Objective	Knowledge	Skill	Attitude/ Values	Performance Standard
Write the week number	Write the Coding only	Write the Coding only	Write the Unit number and Name	Write the Topic number and Name	By the end of this Topic, Students will be able to: Write the learning Objectives for the Topic	Write the essential knowledge to be learnt in this topic	Write the essential skill to be learnt in this topic	Write the essential attitude and values to be learnt in this topic	By the end of this Topic, students will be able to; Write the Performance Standard (if the Benchmark carries one)

Timetabling of Technology and Industrial Arts

The teaching and learning of TIA can be organised in the manner of class rotational basis. There are three teachers who will be teaching the subject TIA.
1: The Home Economics Teacher,
2: The Practical Skills Teacher, and
3. The Maths/Science/Computing Teacher.

These three teachers will be timetabled to teach TIA during the term. Then the planning and programming will be organized in this same manner only each strand teacher will extract the strand program for teaching as these are subject specific content. This is to ensure that teachers are on contact throughout the terms and to maintain their teaching loads.

Sample 1st Rotational Program for the First 13 Weeks (Term1 Week 1-10 and Term 2 Week 1-2)

Class	Strand	Content Teacher	
Class 1 and 2	Food and Textile Technology	Home Economics Teacher	These classes can be rotated so they all cover all the strands of TIA
Class 3 and 4	Construction Technology	Practical Skills Teacher	
Class 5 and 6	Communication and Computer Technology	Computing ICT Teacher	

Sample 2nd Rotational Program for the Next 13 Weeks (Term 2 Week 4 – Term 3 Week 6)

Class	Strand	Content Teacher	
Class 1 and 2	Construction Technology	Practical Skills	These classes can be rotated so they all cover all the strands of TIA
Class 3 and 4	Communication and Computer Technology	Computing ICT Teacher	
Class 5 and 6	Food and Textile Technology	Home Economics Teacher	

Sample 3rd Rotational Program for the Next 13 Weeks (Term 3 Week 7 – Term 4 Week 9)

Class	Strand	Content Teacher	
Class 1 and 2	Communication and Computer Technology Food and Textile Technology	Home Economics	These classes can be rotated so they all cover all the strands of TIA
Class 3 and 4	Food and Textile Technology	Home Economics Teacher	
Class 5 and 6	Construction Technology	Practical Skills	

Step 8: Review, Evaluate and Re-plan the yearly, termly, weekly Programs.

This Process MUST BE DONE COLLABORATIVELY BY ALL WHO TEACH THE SUBJECT.

IT MUST BE DONE PROGRESSIVELY

Recording, Monitoring and Evaluation

Recording and Reporting

Recording and reporting are integral to assessment for students from grades 9 to 12. Therefore, it is commended that reporting and recording of students' achievements for Business and Technology Subjects must be done by grade levels in school based assessment or also referred to as internal school assessment.

The marks awarded to students in their internal assessment will be a combination of the internal assessment mark and the examination mark. Internal assessment provides a measure of student's achievements based on a wider range of syllabus content and benchmarks than maybe covered by the external examination. Business and Technology subjects provide a summation of each student's achievement in Grades 9-12. The internal assessment mark must comply with the types of tasks and assessment rubrics specified in the holistic or analytic rubrics. The external examination provides a measure of student achievement of those aspects of the content standards that can be reliably measured in an examination setting.

Recording

It is required that schools maintain and submit student assessment records according to the school based assessment policy. Teachers can record the evidence of students' demonstrations' of achieving the content standards and benchmarks using assessment instruments that are manageable. Here are some recommended recording methods;

- Individual or class checklists or class grid to record observations
- Comments on students work indicating what they have done well and where they need to improve
- Work samples being added to a portfolio
- Test marks
- Students assessments of their own performances using rubrics or assessment criteria and
- Students assessment of their peers using the assessment criteria

Students are given constructive feedback by the teacher on what they can do well and what they need to improve on. Likewise, teachers are focused on the content they are assessing and are able to apply fair, precise and consistent judgment.

Reporting

Teachers are obliged to report on what students have done or how well they have performed and how they improve further. Formal reporting through written reports and interviews are done to inform parents and guardians of the students learning progress and other related areas such as behavior. Teachers must ensure that the student has demonstrated and achieved the standards independently on a number of occasions.

These can be done formally or informally. The achievements are reported to respected stakeholders in relation to;

- Weaknesses in the learner
- Strengths in the learner
- Parent and guardian support and
- Evaluation

Certification

Certifying of students must be done through an awarding system which will determine the level of achievement. This will be in a form of achievement statements suggested below;
Levels of achievement

1. Very high achievement
2. High achievement
3. Satisfactory achievement
4. Low achievement
5. Below requirement level

All teachers responsible for grades 9-12 must consider school based assessment levels of achievements to be affected across all Business and technology Subjects.

Monitoring and Evaluation

Standards based reporting is and about student understanding and mastering a learning standard and less about grades. A standards based report card can list the most important skills students should learn in each subject at a particular grade level. Instead of letter grades, students receive marks or a code that show how well they have mastered the skills. The marks or codes that schools use to represent student progress are;
A- Advanced
B- Proficient
C- Progressing
D-Novice

The learning standards are basically the learning standards and expectations for each grade level. SBC requires a new way of recording and reporting to measure progress. Reporting progress is based on the teaching and learning strategies for performance based learning which are accurately assessing the performance towards mastery. The teaching model is changing therefore the performance measurements of Standards-Based Reporting will be more reflective of learning in the classroom. Hence, SBA lets students know against which criteria they will judge their work, and the standards attached to each of the criteria. It tells students what is required and allows teachers to gain a sense of how students are doing overall based on their achievement of the standards and promotes mastery learning.

Students Are Provided with Appropriate Feedback that Will Improve their Skills

In a standards-based learning approach, teachers are expected to provide their students with quality feedback that will improve student learning. As opposed to the traditional grading system that only provides students with a single numerical or letter grade, the standards-based grading system requires teachers to provide their students with meaningful and appropriate feedback that will accelerate mastery of learning standards. It is believed that standards-based grading allowed students to identify their areas of growth and to improve on their own competencies.

Teachers need to communicate with their students what each proficiency score means and should be explained to the students' parents what each score means and how they can help their children demonstrate mastery of learning standards expected of them for the subject.

Students Can Track their Progress

In a standards-based grading approach, students understand the meaning of each score that they receive. Because there are rubrics that explain the meaning of each proficiency score, students can easily monitor which standards need to be improved further and which learning standards have already been met. As such, students begin to monitor their progress and become accountable for their learning goals.

Interventions and Monitoring

Underachievement is poorer than expected performance. Students who consistently display performance demonstrative of underachievement are identified and interventions for regress are planned to promote learning. Such interventions should be planned not as a general aspect but should address individual students' limitations in learning and should encourage learning.

Monitoring of Students Learning

Monitoring of students learning is done through strategies that teacher devise to track their teaching and students achievement. This is through the assessment program, classroom teaching, and performance in performance-based learning and students self-assessment in achieving the learning standards.

Re-planning

Re-planning of teaching programs and lesson planning are addressed apart from the planning and programming for all other students. This is specifically addressing underachievers. Re-planning includes teaching and learning strategies, resources, remedial activities which can be planned into the normal teaching times instead of creating extra times after classes.

Standards-Based Lesson Planning

What are Standards-Based Lessons?

In a Standards-Based Lesson, the most important or key distinction is that, a student is expected to meet a defined standard for proficiency. When planning a lesson, the teacher ensures that the content and the methods of teaching the content enable students to learn both the skills and the concepts defined in the standard for that grade level and to demonstrate evidence of their learning.

Planning lessons that are built on standards and creating aligned assessments that measure student progress towards standards is the first step teacher must take to help their students reach success. A lesson plan is a step-by-step guide that provides a structure for an essential learning.

When panning a standards-based lesson, teacher instructions are very crucial for your lessons. How teachers instruct the students is what really points out an innovative teacher to an ordinary teacher. Teacher must engage and prepare motivating instructional activities that will provide the students with opportunities to demonstrate the benchmarks. For instance, teacher should at least identify 3-5 teaching strategies in a lesson; teacher lectures, ask questions, put students into groups for discussion and role play what was discussed.

Why is Standards-Based Lesson Planning Important?

There are many important benefits of having a clear and organised set of lesson plans. Good planning allows for more effective teaching and learning. The lesson plan is a guide and map for organising the materials and the teacher for the purpose of helping the students achieve the standards. Lesson plans also provide a record that allows good, reflective teachers to go back, analyze their own teaching (what went well, what didn't), and then improve on it in the future.

Standards-based lesson planning is vital because the content standards and benchmarks must be comparable, rigorous, and measurable and of course evidence based and be applicable in real life that we expect students to achieve. Therefore, teachers must plan effective lessons to teach students to meet these standards. As schools implement new standards, there will be much more evidence that teachers will use to support student learning to help them reach the highest levels of cognitive complexity. That is, students will be developing high-level cognitive skills.

Components of a Standards-Based Lesson Plan

An effective lesson plan has three basic components;

- aims and objectives of the course;
- teaching and learning activities;
- assessments to check student understanding of the topic.

Effective teaching demonstrates deep subject knowledge, including key concepts, current and relevant research, methodologies, tools and techniques, and meaningful applications.

Planning for under-achievers

Who are underachieving students?
Under achievers are students who fail or do not perform as expected. Underachievement may be caused by emotions (low self-esteem) and the environment (cultural influences, unsupportive family)

How can we help underachievement?
Underachievement varies between students. Not all students are in the same category of underachievement.

Given below is a suggested strategies teachers may adopt to assist underachievers in the classroom.

- Examine the Problem Individually

It is important that underachieving students are addressed individually by focusing on the student's strengths.

- Create a Teacher-Parent Collaboration

Teachers and parents need to work together and pool their information and experience regarding the child. Teachers and parents begin by asking questions such as;

  - In what areas has the child shown exceptional ability?
  - What is the child's preferred learning styles?
  - What insights do parents and teachers have about the child's strengths and problem areas?

- Help student to plan every activity in the classroom
- Help students set realistic expectations
- Encourage and promote the student's interests and passions.
- Help children set short and long-term academic goals
- Talk with them about possible goals.
- Ensure that all students are challenged (but not frustrated) by class room activities
- Always reinforce students

Standards-Based Lesson Planning

To help teachers plan effective lessons, there are sample lessons from the five strands provided. Teachers are encouraged to study the layout of the different components of these lessons and follow this design in their preparation and teaching of each lesson. Planning a good lesson helps the teacher in maintaining a standard teaching pattern and does not let the class deviate from the topic.

Sample of Standards-Based Lesson Planning

The following sample lesson can help teachers to plan effective lessons. Teachers are encouraged to study the layout of the different components of these lessons and follow this design in their preparation and teaching of each lesson. Planning a good lesson helps the teacher in maintaining a standard teaching pattern which should not deviate students' learning of the concept from the topic.

Sample Lesson Plan

UNIT 1. Data Communication and Network
Topic 1: Postures in Using Computer Equipment
Content Standard 4.2: Explore and analyses computer fundamentals, the skills to manage and maintain; diagnose, troubleshoot and solve issues that encompass computer systems, networking, interfacing and programming as well as electronics and robotics and be aware of related environmental and societal issues. **Benchmark 9.4.2.1:** Investigate and demonstrate appropriate posture in using computer equipment.

Learning Objective: By the end of this topic, the students will be able to;

- Define Computer Ergonomics and Posture.
- Investigate and identify the importance of posture in computer usage.
- Demonstrate appropriate postures of computer equipment usage.

Lesson 1: Introduction to Ergonomics

Lesson Objective: Students should be able to research and define ergonomics and compute ergonomics and state their importance to heath.

Lesson Procedure

Teacher	Students
Introduction	
1. Ask the Essential Question. Ask students to picture the classroom setting and consider the points to answer what is ergonomics. Study the classroom setting, and discuss arrangement of items in the classroom, seating arrangement access and ease of movement.	1. Students respond to activity to define ergonomics.
Teacher leads students to activities on defining ergonomics and computer ergonomics.	Students respond with interest on defining ergonomics and computer ergonomics through organised activities.
Body	
Activity 1: (Engage) Brainstorming activity on ergonomics and computer ergonomics	Brainstorming activity on the definition of ergonomics and computer ergonomics.
Divide students into groups and design guiding questions for their research.	In groups devise, research questions before conducting research. Group leaders to involve all group members in the research activity.
Activity 2: (Explore) In groups; conduct research on ergonomics and computer ergonomics	Conduct research activity.
Activity 3: (Explain) Presentations of research findings on ergonomics and computer ergonomics	Presentation of research findings on ergonomics and computer ergonomics.
Conclusion	
Teacher to use illustrations to reiterate the importance of ergonomics in designing and computer ergonomics in the usage of computers.	Students take note of different groups presentations and teachers summary notes.
Assessment	
The main purpose of assessment is to find out if students comprehend ergonomics and computer ergonomics are and their importance to health. Assessment should be linked to the performance indicator indicated in the lesson plan and the lesson objective.	**Assessment Rubric** Teacher can devise a grading scale to assess students understanding of concepts

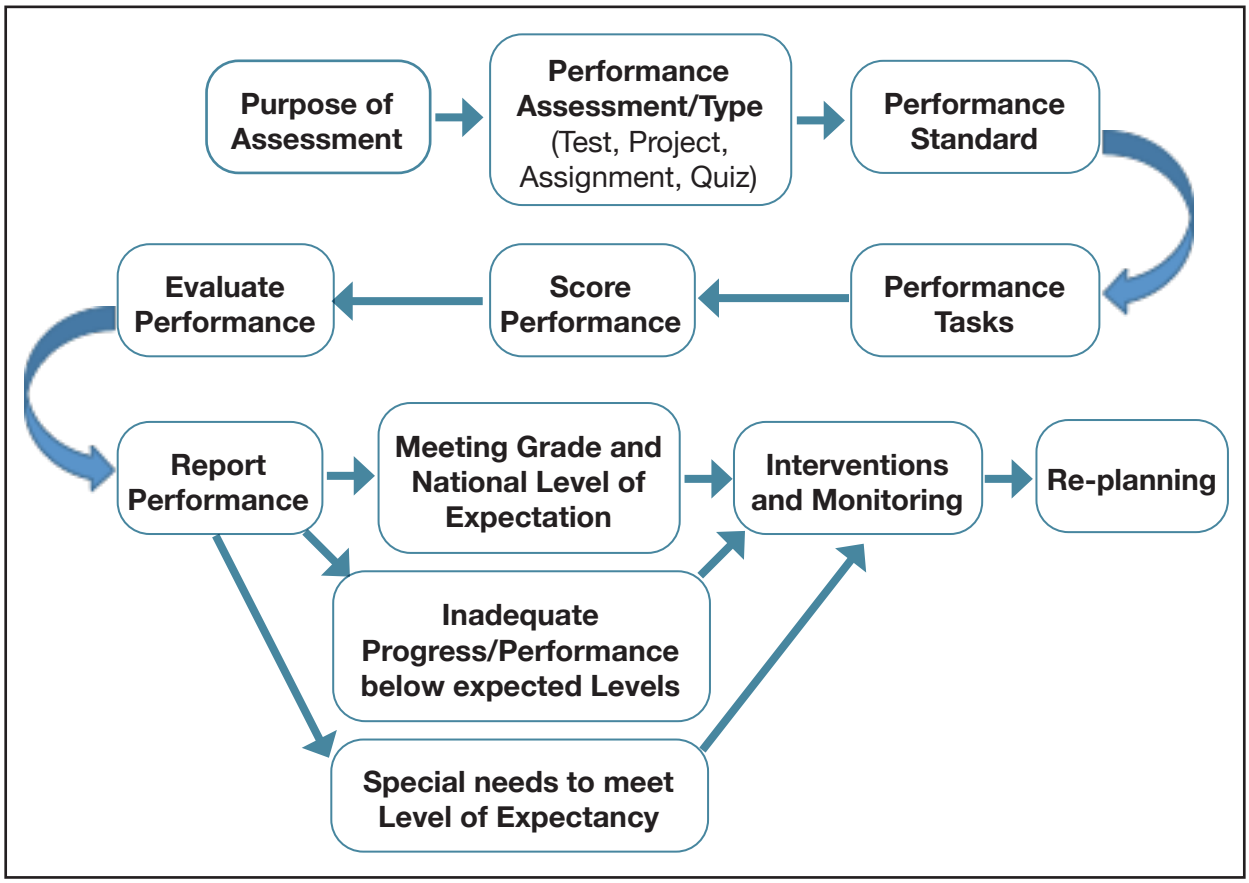
Assessment

What is Standards-Based Assessment (SBA)?

Standards-Based Assessment is an on-going and a systematic process of assessing, evaluating, reporting and monitoring students' performance and progression towards meeting grade and national level expectations. It is the measurement of students' proficiency on a learning objective of a content standard and progression towards the attainment of that content standard and benchmark.

Standards-Based Assessment Cycle

The Standards-Based Assessment Cycle begins with the purpose to assess learning. Teachers must always clearly define the purpose and expectations of the assessment tasks or activities before starting the assessment. The cycle consist the delivery of the assessment, scoring of performance, monitoring or learning, evaluating learning and performance, reporting of achievement and underachievement, developing interventions for underachievers and advance learners and replanning assessment as demonstrated below;



Purpose of Standards-Based Assessment

Standards-Based Assessment (SBA) serves different purposes. These include instruction and learning purposes. The primary purpose of SBA is to improve student learning so that all students can attain the expected level of proficiency or quality of learning.

Enabling purposes of SBA is to:

- measure students' proficiency on well-defined content standards, benchmarks and learning objectives
- ascertain students' attainment or progress towards the attainment of specific component of a content standard
- ascertain what each student knows and can do and what each student needs to learn to reach the expected level of proficiency
- enable teachers to make informed decisions and plans about how and what they would do to assist weak students to make adequate progress towards meeting the expected level of proficiency
- enable students to know what they can do and help them to develop and implement strategies to improve their learning and proficiency level
- communicate to parents, guardians, and relevant stakeholders the performance and progress towards the attainment of content standards or its components
- compare students' performances and the performances of other students

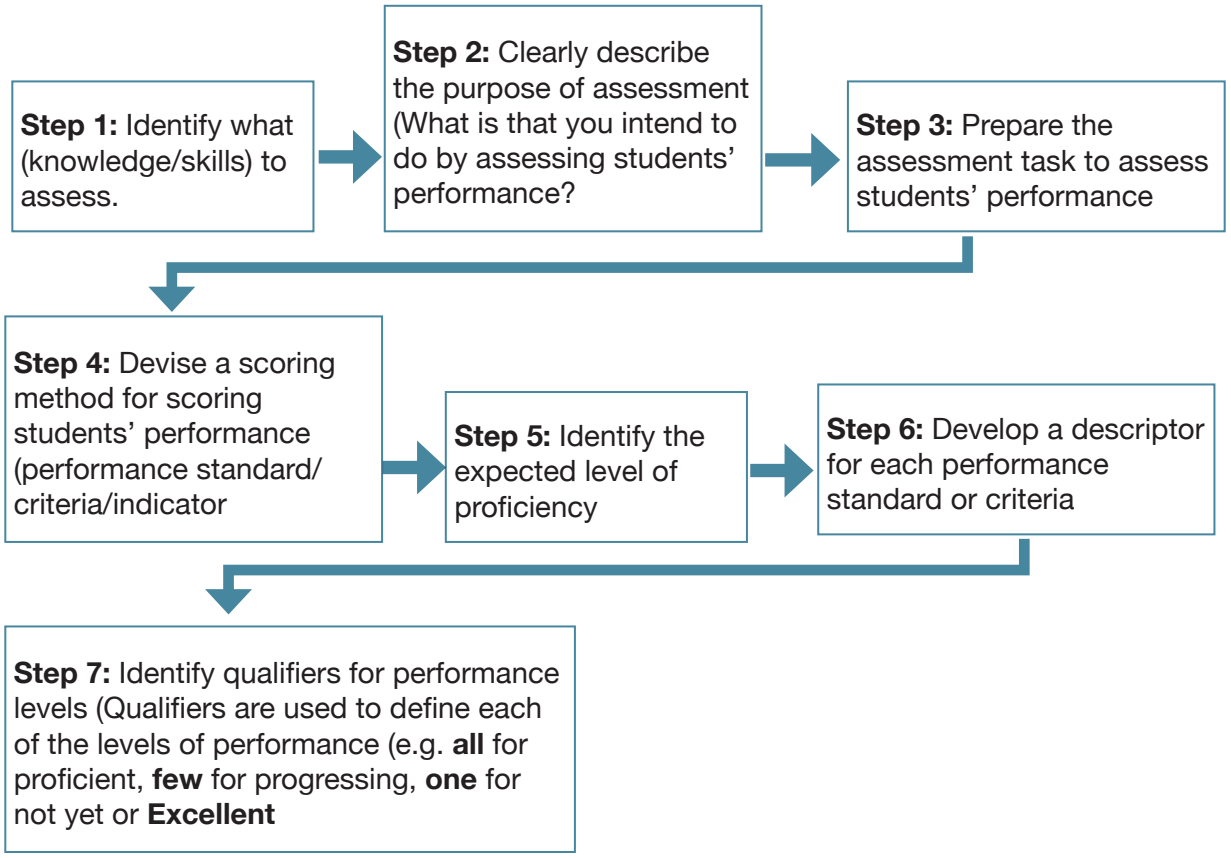
Principles of Standards-Based Assessment

The principle of SBA is for assessment to be;

- emphasing on tasks that should encourage deeper learning
- be an integral component of a course, unit or topic and not something to add on afterwards
- a good assessment requires clarity of purpose, goals, standards and criteria
- of practices that should use a range of measures allowing students to demonstrate what they know and can do
- based on an understanding of how students learn
- of practices that promote deeper understanding of learning processes by developing students' capacity for self-assessment
- improving performance that involves feedback and reflection
- on-going rather than episodic
- given the required attention to outcomes and processes
- be closely aligned and linked to learning objectives, benchmarks and content standards

Standards-Based Assessment Process

Teachers are required to use the steps outlined below when planning assessment. These steps will guide you to develop effective assessments to improve student's learning as well as evaluating their progress towards meeting national and grade –level expectations.



Authentic Assessment

Authentic Assessments in Standards-based (SBA) Assessment directly measure student's performance through "real life tasks" or "situations" that resemble "real life situations." Authentic assessment;

- Is performed in a real life context that approximates as much as possible, the use of a skill or concept in the real world.
- Is based on the development of a meaningful product, performance or process
- Students develop and demonstrate the application of their knowledge, skills, values and attitudes in real life situations which promote and support the development of deeper levels of understanding.
- Is mostly associated with assessment as or while learning and assessment for learning but occasionally or contextually in summative learning.
- includes assessment activities such as demonstrations, debates, field work, simulations, problem solving, project-based learning, Poster Presentations, Research, Laboratory work, Reflections, Problem-based activities, Role Play, Report/Essay, Field experience, Field report, Recounts etc.

Advantages of Authentic Activities

- Empower students to take ownership in their learning
- Appreciates Learning experience
- enables and encourages the Learning experiences to be used as a basis of learning
- Meaningful, relevant, practical
- Assess the actual learning experience which means; you do not need to "teach" and then assess, rather you assess actual learning experience while it is actually happening

Authentic Assessment Criteria

In SBA, teachers are encouraged to step out of their traditional assessment and explore authentic assessment. The criteria in authentic assessment;

- Looks at students actively engaged in completing a task that represents the achievement of a learning objective or standard
- Takes place in real life situations
- Asks students to apply their knowledge, skills, values and attitudes in real life situations
- Students are given the criteria against which they are being assessed

A Comparison of Authentic and Traditional Assessment

Authentic Assessments	Traditional Assessments
• Portfolios, demonstrations, field work, case studies, assignments, lab reports • Students take an active role in process • Qualitative • Interpretive • Focuses on performance, process and product • High level thinking • Use of rubric • Use of criterion levels evaluation • Part of teaching and learning Process • Shows mastery and learning performance • Generally extends over time•	• Multiple choice tests, true-false, fill in the blanks, sentence completion, matching, diagram completions • External – (teacher driven – assessing performance of teacher rather than the student) • Teacher-centered (what is appropriate and convenient for the teacher and what teacher thinks is good for students and decides what should be and should not be learnt) • Quantitative (driven to collect marks) • Objective • End product (only looking for the end product and not concerned about the performance and process) • Standardized or norm referenced • Isolated facts • Low level content • Generally occurs in "one setting

Standards-Based Assessment Types

In SBA, there are three broad assessments types.

1. Formative Assessment

Formative assessment includes 'assessment for and as' and is conducted during the teaching and learning of activities of a topic.

Purposes of assessment for Learning

- On-going assessment that allows teachers to monitor students on a day-to-day basis.

- Provide continuous feedback and evidence to the teachers that should enable them to identify gaps and issues with their teaching, and improve their classroom teaching practice.
- Helps students to continuously evaluate, reflect on, and improve their learning

Purposes of assessment as Learning

- Occurs when students reflect on and monitor their progress to inform their future learning goals
- Helps students to continuously evaluate, reflect, and improve their own learning
- Helps students to understand the purpose of their learning and clarify learning goals

2. Summative Assessment

Summative assessment focuses on 'assessment of learning' and is conducted after or at the conclusion of teaching and learning of activities or a topic.

Purposes of assessment of Learning

- Help teachers to determine what each student has achieved and how much progress he/she has made towards meeting national and grade-level expectations
- Help teachers to determine what each student has achieved at the end of a learning sequence or a unit.
- Enable teachers to ascertain each student's development against the unit or topic objectives and to set future directions for learning.
- Help students to evaluate, reflect on, and prepare for next stage of learning

3. Performance Assessment

Performance assessment is a form of testing that requires students to perform a task rather than select an answer from a ready-made list. For example, a student may be asked to explain historical events, generate scientific hypotheses, solve math problems, converse in a foreign language, or conduct research on an assigned topic. Teachers, then judge the quality of the student's work based on an agreed-upon set of criteria. It is an assessment which requires students to demonstrate that they have mastered specific skills and competencies by performing or producing something.

Types of performance assessment;

i. **Products-Oriented**

This refers to concrete tangible items that students create through either the visual, written or auditory media such as;

- Creating a health/physical activity poster
- Video a class game or performance and write a broadcast commentary
- Write a speech to be given at a school council meeting advocating for increased time for health and physical education in the curriculum

- Write the skill cues for a series of skill photo's
- Create a brochure to be handed out to parents during education week
- Develop an interview for a favourite sportsperson
- Write a review of a dance performance
- Essays
- Projects

ii. Performances-Oriented

It deals with observable affective or psycho-motor behaviours put into action such as;

- Skills check during game play
- Role plays
- Officiating a game
- Debates
- Performing dance/gymnastics routines
- Teaching a skill/game/dance to peers

Performance Standards

Performance standards are measurement standards that are observed through evidence outcomes and performance indicators. Evidence outcomes and Performance Indicators are used to measure students' performances, proficiency, competency, progression and achievement of the desired grade or level of expectation.

Performance Standards are concrete statements of how well students must learn what is set out in the content standards and benchmarks, often called the "be able to do" of "what students should know and be able to do." Performance standards indicate the quality that specifies how competent a students' demonstration or performance must be. They include explanations of how well students must demonstrate the content, explaining "how good is good enough."

Performance standards:

- measure students' performance and proficiency (using performance indicators) in the use of a specific knowledge, skill, value, or attitude in real life or related situations
- provide the basis (performance indicators) for evaluating, reporting and monitoring students' level of proficiency in use of a specific knowledge, skills, value, or attitude
- are used to plan for individual instruction to help students not yet meeting expectations (desired level of mastery and proficiency) to make adequate progress towards the full attainment of benchmarks and content standards
- are used as the basis for measuring students' progress towards meeting grade-level benchmarks and content standards
- A stem statement for Performance Standards will begin with… "Students will be able to……"
- A stem statement for Performance Indicator will begin with …. "Students can be able to……."

Assessment Strategies is important for teachers to know that, assessment is administered in different ways. Assessment does not mean a test only. There are many different ways to find out about student's strengths and weaknesses. Relying on only one method of assessing will not reflect student's achievement.

Provided in the appendices is a list of suggested strategies you can use to assess student's performances. These strategies are applicable in all the standards-based assessment types.

Action Verbs to Assessment Strategies		
Cognitive Learning	**Action Verbs**	**Assessment Strategies**
Knowledge - to recall or remember facts without necessarily understanding them	Arrange, define, duplicate, label, memorise, name, order, recognise, relate, recall, reproduce, list, tell, describe, identify, show, label, collect, examine, tabulate, quote	• Prior knowledge inventory, misconception/preconception check • Focused listing, empty outlines • Pre-post test, quiz, quick poll
Comprehension – to understand and interpret learned information	Classify, describe, discuss, explain, express, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend, translate, review, restate, locate, recognise, report	• Minute paper, muddiest (or clearest) point • Observe and evaluate a student artifact or performance task using a rubric • Directed paraphrasing • Pre-post test, quiz • Interviews
Application – to put ideas and concepts to work in solving problems	Apply, choose, demonstrate, dramatise, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, calculate, complete, show, examine, modify, relate, change, experiment, discover	• Observe and evaluate a student artifact, • performance, or task using a rubric • Directed paraphrasing, real-world application (apply learning in a new context) • Test, quiz • Job/internship evaluation, skill ratings
Analysis – to break information into its components to see interrelationships and ideas	Analyse, appraise, calculate, categorise, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test, separate, order, connect, classify, arrange, divide, infer	• Pro and con grid, categorising grid, compare and contrast, concept maps • Observe and evaluate a student artifact, performance, or task using a rubric • Journaling • Job/internship evaluation, skill ratings
Evaluation – to judge the value of information based on established criteria	Appraise, argue, assess, attach, defend, judge, predict, rate, support, evaluate, recommend, convince, judge, conclude, compare, summarise	• Reflection component of a portfolio or experience • Journaling • Peer evaluation
Affective Learning	appreciate, accept, attempt, challenge, defend, dispute, join, judge, praise, question, share, support	• Reflection component of a portfolio or experience • Journaling • Observe and evaluate group work • Surveys, interviews, focus groups

Assessment Strategies

Strategy	Description
Analogies	Students create an analogy between something they are familiar with and the new information they have learned. When asking students to explain the analogy, it will show the depth of their understanding of a topic.
Classroom Presentations	A classroom presentation is an assessment strategy that requires students to verbalize their knowledge, select and present samples of finished work, and organize their thoughts about a topic in order to present a summary of their learning. It may provide the basis for assessment upon completion of a student's project or essay.
Conferences	A conference is a formal or informal meeting between the teacher and a student for the purpose of exchanging information or sharing ideas. A conference might be held to explore the student's thinking and suggest next steps; assess the student's level of understanding of a particular concept or procedure; and review, clarify, and extend what the student has already completed
Discussions	Having a class discussion on a unit of study provides teachers with valuable information about what the students know about the subject. Focus the discussions on higher level thinking skills and allow students to reflect their learning before the discussion commences.
Essays	An essay is a writing sample in which a student constructs a response to a question, topic, or brief statement, and supplies supporting details or arguments. The essay allows the teacher to assess the student's understanding and/or ability to analyse and synthesize information.
Exhibitions/ Demonstrations	An exhibition/demonstration is a performance in a public setting, during which a student explains and applies a process, procedure, etc., in concrete ways to show individual achievement of specific skills and knowledge.
Interviews	An interview is a face-to-face conversation in which teacher and student use inquiry to share their knowledge and understanding of a topic or problem, and can be used by the teacher to explore the student's thinking; assess the student's level of understanding of a concept or procedure and gather information, obtain clarification, determine positions, and probe for motivations.
Learning Logs	A learning log is an ongoing, visible record kept by a student and recording what he or she is doing or thinking while working on a particular task or assignment. It can be used to assess student progress and growth over time.
Observation	Observation is a process of systematically viewing and recording students while they work, for the purpose of making programming and instruction decisions. Observation can take place at any time and in any setting. It provides information on students' strengths and weaknesses, learning styles, interests, and attitudes.
Peer Assessment	Assessment by peers is a powerful way to gather information about students and their understanding. Students can use set criteria to assess the work of their classmates.
Performance Tasks	During a performance task, students create, produce, perform, or present works on "real world" issues. The performance task may be used to assess a skill or proficiency, and provides useful information on the process as well as the product.
Portfolios	A portfolio is a collection of samples of a student's work, and is focused, selective, reflective, and collaborative. It offers a visual demonstration of a student's achievement, capabilities, strengths, weaknesses, knowledge, and specific skills, over time and in a variety of contexts.
Questions And Answers (Oral)	In the question–and-answer strategy, the teacher poses a question and the student answers verbally, rather than in writing. This strategy helps the teacher to determine whether students understand what is being, or has been, presented, and helps students to extend their thinking, generate ideas, or solve problems.
Quizzes, Tests, Examinations	A quiz, test, or examination requires students to respond to prompts in order to demonstrate their knowledge (orally or in writing) or their skills (e.g., through performance). Quizzes are usually short; examinations are usually longer. Quizzes, tests, or examinations can be adapted for exceptional students and for re-teaching and retesting.

Questionnaires	Questionnaires can be used for a variety of purposes. When used as a formative assessment strategy, they provide teachers with information on student learning that they can use to plan further instruction.
Response Journals	A response journal is a student's personal record containing written, reflective responses to material he or she is reading, viewing, listening to, or discussing. The response journal can be used as an assessment tool in all subject areas.
Selected Responses	Strictly speaking a part of quizzes, tests, and examinations, selected responses require students to identify the one correct answer. The strategy can take the form of multiple-choice or true/false formats. Selected response is a commonly used formal procedure for gathering objective evidence about student learning, specifically in memory, recall, and comprehension.
Student Self-Assessments	Self-assessment is a process by which the student gathers information about, and reflects on, his or her own learning. It is the student's own assessment of personal progress in terms of knowledge, skills, processes, or attitudes. Self-assessment leads students to a greater awareness and understanding of themselves as learners.

Scoring Methods for Performance Assessment

Assessment can be scored during or after the students have completed the assessment task. However, it is best done during a lesson - using a checklist, rating scales & rubrics.

A rubric is a coherent set of criteria for students' work that includes descriptions of levels of performance quality on the criteria. Rubrics have two major aspects: coherent sets of criteria and descriptions of levels of performance. Rubrics include;

(1) Descriptions of the of task
(2) The scales to be used
(3) The dimensions of the task
(4) The description of each dimension on the scale

A Rubric

- Is a scoring guide that helps teachers evaluate student performance, based on a range of criteria.
- A rubric lists the criteria, or characteristics, that student work should exhibit and describes specific quality levels for those criteria.
- Rubrics are a great way to improve communication, learning, and grading fairness.
- Knowing how to create and use rubrics gives you a better understanding of assessment and another option for assessing student performance.
- Are descriptive and not evaluative.
- Of course, rubrics can be used to evaluate, but the operating principle is to match the performance to the description rather than "judge" it.
- Thus rubrics are as good or bad as the criteria selected and the descriptions of the levels of performance under each.
- Effective rubrics have appropriate criteria and well-written descriptions of performance

Purpose of Rubrics

Like any other evaluation tool, rubrics are useful for certain purposes and not for others. *The main purpose of rubrics is to assess performances.* For some performances, you observe the student in the process of doing something, like using an electric drill or discussing an issue. For other performances, you observe the product that is the result of the student's work, like a finished bookshelf or a written report.

1. Support authentic assessment
While traditional tests measure how well students recall content, rubrics measure how well students can apply knowledge to authentic contexts or real-world tasks.

2. Clearly communicate expectations
Because rubrics define student "quality" in terms of objective criteria and standards, they clearly communicate how instructors will evaluate student performance.

3. Improve performance
Rubrics lead to better student performance. When students understand assignments and expectations before they begin, they are more likely to fulfil them. They know what specific criteria and standards of excellence will be used to rate their performance.

4. To inspire fairness
Because rubrics have detailed assessment information, students don't feel that grades are assigned subjectively or arbitrarily. Also, when you have more than one grader, a rubric allows all graders to apply the same criteria in the same way.

Although rubrics have many benefits--and make grading faster and easier--a good rubric takes time, effort and patience to construct.
You'll probably need to change (change, not add to) your grading and assessment methods, based on what you believe about learning assessment. Rubrics are best for critical assessments, major projects, and other assignments that require a multi-dimensional performance evaluation. The trick is to know what type of rubric to create for your situation.

Reasons for Creating Rubrics/Marking schemes

Rubrics or marking schemes are created for;

1. Categories to assess-different components or elements that will assess
    - Factual information
    - Application
    - Analysis
    - Writing Skills
2. Criterion for assessment
    - Accuracy
    - Completeness
    - Length or number of examples
    - Supported with research
    - Range of answer
    - Description and support

3. Levels or points 3-5 levels
    - Exemplary. Proficient, acceptable, not acceptable
    - Excellent, good, fair, poor
    - 10 points, 5 points, 1 point

Parts of a Rubric

- A rubric is a matrix of criteria and their descriptors.
- The left side of a rubric matrix lists the criteria (performance standards) for the expected product or performance.
- Across the top of the rubric matrix is the rating scale that provides a set of values for rating the quality of performance for each criterion.
- Descriptors under the rating scale provide examples or concrete indicators for each level of performance.
- The dimensions of the task that qualifies the achievement

Criteria	Performance Standards (Descriptors)
BEYOND	Beyond Standard(s) - Advanced in Performance and Understanding
	Consistently demonstrates advanced conceptual mathematical understandings Consistently generates tasks that make connections between and among mathematical ideas Consistently applies strategies to unique situations Consistently demonstrated confidence to approach tasks beyond the proficiency level for grade Consistently initiates mathematical investigations
CONSISTENT	Meet Standard(s) - Proficient in Performance and Understanding
	Consistently demonstrates understanding of mathematical standards and cluster at the grade level Consistently demonstrated conceptual understanding Consistently applies multiple strategies flexibly in various situations Understands and fluently applies procedures with understanding Consistently demonstrates perseverance and precision Constructs logical mathematical arguments of thinking and reasoning Uses mathematical language correctly and appropriately
INCONSISTENT	Progressing - Not Yet Proficient in Performance and Understanding
	Inconsistently uses tools appropriately and strategically Demonstrates inconsistent understanding of key mathematical ideas at grade level Demonstrates inconsistent conceptual understanding of key mathematical ideas at grade level Inconsistent in understanding and application of grade level appropriate strategies Depends upon assistance of teacher and/or peers to understand and complete tasks Needs additional time to complete tasks Applies models of mathematical ideas inconsistently
SELDOM	Not Yet - Limited Performance and Understanding
	Exhibits minimal understanding of key mathematic ideas at grade level Rarely demonstrates conceptual understanding Seldom provides precise response Seldom use appropriate strategies Consistently requires assistance and alternative instruction Use tools inappropriately to model mathematics

Types of Rubrics

1. Analytical Rubric

Analytic rubrics describe work on each criterion separately. For most classroom purposes, analytic rubrics are best. Focusing on the criteria one at a time is better for instruction and better for formative assessment because students can see what aspects of their work need what kind of attention. Focusing on the criteria one at a time is good for any summative assessment (grading) that will also be used to make decisions about the future—for example, decisions about how to follow up on a unit or decisions about how to teach something next year.

Template for Analytic Rubrics

Criteria	Beginning	Developing	Accomplished	Exemplary	Score
Criteria 1	Description reflecting beginning	Description reflecting movement toward mastery level of performance	Description reflecting achievement of mastery level of performance	Description reflecting of highest level of performance	
Criteria 2	Description reflecting beginning level performance	Description reflecting movement toward mastery level of performance	Description reflecting achievement of mastery level of performance	Description reflecting of highest level of performance	
Criteria 3	Description reflecting beginning level performance	Description reflecting movement toward mastery level of performance	Description reflecting achievement of mastery level of performance	Description reflecting of highest level of performance	
Criteria 4	Description reflecting beginning level performance	Description reflecting movement toward mastery level of performance	Description reflecting achievement of mastery level of performance	Description reflecting of highest level of performance	

Sample Analytic Rubric

Performance Standard/Criteria	Advanced	Proficient	Progressing	Not Yet
Identify reasons for developing caring relationships	Identify and explain **all** the reasons for developing caring relationships	Identify **all** the reasons for developing caring relationships	Identify only a **few** of the reasons for developing caring relationships	Identify only **one** reason for developing caring relationships
Explain the reasons for developing caring relationships	Explain all the reasons for developing caring relationships and provide an in-depth justification for some of the reasons	Explain all the reasons for developing caring relationships	Explain only a few of the reasons for developing caring relationships	Explain only one reason for developing caring relationships

Holistic Rubrics

Holistic rubrics describe the work by applying all the criteria at the same time and enabling an overall judgment about the quality of the work. Holistic rubrics are based on criteria for good work and on observation of how the work meets those criteria.

One classroom purpose for which holistic rubrics are better than analytic rubrics is the situation in which students will not see the results of a final summative assessment and you will not really use the information for anything except a grade. Some high school final examinations fall into this category. Grading with rubrics is faster when there is only one decision to make, rather than a separate decision for each criterion.

Decide on type of rubric to be used (Holistic or Analytic)

1. When to use Holistic Rubric
   - There is no single correct answer/response to a task
   - The focus has no the overall quality, proficiency, or understanding of a specific content or skills.
   - You are assessing large numbers (eg. 150 portfolios)

Holistic Rubric						
Score	**5**	**4**	**3**	**2**	**1**	**0**
Description	Demonstrate **complete** understanding of the problem. **All** requirements of task are **included in response.**	Demonstrate **considerate** understanding of the problem. **All** requirements of task are **included.**	Demonstrate **partial** understanding of the problem. **Most** requirements of task are **included.**	Demonstrate **little** understanding of the problem. **Many** requirements of task are **missing.**	Demonstrate **no** understanding of the problem.	**No** response/ **not** attempted task

2. When to use Analytic Rubric
   - Several subjects are assessing the student work.
   - Description promote consistent scoring.
   - Stakeholders will be examining the rubric scores.
   - Substantial feedback to students or the subjects is desired.
   - Outlines of specific strengths/weaknesses are anticipated.

Analytic Rubric				
Criteria	**4**	**3**	**2**	**1**
Criteria 1	Description reflecting **highest** level of performance.	Description reflecting **mastery** level of performance.	Description reflecting **movement towards** mastery level of performance.	Description reflecting **beginning** level of performance.
Criteria 2	Description reflecting **highest** level of performance.	Description reflecting **mastery** level of performance.	Description reflecting **movement towards** mastery level of performance.	Description reflecting **beginning** level of performance.
Criteria 3	Description reflecting **highest** level of performance.	Description reflecting **mastery** level of performance.	Description reflecting **movement towards** mastery level of performance.	Description reflecting **beginning** level of performance.
Criteria 4	Description reflecting **highest** level of performance.	Description reflecting **mastery** level of performance.	Description reflecting **movement towards** mastery level of performance.	Description reflecting **beginning** level of performance.

Scoring of Performance for Formative Assessment

(Assessment as/while learning and Assessment for learning)

1. Scoring Assessment using Rating Scale

Rating Scales are a type of checklists that judge the degree to which a criteria is met. They generally have a scale of between 1-6 options.

Types of Rating Scales

A. Frequency Rating Scales

A frequency rating scale scores how often a task is done to meet criteria.

Sample Rating Scale Descriptive Words

1. Words that describe the skill of ***selecting 'the right' information*** at varying levels of quality

Excellent	Proficient	Adequate	Limited
Pertinent	relevant	suitable	trivial
Insightful	meaningful	appropriate	superficial
Significant	relevant	predictable	vague
Perceptive	thoughtful	basic	questionable
Precise	logical	partially correct	confusing
Purposeful	focused	appropriate	irrelevant

2. Words that describe the skill of ***selecting 'enough' information*** at varying levels of quality.

Excellent	Proficient	Adequate	Limited
comprehensive	thorough	cursory	superficial
in-depth	sufficient	partial	incomplete
rich & detailed	specific	simplistic	undeveloped
Extensive	substantial	partial	sketchy

3. Words that describe the skill of ***evaluating product or connecting insights to personal experience*** at varying levels of quality

Excellent	Proficient	Adequate	Limited
insightful	thoughtful	predictable	trivial
astute	relevant	appropriate	unfocused
perceptive	thoughtful	routine	trivial
intuitive	logical	rudimentary	unsubstantiated
innovative	credible	predictable	trite
compelling	meaningful	obvious	tenuous

4. Words that describe the skill of ***designing or constructing*** at varying levels of quality

Excellent	Proficient	Adequate	Limited
efficient	practical	viable	unworkable
innovative	effective	workable	ineffective

5. Words that describe the skill of ***organizing or formatting information*** at varying levels of quality

Excellent	Proficient	Adequate	Limited
skillful	systematic	simplistic	haphazard
purposeful	logical	methodical	disorganized

6. Words that describe the skill of ***analyzing information or data*** at varying levels of quality

Excellent	Proficient	Adequate	Limited
comprehensive	thorough	cursory	superficial
in-depth	sufficient	partial	incomplete
rich & detailed	specific	simplistic	undeveloped
Extensive	substantial	partial	sketchy

7. Words that describe the skill of ***presenting or communicating information or selecting appropriate visuals*** at varying levels of quality

Excellent	Proficient	Adequate	Limited
vivid	interesting	simplistic	lacks appeal
compelling	effective	predictable	does little to
sustain interest	thoughtful	routine	trivial
enhances	supports	partially supports	interferes with
engaging	interesting	straightforward	ineffective
skillful	effective	appropriate	inappropriate
intriguing	interesting	predictable	ineffective

Sample Scoring using Rating Scale to assess "Collaboration"

Criteria	Frequency			
	Always = 4	Sometimes = 3	Rarely = 2	Never - 1
1. Embraces everyone's' abilities and encourages participation	Always Embraces everyone's' abilities and encourages participation	Sometimes Embraces everyone's' abilities and encourages participation	Rarely Embraces everyone's' abilities and encourages participation	Never Embraces everyone's' abilities and encourages participation
2. Ensures everyone is tasked to and activity	Always Ensures everyone is tasked to and activity	Sometimes Ensures everyone is tasked to and activity	Rarely Ensures everyone is tasked to and activity	Never Ensures everyone is tasked to and activity
3. Encourages everyone to achieve together	Always Encourages everyone to achieve together	Sometimes Encourages everyone to achieve together	Rarely Encourages everyone to achieve together	Never Encourages everyone to achieve together

2. Scoring assessment using a Checklist

Check lists are one of the easiest methods of scoring assessment tasks. The criteria i.e. skills, cues or tasks are considered separately according to whether they have been accomplished.

Types of Checklists include

- Yes/No
- Tick/Cross
- Circling
- Narrow scale, e.g. Sometimes, rarely, never
- Colouring
- Symbols (signifiers), e.g. pictures, facials, artifacts, signs, drawings, concept maps)

Sample Scoring using Yes/No Checklist Scale to assess "Collaboration"

No.	Criteria	Write Yes (score 2) or No (score 1)
1	Embraces everyone's abilities and encourages participation	
2	Ensures everyone is tasked to an activity	
3	Encourages everyone to achieve together	

Sample Scoring using Tick/Cross Checklist Scale to assess "Collaboration"

No.	Criteria	Place a tick (score 2) or and X (score 1)
1	Embraces everyone's abilities and encourages participation	
2	Ensures everyone is tasked to an activity	
3	Encourages everyone to achieve together	

Scoring of Performance for Summative Assessment

Grade rating scales are better scoring tools for summative assessment of students' performance. They indicate students' level of performance using such as; A, B, C, D etc

A Grade is given after the accumulated total for a number of assessments has been completed either at the end of and assessment period, a topic, a term, a grade or year.

The subject assessment components, tasks and weightings should be able to guide the grading of achievements as demonstrated in a rubric designed for this purpose.

SAMPLE SUBJECT ASSESSMENT STRUCTURE

The internal assessment for the Technology and Industrial Arts/Business Studies subject is based on the Grade 9 & 10 and Grade 11 and 12 Technology and Industrial Arts/Business Studies Syllabus. The final assessment should be based on a range and balance of assessment strategies and instruments. Assessment must be both normative and criterion.

Component	Weighting	Tasks	Assessment Referencing
Practical Work in response to design brief (Moderation and Projects included here?)	60 % (of mandatory total)	Development and application of design ideas, safe and skillful use of materials, tools and equipment to make a product and the identified processes	Criterion Referencing Rubrics?
Design folio with outcomes of research, investigations and planning	20 % (of mandatory total)	Folio showing results of investigation in response to design brief, rough notes or sketches of design ideas, timelines, final drawings or plans, processes used to make the product and evaluation reports	Referencing Rubrics?
Tests	20 % (of mandatory total)	Theory and also applications in theory	Normative
Marks	100 %	A combination of design folios, practical applications, moderations and tests.	

Sample Assessment

SBC embraces standards and as such, standards must also drive the administration of assessments to students. It is important that every student must be given the outline of the Assessment that has been planned for the term. Each Term will include 6 pieces (can have any number from 4-6) of assessment. Assessment is weighted accordingly.

Assessment Type	Component	Weighting
Topic Tests x 2	Students will be given two topic tests based on the content learnt in the term. 1 will be given mid-term and 1 at end-term. The test will be comprised of 10 multiple choice questions and 5 short written answers.	1 = 15 marks 1 = 10 marks
Portfolio	Individual Students will be assessed……	10 marks
Moderation	In groups of four - five, students work to critically engage with one another in the required design process. Students will address criteria provided in class and prepare and deliver a 5-10 minute presentation addressing the criteria.	30 marks
Project (Application)	In groups of three to four, students work to critically engage with one another in the assigned project. Sudents will address criteria provided in class and prepare and deliver a 5-10 minute presentation addressing the criteria.	20 marks
Participation	2 marks will be allocated each day for attendance. Another 3 marks will be awarded for active participation.	5 marks

Sample Assessment

UNIT 1. Data Communication and Network

Topic 1: Media Communication

Content Standard 4.2: Explore and analyses computer fundamentals, the skills to manage and maintain; diagnose, troubleshoot and solve issues that encompass computer systems, networking, interfacing and programming as well as electronics and robotics and be aware of related environmental and societal issues.

Benchmark 9.4.2.1: Investigate and demonstrate appropriate posture in using computer equipment.

Learning Objective: By the end of this topic, the students will be able to;

- Define Computer Ergonomics and Posture.
- Investigate and identify the importance of posture in computer usage.
- Demonstrate appropriate postures of computer equipment usage.

Purpose of Assessment: To assess whether the students can use their organisation skills to create an ergonomically friendly office environment.

Assessment Strategy: Students will participate in a role play demonstrating employees expressing frustration about the effect of the inappropriate furniture and equipment to their health, safety and productivity.

Duration: 160 minutes periods

Time/Date of Administration: Use Assessment Schedule

Due Date/Time: Use Assessment Schedule

Performance Standard: By the end of the project the student will be able to;

1. Demonstrate a role play of employees expressing frustration about the effect of the inappropriate furniture and equipment to their health.
2. Identify the issues which contribute to worker's dissatisfaction.

Performance Tasks: Students will;

1. Do a write up of the role play
2. Participate in the role play

Performance Assessment Criteria:

1. Do a write up of the role play
2. Participate in the role play

Assessment Scoring: 65 marks

Scoring Tool: SAMPLE 1: FORMATIVE

Criteria	Excellent	Proficient	Adequate	Score
Point	**5**	**4**	**3**	
Write Up of the Role play	**Innovative and well** organised paper with **detailed clarity on the problem**	**Well** organised paper with **clarity on the problem**	**Organised** paper with some **clarity on the problem**	/5
Identify issues affecting the employee	**Appropriately considered details** on issues affecting the employee	**Considered details** on issues affecting the employee	**Some details** on issues affecting the employee	/5
Describe how to solve the problem	**Appropriately describe ALL** the steps in solving the problem	**Considerably describe some** steps in solving the problem	**Describe few** steps in solving the problem	/5
Explain the ergonomics to improve health, safety and productivity	**Vividly explain** the ergonomics to improve health, safety and productivity	**Explain** the ergonomics to improve health, safety and productivity	**Vaguely explain** the ergonomics to improve health, safety and productivity	/5
Total Score				**/20**

Appendices #: Scoring Rubrics

SUMMATIVE

1. Write Up

Criteria	Excellent	Proficient	Adequate	Score
1. Brainstorming problems affecting employees	**Significant evidence** of relevant ideas that show problems	**Relevant** ideas presented to show problems	**Vague** ideas presented to show problems	/3
2. Describe the role play	**Comprehensive** ideas presented to describe the role play	**Sufficient** ideas presented to describe the role play	**Incomplete** ideas presented to describe the role play	/3
3. Develop a paper work on the employees concern	**Innovative** and **well** organised paper with clarity on employee's concern and **well stated** paper work.	**Effective** organised paper with clarity on employee's concern and **appropriate** paper work.	**Workable** organised paper with clarity on employee's concern and **incomplete** paper work.	/3
4. State the steps involve in solving the problem	Demonstrate **complete** understanding of the problem. **All** requirements of task are **included in response.**	Demonstrate **considerate** understanding of the problem. **Most** requirements of task are **included.**	Demonstrate **partial** understanding of the problem. **few** requirements of task are **included.**	/3
5. Submit on Time	Submitted well **before** deadline	Submitted **on** time	Submitted **late**	/3

STEAM Assessment

Steps in Developing a STEAM Activity

1. Identify the Real/Authentic Situations that can be solved through the STEAM Activity
2. Select a well-defined a Benchmark in your subject area that will carry the STEAM Activity
3. Identify related subject areas with their concepts to be used solve the Authentic Situation
4. Note down the Main parts of the Unit Of Work for the STEAM Activity
5. Write a Description of the Authentic Situation for the STEAM Activity based on the identified Authentic situation.
6. Write down the Task Descriptions for the STEAM Activity in order to approach the Authentic situation.
7. Develop the Rubric to Assess the STEAM Activity

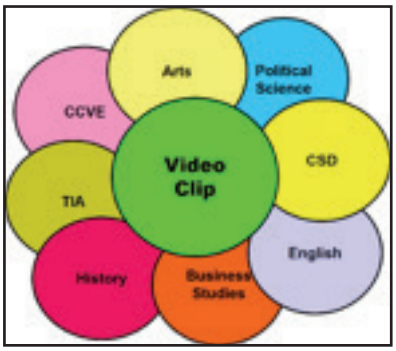
1. Authentic Situation identified for this STEAM Activity

- Students spending too much time using their smart mobile phones on Facebook, WhatsApp and surfing the internet rather than their school work.
- Students still bringing their smart mobile phones to school despite the school rules telling them not to.

- Most schools need to fully utilise their School Rules, Mottos, Missions and Visions which determines the way they want to shape our students' Knowledge, Attitudes and Values, during and after, they leave the school at end of G10 and G12.
- Our schools in our country have been labelled as 'a very good school to a very bad school' due school student fightings and vandalism of school properties.
- Stakeholders of the schools are blaming the school management for the school students behaviour problems and parents are transferring their students out of schools to others school in the country.

2. Select a well-defined Benchmark in your subject area that will carry/drive the STEAM Activity and its associated Big Idea (product, project etc.)

- Sample:
  i. SUBJECT: BUSINESS STUDIES
  ii. BENCHMARK 9.2.5.1. Analyse the impact of information technology on society.
  iii. BIG IDEA/PRODUCT: Video Clip



3. Identify other related subject areas with the appropriate concepts to solve the Authentic Situation(s)

- Identify related subject areas with their concepts/Knowledge, Skills, Attitudes and Values to be used to solve the Steam Authentic Situation

SUBJECTS	BENCHMARKS	BIG IDEA/ PRODUCT	KNOWLEDGE	SKILLS	ATTITUDES	VALUES
1. Arts (Theatre Arts)	9.2.2.2		Video script	Script Writing		
2. Christian Civic Value Education (CCVE)	9.3.1.3		School Rules, Motto, Vision, Mission	Examine Civic values	Responsibility	Ownership, Love
3. Character Social Development (CSD)	9.1.5.1, 9.1.5.2, 9.1.5.3, 9.1.5.4, 9.1.5.5		School Rules, Motto, Vision, Mission	Asses experiences and mistakes	Caring, Positivity	Respect
4. English	9.2.2.1		Descriptive Writing	Descriptive Writing	Neatness	
5. Social Science (History)	9.2.2.3, 9.2.2.4		School history	Discuss school culture		Ownership
6. Social Science (Political Science)	9.3.3.1, 9.3.3.2		National development aspirations/demands of citizens	Anticipative skills		
7. Technology Industrial Arts (TIA)	9.4.1.4, 9.4.1.5, 9.4.1.6		Range of communications media products	Creative media communication	Alertness	
8. Business Studies	9.2.5.6.	Video clip	Media rich projects	Shooting with mobile	Creativity	Innovative

There must be an anchor subject benchmark for any STEAM assessment.

4. Descriptions of the Steam Authentic Situation

- Paragraph 1 describes the problem/situation
- Paragraph 2 describes the solution to the problem/situation and who will be responsible to take up the task

- Paragraph 3 would mention any rewards/awards for an adequate solution to the problem/situation as a booster to create a competitive competition and a promoter of critical thinking amongst the students so that they can come out with the best products.

5. Write down the Task Descriptions for the STEAM Activity

- Plan and write a short write-up for your video-clip.
- Use the notes to Make a 2-minute video clip to advertise and market your school to the public.
- The short video clip must embrace the school rules, motto, and mission and vision statements.
- It must also contain messages of new and competent management.
- This video clip has to have the potential to positively change the image of the school
- This 2-miunte video clip must be captivating and totally convincing to attract students to want to enroll at your school.
- This clip must not be more than 2 minutes (maximum time limit)
- Present your video clip to be assessed
- Submit both your write-up (on a chart) together with your video clip

6. Developing Rubrics to Assess the Steam Video Clips

1.) Decide on type of rubric to be used (Holistic or Analytic)
2.) Decide what point scale rubric to use (always use 3, 4 or 5 point-scale) and rating scales to use (descriptive words or numerals)
3.) Plan the layout to develop the rubric
4.) Decide what to assess from the Category of Tasks Description
5.) Identify and List down the Category of Tasks Description for the Criteria
6.) Reword the Tasks Descriptions to create Criteria
    - Plan and write a short write-up for your video-clip. ***(The write up of the video)***
    - Use the notes to make a 2-minute video clip to advertise and market your school to the public. ***(The development of the video)***
    - The short video clip must embrace the school rules, motto, and mission and vision statements. ***(The content of the video)***
    - It must also contain messages of new and competent management. ***(The content of the video)***
    - This clip must not be more than 2 minutes (maximum time limit) ***(The presentation of the video)***
    - Submit both your write-up (on a chart) together with your video clip. ***(The product)***
7.) List down the criteria against the Task Descriptions in a table
8.) Unpack the Task Descriptions and Identify the essential KSAV that can be assessed
9.) Reword the Task Descriptions with the inclusion of KSAVs into a Descriptor statement for each criteria and distribute into each Competency Level/Level of Achievement
10.) Determine appropriate variance of Qualifiers for each Descriptors of each Achievement Level

11.) Determine the appropriate Descriptive Words or Number for Point Scales of the intended rubric.
12.) Completed rubric sample: Video clip Assessment Rubric
13.) Consider the Applications of the Steam Rubric

Sample 4

Strand 2: Business Management
Unit 5: Information Technology
Content Standard 2.5: Students will be able to explain the information technology concepts and examine the systems and tools needed to gather, access, analyse, synthesise, evaluate, manage, and disseminate information.

Benchmark: 9.2.5.1: Analyse the impact of information technology on society.

Topic: Impact of information technology on society.

Learning Objective: By the end of this Topic, students will be able to demonstrate a positive impact of information technology on society

Purpose of Assessing the Topic (Benchmark):
To assess whether students can be able to use mobile technology to positively Impact their society and analyse this impacts

How the Performance Task will be done: Group Project Presentation

Performance Standard: By the end of the project, students will be able to use mobile technology to positively impact their community/society.

Situation (Authentic)

A school has been faced with the challenge of behavioral issues for some time now and the public has lost its confidence in the school to be a good or genuine school. Most parents fear sending their children to his school and always opt to transfer their children in very first instances. The Board of Governors of the school has decided to raise the Behavior Standards or Benchmarks to a certain degree to improve its image and standards of learning.

To meet the expectations of the BOG, the principal and teachers intend to market the school to the public of NCD to lure students to have the interest to enroll at the school. With such a PAST bad reputation, the school will really need to convince the public that they have raised their standards and that their school is worth enrolling in it. The Principal and the teachers now have a task on hand to convince the public to enroll their children there and they have to try every means to do so.

To achieve this, the school is now requesting the Business and Technology Department to design an assessment Task for a certain Grade to assist with the situation. The Business & Technology Department has opted to design the task for Grade 9 students as one of their projects

towards their assessments. The school principal also announces that the best video assessed by the B&T Department will be rewarded as it is also a competition.

Task Descriptions:

- Plan and write a short write-up for your video-clip.
- Use the notes to make a 2-minute video clip to advertise and market your school to the public.
- The short video clip must embrace the school rules, motto, and mission and vision statements.
- It must also contain messages of new and competent management.
- This video clip has to have the potential to positively change the image of the school
- This 2-miunte video clip must be captivating and totally convincing to attract students to want to enroll at your school.
- This clip must not be more than 2 minutes (maximum time limit)
- Submit both your write-up (on a chart) together with your video clip
- Teacher will present your video clips for the whole class to observe and use the rubric below to assess the video clip.

Materials: Smartphone, butcher papers, markers

1. Developing Rubrics to Assess Video Clips

i. Decide on type of rubrics to be used (Holistic or Analytic)
ii. After you decide, plan the rubrics
iii. Planning to develop the rubric
iv. Categorise the Tasks Description into Criteria's

Sample of Categorising tasks for the rubric

- Plan and write a short write-up for your video-clip. ***(The write up of the video)***
- Use the notes to Make a 2-minute video clip to advertise and market your school to the public. ***(The development of the video)***
- The short video clip must embrace the school rules, motto, and mission and vision statements. ***(The content of the video)***
- It must also contain messages of new and competent management. ***(The content of the video)***
- This video clip has to have the potential to positively change the image of the school ***(The content of the video)***
- This 2-miunte video clip must be captivating and totally convincing to attract students to want to enroll at your school. ***(The content of the video)***
- This clip must not be more than 2 minutes (maximum time limit) ***(The presentation of the video)***
- Present your video clip to be assessed ***(The presentation of the video)***
- Submit both your write-up (on a chart) together with your video clip. ***(The product)***

2. Identify and list down categories of tasks

Category	Task Description
The write up of the video	Plan and write a short write-up for your video-clip.
The development of the video	Use the notes to Make a 2-minute video clip to advertise and market your school to the public.
The content of the video	• The short video clip must embrace the school rules, motto, and mission and vision statements. • It must also contain messages of new and competent management. • This video clip has to have the potential to positively change the image of the school • This 2-minute video clip must be captivating and totally convincing to attract students to want to enroll at your school.
The Presentation of the video	• This clip must not be more than 2 minutes (maximum time limit) • Present your video clip to be assessed
The product	Submit both your write-up (on a chart) together with your video clip.

3. Unpack the Task Descriptions and Identify the essential KSAV that can be assessed

Category	Task Description	Essential KSAVs
The write up of the video script	Plan and write a short write-up for your video-clip.	**Skill:** Procedural Writing
The development of the video	Use the notes to Make a 2-minute video clip to advertise and market your school to the public.	**Values and attitudes:** • Teamwork and cooperation • Creativity Knowledge: Know about the school
The Presentation of the video	• The short video clip must embrace the school rules, motto, and mission and vision statements. • It must also contain messages of new and competent management. • This video clip has to have the potential to positively change the image of the school • This 2-minute video clip must be captivating and totally convincing to attract students to want to enroll at your school.	**Knowledge:** Adequate content about the school **Skill:** convincing and persuasive **Values and attitude:** Encouraging and luring
The Presentation of the video	• This clip must not be more than 2 minutes (maximum time limit) • Present your video clip to be assessed	**Skill:** • Time management • delivery skills (posture, language) and • communication skills • social skills (relativity and connectivity) **Values and attitude:** confidence
The product	Submit both your write-up (on a chart) together with your video clip.	EKSAVs in the Write up and Presentation

4. Reword the Task Descriptions with the inclusion of KSAVs into a Descriptor statement for each criteria and distribute into each Competency Level/Level of Achievement

5. Determine the appropriate Descriptive Words or Number for Point Scales of the intended rubric.

Criteria	Advanced	Progressing	Novice	Mark
The write up of the video script	**Skill:** Procedural Writing **Organised** paper of video script writing procedures	**Organised** paper of video script writing procedures	**Organised** paper of video script writing procedures	/3
The development of the video	**Values and attitudes:** • Teamwork and cooperation • Creativity **Knowledge:** Know about the school The video corresponds to the 2-minutes script and illustrates teamwork	The video corresponds to the 2-minutes script and illustrates teamwork	The video corresponds to the 2-minutes script and illustrates teamwork	/3
Content of the video	**Knowledge:** Adequate content about the school **Skill:** Convincing and persuasive **Values and attitude:** Encouraging and luring The short video clip embraces the core ideas of school rules, motto, and mission and vision statements.	The short video clip embraces the core ideas of school rules, motto, and mission and vision statements.	The short video clip embraces the core ideas of school rules, motto, and mission and vision statements.	/3
Presentation of the video	**Skill:** • Time management • delivery skills (posture, language) and • communication skills • social skills (relativity and connectivity) **Values and attitude:** Confidence The video clip captures essence of vital messages of the new and competent management with potentials to positively change the image of the school and captivating and convincing to attract students to want to enroll at the school.	The video clip captures essence of vital messages of the new and competent management with potentials to positively change the image of the school and captivating and convincing to attract students to want to enroll at the school.	The video clip captures essence of vital messages of the new and competent management with potentials to positively change the image of the school and captivating and convincing to attract students to want to enroll at the school.	/3
The product	**EKSAVs** in the Write up and Presentation: Video clip submitted at the assessment deadline for presentations	Video clip submitted at the assessment deadline for presentations	Video clip submitted at the assessment deadline for presentations	/3

6. Completed rubric sample: Video clip Assessment Rubric

Criteria	Achieved	Progressing	Novice	Mark
Video Script Write up	**Innovative** and **well** organised paper with **clarity** of video script writing procedures	**Well** organised paper with **clarity** of video script writing procedures	Organised paper with some **clarity** of video script writing procedures	/3
Video Development	**Appropriately considered details** for the video are well corresponded to the 2-minutes script and illustrates a well-coordinated teamwork	**Considered details** for the video are **mostly** corresponded to the 2-minutes script and illustrates a coordinated teamwork	**Some details** considered for the video are **partially** corresponded to the 2-minutes script and illustrates a less coordinated teamwork	/3
Video Clip Content	• The short video clip **fully** embraces the core ideas of school rules, motto, and mission and vision statements.	• The short video clip **mostly** embraces the core ideas of school rules, motto, and mission and vision statements.	• The short video clip **somewhat** embraces the core ideas of school rules, motto, and mission and vision statements.	/3
Video Presentation	• The video clip **fully** captures essence of vital messages of the new and competent management with **necessary** potentials to positively change the image of the school and **really** captivating and **totally** convincing to attract students to want to enroll at the school.	• The video clip **mostly** captures the essence of vital messages of the new and competent management with **most** potentials to positively change the image of the school and **mostly** captivating and **partially** convincing to attract students to want to enroll at the school.	• The video clip **somewhat** captures the essence of vital messages of the new and competent management with **some** potentials to positively change the image of the school and **almost** captivating and **less** convincing to attract students to want to enroll at the school.	/3
Video Clip Submission Time	• Video clip submitted **well before** the assessment deadline for presentations	• Video clip submitted **just before** the assessment deadline for presentations	• Video clip submitted **within** the assessment time for presentations	/3

1. How to Score using the rubric

Scoring Rubrics

Criteria	Achieved	Progressing	Novice	Mark
Video Script Write up	**Innovative** and **well** organised paper with **clarity** of video script writing procedures	**Well** organised paper with **clarity** of video script writing procedures	Organised paper with some **clarity** of video script writing procedures	2/3
Video Development	**Appropriately considered details** for the video are well corresponded to the 2-minutes script and illustrates a well-coordinated teamwork	**Considered details** for the video are **mostly** corresponded to the 2-minutes script and illustrates a coordinated teamwork	**Some details** considered for the video are **partially** corresponded to the 2-minutes script and illustrates a less coordinated teamwork	1/3
Video Clip Content	• The short video clip **fully** embraces the core ideas of school rules, motto, and mission and vision statements.	• The short video clip **mostly** embraces the core ideas of school rules, motto, and mission and vision statements.	• The short video clip **somewhat** embraces the core ideas of school rules, motto, and mission and vision statements.	3/3
Video Presentation	• The video clip **fully** captures essence of vital messages of the new and competent management with **necessary** potentials to positively change the image of the school and **really** captivating and **totally** convincing to attract students to want to enroll at the school.	• The video clip **mostly** captures the essence of vital messages of the new and competent management with **most** potentials to positively change the image of the school and **mostly** captivating and **partially** convincing to attract students to want to enroll at the school.	• The video clip **somewhat** captures the essence of vital messages of the new and competent management with **some** potentials to positively change the image of the school and **almost** captivating and **less** convincing to attract students to want to enroll at the school.	3/3
Video Clip Submission Time	• Video clip submitted **well before** the assessment deadline for presentations	• Video clip submitted **just before** the assessment deadline for presentations	• Video clip submitted **within** the assessment time for presentations	2/3
				11/15

2. How to Grade using the rubric

Grading Rubrics

Score Range	Grade	Qualifier (Proficiency)	Descriptor	Percentage
13 – 15	A	Advanced	Description reflecting **highest** level of performance.	76 - 100%
9 - 12	B	Achieved	Description reflecting **mastery** level of performance.	46 - 75%
5 – 8	C	Progressing	Description reflecting **movement towards** mastery level of performance.	26 - 45%
0 - 4	D	Novice	Description reflecting **beginning** level of performance.	0 - 25%

3. How to Report using the rubric

A. Reporting an individual student's performance on the task

Assessment Task Report			
Assessment Task: Video Development Project			
Name:	**Grade:**	**Class:**	**Score and Grade: /15**

Criteria	Achieved A	Progressing B	Novice C
Video Script Write up	**Innovative** and **well** organised paper with **clarity** of video script writing procedures	**Well** organised paper with **clarity** of video script writing procedures	Organised paper with some **clarity** of video script writing procedures
Video Development	**Appropriately considered details** for the video are well corresponded to the 2-minutes script and illustrates a well-coordinated teamwork	**Considered details** for the video are **mostly** corresponded to the 2-minutes script and illustrates a coordinated teamwork	**Some details** considered for the video are **partially** corresponded to the 2-minutes script and illustrates a less coordinated teamwork
Video Clip Content	• The short video clip **fully** embraces the core ideas of school rules, motto, and mission and vision statements.	• The short video clip **mostly** embraces the core ideas of school rules, motto, and mission and vision statements.	• The short video clip **somewhat** embraces the core ideas of school rules, motto, and mission and vision statements.
Video Presentation	• The video clip **fully** captures essence of vital messages of the new and competent management with **necessary** potentials to positively change the image of the school and **really** captivating and **totally** convincing to attract students to want to enroll at the school.	• The video clip **mostly** captures the essence of vital messages of the new and competent management with **most** potentials to positively change the image of the school and **mostly** captivating and **partially** convincing to attract students to want to enroll at the school.	• The video clip **somewhat** captures the essence of vital messages of the new and competent management with **some** potentials to positively change the image of the school and **almost** captivatingand **less** convincing to attract students to want to enroll at the school.
Video Clip Submission Time	• Video clip submitted **well before** the assessment deadline for presentations	• Video clip submitted **just before** the assessment deadline for presentations	• Video clip submitted **within** the assessment time for presentations

Note: The shaded is the student's proficiency score for each task.

Related links to this Business Studies Benchmark in Business Studies with other subject areas:

Subjects	Reference Benchmark Codes
1. Arts (Theatre Arts)	9.2.2.2
2. Christian Civic Value Education (CCVE)	9.3.1.3
3. Character Social Development (CSD)	9.1.5.1, 9.1.5.2, 9.1.5.3, 9.1.5.4, 9.1.5.5
4. English	9.2.2.1
5. Social Science (History)	9.2.2.3, 9.2.2.4
6. Social Science (Political Science)	9.3.3.1, 9.3.3.2
7. Technology Industrial Arts (TIA)	9.4.1.4, 9.4.1.5, 9.4.1.6

The anchor subject in this sample STEAM assessment is Communication Technology.

STEAM Project Assessment

Benchmark 9.4.2.1: Investigate and demonstrate appropriate posture in using computer equipment.

Learning Objective: By the end of this topic, the students will be able to;

- Define Computer Ergonomics and Posture.
- Investigate and identify the importance of posture in computer usage.
- Demonstrate appropriate postures of computer equipment usage.

Purpose of Assessment: To assess whether the students can use their organisation skills to create an ergonomically friendly office environment.

Assessment Strategy: Students will participate in a role play demonstrating employees expressing frustration about the effect of the inappropriate furniture and equipment to their health, safety and productivity.

Duration: 160 minutes periods

Time/Date of Administration: Use Assessment Schedule

Due Date/Time: Use Assessment Schedule

Performance Standard: By the end of the project the student will be able to

1. Demonstrate a role play of employees expressing frustration about the effect of the inappropriate furniture and equipment to their health.
2. Identify the issues which contribute to worker's dissatisfaction.

Performance Tasks: Students will

1. Do a write up of the role play
2. Participate in the role play

Performance Assessment Criteria:

1. Do a write up of the role play
2. Participate in the role play

Assessment Scoring: 30 marks

Rubric on Role Play

Category	Innovative	Effective	Workable
	3	2	1
Quality/ Workmanship	Maximum effort was put forth to complete the project in a professional manner. Project demonstrates a high degree of quality and attention to detail. Workmanship is excellent.	Some effort was made to complete the project to a level that was sufficient for grading, but does not meet a professional level of quality or appearance. Workmanship is of acceptable quality.	Minimal effort was made to complete the project and the quality and workmanship is sub-par, but still meets the minimal standard.
Creativity/ Design	Project reflects many fundamental elements of design and creativity. Project demonstrates an advanced understanding of creative thinking and attention to aesthetics and presentation.	Project reflects some of the elements of design and creativity, but lacks attention to aesthetics and presentation.	Project was completed, but does not reflect the acceptable levels of design and creativity. Effort was minimal and project is mediocre at best.
Functionality	Project meets or exceeds the design requirements of purpose and functionality. All elements of the design have been met and the project does what it was designed to do.	Project meets some of the design requirements of purpose and functionality. Not all elements of the design have been met, but the project does what it was designed to do.	Project is somewhat functional, but reflects minimal effort. It is intermittent and doesn't always do what it was designed to do.
Design Process	Project reflects a clear understanding and application of design process including evidence of research, brainstorming, design and problem solving, prototyping and testing.	Project reflects some understanding and application of accepted design loop principles and sequence including evidence of research, brainstorming, design and problem solving, prototyping and testing.	Project reflects minimal understanding and application of design process.
Criteria/ Constraints	Project was completed with all constraints and criteria met or exceeded. Reflects attention to detail and quality.	Project was completed with some of the constraints and criteria met. Reflects some attention to detail, but quality is minimal.	Project was completed with a few of the constraints and criteria met. Reflects minimal effort and lacks detail or quality
Time Management	Project completed and turned in on time. Student worked diligently when project time was available. Student was on task most of the time.	Project was completed, but had notable errors. Student utilized project time somewhat efficiently, but spent time socializing. Student was on task 70% - 80% of the time.	Project was not turned in on time and/or complete. The student was on task less than 60% of the time.
Resource Management	Always takes responsibility for use and care of all building components and resources. Always returns building components and materials to proper storage compartments.	Consistently takes responsibility for use and care of building components and resources. Somewhat consistent in returning building components to proper storage compartments.	Sometimes takes responsibility for use and care of building components and resources. Inconsistent in returning building components to proper storage compartments.

Teamwork	Notable teamwork shown with a determination to participate/ contribute to team success. Completed required individual tasks that contributed to the success of the team.	Teamwork was noted, but was sometimes off task or working on non-related tasks. Contributed to the success of the team, but could have been more engaged to complete tasks sooner.	Notable time off-task with minimal effort given for team success, or did the project alone without relying on others to do their share of the project.
Writing/ Reflection	Writing/reflection is very well organized and explained. Student includes all details in design process. Document has almost no grammatical errors.	Writing/reflection is somewhat organized and explained. Student includes most details in design process. Document has very few grammatical errors.	Writing/reflection is not organized and explained. Student in¬cludes only a few details in design process. Document has many grammatical errors.
Presentation	Presentation was well organized and presented in a logical sequence. Presentation reflects a full knowledge of the topic with clear answers and explanations to questions asked.	Presentation was fairly organized and most information presented in a logical sequence. Answers to questions were vague or lacked clarity or accuracy.	Presentation was unorganized and lacked a logical sequence. Presentation reflected little attention to detail. Answers to questions were inaccurate and confusing.

Glossary

Terms	Definitions
Assessment	Activities teachers use to help students learn and to measure and monitor their progress towards the attainment of expected levels of proficiency.
Assessment As Learning	Assessment is used to help students understand and reflect on what they have learnt or are having difficulties with, identify areas of strengths and weaknesses, and set clear, measurable, and attainable personal goals to improve their own learning.
Assessment For Learning	A common form of assessment. It is an ongoing assessment process that arises out of the interaction between teaching and learning. Also referred to as formative assessment.
Assessment Of Learning	Provides a summary of students learning over a given period of time and is generally carried out at the end of a course of study. Also referred to as summative assessment.
Assessment Strategies	Different ways or approaches of assessing students work.
Authentic	Based on real life context.
Benchmarks	Benchmarks are more detailed descriptions of a specific level of performance expected of students at particular ages, grades, school levels or levels of development. They are the specific components of the knowledge, process, skill, concept, principle, or idea identified by a content standard.
Content Standards	Content Standards are broadly stated expectations of what (content) students should know. They describe the knowledge, skills, values, and attitudes that students should attain.
Control	The means by which a device or process is activated or regulated.
Environmental sustainability	The creation of products or services and use of resources in a way that allows present needs to be met without compromising the ability of future generations to meet their needs. An important related concept is that of environmental stewardship – the acceptance of responsibility for the sustainable use and treatment of land and other natural resources.
Ergonomics	The design of a product, process, or service in a way that takes the user's well-being with respect to its use or delivery into account – that is, in a way that minimises discomfort, risk of injury, and expenditure of energy.
Evidence Outcomes	Evidence outcomes are indicators that indicate students' mastery of essential knowledge, skills, values and attitudes at the end of each grade or school level.
Function	The use for which a product, process, or service is developed.
Performance Assessment	A form of assessment that is focused on measuring students' mastery of knowledge, skills, values and attitudes taught and learnt in each lesson.
Standard	A standard is a level of quality or achievement, especially a level that is thought to be acceptable. It is something used to measure or estimate the quality or degree of something, for example, how good a piece of work is.
Standards-Based Curriculum	Describes what all students should know and be able to do at the end of a grade or school level. The main idea behind standards-based curriculum is standards.

Standards-Based Education	An academic program in which clearly defined academic content and benchmarks are aligned. It spells out what schools and communities need to do to ensure achievement of expectations. The main idea behind standards-based education is standards.
Standards-Based Assessment	A systematic and ongoing process of collecting and interpreting information about students' achievements.

Terms	Definitions
Analog	Analog is an adjective that describes a continuous measurement or transmission of a signal. It is often contrasted with digital, which is how computers store and process data using ones and zeros.
Adobe Acrobat Reader	A software that allows you to view a PDF document (a document that can be seen but not changed). It can be downloaded free of charge from Adobe.
ADSL	Asymmetric digital subscriber line (ADSL) is type of digital subscriber line (DSL) broadband technology that is used to connect to the internet. It uses standard telephone lines to deliver high speed data communication (up to 24 megabytes per second)
Analogue	A conventional method of transmitting data. Standard landline telephones use analogue technology. It is distinct from digital technology which provides for greater quality and speed of data transmission.
Attachment	A document that is sent with an email message. Many types of files can be sent this way. (e.g. Word documents, PDFs, Excel files, JPEGS). Large files may take too long for the recipient to download, therefore it is good practice to compress the file using software such as Winzip before attaching it.
Back-end	Refers to the part of an application that performs an essential task not apparent to the user.
Backward compatible	If software is backward compatible, it is compatible with earlier (superseded) versions of the same software
Bandwidth	Refers to the maximum amount of data that can travel a communication path in a given time, usually measured in seconds.
Bit	A bit (short for binary digit) is the smallest unit of measurement in computing. 8 bits make up 1 byte.
Bluetooth	Is a wireless communications technology intended to replace cables. It allows short-range connections between two or more Bluetooth compatible devices such as mobile phones, tablets, headsets or medical equipment.
Bookmark	Is a saved link to a particular Web page. Microsoft internet Explorer denotes bookmarks as _favourites'.
Boolean operators	Most search engines (eg Google) allows one to limit his search or make it more specific by using words such as — 'and', 'or' and 'not'. These words are known as Boolean operators because of their origin as terms in logic

Boot (re-boot)	To boot (or re-boot) is to load and initialize the operating system on a computer. Think of it as starting up a computer in Windows one can use the key combination CNTRL and ALT and DEL as a 'soft‘ boot. This means restarting the computer rather than turning it off completely and on again which can cause damage to one‘s computer‘s hard disk under some circumstances.
Bounce back	An email message that cannot be delivered and returns as an error notification to the sender. If this happens check if the address has been typed correctly.
Broadband	A type of communications technology whereby a single wire can carry more than one type of signal at once, for example, audio and video. Cable TV is one technology that uses broadband and data transmission.
Browser	A software program that allows one to surf the web. Popular browsers. Include Google, Chrome, Mozilla, Firefox, Microsoft Edge and Internet Explorer.
Cache	When you download (read) a web page the data is 'cached‘ meaning that it is temporarily stored on the computer. The next time one wants the page instead of requesting the file from the web server, the web browser just accesses it from the cache so the page loads quickly. The downside to this is if the cached web page is often updated, one may miss the latest version. If this is suspected to be so, use the 'refrech‘ button on the browser.
CAD	Computer-aided design) CAD is a type of software that allows users to create 2D and 3D design and modeling. CAD is used by architects, engineers, artists and other professionals to create precise technical drawings.
Chip	A microprocessor that performs many functions and calculations that make ones computer run. The computer chip is also as the CPU (Central Processing Unit) or the processor.
Cloud computing	Refers to the storing and accessing of data and programs over the internet instead of on another type of hard drive. Examples of Cloud services are iCloud, Google Cloud and Drop box.
Compression	The reduction of the size of a file. Compressed files take up less memory and can be downloaded or sent over the internet more quickly.
Content	Refers to a website‘s text and information as opposed to its design and structure.
Cookie	A piece of code or data created by a a web server and stored on a a users computer. It is used to keep track of the user‘s patterns and preferences.
CPU	The central processing unit (CPU) is the brains behind the computer. The CPU is responsible for performing calculations and tasks that make programs work. The higher the speed of a CPU, the faster the CPU undertakes the calculations and tasks.
Cybercrime	Any type of illegal activity that is undertaken (or relies heavily) on a computer. There are thousands of types of cybercrime including network intrusions, identity theft and the spreading of computer viruses.
Device driver	A small program that allows a peripheral device such as a printer or scanner to connect to the PC.
Digital	Digital information is stored using a series of ones and zeros. Computers are digital machines because they can only read information as on or off -- 1 or 0. This method of computation, also known as the binary system, may seem rather simplistic, but can be used to represent incredible amounts of data.
Domain	A set of computers on a network that are managed as a unit.

Download	Is a method by which users access and save or 'pull down‘ software or other files to their own computers from a remote computer via the internet.
DV	DV stands for digital video.
Email	Email or electronic mail is a way of sending messages over the internet. Popular email programs include Outlook, Mozilla Thunderbird, Gmail and Yahoo Mail
Encryption	Is the process of converting electronic data to an unrecognizable or encrypted form one cannot be easily understood by unauthorized parties.
Ethernet	The most common way of connecting computers on a network with a wired wired connection. It is a type of local area network (LAN) technology providing a simple interface for connecting multiple devices.
Firewall	A barrier that acts as a security system to protect trusted computer systems and networks from outside connections and untrusted networks such as the internet.
FTP	File transfer protocol is a common method of transferring files via the internet from one host to another host.
Gateway	A point within a network that interconnects with other networks.
GIF	Graphics interchange format (GIF) is a graphics file format. Because GIF files are compressed they can be quickly and easily transmitted over a network. GIF is one of the main graphics format on the internet.
Hard disk	The physical place where a computer stores information-applications and files-it is known as its hard disk drive(HDD). The bigger the HDD, the more data it can store.
Home page	The page that an internet browser first opens up to. It is usually the starting point of an organisation or individual‘s website.
HTML	Hyper-text markup language (HTML) is a set of symbols inserted into files intended for display on the world wide web. The symbols tell web browsers how to display words and images –e.g. which colour, font and type size to use-and they direct it to link to other pages on the world wide web via hyperlinks.
Internet	A set of interconnected networks that allow computers in different locations to exchange information. The internet includes services such as the world wide web, electronic mail, file transfer protocol (FTP), chat a remote access to networks and computers.
ISP	An internet service provider (ISP) is a company that provides access to the internet.
Intranet	An internet is basically private, internal internet specific to an organisation or group.
Java	A programming language that is commonly used in the development of client server web applications.
JPEG	Joint Photographic Experts Group (JPEG) which was the committee that created the file format known as JPEG. The format is commonly used for photos displayed on the world wide web.
LAN	A local area network is a system that connects computers and other devices that share a common communications line and wireless links generally within a limited geographical area such as a home or office building.
Malware	Malware is short for malicious software. It refers to a software program that has been developed to do harm to other computers. Types of malware include viruses, worms and spyware.

Megabyte	A measure of computer processor storage and real and virtual memory. A megabyte (Mb) is 2 to the 20th power bytes or 1,048,576bytes in decimal notation.
Megahertz	Is the unit used to measure the speed of a computer‘s processor (e.g. 2.8Ghz)
Modem	Is a device that allows computers to transmit information to each other via ordinary telephone lines.
Online	If a computer (computer user) is online, it is connected to a network or to the internet. Online also refers to resources and services available on the internet- e.g. online banking, online dictionary
Operating system	An operating system(OS) is the software that manages all of a computer‘s processes and allows programs and applications to run. The most prominent operating system is Microsoft Windows. Others include Mac OS X and Linux
PDF	Portable document format (PDF) is a file type created by Adobe Systems Inc. PDFs can be read using free software called Adobe Acrobat Reader or another PDF reader.
Phising	Is a type of email fraud in which the perpetrator sends out emails that appear to come from a legitimate service or reputable company such as a bank or an email service provider. These emails aim to lure recipients to reveal confidential information that the perpetrator can use for their financial advantage.
Plug-in	A software plug-in is a component that adds to a software program‘s functionality.
POP	A Post office protocol (POP) is an internet protocol used by an internet service provider (ISP) to handle email. A POP account is an email account.
PPM	Pages per minute (PPM) generally refers to the speed of a printer.
Processor	Is the brains of the computer. It is responsible for performing calculations and tasks that make programs work. The faster the processor, the faster the computer works.
Protocol	Is a standard or set of rules that computers and other devices use when communicating with one another.
RAM	Random access memory (RAM) is usually referred to as the computer memory- it stores information used by programs. Generally the larger the computer‘s RAM, the more programs it can run at once without slowing down.
Read-only	A read only file cannot be edited, modified or deleted.
Resolution	Refers to the number of distinct pixels that make up the display on a computer monitor. It is denoted in DPI (dots per inch). The higher the resolution, the finer and smoother the images appear when displayed at a given size.
ROM	Read only memory. It is the part of a computer‘s memory that cannot be changed by a user. The contents of ROM remain even when the computer is turned of.
Search engine	A search engine enables a computer user to search information on the internet. It is a type of software that that creates indexes of databases or internet sites based on the titles of files or the full text of files, keywords, or the full text of files.
SSL	SSL or secure sockets layer is a protocol that allows internet users to send encrypted messages across the internet. It is generally used when transmitting confidential information e.g. personal data or credit card details. A web address that begins with 'https‘ indicates that an SSL connection is in use.
Server	Is a computer that handles requests for data, email, file transfers and other network services from other computers.

Spam	Refers to unsolicited email messages sent for marketing purposes.
Unzip	To unzip a file is to extract and decompress compressed files from it. If sent a zip file via email one will need to unzip it before the files can be accessed inside it.
URL	A URL (unique resource locator) or web address is the string of characters typed into a browser to access a particular website or other resource on the internet.
Viral	An online video, photo or article experiences a sudden spike in popularity in a short period of time is said to have gone viral.
Virus	A piece of programming code inserted into other programming to cause damage. Viruses can be sent in many forms but are often transmitted via email messages that when opened may erase data or cause damage to a hard disk.
WEP	Wired equivalent privacy (WEP) is a security protocol used in wi-fi networks. It is designed to provide a wireless local area network (LAN) with a level of security similar to that of a regular wired LAN. WEP-secured networks are usually protected by passwords.
Wi-Fi	Wi-Fi is a technology that allows computers and other devices to communicate via a wireless signal. Essentially it means one can browse the internet without tripping over phone cords.
WPA	Wi-Fi protected access(WPA) is a security protocol used in wi-fi networks. It is an improvement on WEP because it offers greater protection through more sophisticated data encryption.
Zip	To zip files is to archive and compress them into one file of smaller size using a program such as WinZip. It‘s a handy way to make files smaller before sending them via email.

Reference

Morrison, B. B., & DiSalvo, B. (2014, March). Khan academy gamifies computer science. *In Proceedings of the 45th ACM technical symposium on Computer science education (pp. 39-44).*

Zhong, B., & Li, T. (2020). Can pair learning improve students' troubleshooting performance in robotics education?. *Journal of Educational Computing Research,* 58(1), 220-248.

Brophy, S., Klein, S., Portsmore, M., & Rogers, C. (2008). Advancing engineering education in P-12 classrooms. *Journal of Engineering Education,* 97(3), 369-387.

Ian, W. (2019). Computer science from the bottom up. URL: https://www. bottomupcs. com/index. xhtml. Accessed, 2.

Caeiro, M., Llamas, M., Castro, M., Tovar, E., Plaza, I., Arcega, F., ... & Domínguez, M. (2010, April). Practice and research in engineering education: Activities of the CESEI Technical Committee. In *IEEE EDUCON 2010 Conference* (pp. 1173-1180). IEEE.

Parsons, J. J., & Oja, D. (2014). *New Perspectives on Computer Concepts 2014, Comprehensive.* Cengage Learning.

Wolf, M. (2016). *The physics of computing.* Elsevier.

Nisan, N., & Schocken, S. (2005). The Elements of Computing Systems. *Building A Modern Computer*

Baker, G., & Bowen, T. (2003). First Byte: *Using Information and Communication Technology.* Oxford University Press.

Phillips, P. L. (2004). *Creating the Perfect Design Brief: How to manage design for strategic advantage.* Skyhorse Publishing Inc..

O'Regan, G., & O'Regan, G. (2012). What Is a Computer?. *A Brief History of Computing,* 23-34.

Goel, A. (2010). *Computer fundamentals.* Pearson Education India.

Anderson, M. (Ed.). (2013). *Contemporary Ergonomics and Human Factors 2013: Proceedings of the International Conference on Ergonomics & Human Factors 2013, Cambridge, UK, 15-18 April 2013.* CRC Press.

Baker G (1986) Doing IT,Pearson College Div
Pinjik P (2014) ICT Grade 12 STUDENT HANDBOOK , Oxford, Sydney
Roderick T and Rush G (2002), ICT for GCSE, Oxford University Press,

Briscoe, N. (2000). Understanding the OSI 7-layer model. *PC Network Advisor,* 120(2), 13-15.

Clark R.C, & Mayer, E.R., (2008). *E-learning and the Science of Instruction: Proven guidelines for consumers and designers of multimedia learning.* San Francisco: Pfeiffer

Greenhow, A, Assiaw, P, Roberts, C, Astbury, C, Teske, A, Gray, S, Blofeld-Watson, J, Basheer, S, Cox, K, Wright, V, Raza, Z, Taylor Press, D, Prabhu, K, Shah, F, and Chikasa, E. 2022 Cambridge IGCSE Information and
Communication Technology Kognity

Hubka, V. (2015). *Principles of engineering design.* Elsevier.

Leibniz, G. W., & Heer, F. (1958). *Gottfried Wilhelm Leibniz.* Fischer Bücherei.

Rahman, N., Aldhaban, F., & Akhter, S. (2013). Emerging technologies in business intelligence. *2013 Proceedings of PICMET'13: Technology Management in the IT-Driven Services (PICMET), 542-547.*

Makridakis, S. (2017). The forthcoming Artificial Intelligence (AI) revolution: Its impact on society and firms. *Futures, 90,* 46-60.

Moreno R., & Mayer E.R., (2000), *A learner-centered approach to multimedia explanations: Deriving instructional design principles from cognitive theory,* Interactive Multimedia Electronic Journal of Computer-Enhanced Learning, 2000, 2(2): E-pub

Peterson, L. L., & Davie, B. S. (2007). *Computer networks: a systems approach.* Elsevier.

YEKINI, E. N. A. (2022). COMPUTER NETWORKING.

Rodzinak D. 2011 The Science Computer Ergonomics

Rogers, E. M. (1986). *Communication technology.* Simon and Schuster.

Venkataraghavan, M. M., & Preetha, R. IMPACT OF SOCIAL MEDIA IN THE FIELD OF PUBLIC RELATIONS AND CORPORATE COMMUNICATIONS.

https://study.com/academy/lesson/what-is-communication-protocol-tcp-ip-lesson- quiz.html
Slideplayer.com/slide/6365193/

https://study.com/academy/lesson/what-is-communication-protocol-tcp-ip-lesson-quiz.html https://computer.howstuffworks.com/what-is-network-server.html https://bbamantra.com/media-types-characteristics/ https://www.theclassroom.com/media-production-5977806.html https://bbamantra.com/media-types-characteristics/ https://www.theclassroom.com/media-production-5977806.html https://digitalmediaresources.weebly.com/types-of-digital-media-products.html https://digitalmediaresources.weebly.com/types-of-digital-media-products.html www.microfo-

cus.com › en-us › what-is › data-security
https://www.microfocus.com/en-us/products /voltages-dataencription-security /how it works https://existek.com/blog/web-application-development-process-flow/ https://www.pearsonschoolsandfecolleges.co.uk/Secondary/DesignAndTechnology/LearningSu pport/CreateProductDesign/Samples/SampleMaterial/CreateProdDesD.pdf https://intertextual.com.au/impact-of-computers-on-small-business/
Christensson, P. (2021, January 22). Computer Ethics Definition. Retrieved 2021, Jul 13, from https://techterms.com

Appendices

Appendix 1: Bloom's Taxonomy

LEVEL OF UNDERSTANDING	KEY VERBS
CREATING Can the student create a new product or point of view?	Construct, design, and develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce, assemble, formulate,
EVALUATING Can the student justify a stand or decision?	Appraise, argue, assess, choose, conclude, critique, decide, defend, evaluate, judge, justify, predict, prioritize, provoke, rank, rate, select, support, monitor,
ANALYZING Can the student distinguish between the different parts?	Analyzing, characterize, classify, compare, contrast, debate, criticise, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, experiment, question, test,
APPLYING Can the student use the information in a new way	Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use, demonstrate, illustrate, interpret, operate, sketch, solve, write,
UNDERSTANDING Can the student comprehend ideas or concepts?	Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report, translate, describe, classify,
REMEMBERING Can the student recall or remember the information?	Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write, duplicate, memorise, recall, repeat, reproduce, state,

Appendix 2: 21st Century Skills

WAYS OF THINKING	**Creativity and innovation** • Think creatively • Work creatively with others • Implement innovations **Critical thinking, problem solving and decision making** • Reason effectively and evaluate evidence • Solve problems • Articulate findings **Learning to learn and meta-cognition** • Self-motivation • Positive appreciation of learning • Adaptability and flexibility
WAYS OF WORKING	**Communication** • Competency in written and oral language • Open minded and preparedness to listen • Sensitivity to cultural differences Collaboration and teamwork • Interact effectively with others • Work effectively in diverse teams • Prioritise, plan and manage projects
TOOLS FOR WORKING	**Information literacy** • Access and evaluate information • Use and manage information • Apply technology effectively **ICT literacy** • Open to new ideas, information, tools and ways of thinking • Use ICT accurately, creatively, ethically and legally • Be aware of cultural and social differences • Apply technology appropriately and effectively
LIVING IN THE WORLD	**Citizenship – global and local** • Awareness and understanding of rights and responsibilities as a global citizen • Preparedness to participate in community activities • Respect the values and privacy of others **Personal and social responsibility** • Communicate constructively in different social situations • Understand different viewpoints and perspectives **Life and career** • Adapt to change • Manage goals and time • Be a self-directed learner • Interact effectively with others

Appendix 3: Teaching And Learning Strategies

Strategy	Teacher	Students
CASE STUDY **Used to extend students understanding of real life issues.**	Provide students with case studies related to the topic of the lesson and allow them to analyse and evaluate.	Study the case study and identify the problem addressed. They analyse the problem and suggest solutions supported by conceptual justifications and make presentations. This enriches the students' existing knowledge of the topic.
DEBATE **A method used to increase students' interest, involvement and participation.**	Provide the topic or question of debate on current issues affecting a bigger population, clearly outlining the expectations of the debate. Explain the steps involved in debating and set a criteria/standard to be achieved.	Conduct researches to gather supporting evidence about the selected topic and summarizing the points. They are engaged in collaborative learning by delegating and sharing tasks to group members. When debating, they improve their communication skills.
DISCUSSION **The purpose of discussion is to educate students about the process of group thinking and collective decision.**	The teacher opens a discussion on certain topic by asking essential questions. During the discussion, the teacher reinforces and emphasises on important points from students responses. Teacher guide the direction to motivate students to explore the topic in greater depth and the topic in more detail. Use how and why followup questions to guide the discussion toward the objective of helping students understand the subject and summarise main ideas.	Students ponder over the question and answer by providing ideas, experiences and examples. Students participate in the discussion by exchanging ideas with others.
GAMES AND SIMULATIONS **Encourages motivation and creates a spirit of competition and challenge to enhance learning.**	Being creative and select appropriate games for the topic of the lesson. Give clear instructions and guidelines.	The game selected must be fun and build a competitive spirit to score more than their peers to win small prices. Go into groups and organize. Follow the instructions and play to win.

Strategy	Teacher	Students
OBSERVATION **Method used to allow students to work independently to discover why and how things happen as the way they are. It builds curiosity.**	Give instructions and monitor every activity students do. Students Observe and ask essential questions	Students possess instinct of curiosity and are curious to see the things for themselves and particularly those things which exist around them. A thing observed and a fact discovered by the child for himself becomes a part of mental life of the child. It is certainly more valuable to him than the same fact or facts learnt from the teacher or a book.
PEER TEACHING & LEARNING **Record Interpret (power point presentations, pair learning) each other using different ways to learn from each other.**	It encourages; team work, develops confidence, feel free to ask questions, improves communication skills and most importantly develop the spirit of inquiry.	Distribute topics to groups to research and teach others in the classroom. Go through the basics of how to present their peer teaching. Go into their established working groups. Develop a plan for the topic. Each group member is allocated a task to work on. Research and collect information about the topic allocated to the group. Outline the important points from the research and present their findings in class.
PERFORMANCE RELATED TASKS **(dramatization, song/lyrics, wall magazines) Encourages creativity and take on the overarching ideas of the topic and are able to recall them at a later date.**	Students are given the opportunity to perform the using the main ideas of a topic. Provide the guidelines, expectations and the set criteria.	Go into their established working groups. Being creative and create dramas, songs/lyrics or wall magazines in line with the topic.
PROJECT **(individual/group) Helps students complete tasks individually or collectively.**	Teacher outline the steps and procedures of how to do and the criteria.	Students are involved in investigations and finding solutions to problems to real life experiences. They carry out researches to analyse the causes and effects of problems to provide achievable solutions. Students carefully utilise the problem-solving approach to complete projects.
USE MEDIA & TECHNOLOGY **to teach and generate engagement depending on the age of the students.**	Show a full movie, an animated one, a few episodes form documentaries, you tube movies and others depending on the lesson. Provide questions for students to answer before viewing.	Viewing can provoke questions, debates, critical thinking, emotion and reaction. After viewing, students engage in Critical thinking and debate.

Appendix 4: Samples of Student Response System Applications

These are web based apps that work with a multitude of devices and operating systems. Here are the 4 best student response systems that interface with multiple devices.

1. Kahoot

Kahoot is a utility that allows teachers to create quizzes and surveys, and then send them to students. Teachers may allow students an unlimited amount of time to respond to questions, or they may set a time limit on each question. Points are awarded to students both for correct answers and for responding quickly with those correct responses. Teachers can track students as they make progress.

2. Socrative

Socrative works excellently both for students working on their own or for students who are collaborating with one another. Socrative offers several different ways for instructors to engage their students. There are space races in which students can compete in teams or as individuals to answer questions as quickly and accurately as possible. Polls allow instructors to receive student feedback.

3. Infuse Learning

Infuse learning is (was!) an excellent student response system for teachers who must support students with a variety of learning styles. With infusion a teacher can create questions, quizzes and writing prompts and send them to students who are participating in virtual classrooms or in an online learning program. What makes Infuse Learning unique is that it allows the teacher to give the student multiple response options.

4. Verso

This is a free utility that teachers can use to create virtual classrooms. Verso works with the teacher's Google Drive account. This means that links, files, videos, images, and documents from the instructor's Google Drive can be added to the Verso classroom for students to access. Students who enter the classroom will be shown new items that have been added to the classroom since their last visit.

https://www.emergingedtech.com/2015/09/top-5-multi-platform-student-response-systems/

Appendix 5: Assessment Strategies

1. Reflective writing

Give your students journals and ask them to reflect on the day's lesson by writing about what they learned as well as what they found challenging. Encourage them to explain how they might apply the lesson or skill they learned in real life. You can then review their entries to determine your students' level of understanding and identify areas to focus on.

2. Choral responses

A choral response is a quick and easy way to assess your students' understanding of a concept they just learned. Ask the entire class a question, and evaluate their level of understanding based on the number and type of responses you receive. This exercise also encourages all students to participate in the question-and-answer process.

3. Presentations

Have students give short presentations to you or the class sharing what they have learned about a particular topic. You could also ask them to summarise the lesson's most important concepts. Rather than grading the presentations, use them as an assessment tool to determine students' level of understanding.

4. Four corners

Four corners is an engaging assessment strategy that gets students moving around the room. Label each corner of the room with a different level of comprehension: strongly agree, agree, disagree and strongly disagree. State facts or details about the current lesson, and ask them to stand in the corner of the room that represents their response. Encourage students to explain why they chose a certain response so that you can make decisions about future lessons.

5. Lists

Midway through a lesson, pause and ask your students to list a certain number of things they've learned. Review their lists to determine if students are at the appropriate level of understanding. You can also use these lists to identify misunderstandings and areas you need to focus on more.

6. One-minute response

Ask your class a question about a topic, and give them one minute to write a response. Encourage them to focus on their ideas and information rather than correct spelling, grammar and writing conventions. Alternatively, you can ask your students to write a one-sentence summary of what they have learned about that topic. Look for detail and understanding in their responses

7. Think-pair-share

Think-pair-share is useful for encouraging students to think critically about

a topic and allowing you to check for understanding. Prompt students with questions about topics like what they learned from a lesson or how they connect with what you discussed in class today. Pair them with another student, and have them discuss their ideas. Reconvene as a group, and call on different pairs to ask them to share their thoughts.

8. Socratic seminar

Hosting a Socratic seminar empowers students to facilitate their own discussions to develop their ideas further. Students ask each other questions about a certain topic, text or starting question. This prompts more questions and comments to enhance their understanding of the main topic.

9. ABC brainstorming

ABC brainstorming challenges students to create a list of all the letters in the alphabet and write down something that begins with each letter that relates to the unit. This can be an effective individual, pair or group activity. Reviewing these lists may help you learn what students understand and what requires more attention, allowing you to modify your lesson plans as needed.

10. 3-2-1

This is another technique to encourage students to reflect on the lessons. It's particularly useful to check for understanding at the end of or near the end of lessons. While the format may vary, this strategy typically involves asking students to write down:

- Three things they learned
- Two things they want to learn more about
- One question they have about

11. Concept maps

Concept maps are useful for helping students visualise what they understand about a topic. Students can create individual concept maps, or this may be an activity you complete as an entire class. Start with the main topic or idea in the middle of the paper, then draw lines out to circles that discuss information related to it. Depending on the subject and the age of the students, you may also ask them to draw lines connecting similar ideas.

12. 30-second share

During a 30-second share, each student discusses something they learned during the lesson. Things like what the student discusses, what language they use and how their response connects to the learning targets can help you assess their understanding.

13. Graffiti wall

Creating a graffiti wall is another assessment strategy that may be useful for working with visual learners. Cover one of your classroom walls with a large piece of paper, and invite students to write or draw on it to show what they learned about a topic. Using this activity allows you to identify

what students understand and what may require additional lessons for them to master. Consider completing this activity during the middle of a unit and leaving the wall up for them to continue to add to as they learn more.

Reference sources: *https://www.indeed.com/career-advice/career-development/assessment-strategies*

Appendix 6: Lesson Plan Template

Strand: ……

Unit: ……

Content Standard: .....

Benchmark: ……

Topic:……

Lesson Topic: ……

Lesson Objective (s): By the end of the lesson, students will be able to;

- ……
- ……
- ……

Essential Questions:

- ……
- ……
- ……

Knowledge:

- ……
- ……

Skill(s):

- ……
- ……

Values:

- ……
- ……

Attitudes:

- ……
- ……

Appendix 7: Assessment Strategies

Strategy	Description
Analogies	Students create an analogy between something they are familiar with and the new information they have learned. When asking students to explain the analogy, it will show the depth of their understanding of a topic.
Classroom Presentations	A classroom presentation is an assessment strategy that requires students to verbalise their knowledge, select and present samples of finished work, and organize their thoughts about a topic in order to present a summary of their learning. It may provide the basis for assessment upon completion of a student's project or essay.
Conferences	A conference is a formal or informal meeting between the teacher and a student for the purpose of exchanging information or sharing ideas. A conference might be held to explore the student's thinking and suggest next steps; assess the student's level of understanding of a particular concept or procedure; and review, clarify, and extend what the student has already completed
Discussions	Having a class discussion on a unit of study provides teachers with valuable information about what the students know about the subject. Focus the discussions on higher level thinking skills and allow students to reflect their learning before the discussion commences.
Essays	An essay is a writing sample in which a student constructs a response to a question, topic, or brief statement, and supplies supporting details or arguments. The essay allows the teacher to assess the student's understanding and/or ability to analyse and synthesize information.
Exhibitions/ Demonstrations	An exhibition/demonstration is a performance in a public setting, during which a student explains and applies a process, procedure, etc., in concrete ways to show individual achievement of specific skills and knowledge.
Interviews	An interview is a face-to-face conversation in which teacher and student use inquiry to share their knowledge and understanding of a topic or problem, and can be used by the teacher to explore the student's thinking; assess the student's level of understanding of a concept or procedure and gather information, obtain clarification, determine positions, and probe for motivations.
Learning Logs	A learning log is an ongoing, visible record kept by a student and recording what he or she is doing or thinking while working on a particular task or assignment. It can be used to assess student progress and growth over time.
Observation	Observation is a process of systematically viewing and recording students while they work, for the purpose of making programming and instruction decisions. Observation can take place at any time and in any setting. It provides information on students' strengths and weaknesses, learning styles, interests, and attitudes.
Peer Assessment	Assessment by peers is a powerful way to gather information about students and their understanding. Students can use set criteria to assess the work of their classmates.
Performance Tasks	During a performance task, students create, produce, perform, or present works on "real world" issues. The performance task may be used to assess a skill or proficiency, and provides useful information on the process as well as the product.

Strategy	Description
Portfolios	A portfolio is a collection of samples of a student's work, and is focused, selective, reflective, and collaborative. It offers a visual demonstration of a student's achievement, capabilities, strengths, weaknesses, knowledge, and specific skills, over time and in a variety of contexts.
Questions And Answers (Oral)	In the question–and-answer strategy, the teacher poses a question and the student answers verbally, rather than in writing. This strategy helps the teacher to determine whether students understand what is being, or has been, presented, and helps students to extend their thinking, generate ideas, or solve problems.
Quizzes, Tests, Examinations	A quiz, test, or examination requires students to respond to prompts in order to demonstrate their knowledge (orally or in writing) or their skills (e.g., through performance). Quizzes are usually short; examinations are usually longer. Quizzes, tests, or examinations can be adapted for exceptional students and for re-teaching and retesting.
Questionnaires	Questionnaires can be used for a variety of purposes. When used as a formative assessment strategy, they provide teachers with information on student learning that they can use to plan further instruction.
Response Journals	A response journal is a student's personal record containing written, reflective responses to material he or she is reading, viewing, listening to, or discussing. The response journal can be used as an assessment tool in all subject areas.
Selected Responses	Strictly speaking a part of quizzes, tests, and examinations, selected responses require students to identify the one correct answer. The strategy can take the form of multiple-choice or true/false formats. Selected response is a commonly used formal procedure for gathering objective evidence about student learning, specifically in memory, recall, and comprehension.
Student Self-Assessments	Self-assessment is a process by which the student gathers information about, and reflects on, his or her own learning. It is the student's own assessment of personal progress in terms of knowledge, skills, processes, or attitudes. Self-assessment leads students to a greater awareness and understanding of themselves as learners.

Appendix 8: A Sample Scoring Rubric

Annotation 1
A statement (descriptors) describing the expected level of competency for each prescribed criteria

Annotation 2
Rating scales includes either numerical or descriptive labels

Annotation 3
Indicators or qualifiers ensures that the levels reflect variance in quality

Annotation 4
Shaded descriptors indicating Student's Marks for the corresponding criteria

Criteria	Achieved 3	Progressing 2	Novice 1	Scoring
Collecting Data for Electronic Stock Taking System (ESTS)	**Well** organized paper with **clarity** identifying, classifying and enumerating the different items.	Organized paper with some **clarity** identifying, classifying and enumerating the different items.	**Poorly** organized paper that lacked **clarity** identifying, classifying and enumerating the different items.	2/3
Development of ESTS	**Collaboratively organise** and categorise data of different items. Illustrate the **most likeable** way the Data can displayed in the MS Excel Application format.	Display **some collaboration** to organise and categorise data of different items. Illustrate a **likeable** way the Data can displayed in the MS Excel Application format.	Display **very little collaboration** to organise and categorise data of different items. Illustrate a way the Data can displayed in the MS Excel Application format.	1/3
Content and Formulae Functions in ESTS	Typed **accurately all the appropriate contents** for each columns and typed in the **all correct** formulae function symbols for the 'SUMrange function' and 'SUMIF function' in **all** their correct MS Excel cell references	Typed **most contents** in their **appropriate** columns and typed in **most** of the **correct** formulae function symbols for the 'SUMrange function' and 'SUMIF function' in **some** of their MS Excel cell references	Typed **very few contents** in their **appropriate** columns and typed in **very few** formulae function symbols for the 'SUMrange function' and 'SUMIF function' in **very few** of their MS Excel cell references	3/3
Presentation of ESTS	**Displayed time consciousness** with **adequate** delivery skills (posture, language), **expected** communication skills and social skill (relativity and connectivity)	**Mostly** time consciousness with **some adequate** delivery skills (posture, language), **some** expected communication skills and **some** social skill (relativity and connectivity) displayed	**Very little** time consciousness with **little adequate** delivery skills (posture, language), **little** expected communication skills and **little** social skill (relativity and connectivity) displayed	3/3
Portfolio of ESTS Developments and MS Excel ESTS – The Product	A **comprehensive** portfolio with all the Steps in planning, designing and developing the ESTS with a **complete** and **functional** MS Excel of the ESTS.	A portfolio with **most** of the Steps in planning, designing and developing the ESTS with a **complete** and **malfunctioned** MS Excel of ESTS.	A portfolio with **very few** of the Steps in planning, designing and developing the ESTS with an **incomplete** and **malfunctioned** MS Excel of ESTS.	3/3
				12/15

Appendix 9: Steps in Developing a Rubric

1. List the Main parts of the Unit Of Work for the Rubric
2. Derive the purpose of Assessing the TASK in the Topic (Benchmark)
3. List the Lesson Title and Objective of the assessment task
4. Organise how the Assessment Task would be done: Individually or in Groups
5. Derive the Performance Standard from the Benchmark
6. Describe the Minor Tasks under the Main Task Description
7. Rephrase the Minor Tasks to create the Categories
8. List Task Descriptions and Categorise them
9. Unpack the Essential KSAV to be assessed from Task Descriptions
10. Design the Rubric type and decide the point-scale rubric for the assessment task
11. Re-word the Task Descriptions including KSAVs and create the Descriptors
12. Use Appropriate Qualifiers for Descriptors for each Achievement Level

Appendix 10: Project Rubric

STEAM Project Assessment

Rubric on Role Play Ergonomics

Category	Innovative	Effective	Workable
	1	2	3
Quality/ Workmanship	Maximum effort was put forth to complete the project in a professional manner. Project demonstrates a high degree of quality and attention to detail. Workmanship is excellent.	Some effort was made to complete the project to a level that was sufficient for grading, but does not meet a professional level of quality or appearance. Workmanship is of acceptable quality.	Minimal effort was made to complete the project and the quality and workmanship is sub-par, but still meets the minimal standard.
Creativity/ Design	Project reflects many fundamental elements of design and creativity. Project demonstrates an advanced understanding of creative thinking and attention to aesthetics and presentation.	Project reflects some of the elements of design and creativity, but lacks attention to aesthetics and presentation.	Project was completed, but does not reflect the acceptable levels of design and creativity. Effort was minimal and project is mediocre at best.
Functionality	Project meets or exceeds the design requirements of purpose and functionality. All elements of the design have been met and the project does what it was designed to do.	Project meets some of the design requirements of purpose and functionality. Not all elements of the design have been met, but the project does what it was designed to do.	Project is somewhat functional, but reflects minimal effort. It is intermittent and doesn't always do what it was designed to do.
Design Process	Project reflects a clear understanding and application of design process including evidence of research, brainstorming, design and problem solving, prototyping and testing.	Project reflects some understanding and application of accepted design loop principles and sequence including evidence of research, brainstorming, design and problem solving, prototyping and testing.	Project reflects minimal understanding and application of design process.
Criteria/ Constraints	Project was completed with all constraints and criteria met or exceeded. Reflects attention to detail and quality.	Project was completed with some of the constraints and criteria met. Reflects some attention to detail, but quality is minimal.	Project was completed with a few of the constraints and criteria met. Reflects minimal effort and lacks detail or quality.
Time Management	Project completed and turned in on time. Student worked diligently when project time was available. Student was on task most of the time.	Project was completed, but had notable errors. Student utilized project time somewhat efficiently, but spent time socializing. Student was on task 70% - 80% of the time.	Project was not turned in on time and/or complete. The student was on task less than 60% of the time.

Resource Management	Always takes responsibility for use and care of all building components and resources. Always returns building components and materials to proper storage compartments.	Consistently takes responsibility for use and care of building components and resources. Somewhat consistent in returning building components to proper storage compartments.	Sometimes takes responsibility for use and care of building components and resources. Inconsistent in returning building components to proper storage compartments.
Teamwork	Notable teamwork shown with a determination to participate/ contribute to team success. Completed required individual tasks that contributed to the success of the team.	Teamwork was noted, but was sometimes off task or working on non-related tasks. Contributed to the success of the team, but could have been more engaged to complete tasks sooner.	Notable time off-task with minimal effort given for team success, or did the project alone without relying on others to do their share of the project.
Writing/ Reflection	Writing/reflection is very well organised and explained. Student includes all details in design process. Document has almost no grammatical errors.	Writing/reflection is somewhat organised and explained. Student includes most details in design process. Document has very few grammatical errors.	Writing/reflection is not organised and explained. Student in¬cludes only a few details in design process. Document has many grammatical errors.
Presentation	Presentation was well organised and presented in a logical sequence. Presentation reflects a full knowledge of the topic with clear answers and explanations to questions asked.	Presentation was fairly organised and most information presented in a logical sequence. Answers to questions were vague or lacked clarity or accuracy.	Presentation was unorganised and lacked a logical sequence. Presentation reflected little attention to detail. Answers to questions were inaccurate and confusing.

MODERATION

MODERATION ASSESSMENT IN TECHNOLOGY AND INDUSTRIAL ARTS

What is moderation as assessment?

Moderation is the process of teachers sharing, working through and agreeing to expected standards of student achievement and progress. It supports teachers to compare their own judgments to either confirm or adjust them. The process involves teacher collaboration to establish a shared understanding of what achievement of standards looks like and whether or not the student has demonstrated achievement of the standard through the evidences of performance tasks. Teachers work towards making judgments of assessments of standards that are consistent and comparable.

Moderation Purposes

"Moderation is concerned with the consistency, comparability and fairness of professional judgments about the levels demonstrated by students." (Maxwell, 2002).

Comparable judgments result from teachers understanding of the curriculum, and agreeing on benchmark assessed. The essence is that, there is common understanding of how to assess progress and achievement within and across schools.

Moderation helps teachers to make dependable, evidence-based decisions and leads to consistency. There is a need for consistency of teacher judgments:

- over time – same evidence viewed at different times or different contexts leading to same judgment by same teacher
- against standards – equivalent application across different types of evidence
- by a teacher - between his/her students
- between teachers – within the same school and different schools
- between teaching years and levels.

Making consistent, reliable and valid decisions across different points in time is important when schools report on student progress, make decisions on school targets and resourcing, or compare different grades data with past information.

All schools experience variables that challenge the consistency of practice such as staff changes, changes in student numbers or changing education demands. Consistent moderation over time can prevent this in a number of ways.

- Always applying the same standardised criteria ensures consistency over time.
- Where nationally standards criteria or exemplars are available, these become the same external reference used each year or each time.
- Moderators will change over time but the same criteria and associated references will remain and continue to guide decisions.

The benefits of moderation

The benefits of involving students in moderation

- When students are actively involved they can participate in selecting evidence (e.g. samples of their work) that best demonstrate the intended learning outcomes.
- The process of assessment develops students‘ understanding of the desired outcomes and success criteria or expected rubrics developed.
- Making judgments is closely linked to developing the skills of self and peer-assessment.
- This can lead to shared expectations of learning and understandings of standards between teachers and students.
- Greater student confidence in teacher judgments.
- Provides greater transparency of the assessment process.

The benefits of moderation for teachers

- Brings together collective wisdom, resulting in greater consistency of judgment, and focused teaching.
- Provides greater confidence in teacher judgments and assurance that judgments are consistent with other professionals.
- Leads to shared expectations of learning and understandings of levels and progression of learning.
- Develops deeper understandings about content and progressions of learning.
- Improves quality of assessment.
- Alignment of expectations and judgments with curriculum expectations or progressions, and hence improved teaching and learning.
- Assurance to parents and others that interpretations of students' progress and achievement are in line with other professionals.

Process of Moderation

Purpose, learning area and context of the moderation:
It could be moderation of a proficiency based project or design portfolios or the understanding of how to take a running record or of judgments of student achievement and progress for reporting.

Who is involved?

Who needs to be involved? Who will be the co-ordinator?
It is preferable that the leader/co-ordinator has the authority to make decisions? The timing, duration and frequency of moderation meetings: Will they be extra meetings, or part of staff or team meetings, or non-contact days? What is the attainment requirement for the moderation? School based certification?

The evidence of student learning that will be moderated:

- For a piece of writing, student writing samples will be used.
- For moderating a design portfolio, the task, text and questions the student responded to may be used, along with notes of student questions, samples of work done and annotated tasks in line with the assessment task and criteria .
- For supervision of an assessment tool: this could be a student's running record and the teacher
- For judgments of student achievement and progress for reporting to parents, a range will be required, covering both formal and informal collection of evidence.
- Developed rubrics written against national exemplar may be used as assessment tools of moderation which can be maintained and improved every year

When to use moderation in TIA

A. Moderation assessment for TIA will be project based and or evidence based assessment. This can be carried out in a year from grades 9-12. This could mean one project in one of the strands or an incorporation of

all the strands of the subject TIA in grade 12 where each school makes the decision to undertake moderation as assessment. This could be the final moderation project that will incorporate all the strands in TIA. For grades 9,10, and 11, the moderated projects can be strand based.

Sample Grade 9 Moderation

Textiles Technology

Unit 2: Textiles and Clothing

Content Standard: 1.2 Integrate and apply principles and techniques in presenting fashion ideas and illustrations in pattern making and garment construction for a variety of needs and occasions

9.1.2.1. Describe historical influences, technological progression and emerging trends as inspirational sources of design

9.1.2.2. Demonstrate an awareness of the fundamentals of the design process through various artistic versions.

9.1.2.3. Demonstrate an understanding of garment patterning techniques

9.1.2.4. Apply a broad range of contemporary and appropriate tools and techniques with competence and in the development of design projects

9.1.2.5. Apply the design process to respond to needs and opportunities in textile design projects.

9.1.2.6. Select and use appropriate technology to creatively document, communicate and present design and project work

The main moderation benchmark is BM 9.1.2.5 as it is using the design process. However the moderation project is a combination of all benchmarks in a unit. All the other benchmarks in grade 9 unit 2 will provide the essential knowledge, skills, values and attitudes for the moderated project. There will be other evidence based assessments that will be carried out in the unit as well. In essence, the moderation for TIA is a unit based project.

Sample work Textiles Technology Student Textile Project

Description of activity

Students design, produce and evaluate an assigned textile project. The textile item needs to demonstrate a clear link to the inspiration and reflect appropriate choice of fabrics and construction techniques including tools and equipment. The supporting documentation [design portfolio] should include:

- sources of inspiration
- generation of final design ideas
- samples of resources
- an appropriate care label
- experimentation and justification of equipment and construction

Context

Students have a prior knowledge in designing and constructing textile projects and have managed a range of design and production learning experiences to completion. Students can recognise that appropriate time and resource management skills will ensure the production of a quality textile item. With tan upcoming arts production and fashion

Benchmarks

A student

9.1.2.1. Describe historical influences, technological progression and emerging trends as inspirational sources of design

9.1.2.2. Demonstrate an awareness of the fundamentals of the design process through various artistic versions.

9.1.2.3. Demonstrate an understanding of garment patterning techniques

9.1.2.4. Apply a broad range of contemporary and appropriate tools and techniques with competence and in the development of design projects

9.1.2.4. Apply the design process to respond to needs and opportunities in textile design projects.

9.1.2.5. Select and use appropriate technology to creatively document, communicate and present design and project work.

[Even though these are the grade level benchmarks, the essential KSAVS are drawn up in the assessment rubrics to eventually demonstrate proficiencies as having achieved the benchmarks.]

Criteria for assessing learning

(These criteria would normally be communicated to students with the activity.) Students will be assessed on their ability to:

- produce a quality textile item with consideration to creativity, degree of difficulty, proficiency in manufacture and time management
- select and use appropriate textile equipment, techniques and materials to construct a quality textile item
- document project work and show evidence of:
  - inspiration and evaluation
  - generation of final sketch
  - collection and justification of resources
  - appropriate care label
  - Experimentation with and justification of techniques and equipment.

Assessment Rubrics

The development of assessment rubrics will cover the three focus areas.

1. Design Portfolio
2. Textile Project Construction
3. The Design Process

1. THE DESIGN PORTFOLIO

As this is an ongoing or running file of student work the assessment criteria is developed formatively. This portfolio will show all evidence of work done in the designing, planning, making and evaluating the project. The criteria are drawn from the description of assessment activity.

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
sources of inspiration	Shows precise evidence of sources of inspiration of the design selected with meticulous descriptions of design with complete evidence of the elements of design.	Shows evidence of sources of inspiration of the design selected with meticulous descriptions of design with evidence of the elements of design.	Shows minimal evidence of sources of inspiration of the design selected with careless descriptions of design with minimal evidence of the elements of design.	Shows lack of evidence of sources of inspiration of the design selected with careless descriptions of design with sloppy evidence of the elements of design.
generation of final design ideas	Shows precise evidence of final design ideas with evidences (sketches) and clear justifications.	Shows precise evidence of final design ideas with evidences (sketches) and justifications.	Shows minimal evidence of final design ideas with evidences (sketches) and minimal justifications.	Shows lack of evidence of final design ideas with sloppy evidences (sketches) and no justifications.
samples of resources	Shows sufficient samples of resources with succinct and correct explanations.	Shows samples of resources with correct explanations.	Shows minimal samples of resources with few correct explanations.	Shows lack of samples of resources with no explanations.
an appropriate care label	Shows sufficient evidence of care label appropriate to the textile project design.	Shows evidence of care label appropriate to the textile project design.	Shows minimal evidence of care label appropriate to the textile project design.	Shows lack of evidence of care label appropriate to the textile project design.
experimentation and justification of equipment and construction	Shows exceptional and deliberate evidences of every step taken to experiment and justify all decisions and the construction of the textile project in the design portfolio.	Shows deliberate evidences of every step taken to experiment and justify all decisions and the construction of the textile project in the design portfolio.	Shows minimal evidences of every step taken to experiment and justify all decisions and the construction of the textile project in the design portfolio.	Shows lack and careless evidences of every step taken to experiment and not justify all decisions and the construction of the textile project in the design portfolio.

2. THE TEXTILE PROJECT CONSTRUCTION

The construction of the Textile product will include;

1. the design of the textile design.
2. inspirations that inspired the design
3. produce a quality textile item with consideration to creativity, degree of difficulty, proficiency in manufacture and time management
4. select and use appropriate textile equipment, techniques and materials to construct a quality textile item

For this phase of the project; an analytic as well as a holistic rubric will be developed.

1. The design of the textile design.

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Relevance to the focus of project	Excellent description of item/s and individually designed patterns and technical sketches	Description of item/s and individually designed patterns and technical sketches	Poor description of item/s and individually designed patterns and technical sketches	No description of item/s and no individually designed patterns and technical sketches
Appropriate use of the elements of design	Excellent presentation as either graphic or free, and indicates mood, feel and emotion of the design and provides specific information about the design features	Presentation as either graphic or free, and indicates mood, feel and emotion of the design and provide specific information about the design features	Poor presentation as either graphic or free, and poor indications of mood, feel and emotion of the design and provides few information about the design features	No presentation as either graphic or free, and does not indicate mood, feel and emotion of the design and provides lack of information about the design features
Appropriate design including aesthetic and functional aspects	Critical analysis of the functional and aesthetic aspects of the design, considering strengths and weaknesses, with reference to the elements and principles of design	Good analysis of the functional and aesthetic aspects of the design, considering strengths and weaknesses, with reference to the elements and principles of design	Poor analysis of the functional and aesthetic aspects of the design, considering strengths and weaknesses, with reference to the elements and principles of design	No analysis of the functional and aesthetic aspects of the design, not considering strengths and weaknesses, with no reference to the elements and principles of design
Creative and innovative design	Outstanding design development reflects research, the process of creative thinking, and development of individual style.	Good development reflects the understanding of research, the process of creative thinking, and the development of individual style,	Design development reflects some attempt at research, creativity and originality but some inappropriate choices made.	Design development lacks research demonstrate little creative thinking, and no development of individual style.
Presentation and communication of design of the textile design	Excellent presentation of the development of ideas and concepts in a logical and sequential way	Presentation of the development of ideas and concepts in a logical and sequential way	Mediocre presentation of the development of ideas and concepts in less a logical and sequential way	Poor Presentation of the development of ideas and concepts in a non-logical and sequential way

2. Inspirations that inspired the design

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Relevance to the focus of project	The product solution shows excellent relevance to the focus of the task	Clear relevance evident in the focus of the product.	The product solution shows minimal relevance to the focus of the project.	The product is not relevant to the focus of the project.
Theme used as inspiration for the design	Excellent representation of inspiration evident in the design chosen.	Clear representation of inspiration evident in the design chosen.	There is minimal representation of theme evident as inspiration for the design.	No representation of inspiration evident in the design
Technological innovations	An excellent use of technology tools and practice that are used to inspire the design	Making full use of technology innovations of colour, design, texture, line and shape to inspire design.	Minimal use of technological innovations to inspire the design.	No clear use of technological innovations in the design.

3. produce a quality textile item with consideration to creativity, degree of difficulty, proficiency in manufacture and time management

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Selection of appropriate Fabrics and materials, colours and textile equipment	An exceptional selection of appropriate fabrics and materials, considering colours and the textile equipment	selection of appropriate fabrics and materials, considering colours and the textile equipment	Poor selection of appropriate fabrics and materials, not much considering colours and the textile equipment	No selection of appropriate fabrics and materials, no consideration colours and the textile equipment
Pattern Making Use of measurements and calculations to daft basic patterns and with pattern adaptations	Pattern Making Use of measurements and calculations to daft basic patterns and with pattern adaptations are excellently done.	Pattern Making Use of measurements and calculations to daft basic patterns and with pattern adaptations are done well.	Pattern Making Use of measurements and calculations to daft basic patterns and with pattern adaptations are done to minimal expectations	Pattern Making, Use of measurements and calculations to daft basic patterns and with pattern adaptations are strictly not done well.
Construction/ of textile product and the Demonstration of sewing techniques, stitches, seams, fastening, pleats and darts	Excellent construction/ of textile product with excellent Demonstration of sewing techniques, stitches, seams, fastening, pleats and darts	Good construction/ of textile product and with good demonstration of sewing techniques, stitches, seams, fastening, pleats and darts	Poor construction/ of textile product and with poor Demonstration of sewing techniques, stitches, seams, fastening, pleats and darts	Very poor construction/ of textile product and with Demonstration of sewing techniques, stitches, seams, fastening, pleats and darts
Issues of challenges overcome and management of time	Issues of challenges are greatly overcome and excellent management of time	Issues of challenges are managed to be overcome and good management of time	Issues of challenges are partially overcome and slack in the management of time	Issues of challenges not overcome and management of time is not evident.

Appropriate for wear and market	Excellently made appropriate for wear and market	Very appropriate for wear and market	acceptable and appropriate for wear and market	Not appropriate for wear and market

4. select and use appropriate textile equipment, techniques and materials to construct a quality textile item

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Selection of the appropriate textile equipment	Excellent selection of the appropriate textile equipment	Good selection of the appropriate textile equipment	Poor selection of the appropriate textile equipment	Very poor selection of the appropriate textile equipment
Correct use of textile equipment	Excellent use of textile equipment	Correct use of textile equipment	Poor use of textile equipment	Incorrect use of textile equipment
Correct techniques used in pattern layout, pinning, cutting, seam allowance, darts, joining, and finishing	Excellent and correct techniques used in pattern layout, pinning, cutting, seam allowance, darts, joining, and finishing	Good and correct techniques used in pattern layout, pinning, cutting, seam allowance, darts, joining, and finishing	Poor techniques used in pattern layout, pinning, cutting, seam allowance, darts, joining, and finishing	Incorrect techniques used in pattern layout, pinning, cutting, seam allowance, darts, joining, and finishing
Correct construction and fitting of textile product	Excellent and Correct construction and fitting of textile product	Good and correct construction and fitting of textile product	Poor construction and fitting of textile product	Incorrect construction and fitting of textile product

3. THE DESIGN PROCESS

The design process will be assessed as it is the driver of the design portfolio evolving into the textile design project.

Each stage of the design process will be assessed with their specific rubrics developed. Engineering Design Process

1. Analyse the context and background, and clearly define the problem.

Context and background

There is an arts production and fashion show that is set in contemporary Papua New Guinea. PNG has gone through significant transitions from traditional to the modern with great influences from other cultures. Textiles, clothing and fashion have seen so much change which has also taken inspirations from other cultures, historical eras, fashion trends, street fashion or iconic people in the entertainment industries and sports. There is a need for the design and construction of contemporary textiles project to be showcased during the arts production and fashion show.

Students design, produce and evaluate an assigned textile project. The textile item needs to demonstrate a clear link to the inspiration and reflect appropriate choice of fabrics and construction techniques including tools and equipment. The supporting documentation [design portfolio] should

include:

- sources of inspiration
- generation of final design ideas
- samples of resources
- an appropriate care label
- experimentation and justification of equipment and construction

The Design Process

Identify the Problem

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Analyse the context and analyse issue and the problem	Analyse the context and analyse issue and the problem with logical results, justifications and examples	Analyse the context and analyse issue and the problem with clear results and justifications	Analyse the context and analyse issue and the problem with no clear results	Do not analyse the context and analyse issue and the problem
Considerations of ideas, themes,	More considerations of ideas, themes, with examples	A lot of considerations of ideas, themes,	Few considerations of ideas, themes,	No considerations of ideas, themes,
Propose design solutions	Propose design solutions with clear and realistic expectations of results	Propose design solutions with clear expectations of results	Propose design solutions with no clear results	Do not propose design solutions
Selection of the appropriate design solution	Excellent selection of the appropriate design solution	Very good Selection of the appropriate design solution	Poor selection of the appropriate design solution	Do not select of the appropriate design solution

Do Research

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Design research questions	Excellent design of research questions	Very good design of research questions	Poor design of research questions	Do not design research questions
Conduct research	Excellent Conduct of research	Very good Conduct of research	Few research done	Do not conduct research
Evidence of research findings	Excellent Evidence of research findings	Very good Evidence of research findings	Poor evidence of research findings	No evidence of research findings
Evidence of constraints and limits identified	Excellent evidence of constraints and limits identified	Very good evidence of constraints and limits identified	Poor evidence of constraints and limits identified	No evidence of constraints and limits identified
Evidence of critical considerations of how the solution is the most appropriate	Excellent evidence of critical considerations of how the solution is the most appropriate	Very good evidence of critical considerations of how the solution is the most appropriate	Poor evidence of critical considerations of how the solution is the most appropriate	No evidence of critical considerations of how the solution is the most appropriate

Develop Possible Solutions

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Brainstorm possible design solutions to address the problem identified	Excellent and logical brainstorm of possible design solutions to address the problem identified	Logical brainstorm of possible design solutions to address the problem identified	Some brainstorm done for possible design solutions to address the problem identified	No brainstorm of possible design solutions to address the problem identified
Evidence of variations of design solution being proposed	A good collection of evidence of variations of design solution being proposed	Clear and sufficient evidence of variations of design solution being proposed	Some evidence of variations of design solution being proposed	No evidence of variations of design solution being proposed
Identify the pros and cons of a possible design solution	Clearly identify the pros and cons of a possible design solution with checklist done	Clearly identify the pros and cons of a possible design solution	Does identify the pros and cons of a possible design solution	Do not identify the pros and cons of a possible design solution

Choose One Solution

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Presentation of proposed design solutions in detail	Excellent presentation of proposed design solutions in detail	Very good presentation of proposed design solutions in detail	Poor presentation of proposed design solutions in less detail	No presentation of proposed design solutions in detail
Study of details of proposed design	Meticulous In-depth study of the details of the proposed design	Good and in-depth study of details of the proposed design	Minimal study of the details of proposed design	No study of the details of the proposed design
Considerations of constraints, cost and time in making the design solution	Clear and justified considerations of constraints, cost and time in making the design solution	Clear considerations of constraints, cost and time in making the design solution	Minimal considerations of constraints, cost and time in making the design solution	No considerations of constraints, cost
Selecting the appropriate design solution	Clear and justified selection of the appropriate design solution	Clear selection of the appropriate design solution	No clear selection of the appropriate design solution	No selection of the appropriate design solution

Design and Construct a Prototype

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Technical sketches of design product complete with measurements	All technical sketches of design product are complete with and guided explanations	All technical sketches of design product complete with measurements	Few technical sketches of design product with some measurements	No technical sketches of design product
Sketches are in 2D and 3D	All sketches are in 2D and 3D drawings and have very clear details	All sketches are in 2D and 3D drawings with clear details	Not all sketches are in 2D and 3D drawings	Sketches are not in 2D and 3D drawings
Materials are selected	Appropriate materials are selected well considering criteria for performance in making the prototype	Appropriate materials are selected well for good performance when making the prototype	Materials are selected for performance but not considering performance when making the prototype	Materials are not selected for performance in the making of the prototype
The processes in making the prototype	The processes in making the prototype are outlined and followed	The processes in making the prototype are followed	The processes in making the prototype are followed but with some stages missed.	The processes in making the prototype are not followed
Testing the prototype	Complete and successful testing of the prototype	Complete testing of the prototype	Incomplete testing of the prototype	No testing of the prototype done
Design of questions asked when the prototype is tested	Very Clear and well design of questions fortesting the prototype	Clear and direct Design of questions for testing the prototype	Few questions designed for testing the prototype	No design of questions for testing the prototype
Keeping a record of the process of testing the prototype	Excellent record kept of the process of testing the prototype	Good and clear record kept of the process of testing the prototype	Incomplete record kept of the process of testing the prototype	No record kept of the process of testing the prototype

Communicate Results

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Communicating the results of the prototype test using detailed diagrams	Very clear and detailed communication of the results of the prototype test using detailed diagrams	Clear communication of the results of the prototype test using detailed diagrams	No clear Communication of the results of the prototype test	No Communication the results of the prototype test
Use of mathematical evidence, sketches, graphs	Clear and detailed use of mathematical evidence, sketches, graphs including conclusions	Clear and detailed use of mathematical evidence, sketches, graphs	Minimal use of mathematical evidence, sketches, graphs	No use of mathematical evidence, sketches, graphs
Evidence of shared learning in analysing the results of the test	Clear evidence of shared learning in analysing the results of the test	Good evidence of shared learning in analysing the results of the test	Minimal evidence of shared learning in analysing the results of the test	No evidence of shared learning in analysing the results of the test

Evaluate and Redesign

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
Evaluate the results of the prototype test	Clear evaluation of the results of the prototype test with details shown	Clear evaluation of the results of the prototype test	No clear evaluation the results of the prototype test	No evaluation of the results of the prototype test
Considerations of what worked and what did not	Clear and confident considerations of what worked and what did not	Clear considerations of what worked and what did not	No clear considerations of what worked and what did not	No considerations of what worked and what did not
Evidence of decisions made after the prototype test, to re-modify or change the design solution	Clear and concrete evidence of decisions made after the prototype test, to re-modify or change the design solution	Very clear evidence of decisions made after the prototype test, to re-modify or change the design solution	No clear evidence of decisions made after the prototype test, to re-modify or change the design solution	No Evidence of decisions made after the prototype test, to re-modify or change the design solution

GRADING

The Grading of the Moderation Project will cover the three components.

Performance Standard/Criteria	Advanced 4	Meet Standard 3	Progressing 2	Not Yet 1
The Design Portfolio	An excellent and orderly compilation of all evidences of the project designing, making and evaluating.	An excellent compilation of all evidences of the project designing, making and evaluating.	A good compilation of evidences of the project designing, making and evaluating.	A poor compilation of evidences of the project designing, making and evaluating.
The Textile Product Construction	Completed construction of the textile product on time with controlled costs and time	Completed construction of the textile product on time	Completed construction of the textile product with no consideration for time, costs	Poorly completed construction of the textile product
The Design Process	Strictly followed the design process fulfilling all the stages.	Followed the design process fulfilling all the stages.	Followed the design process fulfilling some stages but yet incomplete	Not followed the design process and not fulfilling the stages.

CERTIFICATION

b. School based
c. Trade based accreditation in line with TVET competency and proficiency tests