

**Technology and Industrial Arts**

# **Communication Technology**

## **Senior High**

**Grade 11**

# **Teacher Guide**

**Standards-Based**



Papua New Guinea

Department of Education

**'FREE ISSUE  
NOT FOR SALE'**



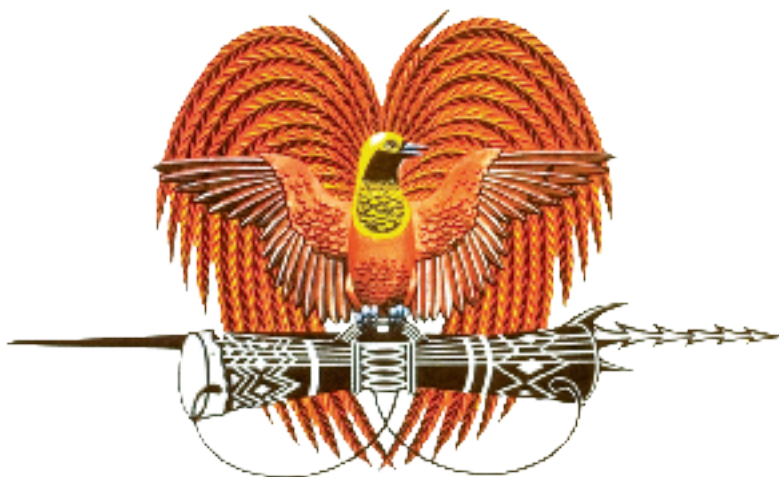
Technology and Industrial Arts

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*Papua New Guinea*

**Department of Education**

Issued free to schools by the Department of Education

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# 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                                       |
| CT    | Computer Technology                                    |
| 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 |
| TIA   | Technology and Industrial Arts                         |

# 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. Education will therefore focus on providing students with careers, higher education, and citizenship preparedness knowledge, skills, values, and attitudes that they can use to work, study and live in the 21st century.

Standards-Based Curriculum (SBC) in PNG is closely aligned to and is key to achieving this aim and its related operational goals. The curriculum is underpinned by four key pillars:

- morals, values and attitudes
- cognitive, reasoning, decision-making, problem-solving, high level, and 21st century skills
- Science, Technology, Engineering, Arts and Mathematics (STEAM), and
- core curriculum

Technology & Industrial Art is a significant curriculum framework for teaching students and enabling them to progressively develop proficiency on fundamental ideas of Food Technology, Textile Technology, Construction Technology, Communication Technology and Computer Technology. This curriculum addresses Computer Technology Strand skills and processes that enable students to visualise abstract concepts, participate in rigorous simulations, gather data via scientific probes, analyse and manipulate data, and compose initiatives. It promotes the idea of Computer Science as well as STEAM and global technology awareness.

Thus, students will be able to make informed decisions, problem – solving and management knowledge, skills, values and attitudes in Computer Technology Strand. This enables them to function effectively in the work and higher education environments as productive and useful citizens of a culturally diverse and democratic society in an interdependent world.

In Computer Technology Strand teachers are expected to effectively plan, teach, and assess these knowledge, skills, values, and attitudes. The Computer Technology Strand teacher guide describes what teachers are expected to know and do to enable all their students to effectively learn and demonstrate the expected levels of proficiency in all the grade level Computer Technology Strand knowledge, skills, values and attitudes, and attain the national content standards.

I approve and commend this Computer Technology Strand Teacher Guide to be used by Grade 11 Teachers in all High Schools throughout Papua New Guinea.

.....  
**UKE W. KOMBRA, PhD**  
 Secretary for Education

# Introduction

Computer Technology Strand 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 should be prepared to gather and understand information, analyze issues critically, learn independently or collaboratively, organize and communicate information, draw and justify conclusions, create new knowledge, and act ethically.

Students' employability will be enhanced through the study and application of STEAM principles. STEAM is an integral component of the core curriculum. All students are expected to study STEAM and use STEAM related skills to solve problems relating to both the natural and the physical environments. The aim of STEAM education is to create a STEAM literate society. It is envisioned that the study of STEAM will motivate students to pursue and take up academic programs and careers in STEAM related fields. STEAM has been embedded in the Technology & Industrial Art curriculum. Computer Technology Strand plays a major role in STEAM education as it promotes the use of computer and appropriate technology skills to use when solving problems in this digital era. Equal opportunities should be provided for all students to learn, apply and master STEAM principles and skills.

Time allocation for Technology & Industrial is 200 minutes for grade 11 to 12 in a week.

# Structure of the Teacher Guide

There are four main parts to this teacher guide. They provide essential information on what all teachers should know and do to effectively implement the Computer Technology Strand.

## 1. General Information of the Subject/Strand

The general information section of the Teacher Guide informs teachers on the Computer Technology 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 Programming
- 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 subject.

## Purpose of the Teacher Guide

This teacher guide describes what all teachers should know and do to effectively plan, teach, and assess Grade 11 Computer Technology content to enable all students to attain the required learning and proficiency standards. The overarching purpose of this teacher guide is to help teachers to effectively plan, teach, assess, evaluate, report and monitor students' learning and mastery of national and grade-level expectations. That is, the essential knowledge, skills, values and attitude described in the content standards and grade-level benchmarks, and their achievement of the national and grade-level proficiency standards.

Ample information with thorough guidelines is provided for the teacher to use to achieve the essential KSAV embedded in the set national content standards and grade level benchmarks.

Thus, the teacher is expected to:

- understand the significance of aligning all the elements of Standards-Based Curriculum (SBC) as the basis for achieving the expected level of education quality;
- effectively align all the components of SBC when planning, teaching, and assessing students' learning and levels of proficiency;
- effectively translate and align the Technology and Industrial Arts syllabi and Computer Technology teacher guide to plan, teach and assess different Computer Technology units and topics, and the KSVAs described in the grade-level benchmarks;
- understand the Computer Technology national content standards, grade-level benchmarks, and evidence outcomes;
- effectively make sense of the content (KSVAs) described in the Computer Technology 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 Computer Technology skills, processes, concepts, ideas, principles, practices, values and attitudes.
- confidently interpret, translate and use Computer Technology content standards and benchmarks to determine the learning objectives and performance standards, and plan appropriately to enable all students to achieve these standards;
- embed the core curriculum in their Computer Technology lesson planning, instruction, and assessment to permit all students to learn and master the core KSVAs required of all students;

- provide opportunities for all students to 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 (man-made) worlds 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, sustaining values), and attitudes in lesson planning, instruction and assessment;
- meaningfully connect what students learn in Computer Technology with what is learnt in other subjects to add value and enhance students' learning so that 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 students' status of progress towards meeting grade-level and nationally expected proficiency standards, and 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 and performance.

# How to the Use the Teacher Guide

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. The different components of the teacher guide are closely aligned with SBC principles and practice, and all the other components of PNG SBC. 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, alignment of PNG SBC components, alignment of the syllabus and teacher guide, setting of content standards and grade-level benchmarks, core curriculum, STEAM, curriculum integration, essential knowledge, skills, values and attitudes, strands, units and topics, learning objectives, SBC lesson planning, and SBC assessment. 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 11 Computer Technology Strand Curriculum. Based on this understanding, teachers should be able to effectively use the teacher guide to do the following:

## ***Determine Learning Objectives and Lesson Topics***

Topics and learning objectives have been identified and described in the Teacher Guide. Lesson objectives are derived from topics that are extracted from the grade-level benchmarks. Lesson topics are deduced from the learning objectives. Teachers should familiarise themselves with this process as it is essential for lesson planning, instruction and assessment. However, depending on the context and students' learning abilities, teachers would be required to determine additional learning objectives and lesson topics. Teachers should use the examples provided in this teacher guide to formulate additional learning objectives and lesson topics to meet the educational or learning needs of their students.

## ***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 spiraling sequence principles. This sequencing of content will enable students to progressively learn the essential knowledge, skills, values and attitudes as they progress further into their schooling. What students learn in previous grades is reinforced and deepens in scope with an increase in the level of complexity and difficulty in the content and learning activities. It is important to understand how the content is organised so that grade appropriate content and learning activities can be selected, if not already embedded in the benchmarks and learning objectives, to not only help students learn and master the content, but ensure that what is taught is rigorous, challenging, and comparable.

## ***Integrate the Core Curriculum in Lesson Planning, Instruction and Assessment***

Teachers should use this teacher guide to help them integrate the core curriculum – values, cognitive and high level skills, 21st century skills, STEAM principles and skills, and reading, writing, and communication skills in their lesson planning,

instruction and assessment. All students in all subjects are required to learn and master these skills progressively through the education system.

*Integrate Cognitive, High Level, and 21st Century Skills in Lesson Planning, Instruction and Assessment*

Teachers should integrate the cognitive, high level and 21st century skills in their annual teaching programs, and give prominence to these skills in their lesson preparation, teaching and learning activities, performance assessment, and performance standards for measuring students' proficiency on these skills. Computer Technology addresses the Technology skills processes of geography, civic and cultural literacy, historical and economical literacy and global awareness. Thus, students will be able to make informed decisions, problem – solving and management knowledge, skills, values and attitudes in Computer Technology. This enables them to function effectively in the work and higher education environments as productive and useful citizens of a culturally diverse and democratic society in an interdependent world.

In addition, it envisaged all students attaining expected proficiency levels in these skills and will be ready to pursue careers and higher education academic programs that demand these skills, and use them in their everyday life after they leave school at the end of Grade 12. Teachers should use the teacher guide to help them to effectively embed these skills, particularly in their lesson planning and in the teaching and learning activities as well as in the assessment of students' application of the skills.

*Integrate Technology values and attitudes in Lesson Planning, Instruction and Assessment*

In Computer Technology subject, students are expected to learn, promote and use work, relationship, peace, health, social, personal, family, community, national and global values in the work and study environments as well as in their conduct as community, national and global citizens. Teachers should draw from the information and suggestions provided in the syllabus and teacher guide to integrate values and attitudes in their lesson planning, instruction, and assessment. They should report on students' progression towards internalising different values and attitudes and provide additional support to students who are yet to reach the internalisation stage to make positive progress towards this level.

*Integrate Science, Technology, Engineering, Arts and Mathematics (STEAM) Principles and Skills in Lesson Planning, Instruction and Assessment*

Teachers should draw from both the syllabus and teacher guide in order to help them integrate STEAM principles and skills, and methodologies in their lesson planning, instruction and assessment. STEAM teaching and learning happens both inside and outside of the classroom. Effective STEAM teaching and learning requires both the teacher and the student to participate as core investigators and learners, and to work in partnership and collaboration with relevant stakeholders to achieve maximum results. Teachers should use the syllabus, teacher guides and other resources to guide them to plan and implement this and other innovative and creative approaches to STEAM teaching and learning to make STEAM principles and skills learning fun and enjoyable and, at the same time, attain the intended quality of learning outcomes.

Identify and Use Grade and Context Appropriate, Innovative, Differentiated and Cre-

### Active Teaching and Learning Methodologies

SBC is an eclectic curriculum model. It is an amalgam of strengths of different curriculum types, including behavioural objectives, outcomes, and competency. Its emphasis is on students attaining clearly defined, measurable, observable and attainable learning standards, i.e., the expected level of education quality. Proficiency (competency) standards are expressed as performance standards/criteria and evidence outcomes, that is, what all students are expected to know (content) and do (application of content in real life or related situations) to indicate that they are meeting, have met or exceeded the learning standards. The selection of grade and contextually appropriate teaching and learning methodologies is critical to enabling all students to achieve the expected standard or quality of education. Teaching and learning methodologies must be aligned to the content, learning objective, and performance standard in order for the teacher to effectively teach and guide students towards meeting the performance standard for the lesson. They should be equitable and socially inclusive, differentiate, student-centred, and lifelong. They should enable STEAM principles and skills to 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 Standards-Based Lessons

SBC lesson planning is quite difficult to do. However, this will be easier with more practice and experience over time. Effective SBC lesson plans must meet the required standards or criteria so that the learning objectives and performance standards are closely aligned to attain the expected learning outcomes. Teachers should use the guidelines and standards for SBC lesson planning and examples of SBC lesson plans provided in the teacher guide to plan their lessons. When planning lessons, it is important for teachers to ensure that all SBC lesson planning standards or criteria are met. If standards are not met, instruction will not lead to the attainment of intended performance and proficiency standards. Therefore, students will not attain the national content standards and grade-level benchmarks.

### Use Standards-Based Assessment

Standards-Based Assessment has a number of components. These components are intertwined and serve to measure evaluate, report, and monitor students' achievement of the national and grade-level expectations, i.e., the essential knowledge, skills, values and attitudes they are expected to master and demonstrate proficiency on. Teachers should use the information and examples on standards-based assessment to plan, assess, record, evaluate, report and monitor students' performance in relation to the learning standards.

### Make informed Judgments About Students' Learning and Progress Towards Meeting Learning Standards

Teachers should use the teacher guide to effectively evaluate students' performance and use the evidence to help students to continuously improve their learning as well as their classroom practice.

It is important that teachers evaluate the performance of students in relation to the performance standards and progressively the grade-level benchmarks and content standards to make informed judgments and decisions about the quality of their

work and their progress towards meeting the content standards or components of the standards. Evaluation should not focus on only one aspect of students' performance. It should aim to provide a complete picture of each student's performance. The context, inputs, processes, including teaching and learning

processes, and the outcomes should be evaluated to make an informed judgment about each student's performance. Teachers should identify the causal factors for poor performance, gaps in students learning, gaps in teaching, teaching and learning resource constraints, and general attitude towards learning. Evidence-based decisions can then be made regarding the interventions for closing the gaps to allow students to make the required progress towards meeting grade-level and national expectations.

### Prepare Students' Performance Reports

Reporting of students' performance and progress towards the attainment of learning standards is an essential part of SBC assessment. Results of students' performance should be communicated to particularly the students and their parents to keep them informed of students' academic achievements and learning challenges as well as what needs to be done to enable the students' make positive progress towards meeting the proficiency standards and achieve the desired level of education quality. Teachers should use the information on the reporting of students' assessment results and the templates provided to report the results of students' learning.

### Monitor Students' Progress Towards Meeting the National Content Standards and Grade-Level Benchmarks

Monitoring of student's progress towards the attainment of learning standards is an essential component of standards-based assessment. It is an evidence-based process that involves the use of data from students' performance assessments to make informed judgments about students' learning and proficiency on the learning standards or their components, identify gaps in students' learning and the causal factors, set clear learning improvement targets, and develop effective evidence-based strategies (including preplanning and re-teaching of topics), set clear timeframes, and identify measures for measuring students' progress towards achieving the learning targets.

Teachers should use the teacher guide to help them use data from students' performance assessments to identify individual students' learning weaknesses and develop interventions, in collaboration with each student and his/her parents or guardians, to address the weaknesses and monitor their progress towards meeting the agreed learning goals.

### Develop additional Benchmarks

Teachers can develop additional benchmarks using the examples in the teacher guide to meet

the learning needs of their students and local communities. However, these benchmarks will not be nationally assessed as these are not comparable. They are not allowed to set their own content standards or manipulate the existing ones. The setting of national content standards is done at the national level to ensure that required learning standards are maintained and monitored to sustain the required level of education quality.

### Avoid Standardisation

The implementation of Computer Technology curriculum must not be standardised. SBC does not mean that the content, lesson objectives, teaching and learning strategies, and assessment are standardised. This is a misconception and any attempt to standardise the components of curriculum without due consideration of the teaching and learning contexts, children's backgrounds and experiences, and different abilities and learning styles of children will be counterproductive. It will hinder students from achieving the expected proficiency standards and hence, high academic standards and the desired level of education quality. That is, they should not be applied across all contexts and with all students, without considering the educational needs and the characteristics of each context. Teachers must use innovative, creative, culturally relevant, and differentiated teaching and learning approaches to teach the curriculum and enable their students to achieve the national content standards and grade-level benchmarks. And enable all students to experience success in learning the curriculum and achieve high academic standards.

What is provided in the syllabus and teacher guide are not fixed and can be changed. Teachers should use the information and examples provided in the syllabus and the teacher guide to guide them to develop, select, and use grade, context, and learner appropriate content, learning objectives, teaching and learning strategies, and performance assessment and standards. SBC is evidence-based hence decisions about the content, learning outcomes, teaching and learning strategies, students' performance, and learning interventions should be based on evidence.

# Syllabus and Teacher Guide Alignment

The Grade 11 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                                                                                                                                                                                                                                                                                                                                                                              | Teacher Guide                                                                                                                                                                                                                                                                                                                                          |
| Outlines the ultimate aim and goals, and what to teach and why teach it                                                                                                                                                                                                                                                                                                               | Describes how to plan, teach, and assess students' performance                                                                                                                                                                                                                                                                                         |
| <ul style="list-style-type: none"> <li>• Overarching and SBC principles</li> <li>• Content overview</li> <li>• Core curriculum</li> <li>• Essential knowledge, skills, values and attitudes</li> <li>• Strands and units</li> <li>• Evidence outcomes</li> <li>• Content standards and grade-level benchmarks</li> <li>• Overview of assessment, evaluation, and Reporting</li> </ul> | <ul style="list-style-type: none"> <li>• Determine topics for lesson planning, instruction and assessment</li> <li>• Formulate learning objectives</li> <li>• Plan SBC lesson plans</li> <li>• Select teaching and learning strategies</li> <li>• Implement SBC assessment and evaluation</li> <li>• Implement SBC reporting and monitoring</li> </ul> |

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 11 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 perfor-

mance 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.

### 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.

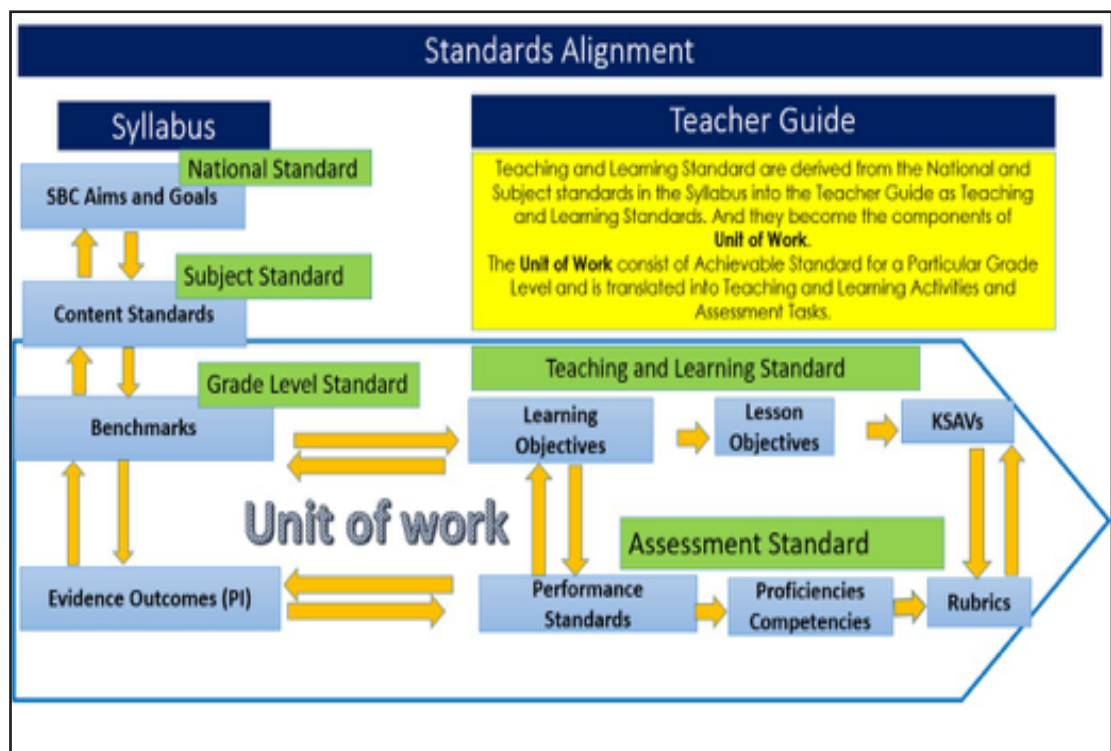


Figure 3 Standards Alignment that shows the alignment of standards in the syllabus and teacher guide

# Learning and Performance Standards

## What Teachers Should Know:

Standards-Based Education (SBE) and SBE are underpinned by the notion of quality. Standards define the expected level of education quality that all students should achieve at a particular point in their schooling. Students' 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 or competency. When they are judged to have attained proficiency on a content standard or benchmark or components of these standards, they are then deemed to have met the standard(s) that is, achieved the intended level of education quality.

Content standards, benchmarks, and learning objectives are called learning standards while performance and proficiency standards (evidence outcomes) can be categorised 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 lesson planning, instruction and assessment

## 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 contextualised 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 by anyone except the National Subject-Based Standards Councils.

## 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.

### Approach for Setting National Content Standards and Grade-Level Benchmarks

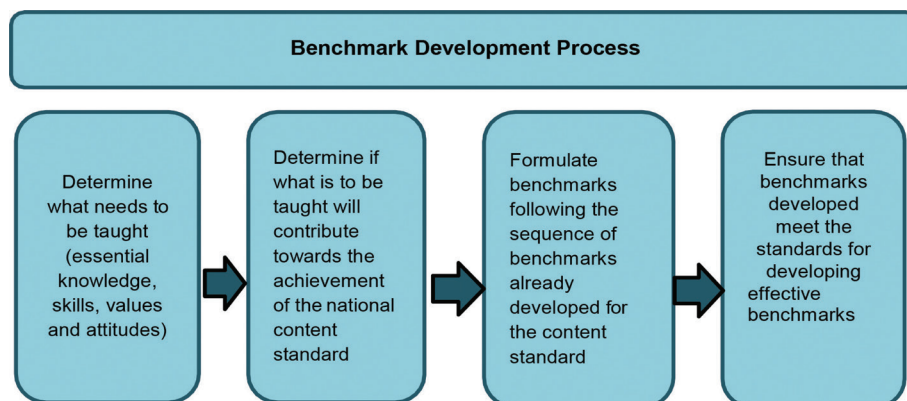


### What Teachers Should Do:

#### 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



### 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 parts of a computer.

### 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” or “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.

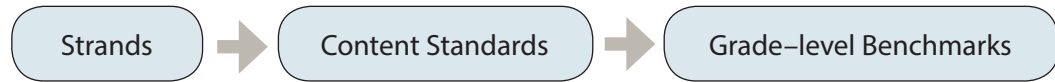
#### Performance standards

- 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.

Approach for Setting National Content Standards and Grade-Level Benchmarks



# Core Curriculum

## What Teachers Should Know:

A core set of common learnings (knowledge, skills, values, and attitudes) are integrated into the content standards and grade-level benchmarks for all subjects. This is to equip all students with the most essential and in-demand knowledge, skills, and dispositions they will need to be successful in modern/postmodern work places, higher-education programs and to be productive, responsible, considerate, and harmonious citizens. Common set of learnings are spirally sequenced from Preparatory - Grade 9 to deepen the scope and increase the level of difficulty in the learning activities so that what is learned is reinforced at different grade levels.

### The core curriculum includes

- cognitive (thinking) skills (Refer to the syllabus for a list of these skills);
- reasoning, decision-making and problem-solving skills
- high level thinking skills (analysis, synthesis and evaluation skills);
- 21st century skills (Refer to illustrative list in the Appendix);
- reading, writing and communication skills;
- STEAM principles and skills;
- essential values and attitudes (Core personal and social values, and sustaining values), and
- spiritual values and virtues

The 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.

All teachers are expected to include the core learnings in their lesson planning, teaching, and assessment of students in all their lessons. They are expected to foster, promote and model the essential values and attitudes as well as the spiritual values and virtues in their conduct, practice, appearance, and their relationships and in their professional and personal lives. In addition, teachers are expected to mentor, mould and shape each student to evolve and possess the qualities envisioned by society.

Core values and attitudes must not be taught in the classroom only; they must also be demonstrated by students in real life or related situations inside and outside of the classroom, at home, and in everyday life. Likewise, they must be promoted, fostered and modeled by the school community and its stakeholders, especially parents. A whole of school approach to values and attitudes teaching, promoting and modeling is critical to students and the whole school community internalising the core values and attitudes and making them habitual in their work and school place, and in everyday life. Be it work values, relationship values, peace values, health values, personal and social values, or religious values, teachers should give equal prominence to all common learnings in their lesson planning, teaching, assessment, and learning interventions.

Common learnings must be at the heart of all teaching and extracurricular programs and activities.

## Science, Technology, Engineering, Arts and Mathematics (STEAM)

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 environmental contexts and identifying and solving authentic (real life) natural and physical environment problems by integrating STEAM-based principles, cognitive, high level and 21st century skills and processes, and values and attitudes.

Computer Technology is focused on both goals of STEAM rather than just the goal of problem-solving. This is to ensure that all students are provided opportunities to learn, 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:

- examine and use evidence to draw conclusions about how STEAM has and continues to change the social, political, economic, cultural and environmental contexts.
- Investigate and draw conclusions on the impact of STEAM solutions to problems on the social, political, economic, cultural and environmental contexts.
- Identify and solve problems using STEAM principles, skills, concepts, ideas and process.
- Identify, analyse and select the best solution to address a problem.
- build prototypes or models of solutions to problems.
- replicate a problem solution by building models and explaining how the problem was or could be solved.
- test and reflect on the best solution chosen to solve a problem.
- collaborate with others on a problem and provide a report on the process of problem solving used to solve the problem.
- use skills and processes learnt from lessons to work on and complete STEAM projects.
- demonstrate STEAM principles, skills, processes, concepts and ideas through simulation and modeling.
- explain the significance of values and attitudes in problem-solving.

## Content Overview:

STEAM is a multidisciplinary and integrated approach to understanding how science, technology, engineering, arts and mathematics shape and are shaped by our material, intellectual, cultural, economic, social, political and environmental contexts. And for teaching students the essential in demand cognitive, high level and 21st century skills, values and attitudes, and empower them to effectively use these skills and predispositions to identify and solve problems relating to the natural and physical environments as well as the impact of STEAM-based solutions on human existence and livelihoods, and on the social, political, economic, cultural, and environmental systems.

STEAM disciplines have and continue to shape the way we perceive knowledge and reality, think and act, our values, attitudes, and behaviours, and the way we relate to each other and the environment. Most of the things we enjoy and consume are developed using STEAM principles, skills, process, concepts and ideas. Things humans used and enjoyed in the past and at present are developed by scientists, technologists, engineers, artists and mathematicians to address particular human needs and wants. Overtime, more needs were identified and more products were developed to meet the ever changing and evolving human needs. What is produced and used is continuously reflected upon, evaluated, redesigned, and improved to make it more advanced, multipurpose, fit for purpose, and targeted towards not only improving the prevailing social, political, economic, cultural and environmental conditions but also to effectively respond to the evolving and changing dynamics of human needs and wants. And, at the same time, solutions to human problems and needs are being investigated and designed to address problems that are yet to be addressed and concurred. This is an evolving and ongoing problem-solving process that integrates cognitive, high level, and 21st century skills, and appropriate values and attitudes.

STEAM is a significant framework and focal point for teaching and guiding students to learn, master and use a broad range of skills and processes required to meet the skills demands of PNG and the 21st century. The skills that students will learn will reflect the demands that will be placed upon them in a complex, competitive, knowledge-based, information-age, technology-driven economy and society. These skills include cognitive (critical, synthetic, creative, reasoning, decision-making, and problem-solving) skills, high level (analysis, synthesis and evaluation) skills and 21st century skills (see Appendix 4). Knowledge-based, information, and technology driven economies require knowledge workers not technicians. Knowledge workers are lifelong learners, are problem solvers, innovators, creators, critical and creative thinkers, reflective practitioners, researchers (knowledge producers rather than knowledge consumers), solutions seekers, outcomes oriented, evidence-based decision makers, and enablers of improved and better outcomes for all.

STEAM focuses on the skills and processes of problem solving. These skills and processes are at the heart of the STEAM movement and approach to not only problem solving and providing evidence-based solutions but also the development and use of other essential cognitive, high level and 21st century skills. These skills are intertwined and used simultaneously to gain a broader understanding of the problems to enable creative, innovative, contextually relevant, and best solutions to be developed and implemented to solve the problems and attain the desired outcomes. It is assumed that by teaching students STEAM-based problem-solving skills and providing learning opportunities inside and outside the classroom will motivate more of them to pursue careers and academic programs in STEAM related fields thus, closing the skills gaps and providing a pool of cadre of workers required by technology, engineering, science, and mathematics-oriented industries.

Although, STEAM focuses on the development and application of skills in authentic (real life) contexts, for example the use of problem-solving skills to identify and solve problems relating to the natural and physical worlds, it does not take into account the significant influence values and attitudes have on the entire process of problem solving. Values and attitudes are intertwined with knowledge and skills. Knowledge, skills, values and attitudes are inseparable. Decisions about skills and processes of skills development and application are influenced by values and attitudes (mindset) that people hold. In the same light, the use of STEAM principles, processes and skills to solve problems in order to achieve the outcomes envisaged by society are influenced by values and the mindset of those who have identified and investigated the problem as well as those who are affected by the problem and will benefit from the outcome.

### **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 problem-solving methods and approaches, they share some of the steps of problem-solving. For example:

- identifying the problem;
- understanding the problem by collecting data;
- analyse and interpret the data;
- draw conclusions;
- use data to consider possible solutions;
- select the best solution;
- test the effectiveness of the solution by trialling and evaluating it, and
- review and improve the solution.

STEAM problem solving processes go from simple and technical to advance 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.

The following are some of the STEAM problem solving processes.

#### **1. Engineering and Technology Problem Solving Methods and Approaches**

Engineering and technology problem-solving methods are used to identify and solve problems relating to the physical world using the design process. The following are some of the methods and approaches used to solve engineering and technology related problems.

#### **2. Parts Substitution**

It is the most basic of the problem-solving methods. It simply requires the parts to be substituted until the problem is solved.

## 3. Diagnostics

After identifying a problem, the technician would run tests to pinpoint the fault. The test results would be used either as a guide for further testing or for replacement of a part, which also need to be tested. This process continues until the solution is found and the device is operating properly.

## 4. Troubleshooting

Troubleshooting is a form of problem solving, often applied to repair failed products or processes.

## 5. Reverse Engineering

Reverse engineering is the process of discovering the technological principles underlying the design of a device by taking the device apart, or carefully tracing its workings or its circuitry. It is useful when students are attempting to build something for which they have no formal drawings or schematics.

## 6. Divide and Conquer

Divide and conquer is the technique of breaking down a problem into sub-problems, then breaking the sub-problems down even further until each of them is simple enough to be solved. Divide and conquer may be applied to all groups of students to tackle sub-problems of a larger problem, or when a problem is so large that its solution cannot be visualised without breaking it down into smaller components.

## 7. Extreme Cases

Considering “extreme cases” – envisioning the problem in a greatly exaggerated or greatly simplified form, or testing using extreme condition – can often help to pinpoint a problem. An example of the extreme-case method is purposely inputting an extremely high number to test a computer program.

## 8. Trial and Error

The trial and error method involve trying different approaches until a solution is found. It is often used as a last resort when other methods have been exhausted.

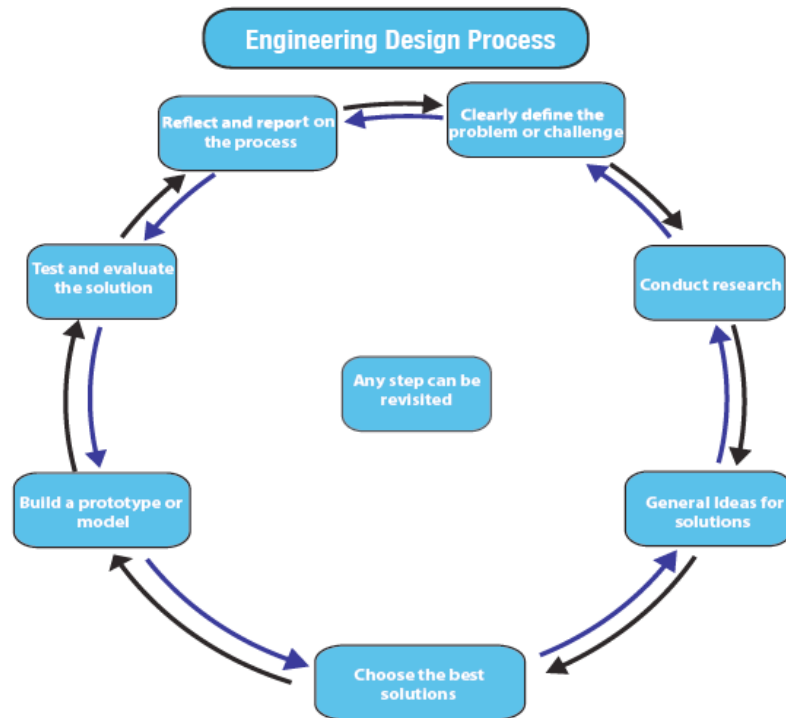
**Engineering Design Process**

Technological fields use the engineering design process to identify and define the problem or challenge, investigate the problem, collect and analyse data, and use the data to formulate potential solutions to the problem, analyse each of the solutions in terms of its strengths and weaknesses, and 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 a sequence of steps such as the following:

- Analyse 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

sketch ing.

- 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.



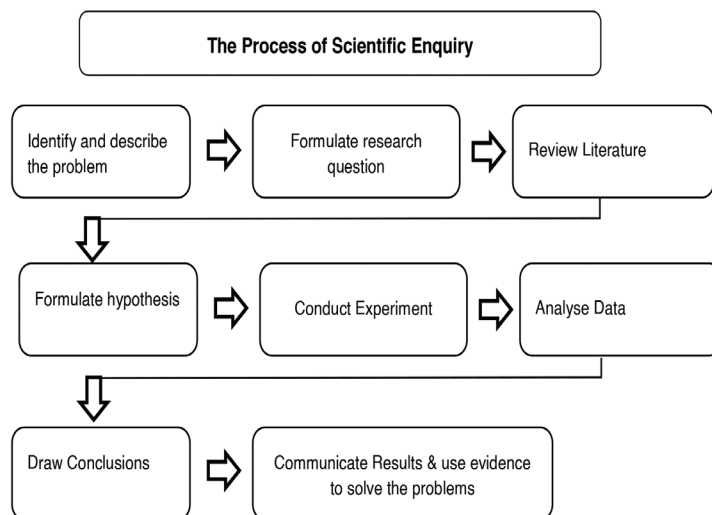
### The Scientific Method and Approach to Problem-Solving

Science uses predominantly the quantitative-scientific inquiry process to investigate, understand, and make informed decisions about problems relating to the natural world. The steps in the process vary, depending on the purpose of the inquiry and the types of questions asked.

There are six basic science process skills:

- Observation
- Communication
- Classification
- Measurement
- Inference
- Prediction

These processes are at the heart of the scientific inquiry and problem-solving process.



The steps above should be taught and demonstrated by students separately and jointly before they implement the inquiry process. 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. A brief explanation and examples of each step are provided below to help teachers plan and teach each step. Students 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.

### Step 1: Identify and describe the problem

Problems are identified mainly from observations and the use of the five senses – smell, sight, sound, touch and taste. Students should be guided and provided opportunities to identify natural and physical environment problems using their five senses and describe what the problem is and its likely causes.

#### Example: Observation

When I turn on a flashlight using the on/off switch, light comes out of one end.

### Step 2: Formulate research question

After the problem is identified and described, the question to be answered is then formulated. This question will guide the scientist in conducting research and experiments.

#### Example: Question

What makes light come out of a flash light when I turn it on?

### Step 3: Review literature

It is more likely that the research problem and question have already been investigated and reported by someone. Therefore, after asking the question, the scientist spends some time reading and reviewing papers and books on past research and discussions to learn more about the problem and the question asked to prepare her for his own research. Conducting literature review helps the scientist to better understand his/her research problem, refine the research question and decide on experi-

ment/research approach before the experiment is conducted.

Example: Literature review

The scientist may look in the flashlight's instruction manual for tips or conduct online search on how flashlights work using the manufacturer's or relevant websites. Scientist may even analyse information and past experiments or discoveries regarding the relationship between energy and light.

#### Step 4: Formulate hypothesis

With a question in mind, the researcher decides on what he/she wants to test (The question may have changed as a result of the literature review). The research will clearly state what he/she wants to find out by carrying out the experiment. He/She will make an educated guess that could answer the question or explain the problem. This statement is called a hypothesis. A hypothesis guides the experiment and must be testable.

Example: Hypothesis

The batteries inside a flashlight give it energy to produce light when the flashlight is turned on.

#### Step 5: Conduct experiment

This step involves the design and conduct of experiment to test the hypothesis. Remember, a hypothesis is only an educated guess (a possible explanation), so it cannot be considered valid until an experiment verifies that it is valid.

Example: Experimental Procedure

Remove the batteries from the flashlight, and try to turn it on using the on/off switch.

Result: The flashlight does not produce light

Reinsert the batteries into the flashlight, and try to turn it on using the on/off switch.

Result: The flashlight does produce light.

Write down these results

In general, it is important to design an experiment to measure only one thing at a time. This way, the researcher knows that his/her results are directly related to the one thing he/she changed. If the experiment is not designed carefully, results may be confusing and will not tell the researcher anything about his/her hypothesis. Researchers collect data while carrying out their experiments. Data are pieces of information collected before, during, or after an experiment. To collect data, researchers read the measuring instruments carefully. Researchers record their data in notebooks, journals, or on a computer.

#### Step 6: Analyse data

Once the experiment is completed, the data is then analysed to determine the results. In addition, performing the experiment multiple times can be helpful in determining the credibility of the data.

Example: Analysis

Record the results of the experiment in a table.  
Review the results that have been written down.

#### Step 7: Draw conclusions

If the hypothesis was testable and the experiment provided clear data, scientist can make a statement telling whether or not the hypothesis was correct. This statement is known as a conclusion. Conclusions must always be backed up by data. Therefore, scientists rely heavily on data so they can make an accurate conclusion.

If the data support the hypothesis, then the hypothesis is considered correct or valid. If the data do not support the hypothesis, the hypothesis is considered incorrect or invalid.

#### Example: Valid Hypothesis

The flashlight did not produce light without batteries. The flashlight did produce light when batteries were inserted. Therefore, the hypothesis that batteries give the flashlight energy to produce light is valid, given that no changes are made to the flashlight during the experiment.

#### Example: Invalid Hypothesis

The flashlight did NOT produce light when the batteries were inserted. Therefore, the hypothesis that batteries give the flashlight energy to produce light is invalid. In this case, the hypothesis would have to be modified to say something like, "The batteries inside a flashlight give it energy to produce light when the batteries are in the correct order and when the flashlight is turned on." Then, another experiment would be conducted to test the new hypothesis.

An invalid hypothesis is not a bad thing! Scientists learn something from both valid and invalid hypotheses. If a hypothesis is invalid, it must be rejected or modified. This gives scientists an opportunity to look at the initial observation in a new way.

They may start over with a new hypothesis and conduct a new experiment. Doing so is simply the process of scientific inquiry and learning.

#### Step 8: Communicate findings

Scientists generally tell others what they have learned. Communication is a very important component of scientific progress and problem solving. It gives other people a chance to learn more and improve their own thinking and experiments. Many scientists' greatest breakthroughs would not have been possible without published communication or results from previous experimentation.

Every experiment yields new findings and conclusions. By documenting both the successes and failures of scientific inquiry in journals, speeches, or other documents, scientists are contributing information that will serve as a basis for future research and for solving problems relating to both the natural and physical worlds. Therefore, communication of investigative findings is an important step in future scientific discovery and in solving social, political, economic, cultural, and environmental problems.

#### Example: Communication of findings

Write your findings in a report or an article and share it with others, or present your findings to a group of people. Your work may guide someone else's research on creating alternative energy sources to generate light, additional uses for battery power, etc.

### Artistic Design

Artistic Design is the process of beautifying a product. The design process begins with identifying a precise problem and ends with an evaluation. The design process usually consists of a series of steps that designers, engineers, architects or scientists follow to produce a solution to a specific problem. The scope of solutions they come up with are required to meet the criteria specified in the definition of the problem or perform a specific task.

### 7 steps of the design process

The design process begins by asking a few questions regarding the main point you're trying to solve. This is crucial to defining the specific need in order to come up with a viable solution. The general steps of a design process should resemble the ones below, customized to your project:

#### Define the problem

Identify what the need is and why you should solve it.

#### Conduct research

Research on similar projects and take note of the weak points and positive outcomes. Develop research questions to guide you.

#### Brainstorming and conceptualization

Once you have defined the basis for your project and its specification ideas will begin to form. Brainstorm and compare ideas to decide on the best features for your product.

#### Create a prototype

Testing your ideas means creating a prototype that simulates the finished product. Your outline will begin to take shape and throughout your prototype process you will likely to discover new areas for improvements as well as validating your experience.

#### Build and market your product

This phase requires you to consider all the feedback you gathered from your feedback from the prototype testing to build the final product.

#### Product analysis

When a product is bought, used and reviewed. Feedbacks can be used to develop the next version of the product.

#### Troubleshooting

Problems encountered during marketing, design or functionality are opportunities for improvement and growth to maximise future market of the product.

The equipping and enabling of students to become proficient in a broad range of

STEAM skills, processes and predispositions can also lead to the attainment of many other societal goals, including national and global development goals and aspirations. These goals include:

sustainability goals;

peaceful related goals;

work related goals;

academic goals;

relationship goals;

health goals;

adoption and internalisation of values and attitudes accepted by society, and improved social, political, economic outcomes.

Even though the original purpose and the drive of STEAM was to develop a pathway to engage students in learning about, experiencing, and applying STEAM skills in real life situations to motivate and hopefully get them to pursue careers in STEAM related fields and undertake STEAM related higher education programs to meet the demand for STEAM workers, STEAM education can also be used to teach and engage students in study more broadly the impact of STEAM on the social, economic, political, intellectual, cultural and environmental contexts. This line of inquiry is more enriching, exciting, empowering and transformative.

## What Teachers Should Do

### STEAM-Based Lesson planning

Effective STEAM lesson planning is key to the achievement of expected STEAM 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 STEAM-based lesson plan is provided in appendix. 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

Knowing how to integrate STEAM problem-solving skills, principles, values and attitudes as well as STEAM teaching, learning, and assessment strategies into standards-based lesson plans is essential for achieving the desired STEAM learning outcomes. When integrating STEAM problem-solving skills into the standards-based lesson plans, teachers should ensure that these skills are not only effectively aligned to the learning objective and performance standards, they must also be effectively taught and assessed.

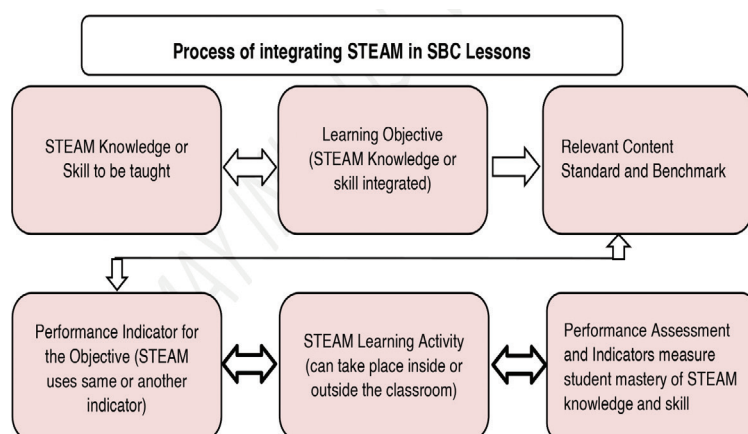
STEAM principles and problem-solving skills are integrated into the content standards and grade-level benchmarks. A list of these skills, including 21st century skills, is provided in the

grade 9 syllabus. Teachers should ensure that these skills are integrated in their standards-based lesson plans, taught and assessed to determine students' level of proficiency on each skill or specific components of the skill. Teachers should use the follow-

ing process as guide to integrate STEAM principles and problem-solving skills into the standards-based lesson plans.

Teachers are expected to integrate the essential STEAM principles, processes, skills, values and attitudes described in the grade 9 benchmarks when formulating their standards-based lesson plans. Opportunities should be provided inside and outside of the classroom for students to learn, explore, model and apply what they learn in real life or related situations. These learning experiences will enable students to develop a deeper understanding of STEAM principles, processes, skills, values and attitudes and appreciate their application in real life to solve problems.

### 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.

**Step 1:** Identify the STEAM knowledge or skill to be taught (From the table of KSVAs for each content standard and benchmark). This is could already be 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 the STEAM knowledge or skill specified by the learning objective and appropriate statement of the standards). Activity can take place inside or outside of the classroom, and during or after school hours.

**Step 4:** Develop and use performance descriptors (standards or indicators) to analyse students' STEAM related behaviours and 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 Teaching Strategies

STEAM education takes place in both formal and informal classroom settings. It takes place during and after school hours. It is a continuous process of inquiry, data analysis,

making decisions about interventions, and implementing and monitoring interventions for improvements.

There are a variety of STEAM teaching strategies. However, teaching strategies selected must enable teachers to guide students to use the engineering and artistic design processes to identify and solve natural and physical environment problems by designing prototypes and testing and refining them to effectively mitigate the problems identified. The following are some of the strategies that could be used to utilize the STEAM approach to solve problems and coming up with technological solutions.

Inquiry-Based Learning

Problem-Based Learning

Project-based learning

Collaborative Learning

Collaborative learning involves individuals from different STEAM disciplines and expertise in a variety of STEAM problem solving approaches working together and sharing their expertise and experiences to inquire into and solve a problem.

Teachers should plan to provide students opportunities to work in collaboration and partnership with experts and practitioners engaged in STEAM related careers or disciplines to learn first-hand about how STEAM related skills, processes, concepts, and ideas are applied in real life to solve problems created by natural and physical environments. Collaborative learning experiences can be provided after school or during school holidays to enable students to work with STEAM experts and practitioners to inquire and solve problems by developing creative, innovative and sustainable solutions. Providing real life experiences and lessons, e.g., by involving students to actually solve a scientific, technological, engineering, or mathematical, or arts problem, would probably spark their interest in a STEAM career path. Developing STEAM partnerships with external stakeholders e.g., high education institutions, private sector, research and development institutions, and volunteer and community development organizations can enhance students' learning and application of STEAM problem solving principles and skills.

Participatory Learning

Group-Based Learning

Task Oriented Learning

Action Learning

Experiential Learning

Modeling

Simulation

### STEAM Learning Strategies

Teachers should include in their lesson plans STEAM learning activities. These activities should be aligned to principle or a skill planned for students to learn and demonstrate proficiency at the end of the lesson to expose students to STEAM and giving them opportunities to explore STEAM-related concepts, they will develop a passion for it and, hopefully, pursue a job in a STEAM field. Providing real life experiences and lessons, e.g., by involving students to actually solve a scientific, technological, engineering, or mathematical, or arts problem, would probably spark their interest in a STEAM career path. This is the theory behind STEAM education.

## STEAM-Based Assessment

STEAM-based assessment is closely linked to standards-based assessment where assessment is used to assess students' level of competency or proficiency 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, assessments are designed for what students should know and be able to do. In STEAM learning students are assessed in a variety of ways including portfolios, project/problem-based assessments, backwards design, authentic assessments, or other student-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 Assessments (PBAs)
3. Portfolios
4. Student self-assessment
5. Peer-assessment
6. Student Response Systems(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 in use fit under one or more of the categories discussed. Furthermore, it is important to note that these strategies also connect in a variety of ways.

### 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 discrete 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 discussed in those sections as well.

### Performance-Based Assessments

Performance-Based Assessments (PBA), also known as project-based or authentic assessments, 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.

### Portfolio Assessment

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

### Self-assessment

While the previous assessment tools and strategies listed in this report generally function as summative approaches, self-assessment is generally viewed as a formative strategy, rather than one used to determine a student’s final grade. 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 is negotiated between 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.

### 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 variety of products like papers, presentations, projects, or other skilled behaviours. Peer 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 assessee’s skills and knowledge.

The primary goal for using peer assessment is to provide feedback to learners. This strategy may be particularly relevant in classrooms with many students per teacher since student time will always be more plentiful than teacher time. Although any single student’s feedback may not be rich or in-depth as teacher’s feedback, the research suggests that peer assessment can improve learning.

### Student Response System

Student response system (SRS), also known as classroom response (CRS), audience response system (ARS) is a 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 teachers analysing information quickly and then devising real-time instructional solutions to maximize student learning. This includes a suggested approach to help teachers and trainers assess learning.

# Curriculum Integration

## What is Curriculum Integration?

Curriculum integration is making connections in learning across the curriculum. The ultimate aim of curriculum integration is to act as a bridge to increase students' achievement and engage in relevant curriculum. (Susan M. Drake and Rebecca C. Burns)

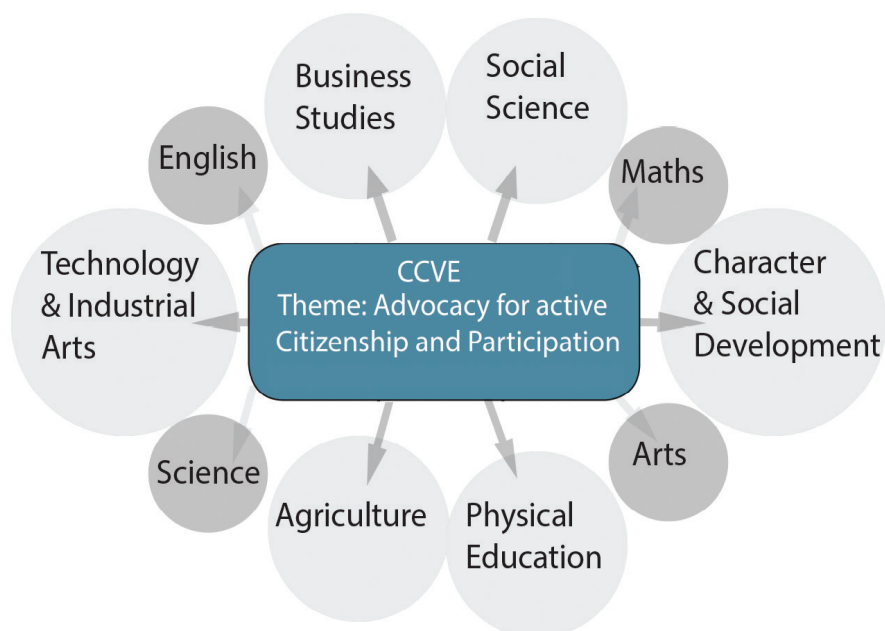
Teachers must develop intriguing curriculum by going beyond the traditional teaching of content based or fragmented teaching to one who is knowledge based and who should be perceived as a 21st century innovative educator. Curriculum integration is a holistic approach to learning thus curriculum integration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

There are three approaches that PNG SBC will engage to foster conducive learning for all its 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 thus they can be able to see themselves as catalyst of change for a competitive PNG. Not only that but they will be 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 who will foresee themselves as assets through their achievements thus contribute meaningfully to their country. They themselves are the agents of change. Integrated learning will bear forth 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. That is, content of a particular theme will be taught right across all subjects as shown in the diagram below. For instance, if the theme is global warming, subject areas create lessons or assessment as per their subjects around this theme. Social Science will address this issue, Science and all other subject likewise.

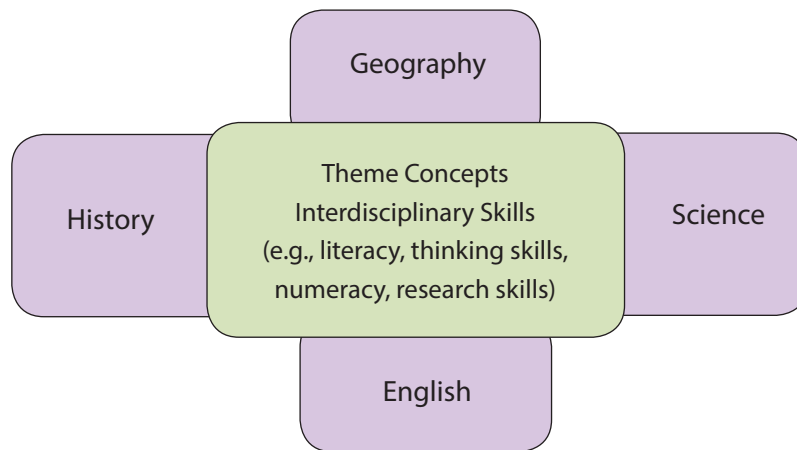


### (ii) Interdisciplinary Approach

This approach addresses learning similarly to the multidisciplinary approach of integrated learning whereby learning takes place within the subject area. However, it is termed interdisciplinary in that the core curriculum of learning is interwoven into each subject under study by the students. For instance; in Social Science under the strand of geography students write essay on internal migration however, apart from addressing the issues of this topic, they are to apply the skill of writing text types in their essay such as argumentative essay, informative, explanatory, descriptive, expository and narrative essay while writing their essay. They must be able to capture the mechanics of English skills such as grammar, punctuation and so forth. Though these skills are studied under English they are considered as core skills that cut across all subjects under study. For example; if Science students were to write about human development in biology then the application of writing skills has to be captured by the students in their writing. It is not seen as an English skill but a standard essential skill all students must know and do regardless.

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.

This approach involves teachers integrate sub disciplines within a subject area. For instance, within the subject Social Science, the strands (disciplines) of geography, environment, history, political science and environment will all be captured studying a particular content for Social Science. For example, under global warming, students will study the geographical aspects of global warming, environmental aspect of global warming and likewise for history, political science and economics. Thus, children are well aware of the issues surrounding global warming and can address it confidently at each level of learning.



### (iii) 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 need. The trans-disciplinary approach addresses real-life situations thus giving 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).

Teachers and students select a topic of study based on student interests, curriculum standards, and local resources

The teacher finds out what the students already know and helps them generate questions to

explore. The teacher also provides resources for students and opportunities to work in the field.

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 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)

SUBJECT AREAS

Theme

Concepts

Life Skills

Real world Context - (Voluntary services/Part time job  
experience, exchange programs)

Students Questions

# Essential knowledge, Skills, values, and Attitudes

Students' level of proficiency and progression towards the attainment of content standards will depend on their mastery and application of essential knowledge, skills, values, and attitudes in real life or related situations. Provided here are examples of different types of knowledge, processes, skills, values, and attitudes that all students are expected to learn and master as they progress through the grades. These are expanded and deepen in scope and the level of difficulty and complexity are increased to enable students to study in-depth the subject content as they progress from one grade to the next.

These knowledge, skills, values and attitudes have been integrated into the content standards and benchmarks. They will also be integrated into the performance standards. Teachers are expected to plan and teach essential knowledge, skills, values and attitudes in their lessons, and assess students' performance and proficiency, and progression towards the attainment of content standards.

## Types of Knowledge

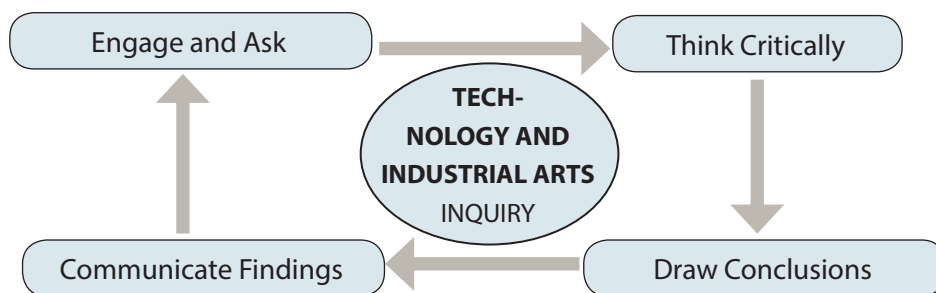
| <b>There are different types of knowledge. These include;</b>                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Public and private (privileged) knowledge</li> <li>• Specialized knowledge</li> <li>• Good and bad knowledge</li> <li>• Concepts, processes, ideas, skills, values, attitudes</li> <li>• Theory and practice</li> <li>• Fiction and non-fiction</li> <li>• Traditional, modern, and postmodern knowledge</li> </ul> | <ul style="list-style-type: none"> <li>• Subject and discipline-based knowledge</li> <li>• Lived experiences</li> <li>• Evidence and assumptions</li> <li>• Ethics and Morales</li> <li>• Belief systems</li> <li>• Facts and opinions</li> <li>• Wisdom</li> <li>• Research evidence and findings</li> <li>• Solutions to problems</li> </ul> |

## Types of Processes

| <b>There are different types of processes. These include;</b>                                                                                                                                                                                    |                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Problem-solving</li> <li>• Logical reasoning</li> <li>• Decision-making</li> <li>• Reflection</li> </ul>                                                                                                | <ul style="list-style-type: none"> <li>• Cyclic processes</li> <li>• Mapping (e.g. concept mapping)</li> <li>• Modeling</li> <li>• Simulating</li> </ul> |
| <b>Technology Inquiry processes include:</b> <ul style="list-style-type: none"> <li>• Gathering information</li> <li>• Analysing information</li> <li>• Evaluating information</li> <li>• Making judgements</li> <li>• Taking actions</li> </ul> |                                                                                                                                                          |

## Technology Inquiry Processes:

|                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Engage and Ask</b>       | <ul style="list-style-type: none"> <li>• How will I engage my students in the topic and prompt them to ask questions?</li> <li>• Determine the enduring understandings about the topic being studied.</li> <li>• Engage your students with the topic by grabbing their interest with a hook connected to the enduring understandings.</li> <li>• Allow students to generate questions based upon the topic and hook.</li> <li>• Determine what questions will be essential to achieving the enduring understandings. (Student generated or teacher determined)</li> <li>• With students, determine what other information is needed in order to fully answer the questions.</li> </ul> |
| <b>Think Critically</b>     | <p>How will students access and analyse information about this topic?</p> <ul style="list-style-type: none"> <li>• Have students think about where they can find answers to the questions posed about the topic.</li> <li>• Gather and organise multiple primary and secondary sources.</li> <li>• Ensure that sources used expose students to different perspectives and viewpoints about the topic.</li> <li>• Students should use sources to collect, analyse, and interpret data.</li> <li>• Ensure students are analysing sources for credibility, bias, and perspective in order to identify gaps in the research.</li> </ul>                                                    |
| <b>Draw Conclusion</b>      | <p>How will students synthesise ideas to answer the questions posed based on sources used?</p> <ul style="list-style-type: none"> <li>• Students should engage in civic discussion to answer the questions posed while respecting diverse opinions.</li> <li>• Engage students in evaluating possible courses of action and their consequences.</li> <li>• Students should make and justify an informed decision or choice and/or design an action plan supported by evidence from sources.</li> <li>• Have students evaluate the consequences of a decision or choice.</li> <li>• Allow students to make revisions based on feedback and further study.</li> </ul>                    |
| <b>Communicate Findings</b> | <p>How will students demonstrate what they have learned and take action on that learning?</p> <ul style="list-style-type: none"> <li>• Determine how students will apply what they have learned and share their findings with others.</li> <li>• Explore appropriate audiences for students to present conclusions.</li> <li>• Determine if there is an opportunity for students to take action and influence others to make more informed decisions.</li> <li>• Have students develop strategies to persuade others, including policy makers when applicable.</li> <li>• Prepare students to defend their analysis against alternative.</li> </ul>                                    |



## Types of Skills:

There are different types of skills. These include:

### i. Cognitive (Thinking) Skills

Thinking skills can be categorized into critical thinking and creative thinking skills.

#### Critical Thinking Skills

A person who thinks critically always evaluates an idea in a systematic manner before accepting or rejecting it. Critical thinking skills include;

- |                                                                                                                                                                                                             |                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Attributing</li> <li>• Comparing and contrasting</li> <li>• Grouping and classifying</li> <li>• Sequencing</li> <li>• Prioritising</li> <li>• Analysing</li> </ul> | <ul style="list-style-type: none"> <li>• Detecting bias</li> <li>• Evaluating</li> <li>• Metacognition (Thinking about thinking)</li> <li>• Making informed conclusions.</li> </ul> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Creative Thinking Skills

A person who thinks creatively has a high level of imagination, able to generate original and innovative ideas, and able to modify ideas and products. Creative thinking skills include;

- |                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Generating ideas</li> <li>• Deconstruction and reconstruction</li> <li>• Relating</li> <li>• Making inferences</li> <li>• Predicting</li> <li>• Making generalisations</li> <li>• Visualising</li> </ul> | <ul style="list-style-type: none"> <li>• Synthesising</li> <li>• Making hypothesis</li> <li>• Making analogies</li> <li>• Invention</li> <li>• Transformation</li> <li>• Modeling</li> <li>• Simulating</li> </ul> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

ii. Reasoning Skills - Reason is a skill used in making a logical, just, and rational judgment.

iii. Decision-Making Skills - Decision-making involves selection of the best solution from various alternatives based on specific criteria and evidence to achieve a specific

aim.

iv. Problem Solving Skills – These skills involve finding solutions to challenges or unfamiliar situations or unanticipated difficulties in a systematic manner.

v. 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.

| The following literacy skills are intended to be exemplary rather than definitive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Listens, read, write, and speak with comprehension and clarity</li> <li>• Define and apply discipline-based conceptual vocabulary</li> <li>• Describe people, places, and events, and the connections between and among them</li> <li>• Arrange events in chronological sequence</li> <li>• Differentiate fact from opinion</li> <li>• Determine an author's purpose</li> <li>• Determine and analyse similarities and differences</li> <li>• Analyse cause and effect relationships</li> <li>• Explore complex patterns, interactions and relationships</li> <li>• Differentiate between and among various options</li> </ul> | <ul style="list-style-type: none"> <li>• Listens, read, write, and speak with comprehension and clarity</li> <li>• Define and apply discipline-based conceptual vocabulary</li> <li>• Describe people, places, and events, and the connections between and among them</li> <li>• Arrange events in chronological sequence</li> <li>• Differentiate fact from opinion</li> <li>• Determine an author's purpose</li> <li>• Determine and analyse similarities and differences</li> <li>• Analyse cause and effect relationships</li> <li>• Develop an ability to use and apply abstract principals</li> <li>• Explore and/or observe, identify, and analyse how individuals and/or societies relate to one another</li> </ul> |

vi. High Level Thinking Skills - These skills include analysis, synthesis, and evaluation skills.

vii. 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.

| Key Words      |              |           |           |              |
|----------------|--------------|-----------|-----------|--------------|
| Analyse        | Differences  | Find      | List      | 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        |
| Categorise     | Distinguish  | In-depth  | Point out |              |
| Cause & effect | Dissect      | Inference | Research  |              |

|           |           |             |          |  |
|-----------|-----------|-------------|----------|--|
| Choose    | Divide    | Inspect     | See      |  |
| Classify  | Establish | Isolate     | Select   |  |
| Comparing | Examine   | Investigate | Separate |  |

viii. 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.

ix. 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.

### Types of Values:

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

#### i. Personal Values (importance, worth, usefulness, etc.)

| Core values                                                                                                                                                                                                                                                                                           | Sustaining values                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Sanctity of life</li> <li>• Truth</li> <li>• Aesthetics</li> <li>• Honesty</li> <li>• Human</li> <li>• Dignity</li> <li>• Rationality</li> <li>• Creativity</li> <li>• Courage</li> <li>• Liberty</li> <li>• Affectivity</li> <li>• Individuality</li> </ul> | <ul style="list-style-type: none"> <li>• Self-esteem</li> <li>• Self-reflection</li> <li>• Self-discipline</li> <li>• Self-cultivation</li> <li>• Principal morality</li> <li>• Self-determination</li> <li>• Openness</li> <li>• Independence</li> <li>• Simplicity</li> <li>• Integrity</li> <li>• Enterprise</li> <li>• Sensitivity</li> <li>• Modesty</li> <li>• Perseverance</li> </ul> |

#### ii. Social Values

| Core Values                                                                                                             | Sustaining Values                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Equality</li> <li>• Kindness</li> <li>• Benevolence</li> <li>• Love</li> </ul> | <ul style="list-style-type: none"> <li>• Plurality</li> <li>• Due process of law</li> <li>• Democracy</li> <li>• Freedom and liberty</li> </ul> |

|                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Freedom</li> <li>• Common good</li> <li>• Mutuality Justice</li> <li>• Trust</li> <li>• Interdependence</li> <li>• Sustainability</li> <li>• Betterment of human kind</li> <li>• Empowerment</li> </ul> | <ul style="list-style-type: none"> <li>• Common will Patriotism</li> <li>• Tolerance Gender equity and social inclusion</li> <li>• Equal opportunities</li> <li>• Culture and civilisation</li> <li>• Heritage</li> <li>• Human rights and responsibilities</li> <li>• Rationality</li> <li>• Sense of belonging Solidarity</li> <li>• Peace and harmony</li> <li>• Safe and peaceful communities</li> </ul> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Types of Attitudes:

| Attitudes - Ways of thinking and behaving, points of view                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Optimistic</li> <li>• Participatory</li> <li>• Critical</li> <li>• Creative</li> <li>• Appreciative</li> <li>• Empathetic</li> <li>• Caring and concern</li> <li>• Positive</li> <li>• Confident</li> <li>• Cooperative</li> </ul> | <ul style="list-style-type: none"> <li>• Responsible</li> <li>• Adaptable to change</li> <li>• Open-minded</li> <li>• Diligent</li> <li>• With a desire to learn</li> <li>• With respect for self, life, equality and excellence, evidence, fair play, rule of law, different ways of life, beliefs and opinions, and the environment.</li> </ul> |

# Teaching and Learning Strategies

Computer Technology Strand emphasises 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, organize and communicate information, draw and justify conclusions, create new knowledge, and act ethically.

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 11. 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 organised 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 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 11 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. |

|   |                            |                       |                                                                                                                                                                                                                                                                                                             |
|---|----------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | <b>Computer Technology</b> | Computer Architecture | <b>CS5.1</b> 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     | <b>CS5.2</b> 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;

- Data Communication and Network
- Computer Security and Safety

| UNITS                                  | TOPICS                                                                                                     | Lesson Titles                                                                                                                     |
|----------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Unit 1. Data Communication and Network | 1: Peer to Peer Network                                                                                    | 1. Introduction Networking – Feature of Network<br>2. Peer-to-Peer Network<br>3. Types of Network                                 |
|                                        | 2: TCP/IP Reference Model                                                                                  | 1. Introduction to OSI – Network Layer<br>2. Layering in TCP/IP reference model<br>3. Network Utilities in TCP/IP                 |
|                                        | 3: Network Servers and it's Applications                                                                   | 1. Introduction to Network servers<br>2. Network Operating Systems and Application<br>3. Services provided by the network servers |
|                                        | 4: Production skills and Techniques                                                                        | 1. Introduction to media communication – types of Media Products<br>2. Skills & Techniques in Media Production or services        |
|                                        | 5: Knowledge of Technical Terminologies, Mathematics and Science Concepts used in Communication Technology | 1. Technical terminology<br>2. Media Production<br>3. Apply mathematical and scientific concepts in creation of Media products    |

|                                      |                               |                                                                                                        |
|--------------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------|
| Unit 2: Computer Security and Safety | 1: Computer and Data Security | 1. Computer Security<br>2. Data Security                                                               |
|                                      | 2: Health and Safety Measures | 1. Fundamental Health and safety<br>2. Proper Health and Safety Measures (Application)                 |
|                                      | 3: Computer and Data Security | 1. Computer Security<br>2. Data Security                                                               |
|                                      | 4: Embedded Systems           | 1. Introduction to embedded systems<br>2. Types of Embedded systems<br>3. Model of an embedded systems |
|                                      | 5: Responsible Citizenship    | 1. Citizenship and the technology<br>2. What is a responsible digital citizen?                         |

## UNIT 1: DATA COMMUNICATION AND NETWORK

| Unit                           | Benchmark | Topics                                                                 | Lesson Titles                                                                                                                     |
|--------------------------------|-----------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Data Communication and Network | 11.4.1.1  | Peer-to-Peer Network                                                   | 1. Introduction Networking – Feature of Network<br>2. Peer-to-Peer Network<br>3. Types of Network                                 |
|                                | 11.4.1.2  | TCP/IP Reference Model                                                 | 1. Introduction to OSI – Network Layer<br>2. Layering in TCP/IP reference model<br>3. Network Utilities in TCP/IP                 |
|                                | 11.4.1.3. | Network Servers and it's Applications                                  | 1. Introduction to Network servers<br>2. Network Operating Systems and Application<br>3. Services provided by the network Servers |
|                                | 11.4.1.4. | Production skills and Techniques                                       | 1. Introduction to media communication – types of Media Products<br>2. Skills & Techniques in Media Production or services        |
|                                | 11.4.1.5. | Knowledge of Technical Terminologies, Mathematics and Science Concepts | 1. Technical terminology<br>2. Media Production<br>3. Apply mathematical and scientific concepts in creation of Media products    |

## 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 11.4.1.1** Apply knowledge to create a simple peer-to-peer network using WAN and LAN

### Topic 1: Peer-to-Peer Network

#### Learning Objectives

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

- Demonstrate knowledge to create peer-to-peer network.
- Develop simple peer-to peer using WAN and LAN

#### Essential Questions:

1. What is a network?
2. What are the Hardware and Software features of a simple computer Network?
3. What is peer to peer networking?
4. What are the two main different types of network?

#### Essential Knowledge, Skills, Values and Attitudes

| Knowledge            | Skills        | Values                                   | Attitudes                                                                      |
|----------------------|---------------|------------------------------------------|--------------------------------------------------------------------------------|
| Peer to Peer Network | Apply, Create | Creativity, Self-reflection, Rationality | Appreciate the knowledge gained about the different types of computer networks |

Technology Application: Data and communication and computer network

## Content Background

### Introduction to Networking and its Features

1. What is Computer Network?

Computer network is interconnectivity of two or more computer system for the purpose of sharing data. A computer network is a communication system much like a telephone system, any connected device can use the network to send and receive information. In essence a computer network consists of two or more computers connected to each other so that they can share resources. Networking arose from the need to share resources in a timely fashion. Sharing expensive peripherals is often promoted as the primary reason to network

Networks can be wired or wireless. A wireless connection includes connecting via wireless technology. A wired connection includes connection of nodes with cables and connecting devices.

2. Why computer networking?

A computer network is important because it involves the use of hardware and software, communication, the use of technology in an organization. Computer networks components comprise both physical parts and software. Installations and configurations allow the complete connectivity of the network in creating computer networks. The hardware components are used to connect the devices together examples include server, client, peer, transmission medium, and connecting devices. Hardware devices vary according to the type of network that you want to create.

Every network includes at least two computers, NIC or Network interface Adapter on each computer, a connection medium (Wired or wireless) and Network operating system software. A hub or a switch is also important in connecting the computers.

It is important to consider your transmission medium as wired or wireless. Modern devices come with their in-built wireless network adapter. A Personal computer must have a Network Interface Card (NIC) or Ethernet Card in which most modern devices have this component built into their motherboards including laptops.

- A computer network allows sharing of resources over multiple computers at one.
- Better communication that enables collaboration between individuals and groups . Better response time can be achieved through networking.
- Peripherals attached to a network tend to be faster than those attached to stand alone computers.
- Network supports transport of data and information across a variety of platforms and devices.

### Features of Networks:

#### Type of Networks

##### 1. Personal Area Network

A personal area network (PAN) is the interconnection of information technology devices within the range of an individual person, typically within a range of 10 meters. Computers are characterized by size and purpose and can be expressed by geographical area they occupy and the number of computers that are part of the network.

- Size limited to a few kilometers
- Distinguish by transmission media and topology (use only one transmission media and topology)
- Share resources between personal computers or workstation at the speed of 100mbps or 1000mbps

For example, a person traveling with a laptop, a personal digital assistant (PDA), and a portable printer could interconnect them without having to plug anything in, using some form of wireless technology.

PAN computers are characterized by size and purpose and can be expressed by geographical area they occupy and the number of computers that are part of the network.

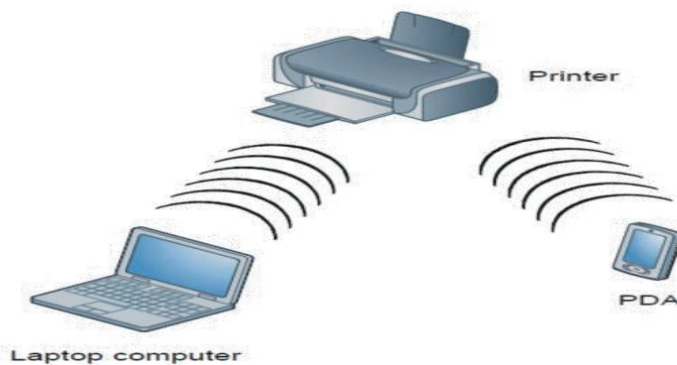


Figure 1: Personal Area Network

## 2. Local Area Network

A local area network (LAN) is usually privately owned and links the devices in a single office, building, or campus.

Depending on the needs of an organization and type of technology used, a LAN can be as simple as two desktops and a printer in someone's home office; or it can extend throughout a company and include audio and video peripherals.

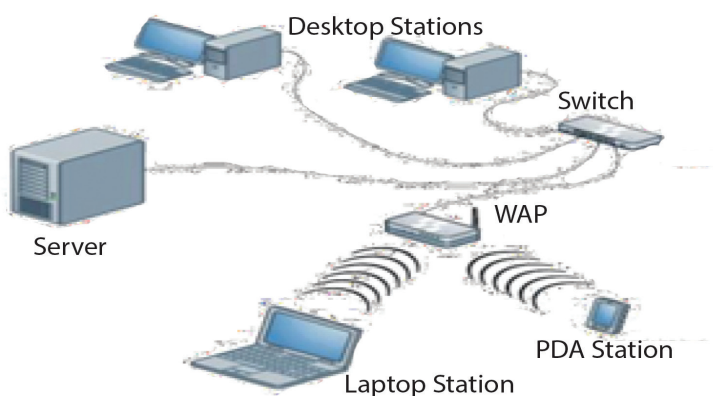


Figure 2: Local Area Network

## 3. Metropolitan Area Network

A metropolitan area network (MAN) is a network with a size between a LAN and a WAN. It normally covers the area inside a town or a city. It is designed for customers who need a highspeed connectivity, normally to the internet, and have endpoints

spread over a city or part of city.

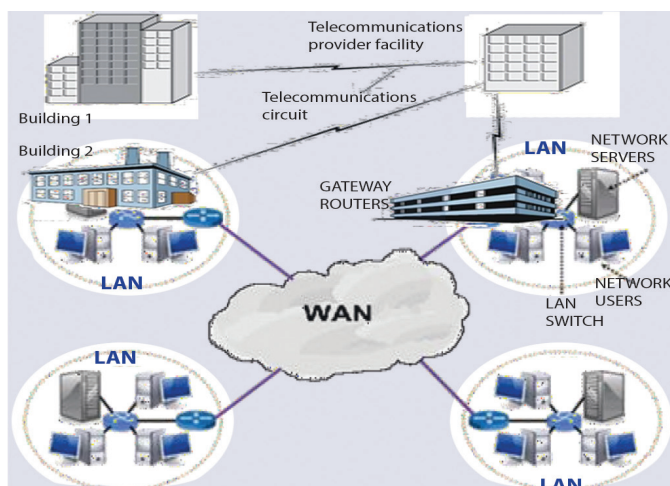


Figure 3: Metropolitan area Network

#### 4. Wide Area Network

A wide area network (WAN) provides long- distance transmission of data, image, audio, and video information over large geographic areas that may comprise a country, a continent, or even the whole world. A wide Area Network (WAN) provides long distance transmission of data, images, audio and video information over large geographical areas that may comprise a country, a continent or even the whole world. Example, an organisation like the banks have offices in different cities, provinces and countries will use WAN to connect and share data and resources.

Figure 4: Wide Area Network

#### The Internet:

The Internet is a type of Wide Area Network but has the ability to link computers provide applications online other reliable services that needs to be connected online. It serves as a platform for any online activities and has become an essential part of Modern Society. However the internet and Network can differ in several ways as to ownership. Also LAN is Private while internet is a WAN is public network managed by large number of ISP (Internet Service Providers )

#### Intranets:

Privately owned network that provides internet service to its organisation. Strictly to

certain users. It helps organisation to enhance collaboration and increased productivity.

### Extranets:

Private computer network uses internet technology to enable communication and collaboration between its external partners.

### Network Topologies:

The term topology in computer networking refers to the way in which a network is laid out physically. Two or more devices connect to a link; two or more links form a topology. The topology of a network is the geometric representation of the relationship of all links and linking devices (usually called nodes) to one another. The cost and flexibility of a network installation are partly affected by as is system reliability. Many network topologies are commonly used, but they all have certain similarities. Information is carried either through space (wireless) or cable. The cable must control the movement of information on the network so that data can be transmitted in a reliable manner. There are four basic topologies possible: mesh, star, bus, and ring. See Figure 5.

#### Types of Network Topology

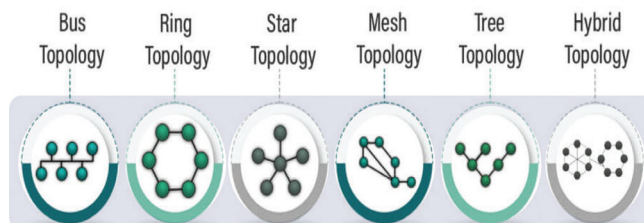
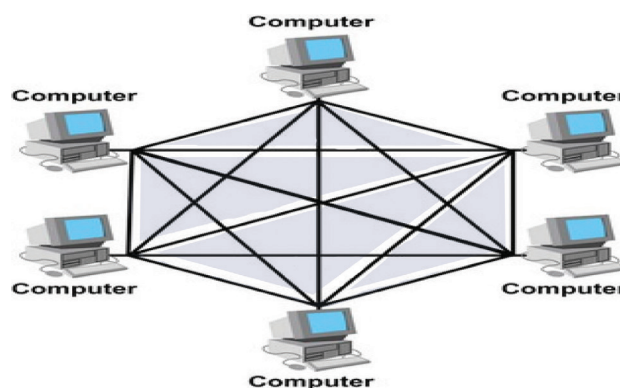


Figure 5: Network Topology

#### 1. Mesh

A mesh topology is the one where every node is connected to every other node in the network.



Mesh Network Topology

The number of connections in this network can be calculated using the following formula ( $n$  is the number of computers in the network):  $n(n-1)/2$ . In a partially connected mesh topology, at least two of the computers in the network have connections to multiple other computers in that network. It is an inexpensive way to implement redundancy in a network. In the event that one of the primary computers or connec-

tions in the network fails, the rest of the network continues to operate normally.

#### Advantages of a mesh topology

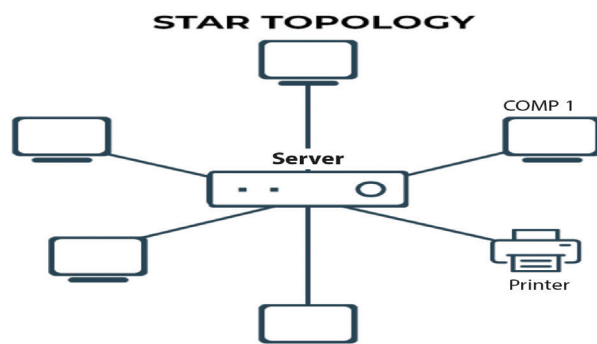
- Can handle high amounts of traffic, because multiple devices can transmit data simultaneously.
- A failure of one device does not cause a break in the network or transmission of data.
- Adding additional devices does not disrupt data transmission between other devices.

#### Disadvantages of a mesh topology

- The cost to implement is higher than other network topologies, making it a less desirable option.
- Building and maintaining the topology is difficult and time consuming.
- The chance of redundant connections is high, which adds to the high costs and potential for reduced efficiency.

## 2. Star

A star network, star topology is one of the most common network setups. In this configuration, every node connects to a central network device, like a hub, switch, or computer. The central network device acts as a server and the peripheral devices act as clients. Depending on the type of network card used in each computer of the star topology, a coaxial cable or a RJ-45 network cable is used to connect computers together.



Star Network Topology

#### Advantages of star topology

- Centralised management of the network, through the use of the central computer, hub, or switch.
- Easy to add another computer to the network.
- If one computer on the network fails, the rest of the network continues to function normally.
- The star topology is used in local-area networks (LANs), High-speed LANs often use a star topology with a central hub.

#### Disadvantages of star topology

- Can have a higher cost to implement, especially when using a switch or router as

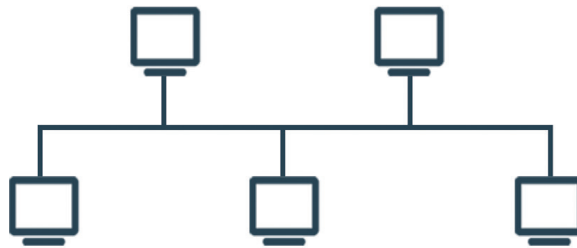
the central network device.

- The central network device determines the performance and number of nodes the network can handle.
- If the central computer, hub, or switch fails, the entire network goes down and all computers are disconnected from the network.

#### 4. Bus Topology

a line topology, a bus topology is a network setup in which each computer and network device are connected to a single cable or backbone.

### BUS TOPOLOGY



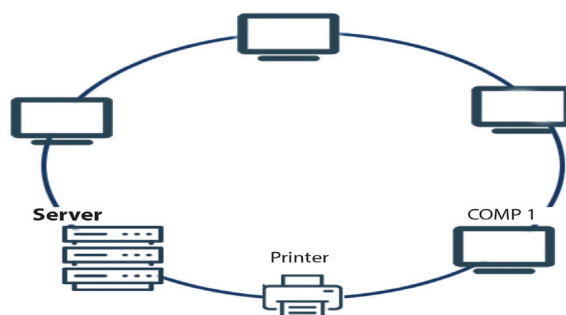
Bus Network Topology

Advantages of bus topology

- It works well when you have a small network.
- It's the easiest network topology for connecting computers or peripherals in a linear fashion.
- It requires less cable length than a star topology.
- Disadvantages of bus topology
- It can be difficult to identify the problems if the whole network goes down.
- It can be hard to troubleshoot individual device issues.
- Bus topology is not great for large networks.
- Terminators are required for both ends of the main cable.
- Additional devices slow the network down.
- If a main cable is damaged, the network fails or splits into two.

A ring topology is a network configuration in which device connections create a circular data path. In a ring network, packets of data travel from one device to the next until they reach their destination.

### RING TOPOLOGY



Ring Network Top

Most ring topologies allow packets to travel only in one direction, called a unidirectional

tional ring network. Others permit data to move in either direction, called bidirectional. The major disadvantage of a ring topology is that if any individual connection in the ring is broken, the entire network is affected. Ring topologies may be used in either local area networks (LANs) or wide area networks (WANs).

#### Advantages of ring topology

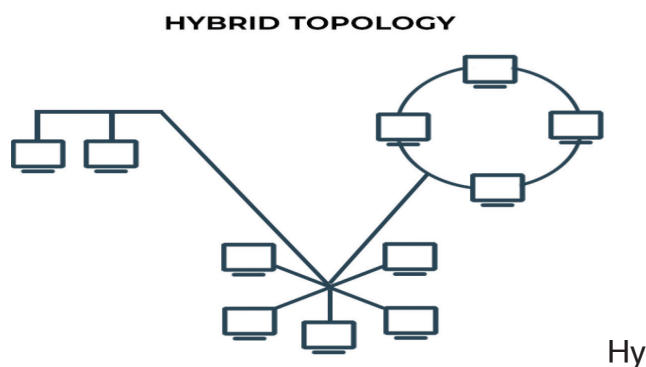
- All data flows in one direction, reducing the chance of packet collisions.
- A network server is not needed to control network connectivity between each workstation.
- Data can transfer between workstations at high speeds.
- Additional workstations can be added without impacting performance of the network.

#### Disadvantages of ring topology

- All data being transferred over the network must pass through each workstation on the network, which can make it slower than a star topology.
- The entire network will be impacted if one workstation shuts down.
- The hardware needed to connect each workstation to the network is more expensive than Ethernet cards and hubs/switches.

### 6. Hybrid Topology

A network can be hybrid. For example, we can have a main star topology with each branch connecting several stations in a bus topology as shown hybrid topology diagram



### Components of Networks:

There are three primary components to understanding networks: physical connections, network operating system and application component. Let us discuss each in detail

#### 1. Physical Connections

The physical components are the network topology and network connecting devices, which include network interface cards (NIC), cabling, connections, and all other hardware to connect the computers.

## 2. Network Operating System

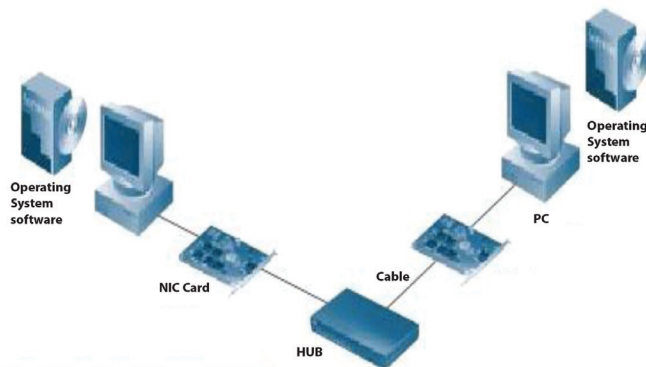
In order to communicate on a network, computers must use the appropriate operating protocol selected for the network. This protocol enables the computer to exchange information and ensure correct data transmission. The network operating system (NOS) is the controlling software that enables a server to accommodate multiple clients and provide the communication network between them. Examples of NOS include Microsoft Windows Server, Novel Netware LANtastic from Atisoft. The most common network protocols and the products supporting the protocol are: · TCP/IP - Unix, Windows NT™ server, Linux, Internet products. (TCP/IP is the protocol being used on the Internet and for intranets) · IPX/SPX - Novell NetWare™, Windows NT Server™. · NetBIOS - OS/2 WARP Server™, Windows NT Server™.

## 3. Application Component

The value of networking lies in the capability of sharing up-to-date information, software and hardware resources with other users on the system. The primary application software networking programs used in the legal profession are word processing, time & billing, calendar/docket/address book, E-mail, document management, conflict management, litigation support, and peripheral sharing such as printers, CD-ROM, PC fax systems, modems and any other hardware. Microsoft Office applications or any Word processing documents, spreadsheet, database, graphics, programming etc. Hosts, routers & links form the hardware component. Protocols and applications form the software component. Protocols can be viewed as the —gluell that binds everything else together. Network components are vital for the setting up of a network.

Computer networks components comprise both physical parts and software. Installations and configurations allow the complete connectivity of the network in creating computer networks. The hardware components are used to connect the devices together examples include server, client, peer, transmission medium, and connecting devices. Hardware devices vary according to the type of network that you want to create.

Every network includes at least two computers, NIC or Network interface Adapter on each computer, a connection medium (Wired or wireless) and Network operating system software. A hub or a switch is also important in connecting the computers.



It is import to consider your transmission medium as wired or wireless. Modern devices come with their in-built wireless network adapter. A Personal computer must have a Network Interface Card (NIC) or Ethernet Card in which most modern devices have this component built into their motherboards including laptops.

The software components are the software installed on the computers to allow them to communicate. These are the operating system and protocols.

### 1. Networking Operating System:

Network Operating Systems is typically installed in the server and facilitate workstations in a network to share files, database, applications, printers etc.

2. Protocol Suite: A protocol is a rule or guideline followed by each computer for data communication. Protocol suite is a set of related protocols that are laid down for computer networks. The two popular protocol suites are:

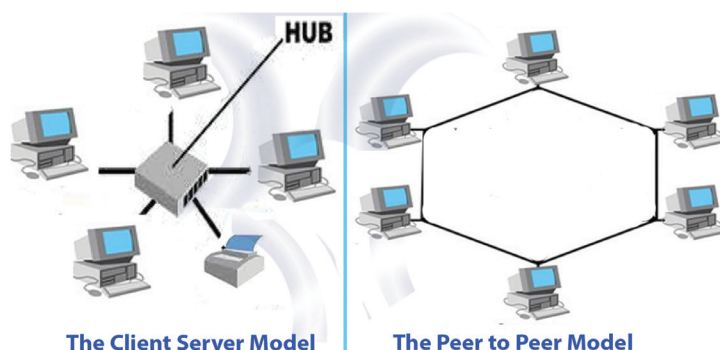
- OSI Model (Open System Interconnections)
- TCP / IP Model

### Peer-to-Peer Network:

Computers can be linked together in a network. Many schools, business and other organisations use network to share files, resources e.g., Printer on the server and programs. They are usually stored on the File Server (server) in which computers gain access to the server via a hub. A file server is not used as normal computer terminals its job is dedicated to the task of managing shared files. Here the client server model is used to differentiate from the peer-to-peer model.

When a network does not have a file server, it is called a peer-to-peer network. In a peer-to-peer network each computer acts as a server to other computers. It allows users to access each other's hard disks and peripherals.

Today, virtually all of the computers on a network are capable of functioning as both clients and servers simultaneously, and their roles are more a matter of the administrator's choice than the software running on the computer. On a peer-to-peer network, for example, a computer can share its drives with the rest of the network and can also access shared drives on other computers, regardless of whether the system is running a server or a client operating system.



An internet is a network that links computer network all over the world by Satellite and telephone connecting users with service networks such as e-mail and the world wide web. This service is provided by an Internet Service Provider created and maintained by specialized companies.

It was a global computer network that originally developed as a military project than handed over to the National Science Foundation for research and academic use. In 1967, at an Association for Computing Machinery (ACM) Meeting, ARPA presented its ideas for ARPANET, the idea is to connect each host computer to a specialized computer called an interface message processor. 1969 it was a reality whereby four nodes, at the University of California at Los Angeles, University of California at Santa Barbara, Stanford research Institute and the University of Utah, were connected via the IMPs to form a network. In 1972 Vint Cerf and Bob Kahn, collaborated an internet project. 1973 they outlined the protocol to receive end to end delivery of packets. TCP included concepts such as encapsulation the datagram and the functions of the Gateway.

An intranet is a private network set up by an organisation or company. It allows only authorised users to access its information. Information about the organisation will not be accessible to persons on the internet because it is not for public use.

An extranet is an extension of an organisation intranet. If you extend your intranet out to select business partners or customers have created an extranet.

### 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 Titles:

Introduction to Networking (Feature of Network)

### Lesson Objective:

By the end of the lesson, students should be able to:

- define Computer Networking and identify network components and features.

### Knowledge, Skills, Values and Attitudes

| Knowledge                                     | Skills                                                   | Values                                                             | Attitudes                                                                    |
|-----------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------|
| features Identify a peer to peer network-ing. | Apply the knowledge to create a simple computer network. | Show self-determina-tion in identifying and being aware of network | Appreciate the features of the network that en-ables communication globally. |

### Teaching and Learning Strategies

| Teacher will .....             | Student will .... |
|--------------------------------|-------------------|
| Introduction (time in minutes) |                   |

|                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Engage students in this lesson;<br>1. Recap previous content knowledge through open discussions with specific questions relating to terms learnt in grade 9 networks.<br><br>2. Ask essential question.<br><br>How does computer network look like? Give examples of a computer network happening in our daily lives.<br><br>Why is a computer network important? | Students respond:<br><br>1. Answer specific revision questions<br><br>2. Students illustrate a computer network using the mind map or concept map using computer terms. |
| Body (time in minutes)                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                         |
| Modeling                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                         |
| 1. Teacher asks students to discuss in groups. Students discuss and define computer network terminology.<br><br>Using the mind map from the introduction, illustrate clearly a simplified computer network as seen in a computer lab.                                                                                                                             | 1. Students define computer network terminology<br><br>2. Students work hands on with the teacher to illustrate a simplified computer network in a computer lab.        |
| Guided Practice                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                         |
| 1. Teacher Illustrates types of components/features connection in a simple computer network.<br><br>2. Teacher asks students to identify the                                                                                                                                                                                                                      | 1. Students discuss, explain and give examples of components/features connection in a simple computer network.<br><br>2. Students carryout discussions to               |
| Hardware and software features of a network.<br><br>3. Teacher Illustrates components and features of computer network.                                                                                                                                                                                                                                           | identify the Hardware and software features of a network.<br><br>3. Students discuss, explain and give examples of components/features connection.                      |
| Independent Practice                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                         |
| 1. Teacher provides the pictures for a computer network and allows students to identify a simple wired and wireless connection stating the devices clearly.<br><br>2. They provide explanation of the wired and wireless network.                                                                                                                                 | 1. Students create a simple wired and wireless connection stating the devices clearly and with clear explanations of both wired and wireless connections in networks.   |
| Conclusion (time in minutes)                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                         |
| Allow students to present their results in terms of labeling the parts correctly and stating the uses.                                                                                                                                                                                                                                                            | <b>Students present by giving description of their final work</b>                                                                                                       |

D.)Lesson Body ( Independent Practice) Note this diagram is for the Independent practice.

Students identify a simple wired and wireless connection stating the devices clearly .



## Lesson 2: Peer-to-Peer Network

### Teaching Strategies

1. Activity 1: Engage students to participate in the explanation of why the Client server is used to differentiate with the peer-to-peer.
2. Activity 2: Engage students to now discuss in groups the flow of data between the two networks set up.
3. Activity 3: Engage students to identify in component/features between the two network setup.

### Learning Strategies

1. Activity 1 Students analyze the difference between client server and peer-to-peer network.
2. Activity 2 Students discuss in groups the flow of data between the two networks set up. Activity 3 Students identify the devices in each and design both setups.

### Resources

Slideplayer.com/slide/6365193/

## Lesson 3: Network topology

### Teaching Strategies

Arrange for students to discover the different types of network and the advantages and disadvantages of each network.

### Learning Strategies

Differentiate types of Network.

1. Activity 1. Discuss the different types of network and their functions.
2. Activity 2. Design a model for each network type.
3. Activity 3. Create scenarios and present how the different types of network is used.

### Resources

Resources: Slideplayer.com/slide/6365193/

## STEAM Activity:

Students work in groups to design either a simple peer-to-peer network using software programs (packet tracer) and practically create a simple network.

## Assessment:

The main purpose of assessment is to find out if students can use the skill of synthesis to create and manage a simple network. Assessment should be linked to the performance indicator indicated in the lesson plan and the lesson objective.

### Performance Assessment

Define peer-to-peer networking

Identify the correct network type for different network descriptions.

Differentiate peer-to-peer and a client-server.

### Performance Assessment Scoring:

Assessment can be scored using a rubric (analytical rubric), checklists, or rating scales.

| Performance Standard/Criteria                                                   | Advanced A                                                                    | Meet Standard B                                                       | Progressing C                                                       | Not Yet D                                                  |
|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------|
| 1. Define peer-to-peer networking and identify the basic components needed.     | Define full definition of peer to peer and identify all components correctly. | Define full definition and identify most of the components correctly. | Define part of definition identify few of the components correctly. | Unable to define the term clearly and identify components. |
| 2. Differentiate peer-to-peer and a client server in 1 paragraph.               | Correct description in 1 or more paragraph                                    | Correct description in less than 3 sentences                          | Description in less than 2 sentences                                | Description in less than a sentences                       |
| 3. Build using cardboards etc... and present on the diagrams of the two models. | Model has connections with all the devices connected.                         | Model has 1 or 2 components not in order.                             | Model has 3 or more components not in order                         | No effort at all.                                          |

## UNIT 1. Data Communication and Network

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

**Benchmark: 11.4.1.2** Evaluate the concepts of layering in TCP/IP reference model and use appropriate network utilities to solve TCP/IP problems.

### Topic 2: TCP/IP Reference Model

### Learning Objectives

By the end of this topic, the students will be able to;  
 Evaluate the concept of layering in TCP/IP reference model.  
 Use appropriate network utilities to solve TCP/IP problems

### Essential Questions:

What is the OSI Reference Model?  
 What is the TCP/IP Reference Model?  
 How is TCP/IP Model Relating to OSI Model?  
 What are Network Utilities?

### Essential Knowledge, Skills, Values and Attitudes

| Knowledge        | Skills           | Values                           | Attitudes                                                                                       |
|------------------|------------------|----------------------------------|-------------------------------------------------------------------------------------------------|
| TCP/ IP Layering | Evaluate \ Apply | Rationality,<br>Self- Reflection | Appreciate the concept of OSI layering and be open-minded and creative in solving TCP/IP issues |

Technology and Industrial Arts Application: Communication Technology

## Content Background

### Introduction to TCP/IP:

With so many different computer networks linked together on the internet , there has had to be a standard way in which different networks are linked together, the set of rules, sometimes known as protocol for sending and receiving data over the internet is known as TCP/IP (Transmission Control Protocol and Internet Protocol. TCP/IP breaks down the data into little chunks , or packets which are sent to other computers on the internet. TCP/IP then ensures that the data is reassembled into its original form.

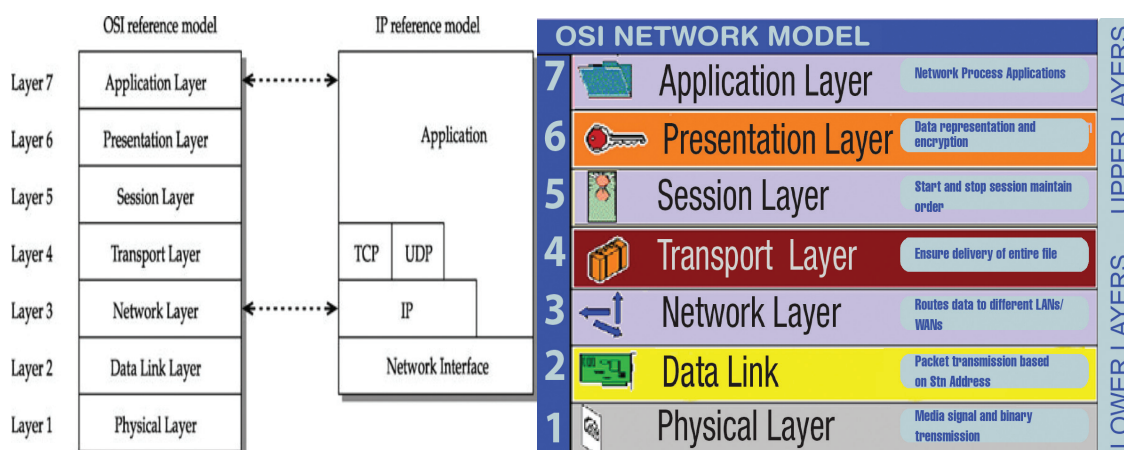
Another standard that exist is the OSI (Open Source Interconnection) Model. It is important to also discover knowledge on the OSI reference Model to relate with TCP/IP Reference Model. Since this topic has been covered in Grade 9, in these lessons we familiarise and recall this OSI model.

### OSI Reference Model

The OSI reference model was developed in the 1980s to present a general reference model for how computer network architecture should be functionally divided. As part of OSI, many protocols have also been developed. Here, we will present the basic reference model.

This model describes how information is transferred from one network to another. Similar to constructing how a blueprint defines the material and technologies that are used in constructing the house. The protocols and devices will be identified in

each layer. A protocol is a set of rules that governs the transfer of data between computers.



A protocol defines how a link is established, how data is transmitted and how errors are detected and corrected. When the same protocols are used, different types of computers and devices can communicate with each other. There are numerous protocols that have been developed for specific technology. Technically, a networking model is a comprehensive set of documents that describes how everything should happen in network. Individually, each document describes a functionality, protocol or device that is required by a small portion of the network.

### Layering in TCP/IP

- **IP:** The Internet Protocol is responsible for moving data, in the form of electronic packets, along the internet network until the packets are received at the intended destination or IP address.
- **TCP:** The Transmission Control Protocol is responsible for ensuring safe delivery of each data packet from the sending node to the receiving node within a network. In addition, because data packets can be misdirected or damaged during transmission, the TCP detects these errors as they occur during the transmission and automatically retransmits each questionable data packet.

During the late 1970's and into the 80's, the U.S. Department of Defense experienced numerous technical failures when attempting to connect multiple computers (nodes) and multiple networks with the intent of sharing data and information. In 1981, the government was successful following the implementation of the Transmission Control Protocol (TCP) and the Internet Protocol (IP) technologies. In bringing the Internet alive with these combined (TCP/IP) technologies, project engineers and researchers were able to meet the needs of most users by enabling online capabilities to file transfers, e-mail, file sharing and remote log on functions. TCP/IP has become the standard protocol used by the internet, it was also developed during the establishment of the internet. As proposed by the international Standards Organization the TCP/IP consist of four protocol layers in which these protocol layers are related to the seven layers of the Operating system interconnection network architecture.

Comparison of the TCP IP REFERENCE MODEL and the OSI picture taken from <http://study.com>

| TCP/IP                                 | OSI                | Description                                                                           |
|----------------------------------------|--------------------|---------------------------------------------------------------------------------------|
| Layer 5 –<br>Application/Process Layer | Application Layer  | Provides end-user applications                                                        |
|                                        | Presentation Layer | Provides data transmission formats and codes                                          |
|                                        | Session Layer      | Supports telecommunications sessions                                                  |
| Layer 4 –<br>Transport Layer           | Transport Layer    | Supports organization and data transfer between nodes on a network.                   |
| Layer 3 –<br>Internet Protocol (IP)    | Network Layer      | Provides routing and connection between network nodes.                                |
| Layer 2 –<br>Network Interface         | Data Link Layer    | Supports accurate transmission of data within the network.                            |
| Layer 1 –<br>Physical Layer            | Physical Layer     | Provides physical transmission of data using telecommunications media on the network. |

## Network Utilities:

The Windows operating system contains numerous built-in, command line networking utilities. Utility command is being designed to monitor, maintain and check the function of the network.

The commands are typed into the run command. Press CTRL + R to bring out the run command. These tools range from the obscure to the common place. However, there are 11 built-in networking tools that Windows networking administrators should be familiar with.

1. Ping: Ping is a familiar command and most widely used of the utilities being discussed in this article, but that does not make it any less essential.

Ping is used to test the ability of one network host to communicate with another. Simply enter the Ping command, followed by the name or the IP address of the destination host. Assuming that there are no network problems or firewalls preventing the ping from completing, the remote host will respond to the ping with four packets. Receiving these packets confirms that a valid and functional network path exists between the two hosts.

```

Command Prompt
Microsoft Windows [Version 10.0.15063]
(c) 2017 Microsoft Corporation. All rights reserved.

C:\Users\Brien>ping www.espn.com

Pinging www.espn.com.gns.go.com [199.181.133.5] with 32 bytes of data:
Reply from 199.181.133.5: bytes=32 time=77ms TTL=238
Reply from 199.181.133.5: bytes=32 time=68ms TTL=238
Reply from 199.181.133.5: bytes=32 time=69ms TTL=238
Reply from 199.181.133.5: bytes=32 time=69ms TTL=238

Ping statistics for 199.181.133.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 68ms, Maximum = 77ms, Average = 70ms

C:\Users\Brien>

```

2. NetStat: If you are experiencing problems with network communications, then network statistics can sometimes help point you toward the root cause of the prob-

lem. That's where the aptly named NetStat command comes into play. This command has a number of different functions, but the most useful of these is to display network summary information for the device. To see this type of summary information, just type NetStat -e.

3. ARP: The ARP command corresponds to the Address Resolution Protocol.. Its job is to map IP addresses to MAC addresses.

4. NbtStat: The computer name is sometimes referred to as the NetBIOS name.

5. Hostname: The previously discussed NbtStat command can provide you with the host name that has been assigned to a Windows device. Typing Hostname at the command prompt returns the local computer name.

6. Tracert: Tracert, or —Trace Route, is a utility for examining the path to a remote host.

Functionally, Tracert works similarly to Ping. The major difference is that Tracert sends a series of ICMP echo requests, and the request's TTL increased by 1 each time. This allows the utility to display the routers through which packets are passing to be identified. When possible, Windows displays the duration and IP address or fully qualified domain name of each hop.

7. IPConfig: The IPConfig. At its simplest, the IPConfig command will display basic IP address configuration information for the device. Simply type IPConfig at the Windows command prompt and you will be presented with the IP address, subnet mask, and default gateway that the device is currently using.

8. NSLookup: NSLookup is a great utility for diagnosing DNS name resolution problems. Just type the NSLookup command, and Windows will display the name and IP address of the device's default DNS server. From there, you can type host names in an effort to see if the DNS server is able to resolve the specified host name.

9. Route: IP networks use routing tables to direct packets from one subnet to another. The Windows Route utility allows you to view the device's routing tables. To do so, simply type Route Print.

10. PathPing: The PathPing tool is a utility that combines the best aspects of Tracert and Ping.

Entering the PathPing command followed by a host name initiates what looks like a somewhat standard Tracert process. Once this process completes however, the tool takes 300 seconds (five minutes) to gather statistics, and then reports latency and packet loss statistics that are more detailed than those provided by Ping or Tracert.

11. NetDiag: The NetDiag command is designed to run a battery of tests on the computer in order to help the technician figure out why the computer is experiencing networking problems.

### 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- Network Layer

### Teaching Strategies

- Engage students in the discussion in group on the research findings Engage students in pairs to Evaluate OSI Models
- Discuss and presentations of the protocols in OSI Models.

### Learning Strategies

1. Activity 1 Define the OSI Model and Research on the Development of the OSI Model.
2. Activity 2 Discover the Layers of the OSI Model
3. Activity 3 Identify protocols in each layer of the OSI Architecture Model

### Resources

[https://study.com/academy/lesson/ what-is-communication-protocol-tcp-ip-lesson-quiz.html](https://study.com/academy/lesson/what-is-communication-protocol-tcp-ip-lesson-quiz.html)

## Lesson 2: Layering in TCP/IP reference model Network Utilities in TCP/IP

### Teaching Strategies

- Engage students in the discussion in group on the research findings Engage students in pairs to Evaluate TCP/IP Models
- Discuss and presentations of the protocols in TCP/IP Models.

### Learning Strategies

1. Activity 1 Define TCP and IP Model and Research on the Development of the TCP/IP Layering.
2. Activity 2 Discover the Layers of the TCP/IP Model
3. Activity 3 Identify protocols in each layer of the TCP/IP Architecture Model

### Resources

<https://study.com/academy/lesson/what-is-communication-protocol-tcp-ip-lesson-quiz.html>

## Lesson 3: Network Utilities in TCP/ IP

### Teaching Strategies

- Engage students in the discussion in group on the research findings
- Engage students in pairs to identify some of the common Network utilities in Windows. Engage the students to practically demonstrate the commands using the run command.

### Learning Strategies

1. Activity 1 Define and understand the importance of network utility in a network.
2. Activity 2 Discuss the 11 Utilities used in Windows, identify for other software applications in other computer OS.
3. Activity 3. Demonstrate on computers the common commands to run network utilities.

### 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: 11.4.1.3** Describe the services provided by network servers and appreciate network applications.

### Topic 3: Network Servers and it's Applications

### Learning Objectives

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

- Describe the service and applications of Network Server.

### Essential Questions:

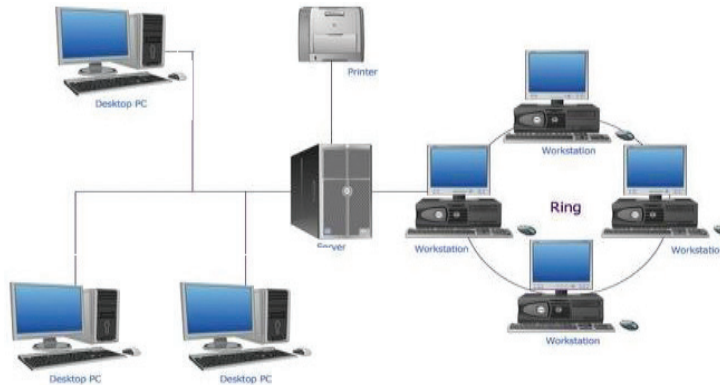
1. What are Network Servers? Types of Network Servers and their Functions
2. What is a Network Operating system?
3. What is a network application?
4. What are the types of services provided by the network servers?

### Essential Knowledge, Skills, Values and Attitudes

| Knowledge                            | Skills                                                | Values                                       | Attitudes                                                                  |
|--------------------------------------|-------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------------|
| Services provided by network servers | Analyse types of network servers and their functions. | Rationality,<br>Interdependent<br>Creativity | Appreciate and be Critical of the operational functions of network servers |

## Content Background:

A network server is a computer system, which is used as the central repository of data and various programs that are shared by users in a network. Network server assists the role of system administrators including those centering around management. It controls the services and maintenance for all computers on the network.



It helps in providing various resources like hardware access to storage space, access to other peripheral devices and computers in network. A network server plays the same role as a workstation computer but has more functions to control.

Network Operating systems (NOS) is a special software that controls and manages a network and has special functions for connecting computers and devices into a Local Area Network or inter-networking. Some popular NOSs for DOS and Windows system include, Windows NT, 2000, 2003, 2008 Server, IBM OS2 and the Cisco IOS (Internet Operating System)

Network operating system has a tasks to control the flow of data between the devices on the network and the requests for data. The network operating system organises messages from nodes until the network is ready to process the message. The tasks performed by a network operating system and the administrator of the network include:

**Administration**—adds, removes and organizes users. Groups of users are often given the same permissions and rights. Permissions and rights allow access to particular files and resources.

**File management**—gives users access to the remote hard disks on the server. It provides a file system and the ability to manage a network directory. Drives and directories are mapped for users.

**Applications**—handles requests from users to share applications. The NOS is used to install software. It is easier for network administrators to comply with software copyright laws using a network. Access to the application files is restricted.

Resource management—allows network devices such as printers and modems to be shared. It assigns users to printers and orders print jobs. The NOS is able to track the use of resources. This assists with budgeting.

### Teaching and Learning Strategies

The teaching is now centered around a network with a server and the services it provides. In terms of software the teacher must come up with a reliable method to enable students understanding on the functions of the software running on server and the network. Teachers are encouraged to introduce students to simulations and engineering thinking process 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 Network servers

### Teaching Strategies

- Engage students in the discussion in group on network and server.
- Engage students in pairs to differentiate the terms Network server/Client server .
- Engage the students to present their discussions on their understanding of a network environment.

### Learning Strategies

1. Activity 1 Define and understand what is a server and when is it used?
2. Activity 2 Discuss the function of a Network server.
3. Activity 3 Demonstrate on computers using an Application to create a network with a server or sketch the diagram.

## Lesson 2: Network Operating Systems and Application

### Teaching Strategies

- Engage students in the discussion in group on software used on Network server soft wares.
- Engage students in pairs to differentiate between the Network Operating and Network Applications.
- Engage the students to present their discussions on their understanding of software used in a network environment.

### Learning Strategies

1. Activity 1 Define and understand the importance of a Network Operating System and Network Applications and when it is used?
2. Activity 2 Discuss the different types of Network operating system software and applications available on the market.
3. Activity 3. Do presentation on the role of software on the network server.

## Lesson 3: Services provided by the network servers

### Teaching Strategies

- Engage students in the discussion in group on the types of services provided by network servers.
- Engage students in pairs to access shared folders or print on shared printer using an existing network.
- Engage the students to practically configure shared folders and devices.

### Learning Strategies

1. Activity 1 Identify the types of services and list down ?
2. Activity 2 Interpret the existing shared folders and devices on current network.
3. Activity 3. Demonstrate on how to configure folders and devices to be shared on a network server.

## 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: 11.4.1.4.** Demonstrate an understanding of the core concepts, techniques, and skills required to produce a range of communications media products or services

### Topic 4: Production Skills and Techniques

### Learning Objectives

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

- Demonstrate and apply the skills and techniques in media productions.

### Essential Questions:

1. What is Media Production?
2. What are the types of Media Production?
3. What are the skills and techniques required in media productions and services?
4. What is Data Communication and Networking
5. What are Production Skills and Techniques (Communication media products and

services)

### Essential Knowledge, Skills, Values and Attitudes

| Knowledge        | Skills      | Values     | Attitudes                                            |
|------------------|-------------|------------|------------------------------------------------------|
| Media Production | Demonstrate | Creativity | Creative in developing communication media products. |

Technology and Industrial Arts application: Communication Technology

## Content Background

### Media:

Media includes any type of communication, information or entertainment intended for a large audience. It can include anything from film and tv to corporate, promotional, educational or web based material. We live in a world dominated by various kinds of media. Every day, people engage with and consume information from many different mediums using various devices, sometimes at the same time. For instance, they may listen to a podcast or the radio while checking social media on their phone or watch TV while looking for recipes on their tablet.

Media refers to any kind of communication whose purpose is to inform , educate or entertain a wide audience, It can be anything from web content to social media to TV, video and radio content.

The media trends are always changing and evolving but one thing is certain the role of media in people's everyday lives and its impact on our personal, social and political circumstances is enormous..

### Print Media

The term 'print media' is used to describe the traditional or "old-fashioned" print-based media that today's parents grew up with, including newspapers, magazines, books, and comics or graphic novels. Historically, only wealthy publishers had access to sophisticated type-setting technologies necessary to create printed material, but this has changed in recent years with the widespread accessibility of desktop publishing software and print-on-demand publication services such as Lulu.com (LINK). More recently, electronic book readers such as the Amazon Kindle which store hundreds of books on a single device and which allow readers to directly download books and newspapers have become popular.

### Television

Television has been entertaining American families for over fifty years. In the beginning, there were few programs to pick from, but today, there are literally hundreds of general and specialty channels to choose from and thousands upon thousands of programs. Where it was once the case that programs had to be watched at the time they were broadcast on a television, this is no longer the case. Today, viewers can summon a movie or television episode whenever they want, through many cable or satellite services' pay-per-view or free on-demand services. They may also down-

load or stream episodes from the Internet and watch them on their computers.

Viewers may use DVR (digital video recorder) devices, such as a Tivo to record programs at one time and watch them at another time. Viewers with certain cell phones may even watch programs through their cell phones.

### **Movies**

Movies (films) are the oldest form of motion picture technology capable of capturing lifelike video-style images. Originally, movies could only be consumed at a neighborhood movie theater, but these days movies are widely available for people to consume in their homes, on their computers, and even in through their telephones. Commercial movies are broadcast on television, and via cable and satellite services which may feature High Definition (HD) video resolution and sound, essentially allowing the movie theater experience to be replicated in a home theater environment. Commercial movies are also distributed on DVD and Blu-Ray disks, which can be rented from stores and through-the-mail services such as Netflix, and through downloadable computer files, which can be legally downloaded from movie rental services such as Amazon and iTunes or streamed through Netflix or on-demand cable services. Home movies produced by amateurs with inexpensive video cameras are now also widely available through video sharing websites such as YouTube.com and Vimeo.com.

### **Video Games**

Available since the early 1980s, video games have only grown in popularity among youth. Today's games make use of advanced graphics and processors to enable three dimensional game play featuring highly realistic landscapes and physics simulations, and the ability to compete against other players through a network connection. Modern video games are immersive, exciting and increasingly interactive. Players feel like they really are in the situation because of the life-like graphics and sounds. Through video games, youth can extend their pretend play, as they become soldiers, aliens, race car drivers, street fighters, and football players.

Popular gaming consoles today include Nintendo Wii, Microsoft Xbox 360 and Sony PlayStation III. There are also hand held consoles which enable mobile game play such as Nintendo's DS. As well, some video games can also be played on personal computers. Most video games use a hand-held device with buttons, joysticks, and other devices for manipulating the characters on the screen. However, the newer games systems use motion-detecting sensors, such as accelerometers which encourage players to move their entire body to complete game activities. For example, in Wii Tennis, a player swings his entire arm to have the player on the screen hit the tennis ball.

Games such as the recently popular World of War craft are played in a networked universe shared simultaneously by thousands of gamers at once. Players may be across the street from one another or across the globe using the Internet to participate in a shared three-dimensional world in which each player can control one or more avatars, and chat using text or voice

### **Types of Media Products:**

Media can be classified into four areas.

1. print media
2. broadcasting media
3. internet
4. Outdoor Advertising

1. Print media Print media uses electronic software to produce Newspapers which are provided to the readers and printed text is given to highlight important news, magazines, journals, books.

2. Broadcasting media The main broadcasting media is television. It combines visual images through sound, motion and videos and is a powerful audio visual media. Radio produces information through frequency signals and lacks visual elements.

3. The internet Internet is expensive as it provides websites for online brochures, and Emails is another advantage of sending information using internet. In Modern society, Digital media products has help with the use of computers and internet access, software's like Desktop Publishing software has the option to create electronic newspapers magazines , and other documents to be used on the internet.

4. Outdoor Advertising Outdoor advertising deals with billboards, boarding, posters, etc. Cinema and video display movies using sound, movement and colour similar to television.

#### **Skills and techniques required in media productions and services.**

| Media Type  | Windows based PC                               | Apple Mcintosh                           |
|-------------|------------------------------------------------|------------------------------------------|
| Words       | .TXT, .RTF, Micro-soft Word                    | Text, RTF,                               |
| Pictures    | .PCX, .BMP, .GIF, .JPG, .CDR, .WMF, .EPS, .TIF | Paintings(PTNG),PICT,GIF,JPEG,EPS-F,TIFF |
| Sounds      | .WAV, QuickTime, RealPlayer                    | AIFF,Quicktime                           |
| Animations  | Animated GIF, Quick-Time                       | Animated GIF, QuickTime                  |
| Video Clips | AVI, QuickTime                                 | Quicktime                                |

A table showing common file format for the different media types.

#### **Teaching and Learning Strategies**

Teachers are encouraged to introduce students to simulations and engineering thinking process 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. Students learn storytelling using a variety of digital media. The general aim of the Unit is to provide opportunities for learners to use different media to create their own media products. Teachers are free to select the skills, knowl-

edge, understanding and contexts which are most appropriate for delivery in their schools. Content and contexts which are used in the teaching of this Unit are at the discretion of the school.

## Lesson 1: Introduction to Media Communication – Types of Media Products

### Teaching Strategies

- Engage the students in group discussions on a task to create a multimedia product and decide whether to use print publication or screen publication. Explain your answer.
- Engage the students to discuss and list down the essential components needed for the multimedia presentation.

### Learning Strategies

1. Activity 1 Discuss in groups a task to create a multimedia product and decide whether to use print publication or screen publication. Explain your answer.
2. Activity 2 Students discuss and list down the essential components needed for the multimedia presentation.

## Lesson 2: Skills and Techniques in Media production and Services

### Teaching Strategies

- Engaging students to demonstrate skills in using capturing devices.
- Engage in Discuss about specific authoring software and describe its features.
- Engage Create appropriate media files to suit the presentation software's used?

### Learning Strategies

1. Activity 1 Demonstrate skills in using capturing devices.
2. Activity 2 Discuss about specific authoring software and describe its features.
3. Activity 3 Create appropriate media files to suit the presentation software used?

### UNIT1. Data Communication and Network

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

**Benchmark: 11.4.1.5.** Demonstrate the knowledge of technical terminology, basic scientific concepts, and mathematical concepts used in communications technology and apply them in creating media products

**Topic 5: Knowledge of Technical Terminologies, Mathematics and Science Concepts (Devices and Technology)**

### Learning Objectives

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

- Explore and state the different technical terminologies in basic scientific concepts and mathematical concepts used in communication technology in media products.

### Essential Questions:

1. What is Media Production?
2. What are some technical terminologies in Media Products?
3. How can we apply the mathematical and scientific aspect in the process of creating media production?

### Essential Knowledge, Skills, Values and Attitudes

| Knowledge                                                         | Skills            | Values     | Attitudes                                           |
|-------------------------------------------------------------------|-------------------|------------|-----------------------------------------------------|
| Technical terminologies and Mathematical and scientific concepts. | Demonstrate apply | Creativity | Creative in developing communication media products |

Technology and Industrial Arts Application: Communication Technology

### Content Background:

#### Media Production:

Media production is the process of creating the types of media into the end products. Multimedia is when the media types are all integrated by a specific software and creates an interactive presentation, Media making uplifts the science and engineering practices of obtaining, evaluating, and communicating information. Students use media to create science documentary using creativity in engineering design process and try to address the real world issues.

#### Newspapers

Newspapers are a digital media product which contains various news and current affairs from all around the world. The production of Newspapers can involve processes hardware and software. Media capture the science, mathematical and technology behind devices, machines, materials and ink.

They are created using DTP software and renowned Newspapers are written and published by large offices all around the world. Newspapers are printed on paper and distributed digitally. Digital newspapers are distributed over the internet and millions of people read such newspapers everyday. A user pays a subscription fee allowing unlimited access to all articles that the newspaper has made available and can choose to opt for an option which only shows the user articles in topics they are interested in.

### Material for Printing Newspaper

- Newsprint is the paper used for printing
- Ink: Newspaper Ink is used because it dries quickly and produces sharp, readable, text images.
- Plates – It transfers the content onto the News print made by aluminum.
- Printing Press. Newspaper printing is done using large scale rotary printing process.
- Prepress Materials – Before the printing process, Layout and design, software, image processing, tools and colour calibration equipment. Identify Mathematical, scientific, engineering and technological process.

### Audio sequences:

Audio generally refers to sound that is captured using a microphone. An audio sequence is a short piece of sound. Audio contains three physical characteristics. Amplitude, wavelength and frequency, Amplitude is the height of the lowest and highest point of the sound wave; wavelength is the size of sound wave and frequency is the rate of the vibration of the wave.

Modifying any of these physical characteristics is the basis of editing audio. Since audio naturally exists in analog form, capturing it requires it to be converted into digital form, a process performed by the microphone and computer hardware.



### Audio Sequence (Materials for recording)

1. Microphone; Used to capture for specific vocals and instruments. Dynamic Condenser, Ribbon, Microphone for specific needs.
2. Audio Interface: Acts as a bridge between computer and microphone converting audio signals from microphone into digital signals.
3. Headphones. Helps you hear accurately
4. Computer store audio recordings and use applications to carry out your recording.
5. Recording Software” Software that suits your needs and support operating system.
6. Acoustic Treatment



### **Musical compositions**

Music can be defined as a series of sounds that are combined to produce sound that is pleasant to the ear and enjoyable. People who produce music are called Composers and the music they produced are called compositions.

Music is produced using instruments. Modern instruments are often electronic and can be connected to a computer using an interface known as MIDI (Musical Instrument Digital Interface). MIDI allows up to 16 devices to be simultaneously connected and played. The quality of the sound is dependent on the synthesizer used to play it. The music played on the instruments are stored on the computer, which can be edited if required. Music from the various instruments are often combined, along with human vocals as well, to create a musical composition.

### **Animation Sequences:**

Animation is the illusion of movement by drawing a series of models or puppets or positions. When the drawn images are presented in rapid succession, it seems to appear that is moving.



Animation is most commonly used to create cartoons, where a drawn character appears to move and interact with its environment and other characters. It is also used in other fields such as video games, movies, educational videos etc.

### **Animation (Types of animation)**

1. Traditional Hand Drawing
2. Computer generated Animation-Creating digital images
3. Stop Motion- Animated photographs are taken at each stage played in sequence. It creates the illusion of movement.
4. D Animation – Technique uses computer.

### **Video Production:**

The process of creating video using digital video cameras and creating a combination of various videos is called video production.

They are combined in order to create a story line. A specific scene is shot using a video camera, which is later transferred to a computer. The scene is then edited. Things such as special effect, sounds etc are added and the video are cropped or trimmed if necessary. After each individual scene (segment of the final product) is edited and finalised, they are combined and any last minute editing is performed such as adding credits at the end etc. The finished product is a video which has a storyline that serves to entertain (e.g. movie) or to convey a message (e.g. advertisement). The entire process from recording the video to editing and finalising it is called video production.

In digital media, a range of file formats are used to store various types of digital media products in digital form. File formats differ depending on the kind of media product. Below is a list of some of the popular file types in use for different types of media products.

### **Video Production (Steps) Video Production requires various skills and equipment.**

1. Concept development –Brainstorm Idea
2. Production Setup
3. Post Production(video editing, import photos, visual effect, audio editing, colour grading, sound design finalising.

### **Audio:**



1. MP3: Short for MPEG Layer-3, MP3 is the most common file format for audio. It is a file format that compresses the data and uses lossy compression to do so. Almost every digital media device capable of playing sound supports MP3.
2. WAV: A file format developed by Microsoft and IBM. It is a file format which compresses the data using lossless compression and is the main audio format used in Windows systems to store audio such as system sounds.
3. WMA: Stands for Windows Media Audio and is a proprietary, lossy file format made by Microsoft. It is supported by most digital media players.
4. OGG: A free, open source file format maintained by the Xiph.Org Foundation. It is unrestricted by software patents and was designed to provide for efficient streaming

and manipulation of high quality digital media.

### Video:



1. MP4: Also known as MPEG-4, is a commonly used video format amongst end computer users. It is a lossy compression file format. It is capable of storing both audio and video in the same file, like most other file formats.
2. AVI: Stands for Audio Video Interleave and was developed by Microsoft. It is a very common video format and it typically uses lossy compression but a format it lossless compression is also available.
3. MOV: A video format developed by Apple, based on MPEG-4 standard. It is a lossy compression file format and is compatible with both Macintosh and Windows systems. It is also a file format used for animation
4. WMV: Short for Windows Media Video, it is a proprietary video file format developed by Microsoft. It used lossy compression and was originally designed for Internet streaming applications.

### Animation:

1. GIF: Short for Graphics Interchange Format, it is a lossless file format used for animation. It is a popular file format on the internet because of its wide support and portability. However, it is not very high quality as it is limited to 256 colours.
2. SWF: Also known as Small Web Format, it is developed by Adobe and is played within browsers using Adobe's Flash player plugin. They contain smooth video and vector graphics based animations. The file format has been designed with fast delivery over the internet in mind.
3. Graphics- Bitmap  
Bitmaps use a photograph composed of pixels while vector graphics uses mathematical equations.



4. **BMP:** Also known as Bitmap Image file, is a file format commonly used raster graphics format for saving image files. It is a lossless file format and is capable of storing high quality graphics. It was first introduced by Windows, but now recognised by many programs on both Windows and Mac

5. **JPEG:** Short for Joint Photographic Expert Group, it is the most commonly use file format to store images. It is a lossy file format and supports 16.7 million colours. It is capable of reducing the file size of an image to just 5% of its original, RAW form, but as with all lossy file formats, some quality is sacrificed in order to achieve this.

**PICT:** Developed in 1984 by Apple computer, it was released to be the default file format on Macintosh computers for graphics. It is a meta-format (generic format) that can be used to store both bitmap and vector graphics. It has slowly been replaced by other file formats and though it is still in use, it is usually used when there are no alternatives.

### Graphics- Vector:

Vector Graphics is a broader term that refers to and is created using mathematical equations, geometric shapes such as lines and polygons.



1. **WMF:** Stands for Windows Metafile. It was designed by Microsoft for Windows computers in the early 1990's. Like the PICT file format, it is a meta-format and supports both bitmap and vector graphics.

2. **EPS:** Short for Encapsulated Postscript Vector graphics, its a file format commonly used by Adobe Illustrator (vector graphic creation software) to store vector graphics. It is becoming an outdated file format and being replaced by better alternatives.

**Text based:**

1. **DOCX:** The most commonly used file format for storing documents that have been created in a word processor. It was introduced in 2007 by Microsoft and is the default format for saving documents. It is supported by all major word processing software such as Microsoft Word and Open Office Writer. It is capable of storing both text and images which can be edited unless the document has been set to “Read- Only”



2. **PDF:** Short for Portable Document Format, it is a file format used to display documents. It encapsulates all elements of a document (text, image) and present them in an image form which can be viewed, printed, navigated etc. Unlike DOCX, where the document can be edited after creation, PDF documents usually cannot be edited.

<https://digitalmediaresources.weebly.com/types-of-digital-media-products.html>

### Teaching and Learning Strategies'

The topic is about completion of terms and terminology with science, mathematics and engineering concepts identified in media products.

Teachers are encouraged to introduce students to simulations and engineering thinking process 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: Technical Terminology

### Teaching Strategies

- Engage students in discussions about Multimedia terms and media ,
- Engage students to formulate sentences using appropriate words

- Engage students to discuss the purpose of using Html.

### Learning Strategies

1. Activity 1 Define multimedia terms.
2. Activity 2 Create sentences using appropriate terms
3. Activity 3 Describe and write down some Html tags.

## Lesson 2: Media production

### Teaching Strategies

- Engage students to give reasons why it is important to consider visual display units in designing multimedia presentation.
- Engage students to discuss the process of creating an interactive multimedia presentation.
- Engage the students to describe the media types and their productions.

### Learning Strategies

1. Activity 1 Students discuss and give reasons to the importance of designing the visual display.
2. Activity 2 Students present on their discussions on what an interactive multimedia production is.
3. Activity 3 Students discuss and list down the media types and media products.

## Lesson 3: Apply mathematical and scientific concepts in creating media products.

### Teaching Strategies

- Engage students to describe the graphics design of media production and the scientific concept involve.
- Engage students to describe the animation of media production and the scientific concept involve.
- Engage students to describe the video of media production and the scientific concept involve.

### Learning Strategies

1. Activity 1 Students describe the graphics design of media production and the scientific concept involve.
2. Activity 2 Students describe the Animation of media production and the scientific concept involve.
3. Activity 3. Students describe the Video of media production and the scientific concept involve.

## UNIT 2: COMPUTER SECURITY AND SAFETY

| Unit                            | Benchmark | Topic                        | Lesson Titles                                                                                          |
|---------------------------------|-----------|------------------------------|--------------------------------------------------------------------------------------------------------|
| 2. Computer Security and Safety | 11.4.2.1  | Computer and Data Security 1 | 1. Computer Security<br>2. Data Security                                                               |
|                                 | 11.4.2.2  | Health and Safety Measures   | 1. Fundamental Health and safety<br>2. Proper Health and Safety Measures (Application)                 |
|                                 | 11.4.2.3  | Computer and Data Security 2 | 1. Computer Security<br>2. Data Security                                                               |
|                                 | 11.4.2.4  | Embedded Systems             | 1. Introduction to embedded systems<br>2. Types of Embedded systems<br>3. Model of an embedded systems |
|                                 | 11.4.2.5  | Responsible Citizenship      | 1. Citizenship and the technology<br>2. What is a responsible digital citizen?                         |

### UNIT 2. Computer Security and Safety

**Content Standard: 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.

**Benchmark: 11.4.2.1** Identify and evaluate devices and technologies used to improve data and computer security.

#### Topic 1: Computer and Data Security 1

#### Learning Objectives

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

- Identify and evaluate the computer and data security.

#### Essential Questions:

1. What is computer security?
2. What devices are used in computer security?
3. What affects the computers?
4. What is data security?
5. What are the devices and technologies used to improve the data security and computer security?

#### Essential Knowledge, Skills, Values and Attitudes

| Knowledge | Skills | Values | Attitudes |
|-----------|--------|--------|-----------|
|-----------|--------|--------|-----------|

|                                                          |                      |                         |                                                                        |
|----------------------------------------------------------|----------------------|-------------------------|------------------------------------------------------------------------|
| Devices and Technology for<br><br>computer data security | Identify<br>Evaluate | Rationality sensitivity | Appreciate the development of technology to protect computer and data. |
|----------------------------------------------------------|----------------------|-------------------------|------------------------------------------------------------------------|

Technology and Industrial Arts Application: Communication Technology

## Content Background

### What is computer security?

Computer security is the protection of computer systems and information from harm, theft, and unauthorised use. It is the process of preventing and deleting unauthorised use of your computer system. There are various types of computer security which is widely used to protect the valuable information of an organisation.

Computer security is by asking what is being secured. For example, Information secured is securing information from unauthorised access, modification & deletion

Application security is securing features to prevent from Cyber Threats such as SQL injection, DOS attacks, data breaches and etc.

Network security means securing a standalone machine by keeping it updated and patched.

Network Security by securing both the software and hardware technologies.

Cyber security is defined as protecting computer system, which communicate over the computer network.

Computer security threats.

These are possible dangers that can possibly hamper the normal functional of your computer. In the present age, cyber threats are constantly increasing as the world is going to digital. The most harmful types of computer security are:

**Virus**

A computer virus is a malicious program which is loaded into the user's computer without user's knowledge. It replicates itself and infects the files and programs on the user's PC.

**Computer worm**

A computer worm is a software program that copy itself from one computer to another, without human interaction. The potential risk here is that it will use up your computer space because a worm can replicate in great volume and with great speed.

### Phishing

Disguising as a trustworthy person or business, phishers attempt to steal sensitive financial or personal information through fraudulent email or instant messages. Phishing is unfortunately very easy to execute. You are deluded into thinking it's the legitimate mail and you may enter your personal information.

### Botnet

A botnet is a group of computers connected to the internet, that have been compromised by a hacker using a computer virus. An individual computer is called 'zombie computer'. The result of this threat is the victim's computer, which is the bot will be used for malicious activities and for a larger scale attack like DDoS.

### Rootkit

A rootkit is a computer program designed to provide continued privileged access to computer while actively hiding its presence. Once a rootkit has been installed, the controller of the rootkit will be able to remotely execute files and exchange system configuration on the host machine.

### Keylogger

Also known as keystroke logger, keyloggers can track the real – time activity of a user on his computer. It keeps a record of all the keystrokes made by user keyboard. Keylogger is also a very powerful threat to steal people's login credential such as username and password.

### Spyware

It is a kind of malware that secretly gathers information about a person or organization and relays this data to other parties.

### What is Computer Security?

Computer security, also known as cyber security or IT security, is the protection of information systems from theft or damage to the hardware, the software, and to the information on them, as well as from disruption or misdirection of the services they provide. It includes controlling physical access to the hardware, as well as protecting against harm that may come via network access, data and code injection, and due to malpractice by operators, whether intentional, accidental, or due to them being tricked into deviating from secure procedures

### What are the concerns of computer security?

Computer Security is concerned with four main areas:

**Confidentiality:-** Only authorized users can access the data resources and information.

**Integrity: -** Only authorised users should be able to modify the data when needed.

**Availability: -** Data should be available to users when needed.

**Authentication: -** are you really communicating with whom you think you are communicating with

Why is computer security important?

Prevention of data theft such as bank account numbers, credit card information, passwords, work related documents or sheets, etc. is essential in today's communications since many of our day to day actions depend on the security of the data paths.

Data present in a computer can also be misused by unauthorised intrusions. An intruder can modify and change the program source codes and can also use your pictures or email accounts to create derogatory content such as pornographic images, fake misleading and offensive social accounts.

Malicious intents can also be a factor in computer security. Intruders often use your computers for attacking other computers or websites or networks for creating havoc. Vengeful hackers might crash someone's computer system to create data loss. DDOS attacks can be made to prevent access to websites by crashing the server.

Above factors imply that your data should remain safe and confidential. Therefore, it is necessary to protect your computer and hence the need for Computer Security arises.

Some unknown facts about computer security Companies are not really aware of the modes of attacks

With technology, attackers have evolved over the years to deploy sophisticated methods and impose attacks on their target networks. Companies are much confident about their progress in IT security, however, in reality, they are not aware of how they are being attacked. 2017 has seen the worst types of attacks of all times – Wanna cry and Petya Ransomware exposed confidential data through data breaches. Considering the same, organisations are at high risks all the time. The risks and threats are always accumulated and created so staying updated and having the correct forms of security measures and consistently monitoring on the new forms of threats would benefit companies to know where they are in terms of security.

Every company is hacked

When we hear about a company's breach, our instant reflex would make us think that the company does not practice proper computer security. However, every company is at high risk and are likely to be attacked anytime.

Penetration testers experience ethical hacking to be very simple and they easily outplay the existing security system of a computer network. Hence it is a verdict that all the computers are not secured. In most information systems, the data is shared by many people this makes the database vulnerable to improper access or use.

### Teaching and Learning Strategies

Teachers are encouraged to introduce students to simulations and engineering thinking process 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: Computer Security

### Lesson Objective

By the end of the lesson students will be able to:

- Define computer security
- Describe computer data and computer security

### Teaching Strategies

- Engage students to define computer security in pairs.
- Engage students to discuss and give evidence of activities in the information system that suffers from theft or damage to the hardware, the software, and to the information on them, as well as from disruption or misdirection of the services they provide.

### Learning Strategies

1. Activity 1. Students define computer security in pairs.
2. Activity 2 Students discuss and give evidence of activities in the information system that suffers from theft or damage to the hardware, the software, and to the information on them, as well as from disruption or misdirection of the services they provide.

## Lesson 2: Data Security

### Teaching Strategies

- Engage students to define the meaning of Data Security.
- Engage students to give access to unauthorized actions and data corruption.

### Learning Strategies

1. Activity 1 Students define the meaning of Data Security
2. Activity 2 Students give examples of access to unauthorized actions and data corruption.

### UNIT 2. Computer Security and Safety

**Content Standard: 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.

**Benchmark: 11.4.2.2** Explore and apply proper health and safety measures

**Topic 2: Health and Safety Measures**

### Learning Objectives

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

- Explore and apply health and safety measures.

### Essential Questions:

1. What is fundamental Health and safety?
2. What is ergonomics?
3. What is social and ethical issue?
4. What is the Development of monitoring and controlling system for; software, hardware, information security in society?

### Essential Knowledge, Skills, Values and Attitudes

| Knowledge                  | Skills         | Values                                                                | Attitudes                                                                       |
|----------------------------|----------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Health and safety measures | Explore, Apply | Self-esteem, adaptable to change, betterment of human sustainability. | Responsible and appreciative of health and safety measure when using computers. |

Technology and Industrial Arts Application: Communication Technology

### Content Background

#### HEALTH AND SAFETY IN TECHNOLOGICAL EDUCATION

Health and safety is of paramount importance in technological education. In every course, students must be made aware that health and safety is everyone's responsibility –at home, at school, and in the workplace.

Before using any piece of equipment or any tool, students must be able to demonstrate knowledge of how the equipment or tool works and of the procedures they must follow to ensure its safe use. Personal protective gear must be worn as required.

Classroom practice and all aspects of the learning environment must comply with relevant municipal, provincial, or federal health and safety legislation.

As much as we can integrate our lives with computers, there are health concerns that result in using technology in our case computers. They are RSI (repetitive Strain Injury, Stress, Eyes Strain ELF (Extremely Low Frequency radiation and Dependency. These are health issues that affect humans as a result of using computers. A computer is screen based equipment and has illuminated display, there are four main areas of concern we can look at .They are the hardware, furniture, operating environment and work practices.

Ways to protect and minimize chances of health problems.

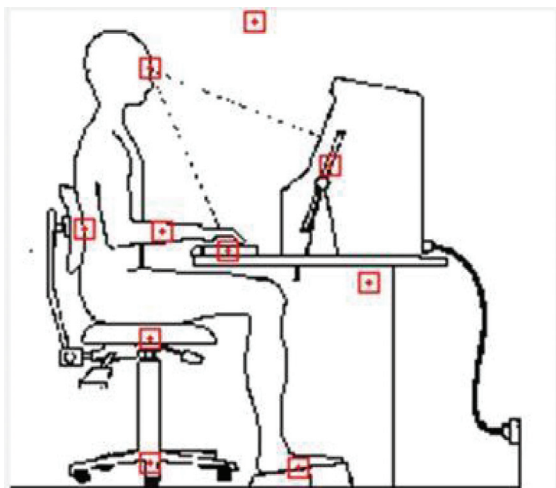
Protect the hardware from theft activities, dust, smoke and heat as it limits the operating conditions set by the manufacturers.

Manufacturers of information technological equipment must design the hardware to be easy and safe for use.

Screen glare covers can be used to reduce the glare from screen.  
 Keyboards that are design to decrease the pressure on keys.  
 The modern mouse can be more ergonomically to fit the hand.  
 Usage of Power Supply to protect the internal components to blow.  
 Positioning in sitting and desktop arrangement must be adequate .  
 Take regular breaks in the use of computer screen and keyboard typing.

### Posture

Posture is one factor that can affect the practice of typing. Please make sure you are seated correctly as indicated.



The optimum viewing angle for keyboard users occurs when the centre of the screen is 20 degrees below the horizontal when in normal typing position. The distance from the eyes to the screen, keyboard and source documents should be the same in order to reduce eyestrain from focusing.

The distance from the eyes to the screen, keyboard and source documents should be the same in order to reduce eyestrain from focusing. Copy holders can be used to position documents in the same visual plane as the screen.

The forearms and wrists must be kept in a straight line parallel to the floor. Do not allow the wrists to drop and rest on the keyboard or desk.

### Fingers

## Teaching and Learning Strategies

Teachers should make use of all available and relevant resources to make students sufficiently aware of the importance of health and safety. Teachers are responsible for ensuring the safety of students during technology lab, shop, and classroom activities. Health and safety issues must also be addressed when learning Involves cooperative education and other workplace experiences Teachers need to encourage and motivate students to assume responsibility for their own safety and the safety of others, and they must help students develop the knowledge and skills needed for safe participation in all technology-related activities. For these reasons, teachers must model safe practices at all times and communicate safety expectations to students in accordance with school board policies and procedures, Ministry of Education policies, and Ministry of Labour regulations.

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: Fundamental Health and Safety

### Lesson Objective

### Teaching Strategies

- Engage students to investigate the types of health problems encountered with the use of computers.
- Engage students to discuss about solutions to better work practices that limit the factors affecting the health of people when using computers.

### Learning Strategies

1. Activity 1. Students investigate the problems faced by computer users in organisations as a result of using computers.
2. Activity 2. Discuss solutions on how to promote better health practices when using computers.

## Lesson 2: Proper Health and Safety Measures (Application)

### Teaching Strategies

- Engage students to discuss about safety in work place
- Engage students to identify appropriate sitting postures

### Learning Strategies

1. Activity 1 Students discuss the rules and regulations of the workshop.
2. Activity 2 Discuss each sitting posture positions and identify the health problems.

### UNIT 2. Computer Security and Safety

**Content Standard: 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.

**Benchmark: 11.4.2.3** Determine and give reasons to justify the concepts of computer and data security..

### Topic 3: Computer and Data Security 2

### Learning Objectives

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

- determine and justify computer data and security.

### Essential Questions:

1. What is the importance of computer and data security?
2. What are the monitoring and security approaches in computer and data security?

### Essential Knowledge, Skills, Values and Attitudes

| Knowledge                  | Skills             | Values      | Attitudes                                                           |
|----------------------------|--------------------|-------------|---------------------------------------------------------------------|
| Computer and data security | Determine, Justify | Rationality | Responsible, Caring and concern for the safety of computer and data |

Technology and Industrial Arts Application: Communication Technology

### Content Background

#### Security of information

A network aims to share resources and provide communication for users. It provides an opportunity for hackers to access data. Network security requires careful planning and needs constant review to ensure procedures are appropriate.

Security of information involves storage, backup and data security. Networks are required to store huge quantities of data. Storage involves using magnetic disk and magnetic tape.

Magnetic disk storage is used when immediate access to data is required. It uses direct access. This form of access allows data to be found directly without accessing all the previous data.

Magnetic tape is used as a backup medium. It can store large quantities of data inexpensively. Magnetic tape uses sequential access. This form of access starts at the beginning of the tape and reads all of the data until the required item is found.

#### Networking systems

Network users are encouraged to store important files on the server. However, a server is exposed to many risks such as a crash, theft or circuitry failure. Regular backups of data stored on the server are essential. A backup is another copy of the data that could be used to rebuild the system. Backups are sent to a warehouse storage facility through the Internet or secured offsite. If the system goes down the recovery process rebuilds the system. The success of backup and recovery depends on implementing appropriate procedures.

Data security is a series of safeguards to protect data. There is a range of security techniques that apply to networks:

User identification is the ability to identify the user to the network and to confirm their identity. A user is identified by entering a user ID and confirms their identity by

entering a valid password. A password is secret words or numbers that are typed on the keyboard to gain access to the system.

Logon security involves protecting user ID and passwords from unauthorised access. The password file should be encrypted and secured.

Access controls restrict users or a group of users to those files and resources they need to perform their job (see Figure 13.10). When connecting to a network a certain level of access is granted. This is done during a process of logging on.

Data encryption is used to prevent data from being intercepted during transmission. Encryption is the process of coding data and decryption the process of changing it back. It is the most effective way to achieve data security during the transmission of data. Data is coded, transmitted, and then converted back to its original form.

Firewalls are used on a network to check all incoming data for the purpose of verification and authentication. A firewall aims to protect the network from hackers trying to access sensitive information. Large networks have more than one firewall because barriers need to be placed at all critical points.

Anti-virus software is used to scan the network for a range of well-known viruses. Data infected by a virus is often costly to repair or impossible to replace. There is no guarantee that antivirus programs will stop every virus, as new viruses are always appearing. However, if the network uses the latest virus definition files and regularly uses the anti-virus program problems will be minimised.

Computer security managers are accountable for securing the computing resources and data of the company on a consistent basis. A security analyst should restrict access to specific users to gain confidential information.

### Planning Security

Security experts analyze and plan the computer protection measures to protect the vital components of the IT infrastructure to counter the possible vulnerabilities and threats.

### Securing the Infrastructure

The critical role of any security specialist is to secure the infrastructure of the corporate network. Even the most sought-after software can have the possibilities of retaining overlooked vulnerabilities that are detected only when there is an audit.

The security specialist is responsible to install a firewall to filter out the possible threats and an antivirus to scan, detect and remove any malware infection from the system.

### Monitoring the Infrastructure

The prime role of any security specialist is to monitor the corporate IT infrastructure. They are accountable to have a check on what goes in and comes out of the

network. They deploy automated security systems to monitor the activities of the system connected to the network. A key component of infrastructure security is the monitoring infrastructure. Security analysts place network and computer monitors at strategic points on the network and on critical servers. These monitors typically communicate with a central server, reporting all activity for later analysis. Security analysts use automated tools to scan the logs produced by the monitors and look for aberrations in the activity.

### 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: Computer Security 2

### Teaching Strategies

- Engage students to discuss about hackers and ethical hackers.
- Engage students to identify theft of data in a Network.
- Engage students to investigate how they can describe well-protected organisations.

### Learning Strategies

1. Activity 1 Students discuss in group what hackers are and why ethical hackers in a profession.
2. Activity 2 Students discuss and present how data and computers can be affected if it is not protected in a network.
3. Activity 3 Students to describe a well-protected organization in terms of data and computers.

## Lesson 2: Data Security 2 Teaching Strategies

### Teaching Strategies

- Engage students to identify theft of data in a network.
- Engage students to plan and outline the actions to encryption
- Engage students to investigate secure data handling practices

### Learning Strategies

1. Activity 1 Students discuss and plan out the active directory of a computer system.
2. Activity 2 Students discuss on the policies of cybercrime act 2016 (NICTA)

3. Activity 3 Students discuss and apply simple backup strategy and encryption methods.

## UNIT 2. Computer Security and Safety

**Content Standard: 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.

**Benchmark: 11.4.2.4.** Explain and implement various encryption schemes that are used to secure data and communication over networks.

### Topic 4: Embedded systems

#### Learning Objectives

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

- Create and evaluate the model of an embedded system.

#### Essential Questions:

- What is embedded system?
- What are the types of embedded system?
- What are some models of embedded system?

#### Essential Knowledge, Skills, Values and Attitudes

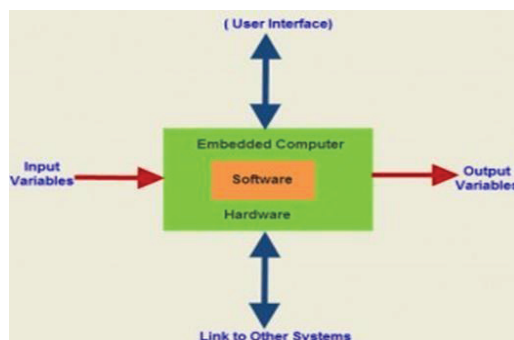
| Knowledge        | Skills          | Values     | Attitudes                                      |
|------------------|-----------------|------------|------------------------------------------------|
| Embedded Systems | Evaluate Create | Creativity | Creative in developing embedded system models. |

Technology and Industrial Arts Application: Communication Technology

#### Content Background

What is Embedded System?

The electronic system which integrates the hardware circuitry with the software programming techniques for providing project solutions is called as embedded systems.

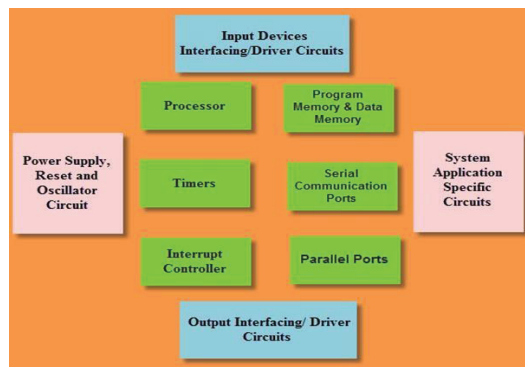


An embedded system is an electron system that has a software and is embedded in computer hardware. It is programmable or non – programmable depending on the application. An Embedded system is defined as a way of work, organising, perform-

ing single or multiple tasks according to set of rules. In an embedded system, all the units assemble and work together according to the program.

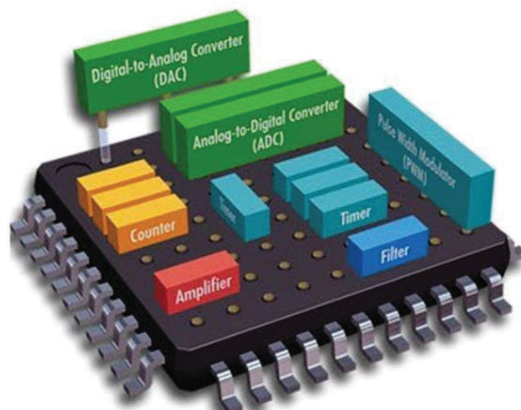
The important characteristics of an embedded systems are speed, size, power, reliability, accuracy and adaptability.

An embedded system consist of hardware such as power supply kit, central processing unit, memory devices, timers, output circuits, serial communication ports and system application, specific circuit components & Circuits.



### Embedded system Hardware

An embedded system is integration of hardware and software.



### Embedded System Software

Embedded system software programming.

The software used in embedded system is set of instructions which are termed as program. The microprocessors or microcontrollers used in the hardware circuits of embedded systems are programmed to perform specific tasks by following the set of instructions. These programs are primarily written using any programming software like Proteus or Lab-view using any programming languages such as C or C++ or embedded C. Then, the program is dumped into the microprocessors or microcontrollers that are used in the embedded system circuit.

Examples of Embedded system hardware includes  
central heating system  
engineering management system

domestic appliances such as dishwashers, TVs and digital phones

digital watches

electronic calculators

GPS system

Fitness trackers

Embedded devices are not usually programmed by a user. The programming is usually done before hand by the manufacturer

### 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 embedded systems

### Teaching Strategies

- Engage student to define what is embedded system
- Engage students to discuss the devices that have embedded system.

### Learning Strategies

1. Activity 1 Students define embedded system and give examples.
2. Activity 2 Students discuss and identify devices that have embedded systems.

## Lesson 2: Types of Embedded systems

### Teaching Strategies

- Engage students to identify different types of embedded systems.
- Engage students to investigate the application of the embedded systems.

### Learning Strategies

1. Activity 1 Students discuss and identify of the functions of devices that have embedded systems.
2. Activity 2 Students research and present on the application and uses of the embedded systems.

## Lesson 3: Model of an embedded system

### Teaching Strategies

- Engage the students to identify the power supply of embedded systems
- Engage the students to identify the input and output of embedded systems
- Engage the students to identify the processor and memory of embedded systems

### Learning Strategies

1. Activity 1 Engage the students to identify the power supply of embedded systems
2. Activity 2 Engage the students to identify the input and output of embedded systems
3. Activity 3. Engage the students to identify the processor and memory of embedded systems

## UNIT 2. Computer Security and Safety

Content Standard: 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.

Benchmark: 11.4.2.5 Define responsible citizenship relative to technology

Topic 5: Responsible Citizenship

### Learning Objectives

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

- define responsible citizenship relative to technology

### Essential Questions:

1. What is responsible citizenship?
2. What is citizenship and technology referring to?
3. How can we be responsible citizenship in the computer world?

### Knowledge, Skills, Values and Attitudes

| Knowledge               | Skills | Values      | Attitudes                     |
|-------------------------|--------|-------------|-------------------------------|
| Responsible Citizenship | Define | Responsible | Responsible technical Citizen |

Technology and Industrial Arts Application: Communication Technology

### Content Background

#### Revolution

The industrial revolution is now outsourced with the latest development of computer technology. The effects of the computers to human society are sometimes called the Second Industrial Revolution. The following are some of the influences that result to this.

### Cashless Society

The trend today is moving away from real cash when purchasing. Banks can now do transactions to move cash around electronically using computers to pay straight to accounts automatically. This happens during purchasing, banking, paying employees, international transfer of money etc. Also the use of Transaction Cards and ATM Machines can play the same role after hours. E.g. Credit card, Visa Card.

### Lifestyle

Lifestyle is all about living with computers in our society. Everything is computerised; this means that machines can now do our jobs giving us more free time. However we tend to lose our jobs and become idle. This may lead to creating social problems.

Computers at home can have a big influence in our family time at the same time a solution to handling more than one responsibility at one place.

Computers have now become part of us to make things work efficiently but along with it come some challengers that affect our normal way of living.

### Computer Crime

People can now hack into the system and steal information for their own benefit. Any other negative intention by the use of computers is called a computer crime. Some ways we can follow to minimise these concerns include;

Computer rooms must be locked. Only authorised person may access with record on entry

The individual having access to a computer must use password.

Systems designers and programmers must work in teams. Any change of programmers must be approved in writing by the team leader.

### Privacy

The computer has a record of all your daily activities and habits the place you have gone to the kind of food and clothes you wear. The personal data of your life can be known and transferred from one system to another without your knowledge. Also whether the information about you is true or not we cannot tell. These are known as privacy issues.

### Computer Ethics

Ethics is about moral, what is right and what is wrong we know that to be honest is right or ethical while to say something that is not true is unethical. We can generally say that the misuse of computer is a crime. Our challenge is to verify that.

### Hacker

A hacker is a person who uses a computer to gain unauthorised access to some restricted database. He is often curious. He does not have a malicious desire to destroy or sell the data. Is this ethical? A lot of new situations are arising which chal-

lenge our ethical standards.

### Future computers

We are now in the fifth generation of computers and we try to predict and look into the future of computers and the future of the world and the way we do things as humans. The fifth generation embarks deep into artificial intelligence and robotics. Artificial Intelligence is technology influence of the fifth generation in which it is design to match the human thought process. I the development of Hardware, the speed of the processors is improving every day. The design of computers will enable the computers to run many task at the same time. Also the way in which humans communicate with computers will improve as the fifth generation computers accept voice and image input.

### Post Script

Computers are and always will be in the hands of people .They only respond to the instructions that the user gives. Computers have no value system, it cannot think even though it is programmed to have a mind. No other machine has made such large impact on mankind within such a short time. As a responsible citizen it is important for you to keep in touch with the advanced in technology and help towards controlling it. Like every other new invention, it creates new opportunities for society but at the same time new problems.

AI is now becoming more and more part of the Society as it raises important considerations with:

Understanding AI potential benefit and risk

Ethical AI Development for AI Systems

Privacy and Data collection for Citizen tp advocate Policy and regulations to protect Citizens rights

Advocating for Fair and unbiased AI systems

Accountability and Transparency in AI systems

Job displacement and Reskilling

Social Impact and Wellbeing-Ai systems are aligned with Human Beings

Collaboration and engagement

### 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: Citizenship and the technology

### Teaching Strategies

- Engage students to investigate the use of computers in an organisation verifying advantages and disadvantages.
- Engage students to study how people and computers can integrate in a society that result in citizens being responsible.

### Learning Strategies

1. Activity 1 Students investigate the benefits of using a computer in an organisation and also the problems caused.
2. Activity 2 Students to do a group study on how people and computers can integrate in a society that result in citizens being responsible.

## Lesson 2: What is a responsible digital citizen?

### Teaching Strategies

- Engage students to identify different values, attitudes, characteristics of a digital citizen?
- Engage students to investigate the application of technology and the responsibility of a digital citizen in the global village of technology.

### Learning Strategies

1. Activity 1 Students discuss and identify different values, attitudes, characteristics of a digital citizen.
2. Activity 2 Students research and present on the application of technology and the responsible practices of a digital citizen in the global village of technology.

## 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 (Sample):

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.

## 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                 |
|--------------------|-----------------------|
| Textile 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                     |
| <b>Totals</b>           | <b>13</b>             | <b>13</b>                         | <b>77</b>                  | <b>77</b>              |

## 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 pose 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 OBE 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 utilized 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    | <b>Textile Technology:</b><br><br><b>Fibres and Fabrics:</b><br><br>CS: 9.11<br><br>BMs: 9.1.1.1 and 9.1.1.2 | <b>Building Technology</b><br><br>CS: 9.3.1<br><br>BMS: 9.3.1.1, 9.3.1.2, 9.3.1.3, | <b>Communication Technology</b><br><br><b>Data Communication and Network</b><br><br>CS: 9.4.2<br><br>BMs: 9.4.1.1, 9.4.1.2, , |

|   |                                                                                                               |                                                                                      |                                                                                                                                     |
|---|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 2 | <b>Textile Technology:</b><br><br><b>Fibres and Fabrics:</b><br><br>CS: 9.1.1<br><br>BMs: 9.1.1.3, .1.1.4,    | <b>Building Technology</b><br><br>CS: 9.3.1<br><br>BMs: 9.3.1.4, 9.3.1.5, 9.3.1.6,   | <b>Communication Technology</b><br><br><b>Data Communication and Network</b><br><br>CS: 9.4.1<br><br>BMs: 9.1.4.3, 9.1.4.4, 9.1.4.5 |
| 3 | <b>Textile Technology:</b><br><br><b>Textile and Clothing:</b><br><br>CS: 9.1.2<br><br>BMs: 9.1.2.1, 9.1.2.2, | <b>Electrical Technology</b><br><br>CS: 9.3.1<br><br>BMs: 9.3.2.1, 9.3.2.2, 9.3.2.3, | <b>Communication Technology</b><br><b>Computer Security and Safety</b><br><br>CS: 9.4.2<br><br>BMs: 9.4.2.1, 9.4.2.2,               |
|   | Assessment                                                                                                    | Assessment                                                                           | Assessment                                                                                                                          |
| 4 | <b>Textile Technology:</b><br><br><b>Textile and Clothing:</b><br><br>CS: 9.1.2<br><br>BMs: 9.1.2.3, 9.1.2.4, | <b>Electrical Technology</b><br><br>CS: 9.3.2<br><br>BMs: 9.3.2.4, 9.3.2.5,          | <b>Communication Technology</b><br><b>Computer Security and Safety</b><br><br>CS: 9.4.2<br><br>BMs: 9.4.2.3, 9.4.2.4                |
| 5 | <b>Textile Technology:</b><br><br><b>Textile and Clothing:</b><br><br>CS: 9.1.2<br><br>BMs: 9.1.2.5, 9.1.2.6, | <b>Electrical Technology</b><br><br>CS: 9.3.2<br><br>BMs: 9.3.2.6, 9.3.2.7           | <b>Communication Technology</b><br><b>Computer Security and Safety</b><br><br>CS: 9.4.2<br><br>BMs: 9.4.2.5, 9.4.2.6,               |
| 6 | <b>Food Technology:</b><br><br><b>Food and Nutrition:</b><br><br>CS: 9.2.1<br><br>BMs: 9.2.1.1, 9.2.1.2       | <b>Plumbing Technology</b><br><br>CS: 9.3.3<br><br>BMs: 9.3.3.1, 9.3.3.2             | <b>Computer Technology</b><br><br><b>Computer Architecture</b><br><br>CS: 9.5.1<br><br>BMs: 9.5.1.1, 9.5.1.2                        |
|   | Assessment                                                                                                    | Assessment                                                                           | Assessment                                                                                                                          |
| 7 | <b>Food Technology:</b><br><br><b>Food and Nutrition:</b><br><br>CS: 9.2.1<br><br>BMs: 9.2.1.3, 9.2.1.4       | <b>Plumbing Technology</b><br><br>CS: 9.3.3<br><br>BMs: 9.3.3.3, 9.3.3.4,            |                                                                                                                                     |
| 8 | <b>Food Technology:</b><br><br><b>Food and Nutrition:</b><br><br>CS: 9.2.1<br><br>BMs: 9.2.1.5, 9.2.1.6,      | <b>Welding Technology</b><br><br>CS: 9.3.4<br><br>BMs: 9.3.4.1, 9.3.4.2,             | <b>Computer Technology</b><br><br><b>Computer Architecture</b><br><br>CS: 9.5.1<br><br>BMs: 9.1.5.3, 9.1.5.4                        |
| 9 | <b>Food Technology:</b><br><br><b>Food and Nutrition:</b><br><br>CS: 9.2.1<br><br>BMs: 9.2.1.7                | <b>Welding Technology</b><br><br>CS: 9.3.4<br><br>BMs: 9.3.4.3, 9.3.4.4, 9.3.4.      | <b>Computer Technology</b><br><br><b>Computer Architecture</b><br><br>CS: 9.5.1<br><br>BMs: 9.1.5.5                                 |
|   | Assessment                                                                                                    | Assessment                                                                           | Assessment                                                                                                                          |

|           |                                                                                                   |                                                                               |                                                                                                          |
|-----------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| 10        | <b>Food Technology:</b><br><br><b>Food Science:</b><br><br>CS: 9.2.1<br><br>BMs: 9.2.2.1, 9.2.2.2 | <b>Engineering Technology</b><br><br>CS: 9.3.5<br><br>BMs: 9.3.5.1, 9.3.5.2,  | <b>Computer Technology</b><br><br><b>Computer Software</b><br><br>CS: 9.5.2<br><br>BMs: 9.5.2.1, 9.5.2.2 |
| 11        | <b>Food Technology:</b><br><br>Food Science:<br><br>CS: 9.2.1<br><br>BMs: 9.2.2.3, 9.2.2.4,       | <b>Engineering Technology</b><br><br>CS: 9.3.5<br><br>BMs: 9.3.5.3, 9.3.5.4,  | <b>Computer Technology</b><br><br><b>Computer Software</b><br><br>CS: 9.5.2<br><br>BMs: 9.5.2.3, 9.5.2.4 |
| 12        | Food Technology:<br><br>Food Science:<br><br>CS: 9.2.1<br><br>BMs: 9.2.2.5                        | Engineering Technology<br><br>CS: 9.3.5<br><br>BMs: 9.3.5.5, 9.3.5.6, 9.3.5.7 | Computer Technology<br><br>Computer Software<br><br>CS: 9.5.2<br><br>BMs: 9.5.2.5,                       |
| <b>13</b> | <b>Summative Assessment</b>                                                                       |                                                                               |                                                                                                          |

### 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:

| <b>STRAND 1: TEXTILE TECHNOLOGY</b>                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UNIT 1: FIBRES AND FABRICS</b>                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Content Standard</b>                                                                                                                                                                                       | <b>Benchmarks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>CS1.1</b> Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing.<br><br>9.1.1.1 – 9.1.1.6 | <b>9.1.1.1</b> Compare and contrast social, economic, cultural and technological changes to textiles, fashion and clothing<br><br><b>9.1.1.2</b> Distinguish the properties and characteristics of fibres and fabrics<br><br><b>9.1.1.3</b> Explore the elements of design and the design and construction of fashion Ideas<br><br><b>9.1.1.4</b> Describe the functions of tools and equipment and their safe usage<br><br><b>9.1.1.5</b> Explore the range of textile construction techniques<br><br><b>9.1.1.6</b> Apply appropriate safety practices in fashion design and construction |

| <b>STRAND 1: TEXTILE TECHNOLOGY</b> |                   |
|-------------------------------------|-------------------|
| <b>UNIT 2: TEXTILE AND CLOTHING</b> |                   |
| <b>Content Standard:</b>            | <b>Benchmark:</b> |

|                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CS1.2</b> 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<br><br>9.1.2.1 – 9.1.2.6                                                                                                            | <b>9.1.2.1</b> Describe historical influences, technological progression and emerging trends as inspirational sources of design                                                                          |
|                                                                                                                                                                                                                                                                                                                              | <b>9.1.2.2.</b> Demonstrate an awareness of the fundamentals of the design process through various artistic versions                                                                                     |
|                                                                                                                                                                                                                                                                                                                              | <b>9.1.2.3</b> Apply a broad range of contemporary and appropriate tools and techniques with competence and in the development of design projects                                                        |
|                                                                                                                                                                                                                                                                                                                              | <b>9.1.2.4</b> Describe how the properties of textile fibres affect textile wear and care                                                                                                                |
|                                                                                                                                                                                                                                                                                                                              | <b>9.1.2.5</b> Apply the design process to respond to needs and opportunities in textile design projects                                                                                                 |
|                                                                                                                                                                                                                                                                                                                              | <b>9.1.2.6</b> Select and use appropriate technology to creatively document, communicate and present design and project work                                                                             |
| <b>STRAND 2: FOOD TECHNOLOGY</b>                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                          |
| <b>UNIT 1: FOOD AND NUTRITION</b>                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                          |
| <b>CS 2.1</b> Students will be able to examine and analyze the characteristics and properties of different types of food and the social, economic, political, cultural and technological influences on the production and compliance with ethical principles and standards<br><br>9.2.1.1 – 9.2.1.7                          | <b>9.2.1.1</b> Compare and contrast the nature and properties of food                                                                                                                                    |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.1.2</b> Practice safety and hygiene procedures in tool and equipment, food handling, meal preparation and food development                                                                        |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.1.3</b> Examine the nutritional components of food and food development and the impact of food consumption on nutrition.                                                                          |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.1.4</b> Explore nutrition as integral to making food choices                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.1.5</b> Discuss economic, social and technological influences of food, food product and food sciences                                                                                             |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.1.6</b> Explore ways of meeting nutritional requirements to maintain optimum nutrition or manage nutritional issues                                                                               |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.1.7</b> Apply the design process to create food items using combinations of basic ingredients with variations using a selection of techniques and food preparation equipment                      |
| <b>STRAND 2: FOOD TECHNOLOGY</b>                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                          |
| <b>UNIT 2: FOOD SCIENCE</b>                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                          |
| <b>CS 2.2</b> 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)<br><br>9.2.2.1 – 9.2.2.6 | <b>9.2.2.1</b> Identify and describe the cultural, physical, biological and nutritional characteristics of food that influence food development                                                          |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.2.2</b> Describe the nutritional and sensory characteristics of food to meet the needs, health and occasions.                                                                                     |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.2.3</b> Apply management strategies in food selection, meal preparation, product development, storage and preservation                                                                            |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.2.4</b> Explore safety and hygiene practices relating to food, and changes that occur in the functional properties of food.                                                                       |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.2.5</b> 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 |
|                                                                                                                                                                                                                                                                                                                              | <b>9.2.2.6</b> Apply the design process to create food solutions.                                                                                                                                        |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                          |
| <b>UNIT 1: BUILDING TECHNOLOGY</b>                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                          |

|                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CS 3.1</b> 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.<br><br>9.3.1.1 – 9.3.1.6                                                          | <b>9.3.1.1</b> Investigate the history and theory of buildings                                                                                                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.1.2</b> Identify and describe a variety of construction materials, components, and Processes                                                                                                              |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.1.3</b> Describe the elements of drawings, and their application in technical drawings.                                                                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.1.4</b> Identify and describe the elements of safety                                                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.1.5</b> Describe the scope and purpose of building codes, and identify other regulations and standards that apply to construction projects                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.1.6</b> Apply mathematical skills and scientific concepts in the planning and building of a variety of construction projects                                                                              |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                  |
| <b>UNIT 2: ELECTRICAL TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                  |
| <b>CS 3.2</b> 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.<br><br>9.3.2.1 – 9.3.2.7                | <b>9.3.2.1</b> Describe the historical development of electricity                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.2.2</b> Investigate and communicate OHS legislation and regulation and assess and employ emergency procedures whilst observing safety                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.2.3</b> 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. |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.2.4</b> Define electricity and conductivity and differentiate insulators from conductors                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.2.5</b> Identify symbols used and explain the functions of components and devices in electrical circuit diagrams                                                                                          |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.2.6</b> Identify the different types of circuits and explain the parts and operation of a simple practical circuit.                                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.2.7</b> Investigate the concepts, principles and practices related to electrical                                                                                                                          |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                  |
| <b>UNIT 3: PLUMBING TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                  |
| <b>CS 3.3</b> 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.<br><br>9.3.3.1 – 9.3.3.4 | <b>9.3.3.1</b> Describe and explain the fundamentals, concepts, and their relevance in the plumbing trade                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.3.2</b> Analyse and describe OHS Regulations and standards in the plumbing trade and work places.                                                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.3.3</b> Demonstrate and apply basic plumbing tools and equipment and their specifications and practice in trade math.                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.3.4</b> Explore and apply basic concepts of trade drawings in plumbing.                                                                                                                                   |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                  |
| <b>UNIT 4: WELDING TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                  |
| <b>CS 3.4</b> 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.<br><br>9.3.4.1 – 9.3.4.5                                                                                    | <b>9.3.4.1</b> Investigate safe workshop setup and safety procedures in welding                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.4.2</b> Explore and interpret welding principles, codes and standards                                                                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.4.3</b> Demonstrate knowledge in fundamental print reading, measurement and layout or fit-up techniques                                                                                                   |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.4.4</b> Investigate and analyse the properties of metals                                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                         | <b>9.3.4.5</b> Investigate the various welding techniques and cutting processes                                                                                                                                  |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                  |

**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 multi-media 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**

|                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>CS 5.1</b> 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.<br><br><b>9.5.1.1 – 9.5.1.6</b> | <b>9.5.1.1</b> Comprehend and explain the Computer System and types of computer.                                                     |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.1.2</b> Explore generations of computer                                                                                       |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.1.3</b> Investigate and describe the design brief of solving problems.                                                        |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.1.4</b> Identify and describe the functions of, as well as important advances related to, electronic and computer components; |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.1.5</b> Demonstrate a basic understanding of binary numbers and digital logic                                                 |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.1.6</b> Explore and describe hardware and software troubleshooting principles                                                 |
| <b>STRAND 5: COMPUTER TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                        |                                                                                                                                      |
| <b>UNIT 2: COMPUTER SOFTWARE</b>                                                                                                                                                                                                                                                                                                            |                                                                                                                                      |
| <b>CS 5.2</b> 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.<br><br><b>9.5.2.1 – 9.5.2.5</b>                                                                                                   | <b>9.5.2.1</b> Explore programming software and applications                                                                         |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.2.2</b> Demonstrate the understanding of Operating Systems/ Software and File Management                                      |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.2.3</b> Apply typing skills with speed (20wpm) and accuracy (80%)                                                             |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.2.4</b> Create documents using Microsoft Office                                                                               |
|                                                                                                                                                                                                                                                                                                                                             | <b>9.5.2.5</b> Explore the Authoring Software or Multimedia associate software                                                       |

**UNIT 1: FIBRES AND FABRICS****STRAND 1: FOOD TECHNOLOGY**

| Content Standard                                                                                                                                                                     | Benchmark                                                                                                                  | Topic                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| <b>CS1.1</b> Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing. | <b>9.1.1.1</b> Compare and contrast social, economic, cultural and technological changes to textiles, fashion and clothing | Impact of changes on textiles, fashion and clothing    |
|                                                                                                                                                                                      | <b>9.1.1.2</b> Distinguish the properties and characteristics of fibres and fabrics                                        |                                                        |
|                                                                                                                                                                                      | <b>9.1.1.3</b> Explore the elements of design and the design and construction of fashion ideas                             | Introduction to fibres and fabrics                     |
|                                                                                                                                                                                      |                                                                                                                            | Designing and Construction                             |
|                                                                                                                                                                                      | <b>9.1.1.4</b> Describe the functions of tools and equipment and their safe usage                                          | Functions and safe usage of tools and equipment        |
|                                                                                                                                                                                      | <b>9.1.1.5</b> Explore the range of textile construction techniques                                                        | Techniques in textile construction                     |
|                                                                                                                                                                                      | <b>9.1.1.6</b> 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**

|                                                                                                                                                                                          |                                                                                                                                                   |                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>CS1.2</b> 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 | <b>9.1.2.1</b> Describe historical influences, technological progression and emerging trends as inspirational sources of design                   | Sources of Design                       |
|                                                                                                                                                                                          |                                                                                                                                                   |                                         |
|                                                                                                                                                                                          | <b>9.1.2.2.</b> Demonstrate an awareness of the fundamentals of the design process through various artistic versions                              | Fundamentals of design process          |
|                                                                                                                                                                                          | <b>9.1.2.3</b> 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 |

|                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                     |                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                     | <b>9.1.2.4</b> Describe how the properties of textile fibres affect textile wear and care                                                                                           | Textiles wear and care                                                                |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.1.2.5</b> Apply the design process to respond to needs and opportunities in textile design projects                                                                            | Designing a textile project                                                           |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.1.2.6</b> Select and use appropriate technology to creatively document, communicate and present design and project work                                                        | Documenting a project portfolio                                                       |
| <b>UNIT 1: FOOD AND NUTRITION</b>                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                     |                                                                                       |
| <b>STRAND 2: FOOD TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                     |                                                                                       |
| <b>CS 2.1</b> Students will be able to examine and analyse the characteristics and properties of different types of food and the social, economic, political, cultural and technological influences on the production and compliance with ethical principles and standards                                                          | <b>9.2.1.1</b> Compare and contrast the nature and properties of food                                                                                                               | Nature and properties of food                                                         |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.2.1.2</b> Practice safety and hygiene procedures in tool and equipment, food handling, meal preparation and food development                                                   | Safety and hygienic practices in food product development                             |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.2.1.3</b> Examine the nutritional components of food and food development and the impact of food consumption on nutrition.                                                     | Food and nutrients                                                                    |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.2.1.4</b> Explore nutrition as integral to making food choices                                                                                                                 | Food metabolism                                                                       |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.2.1.5</b> Discuss economic, social and technological influences of food, food product and food sciences                                                                        | Influences on food product development                                                |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.2.1.6</b> Explore ways of meeting nutritional requirements to maintain optimum nutrition or manage nutritional issues                                                          | Food composition and energy metabolism                                                |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.2.1.7</b> 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                                                              |
| <b>UNIT 2: FOOD SCIENCE</b>                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                     |                                                                                       |
| <b>STRAND 2: FOOD TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                     |                                                                                       |
| <b>CS 2.2</b> 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)<br><br><b>9.2.2.1 – 9.2.2.6</b> | <b>9.2.2.1</b> 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 |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.2.2.2</b> Describe the nutritional and sensory characteristics of food to meet the needs, health and occasions.                                                                | Sensory characteristics of food                                                       |
|                                                                                                                                                                                                                                                                                                                                     | <b>9.2.2.3</b> Apply management strategies in food selection, meal preparation, product development, storage and preservation                                                       | Food management                                                                       |

|                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                          |                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.2.2.4</b> Explore safety and hygiene practices relating to food, and changes that occur in the functional properties of food.                                                                       | Food safety and hygienic practices                |
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.2.2.5</b> 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 |
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.2.2.6</b> Apply the design process to create food solutions                                                                                                                                         | The technology design                             |
| <b>UNIT 1: BUILDING TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                          |                                                   |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                          |                                                   |
| <b>CS 3.1</b> 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.                                                                           | <b>9.3.1.1</b> Investigate the history and theory of buildings                                                                                                                                           | The history and theory of buildings               |
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.1.2</b> Identify and describe a variety of construction materials, components, and processes                                                                                                      | Building construction materials                   |
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.1.3</b> Describe the elements of drawings, and their application in technical drawings.                                                                                                           | Trade drawing                                     |
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.1.4</b> Identify and describe the elements of safety                                                                                                                                              | The Elements Occupational Health and Safety       |
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.1.5</b> Describe the scope and purpose of building codes, and identify other regulations and standards that apply to construction projects                                                        | Building Codes, Standards and regulations         |
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.1.6</b> Apply mathematical skills and scientific concepts in the planning and building of a variety of construction projects                                                                      | Trade Maths                                       |
| <b>UNIT 2: ELECTRICAL TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                          |                                                   |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                          |                                                   |
| <b>CS 3.2</b> 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.<br><br><b>9.3.2.1 – 9.3.2.7</b> | <b>9.3.2.1</b> Describe the historical development of electricity                                                                                                                                        | History of Electricity                            |
|                                                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.2.2</b> Investigate and communicate OHS legislation and regulation and assess and employ emergency procedures whilst observing safety                                                             | Workplace and Electrical safety                   |

|                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                  |                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.2.3</b> 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                  |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.2.4</b> Define electricity and conductivity and differentiate insulators from conductors                                                                                                                  | Fundamentals of electricity                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.2.5</b> Identify symbols used and explain the functions of components and devices in electrical circuit diagrams                                                                                          | Components and devices used on circuit diagrams                  |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.2.6</b> Identify the different types of circuits and explain the parts and operation of a simple practical circuit.                                                                                       | Circuits                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.2.7</b> Investigate the concepts, principles and practices related to electrical                                                                                                                          | Electrical Fundamentals                                          |
| <b>UNIT 3: PLUMBING TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                  |                                                                  |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                  |                                                                  |
| <b>CS 3.3</b> 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.<br><br><b>9.3.3.1 – 9.3.3.4</b> | <b>9.3.3.1</b> Describe and explain the fundamentals, concepts, and their relevance in the plumbing trade                                                                                                        | Fundamental concept and relevance of plumbing trade              |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.3.2</b> Analyse and describe OHS Regulations and standards in the plumbing trade and work places.                                                                                                         | Topic 2: Occupational Health and Safety regulations and standard |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.3.3</b> Demonstrate and apply basic plumbing tools and equipment and their specifications and practice in trade math.                                                                                     | Plumbing tool and equipment                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.3.4</b> Explore and apply basic concepts of trade drawings in plumbing.                                                                                                                                   | Trade Drawing                                                    |
| <b>UNIT 4: WELDING TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                  |                                                                  |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                  |                                                                  |
| <b>CS 3.4</b> 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.<br><br><b>9.3.4.1 – 9.3.4.5</b>                                                                                    | <b>9.3.4.1</b> Investigate safe workshop setup and safety procedures in welding                                                                                                                                  | Workshop Organisation                                            |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.4.2</b> Explore and interpret welding principles, codes and standards                                                                                                                                     | Welding Standards                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.4.3</b> Demonstrate knowledge in fundamental print reading, measurement and layout or fit-up techniques                                                                                                   | Measurement Techniques                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.4.4</b> Investigate and analyse the properties of metals                                                                                                                                                  | Metals                                                           |

|                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                   |                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                        | <b>9.3.4.5</b> Investigate the various welding techniques and cutting processes                                                                                                                   | Cutting and Welding                                                                                                 |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                                                                                                                                                                                                                                               |                                                                                                                                                                                                   |                                                                                                                     |
| <b>UNIT 5: ENGINEERING TECHNOLOGY</b>                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                   |                                                                                                                     |
| <b>CS 3.5</b> 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.<br><br><b>9.3.5.1 – 9.3.5.7</b> | 9.3.5.1 Describe how history and society has influenced the engineering field and critically analyse innovations.                                                                                 | Historical aspects of Engineering Design Process                                                                    |
|                                                                                                                                                                                                                                                                                                        | <b>9.3.5.2</b> Investigate the scope of engineering, roles and responsibilities of an engineer and recognise current innovations                                                                  | Introduction to Engineering                                                                                         |
|                                                                                                                                                                                                                                                                                                        | <b>9.3.5.3</b> Explore and distinguish the different types of the Engineering fields.                                                                                                             | Engineering Fields                                                                                                  |
|                                                                                                                                                                                                                                                                                                        | <b>9.3.5.4</b> Explore and discuss engineering principles and practices and the appropriate materials in engineering.                                                                             | Engineering Principles and practices                                                                                |
|                                                                                                                                                                                                                                                                                                        | <b>9.3.5.5</b> Explore and analyse the general safety practices in engineering.                                                                                                                   | Occupational Health & safety                                                                                        |
|                                                                                                                                                                                                                                                                                                        | <b>9.3.5.6</b> Outline management and problem solving skills using the engineering design process.                                                                                                | Engineering Design Process                                                                                          |
|                                                                                                                                                                                                                                                                                                        | <b>9.3.5.7.</b> Explore and utilise communication practices appropriate to engineering.                                                                                                           | Engineering Communication                                                                                           |
| <b>UNIT 1: DATA COMMUNICATION AND NETWORK</b>                                                                                                                                                                                                                                                          |                                                                                                                                                                                                   |                                                                                                                     |
| <b>STRAND 4: COMMUNICATION TECHNOLOGY</b>                                                                                                                                                                                                                                                              |                                                                                                                                                                                                   |                                                                                                                     |
| <b>CS 4.1</b> Investigate and analyse communication technology utilising multimedia and the practices and systems in designing, installing, configuring and managing networks.                                                                                                                         | <b>9.4.1.1</b> Define the elements of data communication system.                                                                                                                                  | Data Communication Systems                                                                                          |
|                                                                                                                                                                                                                                                                                                        | <b>9.4.1.2</b> Describe the functions of the different components of a computer network.                                                                                                          | Computer Networks                                                                                                   |
|                                                                                                                                                                                                                                                                                                        | <b>9.4.1.3</b> Define the OSI (Open Systems Interconnect) model and how it functions.                                                                                                             | OSI Model                                                                                                           |
|                                                                                                                                                                                                                                                                                                        | <b>9.4.1.4</b> 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<br><br>Basic Scientific and Mathematical Concepts in creating media products |
|                                                                                                                                                                                                                                                                                                        | <b>9.4.1.5</b> Explore and articulate the core concepts, techniques, and skills required to produce a range of communications media products or services.                                         | Media Communication                                                                                                 |
|                                                                                                                                                                                                                                                                                                        | <b>9.4.1.6</b> Research and apply the design brief to design, configure and manage simple network.                                                                                                | Design Brief-Simple Network                                                                                         |
|                                                                                                                                                                                                                                                                                                        | <b>9.4.1.7</b> Explore the Authoring Software or Multimedia associate software                                                                                                                    | Authoring Software Multimedia                                                                                       |

**UNIT 2: COMPUTER SECURITY AND SAFETY****STRAND 4: COMMUNICATION TECHNOLOGY**

**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** 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

**UNIT 1: COMPUTER ARCHITECTURE****STRAND 5: COMPUTER TECHNOLOGY**

**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

**UNIT 2: COMPUTER SOFTWARE****STRAND 5: COMPUTER TECHNOLOGY**

**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

**9.5.2.2** Demonstrate the understanding of Operating Systems/ Software and File Management

Operating System

|  |                                                                                |                                   |
|--|--------------------------------------------------------------------------------|-----------------------------------|
|  | <b>9.5.2.3</b> Apply typing skills with speed (20wpm) and accuracy (80%)       | Keyboarding                       |
|  | <b>9.5.2.4</b> Create documents using Microsoft Office                         | Microsoft Office                  |
|  | <b>9.5.2.5</b> Explore the Authoring Software or Multimedia associate software | Authoring Software/<br>Multimedia |

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

|                                                                        |                                                                                                                                                                                                                   |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>STRAND 1: TEXTILE TECHNOLOGY</b>                                    |                                                                                                                                                                                                                   |
| <b>UNIT 1: FIBRES AND FABRICS</b>                                      |                                                                                                                                                                                                                   |
| <b>Topics</b>                                                          | <b>Lesson Titles</b>                                                                                                                                                                                              |
| <b>Benchmarks</b>                                                      | <b>(9.1.1.1 – 9.1.1.6)</b>                                                                                                                                                                                        |
| <b>Topic 1:</b> Impact of changes on textiles, fashion and clothing    | <b>Lesson 1:</b> Exploring Textiles?<br><br><b>Lesson 2:</b> Origins of textiles, fashion and clothing<br><br><b>Lesson3:</b> Factors affecting changes in textile, fashions and clothing                         |
| <b>Topic2:</b> Introduction to fibres and fabrics                      | <b>Lesson 1:</b> What are fibres and fabrics?<br><br><b>Lesson 2:</b> Characteristics and properties of fibres and fabrics<br><br><b>Lesson 3:</b> From fibres to fabrics.                                        |
| <b>Topic 3:</b> Designing and Construction                             | <b>Lesson 1:</b> Elements of design and design types.<br><br><b>Lesson 2:</b> Sources of fashion ideas.<br><br><b>Lesson 3:</b> Basic construction processes.                                                     |
| <b>Topic 4:</b> Functions and safe usage of tools and equipment        | <b>Lesson 1:</b> Textile Construction methods tools and their functions.<br><br><b>Lesson 2:</b> Safety when using textile tools and equipment.<br><br><b>Lesson 3:</b> Care and maintenance of textile products. |
| <b>Topic 5:</b> Techniques in textile construction                     | <b>Lesson 1:</b> Textile construction methods<br><br><b>Lesson 2:</b> Colouring and decorating methods<br><br><b>Lesson 3:</b> Fabric finishes                                                                    |
| <b>Topic 6:</b> Safety practices in fashion designing and construction | <b>Lesson 1:</b> Differentiating between textile designing and construction processes<br><br><b>Lesson 2:</b> Safety practices in textile.                                                                        |
| <b>STRAND 1: TEXTILE TECHNOLOGY</b>                                    |                                                                                                                                                                                                                   |
| <b>UNIT 2: TEXTILE AND CLOTHING</b>                                    |                                                                                                                                                                                                                   |
| <b>Benchmarks</b>                                                      | <b>9.1.2.1 – 9.1.2.6</b>                                                                                                                                                                                          |
| <b>Topic 1:</b> Sources of Design                                      | <b>Lesson 1:</b> Sources of design<br><br><b>Lesson 2:</b> Technological progression<br><br><b>Lesson 3:</b> Emerging trends                                                                                      |

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| <b>Topic 2:</b> Fundamentals of design process                            | <b>Lesson 1:</b> Importance of design process<br><b>Lesson 2:</b> Skills in the design process<br><b>Lesson 3:</b> Various artistic version                                                                                                                   |
| <b>Topic 3:</b> Tools and techniques in project designs                   | <b>Lesson 1:</b> Fashion and types of garments<br><b>Lesson 2:</b> Transferring patterns from garment to garment<br><b>Lesson 3:</b> Patterning techniques                                                                                                    |
| <b>Topic 4:</b> Textiles wear and care                                    | <b>Lesson 1:</b> Types of tools for textile projects<br><b>Lesson 2:</b> Safe uses of special tools<br><b>Lesson 3:</b> Care for tools                                                                                                                        |
| <b>Topic 5:</b> Designing a textile project                               | <b>Lesson 1:</b> What is design process<br><b>Lesson 2:</b> Phases in Textile Project development<br><b>Lesson 3:</b> Textile Projects                                                                                                                        |
| <b>Topic 6:</b> Documenting a project portfolio                           | <b>Lesson 1:</b> People and textile industry<br><b>Lesson 2:</b> Textile technology equipment<br><b>Lesson 3:</b> Textile Project exhibit                                                                                                                     |
| <b>STRAND 2: FOOD TECHNOLOGY</b>                                          |                                                                                                                                                                                                                                                               |
| <b>UNIT 1: FOOD AND NUTRITION</b>                                         |                                                                                                                                                                                                                                                               |
| <b>Benchmarks</b>                                                         | <b>9.2.1.1 – 9.2.1.7</b>                                                                                                                                                                                                                                      |
| <b>Topic 1:</b> Nature and properties of food                             | <b>Lesson 1:</b> Introduction to food –(Nature and sources of food)<br><b>Lesson 2:</b> Food groups and dietary guidelines<br><b>Lesson 3:</b> Properties of starch, carbohydrates, fats and oil<br><b>Lesson 4:</b> Introduction to food product development |
| <b>Topic 2:</b> Safety and hygienic practices in food product development | <b>Lesson 1:</b> Personal hygiene and safety practices<br><b>Lesson 2:</b> Kitchen hygiene<br><b>Lesson 3:</b> Hygiene practices and safety in food development (preparation etc.)                                                                            |
| <b>Topic 3:</b> Food and nutrients                                        | <b>Lesson 1:</b> Functions of nutrients and food sources<br><b>Lesson 2:</b> Eating practices<br><b>Lesson 3:</b> Meal planning                                                                                                                               |
| <b>Topic 4:</b> Food metabolism                                           | <b>Lesson 1:</b> Digestion and absorption of food<br><b>Lesson 2:</b> Functions of food and nutrients in human body<br><b>Lesson 3:</b> Over nutrition and malnutrition (anorexia, bulimia, obesity, hypertension etc.)                                       |
| <b>Topic 5:</b> Influences on food product development                    | <b>Lesson 1:</b> Food ingredients<br><b>Lesson 2:</b> Principles of cooking methods<br><b>Lesson 3:</b> Food management<br><b>Lesson 4:</b> Economic, Social and technological influences on food product development                                         |

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| <b>Topic 6:</b> Food composition and energy metabolism                                                | <b>Lesson 1:</b> Food composition<br><b>Lesson 2:</b> Food labelling<br><b>Lesson 3:</b> Energy metabolism<br><b>Lesson 4:</b> Meals for special needs                                                                                      |
| <b>Topic 7:</b> Food product development                                                              | <b>Lesson 1:</b> Introduction to food product development<br><b>Lesson 2:</b> Design process<br><b>Lesson 3:</b> Design Brief<br><b>Lesson 4:</b> Sensory analysis                                                                          |
| <b>STRAND 2: FOOD TECHNOLOGY</b><br><b>UNIT 2: FOOD SCIENCE</b>                                       |                                                                                                                                                                                                                                             |
| <b>Benchmarks</b>                                                                                     | <b>9.2.2.1 – 9.2.2.6</b>                                                                                                                                                                                                                    |
| <b>Topic 1:</b> Characteristics and properties of cereals, vegetables, fruits, legumes, fats and oils | <b>Lesson 1</b> Cooking methods in food product development<br><b>Lesson 2</b> Physical and biological properties of cereals, vegetables and fruits<br><b>Lesson 3</b> Physical and biological properties of fruits, legumes, fats and oils |
| <b>Topic 2:</b> Sensory characteristics of food                                                       | <b>Lesson 1</b> Sensory analyses of food<br><b>Lesson 2</b> Nutritional functions of food<br><b>Lesson 3</b> Functional foods                                                                                                               |
| <b>Topic 3:</b> Food management                                                                       | <b>Lesson 1</b> Food management<br><b>Lesson 2</b> Trends, fashion and food<br><b>Lesson 3</b> Seasons and food                                                                                                                             |
| <b>Topic 4:</b> Food safety and hygienic practices                                                    | <b>Lesson 1</b> Food borne diseases<br><b>Lesson 2</b> Contamination<br><b>Lesson 3</b> First Aid                                                                                                                                           |
| <b>Topic 5:</b> Factors influencing food processing and packaging                                     | <b>Lesson 1</b> Factors that influence food processing<br><b>Lesson 2</b> The role of food packaging<br><b>Lesson 3</b> Developments in packaging and distribution<br><b>Lesson 4</b> Techniques to evaluate products and processes         |
| <b>Topic 6:</b> The technology design                                                                 | <b>Lesson 1</b> Design brief and the technological process<br><b>Lesson 3</b> Evaluate the new product<br><b>Lesson 2</b> Using a design product to create a new product                                                                    |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b><br><b>UNIT 1: BUILDING TECHNOLOGY</b>                        |                                                                                                                                                                                                                                             |
| <b>Benchmarks</b>                                                                                     | <b>9.3.1.1 – 9.3.1.6</b>                                                                                                                                                                                                                    |

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| <b>Topic 1:</b> The history and theory of buildings           | <b>Lesson 1:</b> Introduction to Building<br><b>Lesson 2:</b> Definition of Building<br><b>Lesson 3:</b> Different Types of Building<br><b>Lesson 4:</b> Types of material used<br><b>Lesson 5:</b> Importance of building and career paths.                                                               |
| <b>Topic 2:</b> Building construction materials               | <b>Lesson 1:</b> Define Building materials<br><b>Lesson 2:</b> Timber Building Materials<br><b>Lesson 3:</b> Bricks and Concrete materials<br><b>Lesson 4:</b> Metal and steel materials                                                                                                                   |
| <b>Topic 3:</b> Trade drawing                                 | <b>Lesson 1:</b> Define trade drawing<br><b>Lesson 2:</b> Types of trade drawing<br><b>Lesson 3:</b> Isometric drawing<br><b>Lesson 4:</b> Pictorial drawing<br><b>Lesson 5:</b> Orthographic drawing<br><b>Lesson 6:</b> Types of lines use                                                               |
| <b>Topic 4:</b> The Elements (Occupational Health and Safety) | <b>Lesson 1:</b> Define occupational Health and safety<br><b>Lesson 2:</b> The regulations of OHS<br><b>Lesson 3:</b> The standards of OHS                                                                                                                                                                 |
| <b>Topic 5:</b> Building Codes, Standards and regulations     | <b>Lesson 1:</b> Define Building legislations and regulations<br><b>Lesson 2:</b> Types of building codes<br><b>Lesson 3:</b> Types of building regulations                                                                                                                                                |
| <b>Topic 6:</b> Trade Maths                                   | <b>Lesson 1:</b> Define Applied maths<br><b>Lesson 2:</b> Formulae to calculate substructure<br><b>Lesson 3:</b> Define sub-structure member (footings, post, bearers)<br><b>Lesson 4:</b> Define super-structure members (Floor joist, studs, roofing frame)<br><b>Lesson 5:</b> Types of building defect |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                      |                                                                                                                                                                                                                                                                                                            |
| <b>UNIT 2: ELECTRICAL TECHNOLOGY</b>                          |                                                                                                                                                                                                                                                                                                            |
| <b>Benchmarks</b>                                             | <b>9.3.2.1 – 9.3.2.7</b>                                                                                                                                                                                                                                                                                   |
| <b>Topic 1:</b> History of Electricity                        | <b>Lesson 1:</b> Electrical Energy Production & Supply<br><b>Lesson 2:</b> Modern Power Generation methods<br><b>Lesson 3:</b> Renewable and sustainable energy practices.                                                                                                                                 |
| <b>Topic 2:</b> Workplace and Electrical safety               | <b>Lesson 1:</b> Electrical Energy Production & Supply<br><b>Lesson 2:</b> Renewable and sustainable energy practices.<br><b>Lesson 3:</b> Career Pathway in Electrical Technology                                                                                                                         |

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| <b>Topic 3:</b> Electrical or Electronic processes and products         | <b>Lesson 1:</b> OHS legislation & Regulation<br><b>Lesson 2:</b> Personal Safety<br><b>Lesson 3:</b> Emergency procedures.                                                         |
| <b>Topic 4:</b> Fundamentals of electricity                             | <b>Lesson 1:</b> Electrical or Electronic processes<br><b>Lesson 2:</b> Electrical or Electronic products                                                                           |
| <b>Topic 5:</b> Components and devices used on circuit diagrams         | <b>Lesson 1:</b> Electricity<br><b>Lesson 2:</b> Conductivity<br><b>Lesson 3:</b> Conductors and Insulators                                                                         |
| <b>Topic 6:</b> Circuits                                                | <b>Lesson 1:</b> Electrical components & devices<br><b>Lesson 2:</b> Electrical symbols used in circuit diagrams                                                                    |
| <b>Topic 7:</b> Electrical Fundamentals                                 | <b>Lesson 1:</b> OHMs LAW<br><b>Lesson 2:</b> Kirchhoff's Law<br><b>Lesson 3:</b> Circuit Calculations                                                                              |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                |                                                                                                                                                                                     |
| <b>UNIT 3: PLUMBING TECHNOLOGY</b>                                      |                                                                                                                                                                                     |
| <b>Benchmarks</b>                                                       | <b>9.3.3.1 – 9.3.3.4</b>                                                                                                                                                            |
| <b>Topic 1:</b> Fundamental concept and relevance of plumbing trade     | <b>Lesson 1:</b> Introduction to plumbing trade.<br><b>Lesson 2:</b> Importance of plumbing trade.<br><b>Lesson 3:</b> Career pathways of plumbing trade.                           |
| <b>Topic 2:</b> Occupational Health and Safety regulations and standard | <b>Lesson 1:</b> Define Occupational Health Safety regulations and standards.<br><b>Lesson 2:</b> Types of regulations and standards.                                               |
| <b>Topic 3:</b> Plumbing tool and equipment                             | <b>Lesson 1:</b> Define plumbing tools and equipment.<br><b>Lesson 2:</b> Types of manual tools and equipment.<br><b>Lesson 3:</b> Types of plumbing materials and specifications.  |
| <b>Topic 4:</b> Trade Drawing                                           | <b>Lesson 1:</b> Define trade drawing.<br><b>Lesson 2:</b> Methods of Isometric drawing.<br><b>Lesson 3:</b> Methods of Pictorial drawing.<br><b>Lesson 4:</b> Types of lines used. |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                                |                                                                                                                                                                                     |
| <b>UNIT 4: WELDING TECHNOLOGY</b>                                       |                                                                                                                                                                                     |
| <b>Benchmarks</b>                                                       | <b>9.3.4.1 – 9.3.4.5</b>                                                                                                                                                            |
| <b>Topic 1:</b> Workshop Organisation                                   | <b>Lesson 1:</b> Workshop Set-up<br><b>Lesson 2:</b> Workshop safety procedures                                                                                                     |
| <b>Topic 2:</b> Welding Standards                                       | <b>Lesson 1:</b> Welding Principles<br><b>Lesson 2:</b> Welding Codes<br><b>Lesson 3:</b> Welding Standards                                                                         |

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| <b>Topic 3:</b> Measurement Techniques                           | <b>Lesson 1:</b> Measurement<br><b>Lesson 2:</b> Print reading<br><b>Lesson 3:</b> Layout/ fit-up Techniques                                                                                                                              |
| <b>Topic 4:</b> Metals                                           | <b>Lesson 1:</b> Types of metals<br><b>Lesson 2:</b> Metal Properties                                                                                                                                                                     |
| <b>Topic 5:</b> Cutting and Welding                              | <b>Lesson 1:</b> Types of Welding<br><b>Lesson 2:</b> Thermal cutting, heating and gouging<br><b>Lesson 3:</b> Brazing<br><b>Lesson 4:</b> Welding processes                                                                              |
| <b>STRAND 3: CONSTRUCTION TECHNOLOGY</b>                         |                                                                                                                                                                                                                                           |
| <b>UNIT 5: ENGINEERING TECHNOLOGY</b>                            |                                                                                                                                                                                                                                           |
| <b>Benchmarks</b>                                                | <b>9.3.5.1 – 9.3.5.7</b>                                                                                                                                                                                                                  |
| <b>Topic 1:</b> Historical aspects of Engineering Design Process | <b>Lesson 1:</b> Engineering, past, present & Future<br><b>Lesson 2:</b> Engineering Innovations<br><b>Lesson 3:</b> Influence of Engineering in the society.                                                                             |
| <b>Topic 2:</b> Introduction to Engineering                      | <b>Lesson 1:</b> Introduction to Engineering<br><b>Lesson 2:</b> Scope of Engineering<br><b>Lesson 3:</b> Roles and responsibilities of Engineers                                                                                         |
| <b>Topic 3:</b> Engineering Fields                               | <b>Lesson 1:</b> Types of engineering fields<br><b>Lesson 2:</b> Specific terminologies for the different types of engineering.<br><b>Lesson 3:</b> Processes of manufacturing materials in various engineering discipline                |
| <b>Topic 4:</b> Engineering Principles and practices             | <b>Lesson 1:</b> Engineering principles<br><b>Lesson 2:</b> Engineering practices<br><b>Lesson 3:</b> Engineering materials                                                                                                               |
| <b>Topic 5:</b> Occupational Health & safety                     | <b>Lesson 1:</b> OHS legislations and regulations for Engineers<br><b>Lesson 2:</b> Hazards & Risk Control Measures<br><b>Lesson 3:</b> Risk Assessment & Management<br><b>Lesson 4:</b> Basic First –Aid and CPR                         |
| <b>Topic 6:</b> Engineering Design Process                       | <b>Lesson 1:</b> Steps of Engineering Design<br><b>Lesson 2:</b> Management skills                                                                                                                                                        |
| <b>Topic 7:</b> Engineering Communication                        | <b>Lesson 1:</b> Effective communication<br><b>Lesson 2:</b> Interpersonal and intrapersonal communication skills<br><b>Lesson 3:</b> Telephones, emails, directories<br><b>Lesson 4:</b> Report writing,<br><b>Lesson 5:</b> Memorandums |

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| <b>STRAND 4: COMMUNICATION TECHNOLOGY</b>                                                                                             |                                                                                                                                                                                     |
| <b>UNIT 1: DATA COMMUNICATION AND NETWORK</b>                                                                                         |                                                                                                                                                                                     |
| <b>Benchmarks</b>                                                                                                                     | <b>9.4.1.1 – 9.4.1.7</b>                                                                                                                                                            |
| <b>Topic 1:</b> Data Communication Systems                                                                                            | <b>Lesson 1:</b> Introduction to Data Communication Systems<br><b>Lesson 2:</b> Elements of Data Communication systems                                                              |
| <b>Topic 2:</b> Computer Networks                                                                                                     | <b>Lesson 1:</b> Introduction to Computer Networks<br><b>Lesson 2:</b> Functions of Computer Network Components                                                                     |
| <b>Topic 3:</b> OSI Model                                                                                                             | <b>Lesson 1:</b> Introduction OSI Model<br><b>Lesson 2:</b> Functions of the OSI Model                                                                                              |
| <b>Topic 4:</b> Communication Technology Terminologies<br><br>(Basic Scientific and Mathematical Concepts in creating media products) | <b>Lesson 1:</b> Communication Technology Terminologies<br><b>Lesson 2:</b> Application of Terminologies<br><b>Lesson 3:</b> Media Products.                                        |
| <b>Topic 5:</b> Media Communication                                                                                                   | <b>Lesson 1:</b> Introduction to Media Communication<br><b>Lesson 2:</b> Techniques and Skills for application purposes                                                             |
| <b>Topic 6:</b> Design Brief-Simple Network                                                                                           | <b>Lesson 1:</b> Introduction to Design Brief<br><b>Lesson 2:</b> Research and apply Design<br><b>Lesson 3:</b> Brief in simple Networking                                          |
| <b>Topic 7:</b> Authoring Software Multimedia                                                                                         | <b>Lesson 1:</b> Introduction to Multimedia, Authoring Software<br><b>Lesson 2:</b> Categories of Authoring Software<br><b>Lesson 3:</b> Features of Multimedia, Authoring Software |
| <b>STRAND 4: COMMUNICATION TECHNOLOGY</b>                                                                                             |                                                                                                                                                                                     |
| <b>UNIT 2: COMPUTER SECURITY AND SAFETY</b>                                                                                           |                                                                                                                                                                                     |
| <b>Benchmarks</b>                                                                                                                     | <b>9.4.2.1 – 9.4.2.6</b>                                                                                                                                                            |
| <b>Topic 1:</b> Postures in Computer Equipment Usage<br><br>Equipment Usage                                                           | <b>Lesson 1:</b> Introduction to Ergonomics<br><b>Lesson 2:</b> Correct Posture or Positions<br><b>Lesson 3:</b> Case Study - Posture                                               |
| <b>Topic 2:</b> Health and Safety in ICT                                                                                              | <b>Lesson 1:</b> Types Health Hazards associated with use of ICT<br><b>Lesson 2:</b> Good ergonomics practices to minimise Health hazards associated in ICT usage                   |
| <b>Topic 3:</b> Effects of Computer Usage                                                                                             | <b>Lesson 1:</b> Introduction to computer technology<br><b>Lesson 2:</b> Effects of Computer Technology Usage on society                                                            |
| <b>Topic 4:</b> Emerging Technological Impact                                                                                         | <b>Lesson 1:</b> The evolution of emerging technologies<br><b>Lesson 2:</b> Impact of emerging technologies on society and environment<br><b>Lesson 3:</b> Case-Study (Music)       |
| <b>Topic 5:</b> Safe Working Practices/ Habits                                                                                        | <b>Lesson 1:</b> Introduction to Work Place Safety<br><b>Lesson 2:</b> Safe Work Practices                                                                                          |
| <b>STRAND 5: COMPUTER TECHNOLOGY</b>                                                                                                  |                                                                                                                                                                                     |
| <b>UNIT 1: COMPUTER ARCHITECTURE</b>                                                                                                  |                                                                                                                                                                                     |
| <b>Benchmarks</b>                                                                                                                     | <b>9.5.1.1 – 9.5.1.5</b>                                                                                                                                                            |

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

**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.

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                                               |
|------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| 1    | Textile Technology:<br><br>Fibres and Fabrics:<br><br>CS: 9.11<br><br>BMs: 9.1.1.1 and 9.1.1.2, 9.1.1.3, | <b>CS1.1</b> Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing. | <b>9.1.1.1</b> Compare and contrast social, economic, cultural and technological changes to textiles, fashion and clothing | Impact of changes on textiles, fashion and clothing |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 1:</b> Exploring Textiles?                                                                                       |                                                     |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 2:</b> Origins of textiles, fashion and clothing                                                                 |                                                     |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 3:</b> Factors affecting changes in textile, fashions and clothing                                               |                                                     |
|      |                                                                                                          |                                                                                                                                                                                      | <b>9.1.1.2</b> Distinguish the properties and characteristics of fibres and fabrics                                        | Introduction to fibres and fabrics                  |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 1:</b> What are fibres and fabrics?                                                                              |                                                     |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 2:</b> Characteristics and properties of fibres and fabrics                                                      |                                                     |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 3:</b> From fibres to fabrics.                                                                                   |                                                     |
|      |                                                                                                          |                                                                                                                                                                                      | <b>9.1.1.3</b> Explore the elements of design and the design and construction of fashion ideas                             | Designing and Construction                          |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 1:</b> Elements of design and design types.                                                                      |                                                     |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 2:</b> Sources of fashion ideas.                                                                                 |                                                     |
|      |                                                                                                          |                                                                                                                                                                                      | <b>Lesson 3:</b> Basic construction processes                                                                              |                                                     |

|   |                                                                                                             |                                                                                                                                                                                          |                                                                                                                                 |                                                        |
|---|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| 2 | Textile Technology:<br><br>Fibres and Fabrics:<br><br>CS: 9.1.1<br><br>BMs: 9.1.1.4,<br>9.1.1.5,<br>9.1.1.6 | <b>CS1.1</b> Investigate the evolution, characteristics, designs and trends of fabrics and fabric designs, their construction, production, representation, regulation and marketing.     | <b>9.1.1.4</b> Describe the functions of tools and equipment and their safe usage                                               | Functions and safe usage of tools and equipment        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 1:</b> Textile Construction methods tools and their functions.                                                        |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 2:</b> Safety when using textile tools and equipment.                                                                 |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 3:</b> Care and maintenance of textile products.                                                                      |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>9.1.1.5</b> Explore the range of textile construction techniques                                                             | Techniques in textile construction                     |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 1:</b> Textile construction methods                                                                                   |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 2:</b> Colouring and decorating methods                                                                               |                                                        |
| 3 | Textile Technology:<br><br>Textile and Clothing:<br><br>CS: 9.1.2<br><br>BMs: 9.1.2.1,<br>9.1.2.2,          | <b>CS1.2</b> 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 | <b>Lesson 3:</b> Fabric finishes                                                                                                |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>9.1.1.6</b> Apply appropriate safety practices in fashion design and construction                                            | Safety practices in fashion designing and construction |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 1:</b> Differentiating between textile designing and construction processes                                           |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 2:</b> Safety practices in textile.                                                                                   |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>9.1.2.1</b> Describe historical influences, technological progression and emerging trends as inspirational sources of design | Sources of Design                                      |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 1:</b> Sources of design                                                                                              |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 2:</b> Technological progression                                                                                      |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 3:</b> Emerging trends                                                                                                |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>9.1.2.2.</b> Demonstrate an awareness of the fundamentals of the design process through various artistic versions            | Fundamentals of design process                         |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 1:</b> Importance of design process                                                                                   |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 2:</b> Skills in the design process                                                                                   |                                                        |
|   |                                                                                                             |                                                                                                                                                                                          | <b>Lesson 3:</b> Various artistic version                                                                                       |                                                        |

|   |                                                                                                 |                                                                                                                                                                                                                                                                             |                                                                                                                                                   |                                                           |
|---|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| 4 | Textile Technology:<br><br>Textile and Clothing:<br><br>CS: 9.1.2<br><br>BMs: 9.1.2.3, 9.1.2.4, | <b>CS1.2</b> 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                                                                                    | <b>9.1.2.3</b> 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                   |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Fashion and types of garments                                                                                                    |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 2:</b> Transferring patterns from garment to garment                                                                                    |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 3:</b> Patterning techniques                                                                                                            |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>9.1.2.4</b> Describe how the properties of textile fibres affect textile wear and care                                                         | Textiles wear and care                                    |
| 5 | Textile Technology:<br><br>Textile and Clothing:<br><br>CS: 9.1.2<br><br>BMs: 9.1.2.5, 9.1.2.6, | <b>CS1.2</b> 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                                                                                    | <b>Lesson 1:</b> Types of tools for textile projects                                                                                              |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 2:</b> Safe uses of special tools                                                                                                       |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 3:</b> Care for tools                                                                                                                   |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>9.1.2.5</b> Apply the design process to respond to needs and opportunities in textile design projects                                          | Designing a textile project                               |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> What is design process                                                                                                           |                                                           |
| 6 | Food Technology:<br><br>Food and Nutrition:<br><br>CS: 9.2.1<br><br>BMs: 9.2.1.1, 9.2.1.2       | <b>CS 2.1</b> 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 | <b>Lesson 2:</b> Phases in Textile Project development                                                                                            |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 3:</b> Textile Projects                                                                                                                 |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>9.1.2.6</b> Select and use appropriate technology to creatively document, communicate and present design and project work                      | Documenting a project portfolio                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 1</b> People and textile industry                                                                                                       |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 2:</b> Textile technology equipment                                                                                                     |                                                           |
| 6 | Food Technology:<br><br>Food and Nutrition:<br><br>CS: 9.2.1<br><br>BMs: 9.2.1.1, 9.2.1.2       | <b>CS 2.1</b> 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 | <b>Lesson 3:</b> Textile Project exhibit                                                                                                          |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>9.2.1.1</b> Compare and contrast the nature and properties of food                                                                             | Nature and properties of food                             |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | Lesson 1: Introduction to food –(Nature and sources of food)                                                                                      |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 2:</b> Food groups and dietary guidelines                                                                                               |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 3:</b> Properties of starch, carbohydrates, fats and oil                                                                                |                                                           |
| 6 | Food Technology:<br><br>Food and Nutrition:<br><br>CS: 9.2.1<br><br>BMs: 9.2.1.1, 9.2.1.2       | <b>CS 2.1</b> 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 | <b>Lesson 4:</b> Introduction to food product development                                                                                         |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>9.2.1.2</b> Practice safety and hygiene procedures in tool and equipment, food handling, meal preparation and food development                 | Safety and hygienic practices in food product development |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Personal hygiene and safety practices                                                                                            |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 2:</b> Kitchen hygiene                                                                                                                  |                                                           |
|   |                                                                                                 |                                                                                                                                                                                                                                                                             | <b>Lesson 3:</b> Hygiene practices and safety in food development (preparation etc.)                                                              |                                                           |

|   |                                                                                            |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                         |                                        |
|---|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| 7 | Food Technology:<br><br>Food and Nutrition:<br><br>CS: 9.2.1<br><br>BMs: 9.2.1.3, 9.2.1.4  | <b>CS 2.1</b> 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 | <b>9.2.1.3</b> Examine the nutritional components of food and food development and the impact of food consumption on nutrition.                                                                                         | Food and nutrients                     |
|   |                                                                                            |                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Functions of nutrients and food sources<br><b>Lesson 2:</b> Eating practices<br><b>Lesson 3:</b> Meal planning                                                                                         |                                        |
|   |                                                                                            |                                                                                                                                                                                                                                                                             | <b>9.2.1.4</b> Explore nutrition as integral to making food choices                                                                                                                                                     | Food metabolism                        |
|   |                                                                                            |                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Digestion and absorption of food<br><b>Lesson 2:</b> Functions of food and nutrients in human body<br><b>Lesson 3:</b> Over nutrition and malnutrition (anorexia, bulimia, obesity, hypertension etc.) |                                        |
| 8 | Food Technology:<br><br>Food and Nutrition:<br><br>CS: 9.2.1<br><br>BMs: 9.2.1.5, 9.2.1.6, | <b>CS 2.1</b> 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 | <b>9.2.1.5</b> Discuss economic, social and technological influences of food, food product and food sciences                                                                                                            | Influences on food product development |
|   |                                                                                            |                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Food ingredients<br><b>Lesson 2:</b> Principles of cooking methods<br><b>Lesson 3:</b> Food management<br><b>Lesson 4:</b> Economic, Social and technological influences on food product development   |                                        |
|   |                                                                                            |                                                                                                                                                                                                                                                                             | <b>9.2.1.6</b> Explore ways of meeting nutritional requirements to maintain optimum nutrition or manage nutritional issues                                                                                              | Food composition and energy metabolism |
|   |                                                                                            |                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Food composition<br><b>Lesson 2:</b> Food labelling<br><b>Lesson 3:</b> Energy metabolism<br><b>Lesson 4:</b> Meals for special needs                                                                  |                                        |
| 9 | Food Technology:<br><br>Food and Nutrition:<br><br>CS: 9.2.1<br><br>BMs: 9.2.1.7           | <b>CS 2.1</b> 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 | <b>9.2.1.7</b> 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               |
|   |                                                                                            |                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Introduction to food product development<br><b>Lesson 2:</b> Design process<br><b>Lesson 3:</b> Design Brief<br><b>Lesson 4:</b> Sensory analysis                                                      |                                        |

|    |                                                                                           |                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                          |                                                                                       |
|----|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 10 | Food Technology:<br><br>Food Science:<br><br>CS: 9.2.2<br><br>BMs: 9.2.2.1, 9.2.2.2       | <b>CS 2.2</b> 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, | <b>9.2.2.1</b> 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 |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 1</b> Cooking methods in food product development                                                                                                                                              |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 2</b> Physical and biological properties of cereals, vegetables and fruits                                                                                                                     |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 3</b> Physical and biological properties of fruits, legumes, fats and oils                                                                                                                     |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>9.2.2.2</b> Describe the nutritional and sensory characteristics of food to meet the needs, health and occasions.                                                                                     | Sensory characteristics of food                                                       |
| 11 | Food Technology:<br><br>Food Science:<br><br>CS: 9.2.2<br><br>BMs: 9.2.2.3, 9.2.2.4,      | <b>CS 2.2</b> 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, | <b>Lesson 1</b> Sensory analyses of food                                                                                                                                                                 |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 2</b> Nutritional functions of food                                                                                                                                                            |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 3</b> Functional foods                                                                                                                                                                         |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>9.2.2.3</b> Apply management strategies in food selection, meal preparation, product development, storage and preservation                                                                            | Food management                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 1</b> Food management                                                                                                                                                                          |                                                                                       |
| 12 | Food Technology:<br><br>Food Science:<br><br>CS: 9.2.1<br><br>BMs: 9.2.2.5<br><br>9.2.2.6 | <b>CS 2.2</b> 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, | <b>Lesson 2</b> Trends, fashion and food                                                                                                                                                                 |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 3</b> Seasons and food                                                                                                                                                                         |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>9.2.2.4</b> Explore safety and hygiene practices relating to food, and changes that occur in the functional properties of food                                                                        | Food safety and hygienic practices                                                    |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 1</b> Food borne diseases                                                                                                                                                                      |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 2</b> Contamination                                                                                                                                                                            |                                                                                       |
| 12 | Food Technology:<br><br>Food Science:<br><br>CS: 9.2.1<br><br>BMs: 9.2.2.5<br><br>9.2.2.6 | <b>CS 2.2</b> 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, | <b>Lesson 3</b> First Aid                                                                                                                                                                                |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>9.2.2.5</b> 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                                     |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 1</b> Factors that influence food processing                                                                                                                                                   |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 2</b> The role of food packaging                                                                                                                                                               |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 3</b> Developments in packaging and distribution                                                                                                                                               |                                                                                       |
| 12 | Food Technology:<br><br>Food Science:<br><br>CS: 9.2.1<br><br>BMs: 9.2.2.5<br><br>9.2.2.6 | <b>CS 2.2</b> 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, | <b>Lesson 4</b> Techniques to evaluate products and processes                                                                                                                                            |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>9.2.2.6</b> Apply the design process to create food solutions.                                                                                                                                        | The technology design                                                                 |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 1</b> Design brief and the technological process                                                                                                                                               |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 3</b> Evaluate the new product                                                                                                                                                                 |                                                                                       |
|    |                                                                                           |                                                                                                                                                                                                                                                                                | <b>Lesson 2</b> Using a design product to create a new product                                                                                                                                           |                                                                                       |

## Grade 9 Construction Technology Yearly Content Overview:

| Week | Construction Technology                                                           | Content Standard                                                                                                                                                                                                                                                                                      | Benchmark                                                                                                                                                                                                                                    | Topic                               |
|------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 1    | Building Technology<br><br>CS: 9.3.1<br><br>BMS: 9.3.1.1.<br>9.3.1.2,<br>9.3.1.3, | <b>CS 3.1</b> 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. | <b>9.3.1.1</b> Investigate the history and theory of buildings                                                                                                                                                                               | The history and theory of buildings |
|      |                                                                                   |                                                                                                                                                                                                                                                                                                       | <b>Lesson 1:</b> Introduction to Building<br><b>Lesson 2:</b> Definition of Building<br><b>Lesson 3:</b> Different Types of Building<br><b>Lesson 4:</b> Types of material used<br><b>Lesson 5:</b> Importance of building and career paths. |                                     |
|      |                                                                                   |                                                                                                                                                                                                                                                                                                       | <b>9.3.1.2</b> Identify and describe a variety of construction materials, components, and processes                                                                                                                                          | Building construction materials     |
|      |                                                                                   |                                                                                                                                                                                                                                                                                                       | <b>Lesson 1:</b> Define Building materials<br><b>Lesson 2:</b> Timber Building Materials<br><b>Lesson 3:</b> Bricks and Concrete materials<br><b>Lesson 4:</b> Metal and steel materials                                                     |                                     |
|      |                                                                                   |                                                                                                                                                                                                                                                                                                       | <b>9.3.1.3</b> Describe the elements of drawings, and their application in technical drawings.                                                                                                                                               | Trade drawing                       |
|      |                                                                                   |                                                                                                                                                                                                                                                                                                       | <b>Lesson 1:</b> Define trade drawing<br><b>Lesson 2:</b> Types of trade drawing<br><b>Lesson 3:</b> Isometric drawing<br><b>Lesson 4:</b> Pictorial drawing<br><b>Lesson 5:</b> Orthographic drawing<br><b>Lesson 6:</b> Types of lines use |                                     |

|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                            |                                                 |
|---|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| 2 | Building Technology<br><br>CS: 9.3.1<br><br>BMs: 9.3.1.4, 9.3.1.5, 9.3.1.6,   | <b>CS 3.1</b> 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.                                           | <b>9.3.1.4</b> Identify and describe the elements of safety                                                                                                                                                                                                                                                | The Elements Occupational Health and Safety     |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>Lesson 1:</b> Define occupational Health and safety<br><b>Lesson 2:</b> The regulations of OHS<br><b>Lesson 3:</b> The standards of OHS                                                                                                                                                                 |                                                 |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.1.5</b> Describe the scope and purpose of building codes, and identify other regulations and standards that apply to construction projects                                                                                                                                                          | Building Codes, Standards and regulations       |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>Lesson 1:</b> Define Building legislations and regulations<br><b>Lesson 2:</b> Types of building codes<br><b>Lesson 3:</b> Types of building regulations                                                                                                                                                |                                                 |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.1.6</b> Apply mathematical skills and scientific concepts in the planning and building of a variety of construction projects                                                                                                                                                                        | Trade Maths                                     |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>Lesson 1:</b> Define Applied maths<br><b>Lesson 2:</b> Formulae to calculate substructure<br><b>Lesson 3:</b> Define sub-structure member (footings, post, bearers)<br><b>Lesson 4:</b> Define super-structure members (Floor joist, studs, roofing frame)<br><b>Lesson 5:</b> Types of building defect |                                                 |
| 3 | Electrical Technology<br><br>CS: 9.3.2<br><br>BMs: 9.3.2.1, 9.3.2.2, 9.3.2.3, | <b>CS 3.2</b> 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. | <b>9.3.2.1</b> Describe the historical development of electricity                                                                                                                                                                                                                                          | History of Electricity                          |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>Lesson 1:</b> Electrical Energy Production & Supply<br><b>Lesson 2:</b> Modern Power Generation methods<br><b>Lesson 3:</b> Renewable and sustainable energy practices.                                                                                                                                 |                                                 |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.2.2</b> Investigate and communicate OHS legislation and regulation and assess and employ emergency procedures whilst observing safety                                                                                                                                                               | Workplace and Electrical safety                 |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>Lesson 1:</b> Electrical Energy Production & Supply<br><b>Lesson 2:</b> Renewable and sustainable energy practices.<br><b>Lesson 3:</b> Career Pathway in Electrical Technology                                                                                                                         |                                                 |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>9.3.2.3</b> 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 |
|   |                                                                               |                                                                                                                                                                                                                                                                                                                                                 | <b>Lesson 1:</b> OHS legislation & Regulation<br><b>Lesson 2:</b> Personal Safety<br><b>Lesson 3:</b> Emergency procedures.                                                                                                                                                                                |                                                 |

|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                           |                                                                  |
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| 4 | Electrical Technology<br><br>CS: 9.3.2<br><br>BMs: 9.3.2.4, 9.3.2.5, | <b>CS 3.2</b> 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.                | <b>9.3.2.4</b> Define electricity and conductivity and differentiate insulators from conductors                                                           | Fundamentals of electricity                                      |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Electrical or Electronic processes<br><b>Lesson 2:</b> Electrical or Electronic products                                                 |                                                                  |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.2.5</b> Identify symbols used and explain the functions of components and devices in electrical circuit diagrams                                   | Components and devices used on circuit diagrams                  |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Electricity<br><b>Lesson 2:</b> Conductivity<br><b>Lesson 3:</b> Conductors and Insulators                                               |                                                                  |
| 5 | Electrical Technology<br><br>CS: 9.3.2<br><br>BMs: 9.3.2.6, 9.3.2.7  | <b>CS 3.2</b> 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.                | <b>9.3.2.6</b> Identify the different types of circuits and explain the parts and operation of a simple practical circuit.                                | Circuits                                                         |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Electrical components & devices<br><b>Lesson 2:</b> Electrical symbols used in circuit diagrams                                          |                                                                  |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.2.7</b> Investigate the concepts, principles and practices related to electrical                                                                   | Electrical Fundamentals                                          |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> OHMs LAW<br><b>Lesson 2:</b> Kirchhoff's Law<br><b>Lesson 3:</b> Circuit Calculations                                                    |                                                                  |
| 6 | Plumbing Technology<br><br>CS: 9.3.3<br><br>BMs: 9.3.3.1, 9.3.3.2    | <b>CS 3.3</b> 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. | <b>9.3.3.1</b> Describe and explain the fundamentals, concepts, and their relevance in the plumbing trade                                                 | Fundamental concept and relevance of plumbing trade              |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Introduction to plumbing trade.<br><b>Lesson 2:</b> Importance of plumbing trade.<br><b>Lesson 3:</b> Career pathways of plumbing trade. |                                                                  |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.3.2</b> Analyse and describe OHS Regulations and standards in the plumbing trade and work places.                                                  | Topic 2: Occupational Health and Safety regulations and standard |
|   |                                                                      |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Define Occupational Health Safety regulations and standards.<br><b>Lesson 2:</b> Types of regulations and standards.                     |                                                                  |

|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                     |                             |
|---|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 7 | Plumbing Technology<br><br>CS: 9.3.3<br><br>BMs: 9.3.3.3, 9.3.3.4,        | <b>CS 3.3</b> 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. | <b>9.3.3.3</b> Demonstrate and apply basic plumbing tools and equipment and their specifications and practice in trade math.                                                        | Plumbing tool and equipment |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Define plumbing tools and equipment.<br><b>Lesson 2:</b> Types of manual tools and equipment.<br><b>Lesson 3:</b> Types of plumbing materials and specifications.  |                             |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.3.4</b> Explore and apply basic concepts of trade drawings in plumbing.                                                                                                      | Trade Drawing               |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Define trade drawing.<br><b>Lesson 2:</b> Methods of Isometric drawing.<br><b>Lesson 3:</b> Methods of Pictorial drawing.<br><b>Lesson 4:</b> Types of lines used. |                             |
| 8 | Welding Technology<br><br>CS: 9.3.4<br><br>BMs: 9.3.4.1, 9.3.4.2,         | <b>CS 3.4</b> 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.                                                                                    | <b>9.3.4.1</b> Investigate safe workshop setup and safety procedures in welding                                                                                                     | Workshop Organisation       |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Workshop Set-up<br><b>Lesson 2:</b> Workshop safety procedures                                                                                                     |                             |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.4.2</b> Explore and interpret welding principles, codes and standards                                                                                                        | Welding Standards           |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Welding Principles<br><b>Lesson 2:</b> Welding Codes<br><b>Lesson 3:</b> Welding Standards                                                                         |                             |
| 9 | Welding Technology<br><br>CS: 9.3.4<br><br>BMs: 9.3.4.3, 9.3.4.4, 9.3.4.5 | <b>CS 3.4</b> 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.                                                                                    | <b>9.3.4.3</b> Demonstrate knowledge in fundamental print reading, measurement and layout or fit-up techniques                                                                      | Measurement Techniques      |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Measurement<br><b>Lesson 2:</b> Print reading<br><b>Lesson 3:</b> Layout/ fit-up Techniques                                                                        |                             |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.4.4</b> Investigate and analyse the properties of metals                                                                                                                     | Metals                      |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Types of metals<br><b>Lesson 2:</b> Metal Properties                                                                                                               |                             |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>9.3.4.5</b> Investigate the various welding techniques and cutting processes                                                                                                     | Cutting and Welding         |
|   |                                                                           |                                                                                                                                                                                                                                                                                                                                                                | <b>Lesson 1:</b> Types of Welding<br><b>Lesson 2:</b> Thermal cutting, heating and gouging<br><b>Lesson 3:</b> Brazing<br><b>Lesson 4:</b> Welding processes                        |                             |

|    |                                                                               |                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                       |                                                  |
|----|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| 10 | Engineering Technology<br><br>CS: 9.3.5<br><br>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<br>Lesson 2: Engineering Innovations<br>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<br>Lesson 2: Scope of Engineering<br>Lesson 3: Roles and responsibilities of Engineers                                                                          |                                                  |
| 11 | Engineering Technology<br><br>CS: 9.3.5<br><br>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<br>Lesson 2: Specific terminologies for the different types of engineering.<br>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<br>Lesson 2: Engineering practices<br>Lesson 3: Engineering materials                                                                                                |                                                  |
| 12 | Engineering Technology<br><br>CS: 9.3.5<br><br>BMs: 9.3.5.5, 9.3.5.6, 9.3.5.7 | 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. | 9.3.5.5 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                        |
| 13 | SUMMATIVE ASSESSMENT                                                          |                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                       |                                                  |

## Grade 9 Communication and Computer Technology Yearly Content Overview

| Week | Communication and Computer Technology | Content Standard | Benchmark | Topic |
|------|---------------------------------------|------------------|-----------|-------|
|------|---------------------------------------|------------------|-----------|-------|

|   |                                                                                                                          |                                                                                                                                                                                |                                                                                                                                                                                                   |                                                                                                                     |
|---|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1 | Communication Technology<br><br>Data Communication and Network<br><br>CS: 9.4.2<br><br>BMs: 9.4.1.1, 9.4.1.2,,           | <b>CS 4.1</b> Investigate and analyse communication technology utilising multimedia and the practices and systems in designing, installing, configuring and managing networks. | <b>9.4.1.1</b> Define the elements of data communication system.                                                                                                                                  | Data Communication Systems                                                                                          |
|   |                                                                                                                          |                                                                                                                                                                                | <b>Lesson 1:</b> Introduction to Data Communication Systems<br><b>Lesson 2:</b> Elements of Data Communication systems                                                                            |                                                                                                                     |
|   |                                                                                                                          |                                                                                                                                                                                | <b>9.4.1.2</b> Describe the functions of the different components of a computer network.                                                                                                          | Computer Networks                                                                                                   |
|   |                                                                                                                          |                                                                                                                                                                                | <b>Lesson 1:</b> Introduction to Computer Networks<br><b>Lesson 2:</b> Functions of Computer Network Components                                                                                   |                                                                                                                     |
| 2 | Communication Technology<br><br>Data Communication and Network<br><br>CS: 9.4.1<br><br>BMs: 9.4.1.3, 9.4.1.4,            | <b>CS 4.1</b> Investigate and analyse communication technology utilising multimedia and the practices and systems in designing, installing, configuring and managing networks. | <b>9.4.1.3</b> Define the OSI (Open Systems Interconnect) model and how it functions.                                                                                                             | OSI Model                                                                                                           |
|   |                                                                                                                          |                                                                                                                                                                                | <b>Lesson 1:</b> Introduction OSI Model<br><b>Lesson 2:</b> Functions of the OSI Model                                                                                                            |                                                                                                                     |
|   |                                                                                                                          |                                                                                                                                                                                | <b>9.4.1.4</b> 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<br><br>Basic Scientific and Mathematical Concepts in creating media products |
|   |                                                                                                                          |                                                                                                                                                                                | <b>Lesson 1:</b> Communication Technology Terminologies<br><b>Lesson 2:</b> Application of Terminologies<br><b>Lesson 3:</b> Media Products.                                                      |                                                                                                                     |
| 3 | Communication Technology<br><br>Data Communication and Network<br><br>CS: 9.4.1<br><br>BMs: 9.1.4 .5, 9.1.4 .6, 9.1.4 .7 | <b>CS 4.1</b> Investigate and analyse communication technology utilising multimedia and the practices and systems in designing, installing, configuring and managing networks. | <b>9.4.1.5</b> Explore and articulate the core concepts, techniques, and skills required to produce a range of communications media products or services.                                         | Media Communication                                                                                                 |
|   |                                                                                                                          |                                                                                                                                                                                | <b>Lesson 1:</b> Introduction to Media Communication<br><b>Lesson 2:</b> Techniques and Skills for application purposes                                                                           |                                                                                                                     |
|   |                                                                                                                          |                                                                                                                                                                                | <b>9.4.1.6</b> Research and apply the design brief to design, configure and manage simple network.                                                                                                | Design Brief-Simple Network                                                                                         |
|   |                                                                                                                          |                                                                                                                                                                                | <b>Lesson 1:</b> Introduction to Design Brief<br><b>Lesson 2:</b> Research and apply Design<br><b>Lesson 3:</b> Brief in simple Networking                                                        |                                                                                                                     |
|   |                                                                                                                          |                                                                                                                                                                                | <b>9.4.1.7</b> Explore the Authoring Software or Multimedia associate software                                                                                                                    | Authoring Software Multimedia                                                                                       |
|   |                                                                                                                          |                                                                                                                                                                                | <b>Lesson 1:</b> Introduction to Multimedia, Authoring Software<br><b>Lesson 2:</b> Categories of Authoring Software<br><b>Lesson 3:</b> Features of Multimedia, Authoring Software               |                                                                                                                     |

|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                               |                                      |
|---|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| 4 | Communication Technology Computer Security and Safety<br><br>CS: 9.4.2<br><br>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 |
|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      | <b>Lesson 1:</b> Introduction to Ergonomics<br><b>Lesson 2:</b> Correct Posture or Positions<br><b>Lesson 3:</b> 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             |
|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      | <b>Lesson 1:</b> Types Health Hazards associated with use of ICT<br><b>Lesson 2:</b> Good ergonomics practices to minimise Health hazards associated in ICT usage             |                                      |
| 5 | Communication Technology Computer Security and Safety<br><br>CS: 9.4.2<br><br>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            |
|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      | <b>Lesson 1:</b> Introduction to computer technology<br><b>Lesson 2:</b> 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        |
|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      | <b>Lesson 1:</b> The evolution of emerging technologies<br><b>Lesson 2:</b> Impact of emerging technologies on society and environment<br><b>Lesson 3:</b> Case-Study (Music) |                                      |
| 6 | Communication Technology Computer Security and Safety<br><br>CS: 9.4.2<br><br>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        |
|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      | <b>Lesson 1:</b> Introduction to Work Place Safety<br><b>Lesson 2:</b> Safe Work Practices                                                                                    |                                      |
| 7 | Computer Technology<br><br>Computer Architecture<br><br>CS: 9.5.1<br><br>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                      |
|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      | <b>Lesson 1:</b> Information-Processing- Cycle<br><b>Lesson 2:</b> Computer Hardware and Software<br><b>Lesson 3:</b> Types of Computer                                       |                                      |
|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      | 9.5.1.2 Explore generations of computer                                                                                                                                       | History of Computers                 |
|   |                                                                                                      |                                                                                                                                                                                                                                                                                                      | <b>Lesson 1:</b> History of Computers<br><b>Lesson 2:</b> Generation of Computers<br><b>Lesson 3:</b> Classification of Computers                                             |                                      |

|    |                                                                                                |                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                        |                      |
|----|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 8  | Computer Technology<br><br>Computer Architecture<br><br>CS: 9.5.1<br><br>BMs: 9.5.1.3, 9.5.1.4 | <b>CS 5.1</b> 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. | <b>9.5.1.3</b> Investigate and describe the design brief of solving problems.                                                                                                                          | Design Brief         |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Introduction to Design Brief<br><b>Lesson 2:</b> Stage Design Brief<br><b>Lesson 3:</b> Case Study of Design Brief                                                                    |                      |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>9.5.1.4</b> Identify and describe the functions of, as well as important advances related to, electronic and computer components;                                                                   | Computer Electronics |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Fundamentals of Computer Electronics<br><b>Lesson 2:</b> Functions of computer electronic components                                                                                  |                      |
| 9  | Computer Technology<br><br>Computer Architecture<br><br>CS: 9.5.1<br><br>BMs: 9.5.1.5, 9.5.1.6 | <b>CS 5.1</b> 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. | <b>9.5.1.5</b> Demonstrate a basic understanding of binary numbers and digital logic                                                                                                                   | Binary               |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Introduction to Binary Numbers<br><b>Lesson 2:</b> Binary Numbers<br><b>Lesson 3:</b> Digital Logic Circuitry                                                                         |                      |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>9.5.1.6</b> Explore and describe hardware and software troubleshooting principles                                                                                                                   | Troubleshooting      |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Introduction to Computer Troubleshooting Lesson<br><b>Lesson 2:</b> Troubleshooting<br><b>Lesson 3:</b> Case Study of Troubleshooting                                                 |                      |
| 10 | Computer Technology<br><br>Computer Software<br><br>CS: 9.5.2<br><br>BMs: 9.5.2.1, 9.5.2.2     | <b>CS 5.2</b> 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.                                                                                                   | <b>9.5.2.1</b> Explore programming software and applications                                                                                                                                           | Software Programming |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Introduction to Programming.<br><b>Lesson 2:</b> Types of Programming software and applications<br><b>Lesson 3:</b> Example of Software Programs and associated programming languages |                      |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>9.5.2.2</b> Demonstrate the understanding of Operating Systems/ Software and File Management                                                                                                        | Operating System     |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Introduction to Operating System<br><b>Lesson 2:</b> Categories of Operating Systems Software<br><b>Lesson 3:</b> File Management                                                     |                      |
| 11 | Computer Technology<br><br>Computer Software<br><br>CS: 9.5.2<br><br>BMs: 9.5.2.3, 9.5.2.4     | <b>CS 5.2</b> 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.                                                                                                   | <b>9.5.2.3</b> Apply typing skills with speed (20wpm) and accuracy (80%)                                                                                                                               | Keyboarding          |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>9.5.2.4</b> Create documents using Microsoft Office                                                                                                                                                 | Microsoft Office     |
|    |                                                                                                |                                                                                                                                                                                                                                                                                                             | <b>Lesson 1:</b> Introduction to Keyboard<br><b>Lesson 2:</b> Keyboard Techniques<br><b>Lesson 3:</b> Hands on Typing                                                                                  |                      |

|    |                                                                                    |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                              |                                |
|----|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 12 | Computer Technology<br><br>Computer Software<br><br>CS: 9.5.2<br><br>BMs: 9.5.2.5, | <b>CS 5.2</b> 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. | <b>9.5.2.5</b> Explore the Authoring Software or Multimedia associate software<br><br><b>Lesson 1:</b> Introduction to Microsoft Word<br><b>Lesson 2:</b> Introduction to Microsoft Excel<br><b>Lesson 3:</b> Introduction to Microsoft PowerPoint/Publisher | Authoring Software/ Multimedia |
| 13 | <b>SUMMATIVE ASSESSMENT</b>                                                        |                                                                                                                                                                                                           |                                                                                                                                                                                                                                                              |                                |

## 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 strands of TIA.

Below is a proposed Template to develop a Teaching Program for a Term.(13 weeks)

Subject: \_\_\_\_\_ Grade: \_\_\_\_\_ Term: \_\_\_\_\_ Year: \_\_\_\_\_

|                             |                                                                                                                          |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Week</b>                 | Write the week number                                                                                                    |
| <b>Content Standards</b>    | Write the Coding only                                                                                                    |
| <b>Benchmark</b>            | Write the Coding only                                                                                                    |
| <b>Unit</b>                 | Write the Unit number and Name                                                                                           |
| <b>Topic</b>                | Write the Topic number and Name                                                                                          |
| <b>Learning Objective</b>   | By the end of this Topic, Students will be able to:<br><br>Write the learning Objectives for the Topic                   |
| <b>Knowledge</b>            | Write the essential knowledge to be learnt in this topic                                                                 |
| <b>Skill</b>                | Write the essential skill to be learnt in this topic                                                                     |
| <b>Attitude/ Values</b>     | Write the essential attitude and values to be learnt in this topic                                                       |
| <b>Performance Standard</b> | By the end of this Topic, students will be able to;<br><br>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: \_\_\_\_\_ Week: \_\_\_\_\_ Date: \_\_\_\_\_

Year: \_\_\_\_\_

|                                      |                                                                                                                                                |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CS</b>                            | • Write the Coding only                                                                                                                        |
| <b>BM</b>                            | • Write the Coding only                                                                                                                        |
| <b>Unit</b>                          | • Write the Unit number and Name                                                                                                               |
| <b>Topic</b>                         | • Write the Topic number and Name                                                                                                              |
| <b>Learning Objective</b>            | By the end of this Topic, Students will be able to:<br>• Write the learning Objectives for the Topic                                           |
| <b>Knowledge</b>                     | • Write the essential knowledge to be learnt in this topic                                                                                     |
| <b>Skill</b>                         | • Write the essential skill to be learnt in this topic                                                                                         |
| <b>Attitude/ Values</b>              | • Write the essential attitude and values to be learnt in this topic                                                                           |
| <b>Suggested Learning Activities</b> | • List down the learning activities that will be done in this topic                                                                            |
| <b>Performance Standard</b>          | By the end of this Topic, students will be able to;<br>• Write the Performance Standard (only if the Benchmark carries a performance standard) |

## 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: \_\_\_\_\_ Week: \_\_\_\_\_ Date: \_\_\_\_\_

Year: \_\_\_\_\_

|                             |                                                                                                                        |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>CS</b>                   | • Write the Coding only                                                                                                |
| <b>BM</b>                   | • Write the Coding only                                                                                                |
| <b>Unit</b>                 | • Write the Unit number and Name                                                                                       |
| <b>Topic</b>                | • Write the Topic number and Name                                                                                      |
| <b>Learning Objective</b>   | By the end of this Topic, Students will be able to:<br>• Write the learning Objectives for the Topic                   |
| <b>Knowledge</b>            | • Write the essential knowledge to be learnt in this topic                                                             |
| <b>Skill</b>                | • Write the essential skill to be learnt in this topic                                                                 |
| <b>Attitude/ Values</b>     | • Write the essential attitude and values to be learnt in this topic                                                   |
| <b>Performance Standard</b> | By the end of this Topic, students will be able to;<br>• Write the Performance Standard (if the Benchmark carries one) |

|                                      |                      |
|--------------------------------------|----------------------|
| <b>Lesson Number and Titles</b>      | • Lesson 1:          |
|                                      | • Lesson 2:          |
|                                      | • Lesson 3           |
| <b>Lesson Objectives</b>             | • Lesson 1 Objective |
|                                      | • Lesson 2 Objective |
|                                      | • Lesson 3 Objective |
| <b>Suggested Learning Activities</b> |                      |
|                                      |                      |
|                                      |                      |

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

## Performance Assessment 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. A- Advanced
- b. B- Proficient
- c. C- Progressing

## d. 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 under-achievers. 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 planning 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 organized set of lesson plans. Good planning allows for more effective teaching and learning. The lesson plan is a guide and map for organizing 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, analyse 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 are suggested strategies teachers may adopt to assist underachievers in the classroom.

#### 1. Examine the Problem Individually

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

#### 2. 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?

#### 3. Help student to plan every activity in the classroom

#### 4. Help students set realistic expectations

#### 5. Encourage and promote the student's interests and passions.

#### 6. Help children set short and long-term academic goals

#### 7. Talk with them about possible goals.

8. Ensure that all students are challenged (but not frustrated) by classroom activities
9. 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- Topic 1: Simulation Models

**Content Standard:** 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.

**Benchmark 12.5.1.1:** Identify different types of models used for simulations

#### Learning Objective:

By the end of the topic, students will be able to identify different types of simulation models

#### Essential questions:

- What are simulation models?
- Explain the purpose of simulation models
- What are the different types of simulation models?

#### Skills, Knowledge, Attitudes and Values:

| Key Concepts(SKAV) |                                                                |
|--------------------|----------------------------------------------------------------|
| <b>Skills</b>      | Identify different types of simulation models                  |
| <b>Knowledge</b>   | Simulation Models                                              |
| <b>Attitudes</b>   | Creativity in designing different types of simulation modeling |
| <b>Values</b>      | Rationality                                                    |

## Lesson 1: Simulation Modeling

### Lesson Objective:

By the end of the lesson the student will recognise that a model is made up of multiple variables that work together.

### Lesson Procedure:

| Teacher will .....                                                                                                                                                                                                                                                        | Student will ....                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Introduction (time in minutes)</b>                                                                                                                                                                                                                                     |                                                                                                                                                                                                              |
| Ask students to brainstorm what they think a “model” is in science and examples of models they know of.                                                                                                                                                                   | <ul style="list-style-type: none"> <li>Note their ideas in their exercise books.</li> </ul>                                                                                                                  |
| Explain that a model is a representation of something in the real world that can't be experienced directly, such as climate change.                                                                                                                                       | <ul style="list-style-type: none"> <li>Recognise that the models can represent an idea, an object, a process, or a system.</li> </ul>                                                                        |
| <b>Body (time in minutes)</b>                                                                                                                                                                                                                                             |                                                                                                                                                                                                              |
| <b>Modeling</b>                                                                                                                                                                                                                                                           |                                                                                                                                                                                                              |
| Give examples of Simulation models <ul style="list-style-type: none"> <li>- Computer Model</li> <li>- Play Grow a Tree</li> <li>- Illustrate how the gravitational force controls the motion of the planets</li> </ul>                                                    | Discuss their ideas on different simulation models using the examples given.                                                                                                                                 |
| <b>Guided Practice</b>                                                                                                                                                                                                                                                    |                                                                                                                                                                                                              |
| Guide students to Illustrate how the gravitational force controls the motion of the planets.                                                                                                                                                                              | Using the program, they are familiar with, they draw, code and simulate the gravitational force that controls the motion of the planets.                                                                     |
| <b>Independent Practice</b>                                                                                                                                                                                                                                               |                                                                                                                                                                                                              |
| Allow students to explore the different motions that a group of planetary bodies can have.                                                                                                                                                                                | Using the online program explore the different motions that a group of planetary bodies can have.                                                                                                            |
| <b>Conclusion (time in minutes)</b>                                                                                                                                                                                                                                       |                                                                                                                                                                                                              |
| What are computer models good for?                                                                                                                                                                                                                                        | To computer models are good for illustrating ideas, process or system that represent real world.                                                                                                             |
| <b>Assessment</b>                                                                                                                                                                                                                                                         |                                                                                                                                                                                                              |
| Confirm students understanding on models with the following; <ul style="list-style-type: none"> <li>Why are models useful?</li> <li>How can computer models be used to learn about the real world?</li> <li>What can be different about a model vs. the world?</li> </ul> | Affirm understanding on models by; <ol style="list-style-type: none"> <li>Justify the usefulness of models</li> <li>Model a real world</li> <li>State the difference about a model and the world.</li> </ol> |

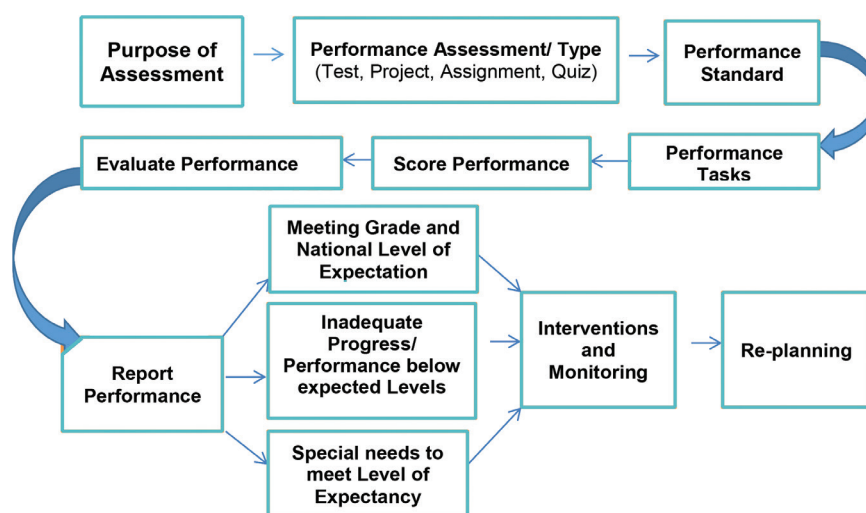
# Assessment, Monitoring And Reporting

## 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

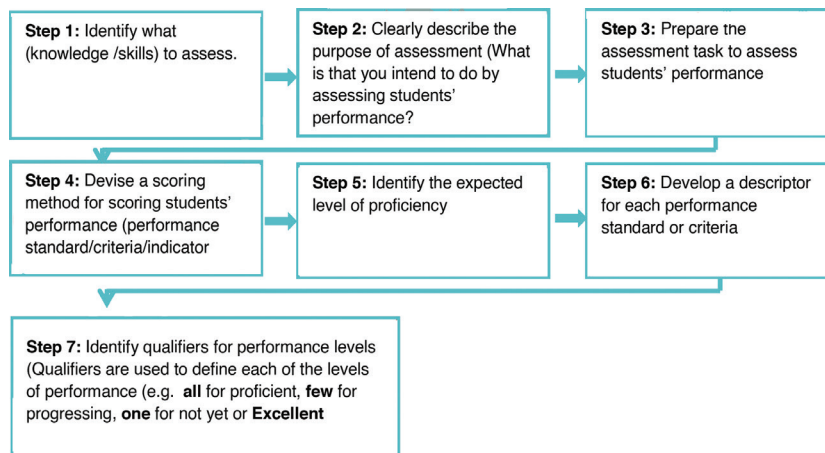
## **Principles of Standards-Based Assessment:**

The principle of SBA is for assessment to be;

- emphasizing 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 ex-

plore 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Portfolios, demonstrations, field work, case studies, assignments, lab reports</li> <li>• Students take an active role in process</li> <li>• Qualitative</li> <li>• Interpretive</li> <li>• Focuses on performance, process and product</li> <li>• High level thinking</li> <li>• Use of rubric</li> </ul> | <ul style="list-style-type: none"> <li>• Multiple choice tests, true-false, fill in the blanks, sentence completion, matching, diagram completions</li> <li>• External –(teacher driven – assessing performance of teacher rather than the student)</li> <li>• 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)</li> <li>• Quantitative (driven to collect marks)</li> <li>• Objective</li> </ul> |
| <ul style="list-style-type: none"> <li>• Use of criterion levels evaluation</li> <li>• Part of teaching and learning Process</li> <li>• Shows mastery and learning performance</li> <li>• Generally extends over time</li> </ul>                                                                                                                    | <ul style="list-style-type: none"> <li>• End product (only looking for the end product and not concerned about the performance and process)</li> <li>• Standardized or norm referenced</li> <li>• Isolated facts</li> <li>• Low level content</li> <li>• Generally occurs in “one setting</li> </ul>                                                                                                                                                                                                                     |

## 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. (move all assessment strategies in the appendices to this section and include strategies suggested by JP, page # 74 and 57)

| Action Verbs to Assessment Strategies                                                 |                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cognitive Learning                                                                    | Action Verbs                                                                                                                                                                                            | Assessment Strategies                                                                                                                                                                                                                                                                                 |
| <b>Knowledge</b> - 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                          | <ul style="list-style-type: none"> <li>• Prior knowledge inventory, misconception/preconception check</li> <li>• Focused listing, empty outlines</li> <li>• Pre-post test, quiz, quick poll</li> </ul>                                                                                                |
| <b>Comprehension</b> – 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    | <ul style="list-style-type: none"> <li>• Minute paper, muddiest (or clearest) point</li> <li>• Observe and evaluate a student artifact or performance task using a rubric</li> <li>• Directed paraphrasing</li> <li>• Pre-post test, quiz</li> <li>• Interviews</li> </ul>                            |
| <b>Application</b> – 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 | <ul style="list-style-type: none"> <li>• Observe and evaluate a student artifact, performance, or task using a rubric</li> <li>• Directed paraphrasing, real-world application (apply learning in a new context)</li> <li>• Test, quiz</li> <li>• Job/internship evaluation, skill ratings</li> </ul> |

|                                                                                                 |                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Analysis</b> – to break information into its components to see inter-relationships and ideas | Analyse, appraise, calculate, categorise, compare, contrast, criticise, differentiate, discriminate, distinguish, examine, experiment, question, test, separate, order, connect, classify, arrange, divide, infer | <ul style="list-style-type: none"> <li>• Pro and con grid, categorising grid, compare and contrast, concept maps</li> <li>• Observe and evaluate a student artifact, performance, or task using a rubric</li> <li>• Journaling</li> <li>• Job/internship evaluation, skill ratings</li> </ul> |
| <b>Evaluation</b> – 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, summarize                                                                        | <ul style="list-style-type: none"> <li>• Reflection component of a portfolio or experience</li> <li>• Journaling</li> <li>• Peer evaluation</li> </ul>                                                                                                                                        |
| <b>Affective Learning</b>                                                                       | appreciate, accept, attempt, challenge, defend, dispute, join, judge, praise, question, share, support                                                                                                            | <ul style="list-style-type: none"> <li>• Reflection component of a portfolio or experience</li> <li>• Journaling</li> <li>• Observe and evaluate group work</li> <li>• Surveys, interviews, focus groups</li> </ul>                                                                           |

## Assessment Strategies

| Strategy                       | Description                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Analogies</b>               | 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.                                                                                                                                                                    |
| <b>Classroom Presentations</b> | 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.                                                 |
| <b>Conferences</b>             | 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 |
| <b>Discussions</b>             | 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.                                                                                                             |
| <b>Essays</b>                  | 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 synthesise information.                                                                                                   |

|                                     |                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Exhibitions/Demonstrations</b>   | 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.                                                                                                                                                                  |
| <b>Interviews</b>                   | 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. |
| <b>Learning Logs</b>                | 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.                                                                                                                                                           |
| <b>Observation</b>                  | 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.                                                             |
| <b>Peer Assessment</b>              | 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.                                                                                                                                                                                                                    |
| <b>Performance Tasks</b>            | 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.                                                                                                                                             |
| <b>Portfolios</b>                   | 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.                                                                                              |
| <b>Questions And Answers (Oral)</b> | 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.                                                                  |
| <b>Quizzes, Tests, Examinations</b> | 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.                                      |
| <b>Questionnaires</b>               | 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.                                                                                                                                                                                |
| <b>Response Journals</b>            | 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.                                                                                                                                              |
| <b>Selected Responses</b>           | 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.             |
| <b>Student Self-Assessments</b>     | 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;

- a. Descriptions of the of task
- b. The scales to be used
- c. The dimensions of the task
- d. The description of each dimension on the scale

### A Rubric:

- 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)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BEYOND</b>     | Beyond Standard (s) -Advanced in Performance and Understanding <ul style="list-style-type: none"> <li>• Consistently demonstrates advanced conceptual mathematical understandings</li> <li>• Consistently generates tasks that make connections between and among mathematical ideas</li> <li>• Consistently applies strategies to unique situations</li> <li>• Consistently demonstrated confidence to approach tasks beyond the proficiency level for grade</li> <li>• Consistently initiates mathematical investigations</li> </ul>                                                                                                                         |
| <b>CONSISTENT</b> | Meet Standard (s)-Proficient in Performance and Understanding <ul style="list-style-type: none"> <li>• Consistently demonstrates understanding of mathematical standards and cluster at the grade level</li> <li>• Consistently demonstrated conceptual understanding</li> <li>• Consistently applies multiple strategies flexibly in various situations</li> <li>• Understands and fluently applies procedures with understanding</li> <li>• Consistently demonstrates perseverance and precision</li> <li>• Constructs logical mathematical arguments of thinking and reasoning</li> <li>• Uses mathematical language correctly and appropriately</li> </ul> |

|                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>INCONSISTENT</b> | Progressing-Not Yet Proficient in Performance and Understanding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                     | <ul style="list-style-type: none"> <li>• Inconsistently uses tools appropriately and strategically</li> <li>• Demonstrates inconsistent understanding of key mathematical ideas at grade level</li> <li>• Demonstrates inconsistent conceptual understanding of key mathematical ideas at grade level</li> <li>• Inconsistent in understanding and application of grade level appropriate strategies</li> <li>• Depends upon assistance of teacher and/or peers to understand and complete tasks</li> <li>• Needs additional time to complete tasks</li> <li>• Applies models of mathematical ideas inconsistently</li> </ul> |
| <b>SELDOM</b>       | Not Yet -Limited Performance and Understanding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                     | <ul style="list-style-type: none"> <li>• Exhibits minimal understanding of key mathematic ideas at grade level</li> <li>• Rarely demonstrates conceptual understanding</li> <li>• Seldom provides precise response</li> <li>• Seldom use appropriate strategies</li> <li>• Consistently requires assistance and alternative instruction</li> <li>• Use tools inappropriately to model mathematics</li> </ul>                                                                                                                                                                                                                  |

## Types of Rubrics

### 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 |
|-------------------|----------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------|-------|
| <b>Criteria 1</b> | 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 |       |
| <b>Criteria 2</b> | 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 |       |

|                   |                                                    |                                                                     |                                                                    |                                                     |  |
|-------------------|----------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------|--|
| <b>Criteria 3</b> | Description reflecting beginning level performance | Description reflecting movement toward mastery level of performance | Description reflecting achievement of mastery level of performance | Description reflecting highest level of performance |  |
| <b>Criteria 4</b> | Description reflecting beginning level performance | Description reflecting movement toward mastery level of performance | Description reflecting achievement of mastery level of performance | Description reflecting highest level of performance |  |

### Sample Analytic Rubric

|                                                         |                                                                                                                           | Qualifier                                                           | Descriptor                                                                    |                                                                     |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------|
| Performance Standard/Criteria                           | Advanced                                                                                                                  | Proficient                                                          | Progressing                                                                   | Not Yet                                                             |
| Identify reasons for developing caring relationships    | Identify and explain <b>all</b> the reasons for developing caring relationships                                           | Identify <b>all</b> the reasons for developing caring relationships | Identify only a <b>few</b> of the reasons for developing caring relationships | Identify only <b>one</b> 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 <b><u>complete</u></b> understanding of the problem. <b><u>All</u></b> requirements of task are <b><u>included in response</u></b> . | Demonstrate <b><u>con-siderate</u></b> understanding of the problem. <b><u>All</u></b> requirements of task are <b><u>included</u></b> . | Demonstrate <b><u>partial</u></b> understanding of the problem. <b><u>Most</u></b> requirements of task are <b><u>included</u></b> . | Demonstrate <b><u>little</u></b> understanding of the problem. <b><u>Many</u></b> requirements of task are <b><u>missing</u></b> . | Demonstrate <b><u>no</u></b> understanding of the problem. | <b><u>No</u></b> re-sponse/ <b><u>not</u></b> 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 <b><u>highest</u></b> level of performance. | Description reflecting <b><u>mastery</u></b> level of performance. | Description reflecting <b><u>movement towards</u></b> mastery level of performance. | Description reflecting <b><u>beginning</u></b> level of performance. |
| Criteria # 2    | Description reflecting <b><u>highest</u></b> level of performance. | Description reflecting <b><u>mastery</u></b> level of performance. | Description reflecting <b><u>movement towards</u></b> mastery level of performance. | Description reflecting <b><u>beginning</u></b> level of performance. |
| Criteria # 3    | Description reflecting <b><u>highest</u></b> level of performance. | Description reflecting <b><u>mastery</u></b> level of performance. | Description reflecting <b><u>movement towards</u></b> mastery level of performance. | Description reflecting <b><u>beginning</u></b> level of performance. |
| Criteria # 4    | Description reflecting <b><u>highest</u></b> level of performance. | Description reflecting <b><u>mastery</u></b> level of performance. | Description reflecting <b><u>movement towards</u></b> mastery level of performance. | Description reflecting <b><u>beginning</u></b> 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

- **Frequency Rating Scales:** A frequency rating scale scores how often a task is done to meet criteria.

### Sample Rating Scale Descriptive Words:

**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   |

**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     |

**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         |

**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 |

**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 |

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

| Excellent  | Proficient | Adequate           | Limited     |
|------------|------------|--------------------|-------------|
| accurate   | logical    | partially accurate | flawed      |
| insightful | logical    | simplistic         | unsupported |
| astute     | credible   | plausible          | inaccurate  |
| precise    | relevant   | basic              | irrelevant  |

**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 |
| 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”

| <b>No</b> | <b>Criteria</b>                                                    | <b>Write Yes (score 2) or No (score 1)</b> |
|-----------|--------------------------------------------------------------------|--------------------------------------------|
| <b>1</b>  | <i>Embraces everyone's' abilities and encourages participation</i> |                                            |
| <b>2</b>  | <i>Ensures everyone is tasked to an activity</i>                   |                                            |
| <b>3</b>  | <i>Encourages everyone to achieve together</i>                     |                                            |

Sample Scoring using Tick/Cross Checklist Scale to assess “Collaboration”

| <b>No</b> | <b>Criteria</b>                                                    | <b>Place a tick(score 2) or and X (score 1)</b> |
|-----------|--------------------------------------------------------------------|-------------------------------------------------|
| <b>1</b>  | <i>Embraces everyone's' abilities and encourages participation</i> |                                                 |
| <b>2</b>  | <i>Ensures everyone is tasked to an activity</i>                   |                                                 |
| <b>3</b>  | <i>Encourages everyone to achieve together</i>                     |                                                 |

## 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 an 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.

| <b>Component</b> | <b>Weighting</b> | <b>Tasks</b> | <b>Assessment Referencing</b> |
|------------------|------------------|--------------|-------------------------------|
|------------------|------------------|--------------|-------------------------------|

|                                                                                     |                              |                                                                                                                                                                                                            |                                       |
|-------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Practical Work in response to design brief (Moderation and Projects included here?) | 60 %<br>(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<br><br>Rubrics? |
| Design folio with outcomes of research, investigations and planning                 | 20 %<br>(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 | Criterion Referencing<br><br>Rubrics? |
| Tests                                                                               | 20 %<br>(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              | Description                                                                                                                                                                                                                                | 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<br>1=10 marks |
| <b>Portfolio</b>             | Individual Students will be assessed.....                                                                                                                                                                                                  | 10 marks                   |
| <b>Moderation</b>            | 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                   |
| <b>Project (Application)</b> | In groups of three to four, students work to critically engage with one another in the assigned project. Students will address criteria provided in class and prepare and deliver a 5-10 minute presentation addressing the criteria.      | 20 marks                   |
| <b>Participation</b>         | 2 marks will be allocated each day for attendance. Another 3 marks will be awarded for active participation.                                                                                                                               | 5 marks                    |

## 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

### **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.

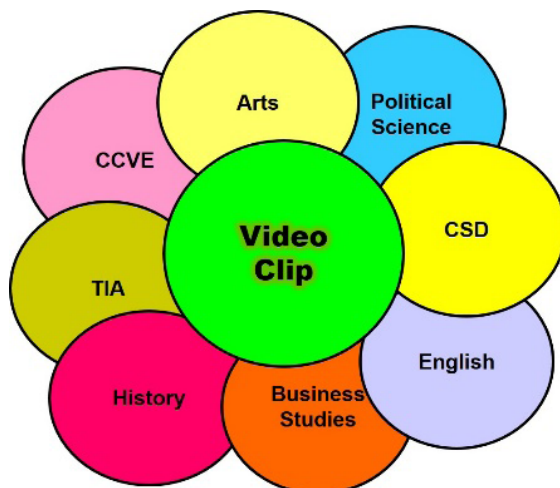
Students still bringing their smart mobile phones to school despite the school rules telling them not to.

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.

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



Product Idea/ Model

- Sample:
  - SUBJECT: BUSINESS STUDIES
  - BENCHMARK 9.2.5.1. Analyse the impact of information technology on society.

○ BIG IDEA/PRODUCT: Video Clip

**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/<br>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.

**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.

**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-minute 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

### **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

### Unit 5: Information Technology

#### Strand 2: Business Management

**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 behavioural 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 Behaviour 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

- i. Plan and write a short write-up for your video-clip.
- ii. Use the notes to make a 2-minute video clip to advertise and market your school to the public.
- iii. The short video clip must embrace the school rules, motto, and mission and vision state ments.
- iv. It must also contain messages of new and competent management.
- v. This video clip has to have the potential to positively change the image of the school
- vi. This 2-minute video clip must be captivating and totally convincing to attract students to want to enrol at your school.
- vii. This clip must not be more than 2 minutes (maximum time limit)
- viii. Submit both your write-up (on a chart) together with your video clip
- ix. 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:

- Decide on type of rubrics to be used (Holistic or Analytic)
- After you decide, plan the rubrics
- Planning to develop the rubric
- 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-minute video clip must be captivating and totally convincing to attract students to want to enrol 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      | <ul style="list-style-type: none"> <li>• The short video clip must embrace the school rules, motto, and mission and vision statements.</li> <li>• It must also contain messages of new and competent management.</li> <li>• This video clip has to have the potential to positively change the image of the school</li> <li>• This 2-minute video clip must be captivating and totally convincing to attract students to want to enrol at your school.</li> </ul> |
| The Presentation of the video | <ul style="list-style-type: none"> <li>• This clip must not be more than 2 minutes (maximum time limit)</li> <li>• Present your video clip to be assessed</li> </ul>                                                                                                                                                                                                                                                                                              |
| 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: <ul style="list-style-type: none"> <li>• Teamwork and cooperation</li> <li>• Creativity</li> </ul> Knowledge: Know about the school |

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                            |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The content of the video      | <ul style="list-style-type: none"> <li>The short video clip must embrace the school rules, motto, and mission and vision statements.</li> <li>It must also contain messages of new and competent management.</li> <li>This video clip has to have the potential to positively change the image of the school</li> <li>This 2-minute video clip must be captivating and totally convincing to attract students to want to enrol at your school.</li> </ul> | <p>Knowledge:</p> <p>Adequate content about the school</p> <p>Skill: convincing and persuasive</p> <p>Values and attitude:</p> <p>Encouraging and luring</p>                                                                                               |
| The Presentation of the video | <ul style="list-style-type: none"> <li>This clip must not be more than 2 minutes (maximum time limit)</li> <li>Present your video clip to be assessed</li> </ul>                                                                                                                                                                                                                                                                                          | <p>Skill:</p> <ul style="list-style-type: none"> <li>Time management</li> <li>delivery skills (posture, language) and</li> <li>communication skills</li> <li>social skills (relativity and connectivity)</li> </ul> <p>Values and attitude: confidence</p> |
| 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 | <p>Skill: Procedural Writing</p> <p>Organised paper of video script writing procedures</p>                                                                                                           | Organised paper of video script writing procedures                     | Organised paper of video script writing procedures                     | /3   |
| The development of the video     | <p>Values and attitudes:</p> <p>Teamwork and cooperation</p> <p>Creativity</p> <p>Knowledge: Know about the school</p> <p>The video corresponds to the 2-minutes script and illustrates teamwork</p> | 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      | <p><b>Knowledge:</b></p> <p>Adequate content about the school</p> <p><b>Skill:</b> convincing and persuasive</p> <p><b>Values and attitude:</b></p> <p>Encouraging and luring</p> <p>The short video clip embraces the core ideas of school rules, motto, and mission and vision statements.</p>                                                                                                                                                                                                                            | 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 | <p><b>Skill:</b></p> <ul style="list-style-type: none"> <li>• Time management</li> <li>• delivery skills (posture, language) and</li> <li>• communication skills</li> <li>• social skills (relativity and connectivity)</li> <li>• Values and attitude: confidence</li> </ul> <p>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.</p> | 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               | <p><b>EKSAVs in the Write up and Presentation:</b></p> <p><b>Video clip submitted at the assessment deadline for presentations</b></p>                                                                                                                                                                                                                                                                                                                                                                                      | <b>Video clip submitted at the assessment deadline for presentations</b>                                                                                                                                                               | <b>Video clip submitted at the assessment deadline for presentations</b>                                                                                                                                                               | /3 |

## 6. Completed rubric sample: Video clip Assessment Rubric

| Criteria | Achieved | Progressing | Novice | Marks |
|----------|----------|-------------|--------|-------|
|----------|----------|-------------|--------|-------|

|                                   |                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                   |    |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Video Script Write up</b>      | <b>Innovative</b> and <b>well</b> organised paper with <b>clarity</b> of video <u>script</u> writing procedures                                                                                                                                                                                                                                    | <b>Well</b> organised paper with <b>clarity</b> of video <u>script</u> writing procedures                                                                                                                                                                                                                                                            | Organised paper with some <b>clarity</b> of video <u>script</u> writing procedures                                                                                                                                                                                                                                                                | /3 |
| <b>Video Development</b>          | <b>Appropriately considered details</b> for the video are <b>well</b> corresponded to the 2-minutes script and illustrates a well-coordinated teamwork                                                                                                                                                                                             | <b>Considered details</b> for the video are <b>mostly</b> corresponded to the 2-minutes script and illustrates a coordinated teamwork                                                                                                                                                                                                                | <b>Some details</b> considered for the video are <b>partially</b> corresponded to the 2-minutes script and illustrates a less coordinated teamwork                                                                                                                                                                                                | /3 |
| <b>Video Clip Content</b>         | <ul style="list-style-type: none"> <li>The short video clip <b>fully</b> embraces the core ideas of school rules, motto, and mission and vision statements.</li> </ul>                                                                                                                                                                             | <ul style="list-style-type: none"> <li>The short video clip <b>mostly</b> embraces the core ideas of school rules, motto, and mission and vision statements.</li> </ul>                                                                                                                                                                              | <ul style="list-style-type: none"> <li>The short video clip <b>somewhat</b> embraces the core ideas of school rules, motto, and mission and vision statements.</li> </ul>                                                                                                                                                                         | /3 |
| <b>Video Presentation</b>         | <ul style="list-style-type: none"> <li>The video clip <b>fully</b> captures essence of vital messages of the new and competent management with <b>necessary</b> potentials to positively change the image of the school and <b>really</b> captivating and <b>totally</b> convincing to attract students to want to enrol at the school.</li> </ul> | <ul style="list-style-type: none"> <li>The video clip <b>mostly</b> captures the essence of vital messages of the new and competent management with <b>most</b> potentials to positively change the image of the school and <b>mostly</b> captivating and <b>partially</b> convincing to attract students to want to enrol at the school.</li> </ul> | <ul style="list-style-type: none"> <li>The video clip <b>somewhat</b> captures the essence of vital messages of the new and competent management with <b>some</b> potentials to positively change the image of the school and <b>almost</b> captivating and <b>less</b> convincing to attract students to want to enrol at the school.</li> </ul> | /3 |
| <b>Video Clip Submission Time</b> | <ul style="list-style-type: none"> <li>Video clip submitted <b>well before</b> the assessment deadline for presentations</li> </ul>                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>Video clip submitted <b>just before</b> the assessment deadline for presentations</li> </ul>                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>Video clip submitted <b>within</b> the assessment time for presentations</li> </ul>                                                                                                                                                                                                                        | /3 |

## How to Score using the rubric

### Scoring Rubrics:

| Criteria                     | <b>Achieved<br/>3</b>                                                                                           | <b>Progressing<br/>2</b>                                                                  | <b>Novice<br/>1</b>                                                                | Scoring |
|------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------|
| <b>Video Script Write up</b> | <b>Innovative</b> and <b>well</b> organised paper with <b>clarity</b> of video <u>script</u> writing procedures | <b>Well</b> organised paper with <b>clarity</b> of video <u>script</u> writing procedures | Organised paper with some <b>clarity</b> of video <u>script</u> writing procedures | 2/3     |

|                            |                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                   |     |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Video Development          | Appropriately considered details for the video are <b>well</b> corresponded to the 2-minutes script and illustrates a well-coordinated teamwork                                                                                                                                                     | Considered details for the video are <b>mostly</b> corresponded to the 2-minutes script and illustrates a coordinated teamwork                                                                                                                                                                       | <b>Some details</b> considered for the video are <b>partially</b> corresponded to the 2-minutes script and illustrates a less coordinated teamwork                                                                                                                                                | 1/3 |
| Video Clip Content         | • The short video clip <b>fully</b> embraces the core ideas of school rules, motto, and mission and vision statements.                                                                                                                                                                              | • The short video clip <b>mostly</b> embraces the core ideas of school rules, motto, and mission and vision statements.                                                                                                                                                                              | • The short video clip <b>somewhat</b> embraces the core ideas of school rules, motto, and mission and vision statements.                                                                                                                                                                         | 3/3 |
| Video Presentation         | • The video clip <b>fully</b> captures essence of vital messages of the new and competent management with <b>necessary</b> potentials to positively change the image of the school and <b>really</b> captivating and <b>totally</b> convincing to attract students to want to enroll at the school. | • The video clip <b>mostly</b> captures the essence of vital messages of the new and competent management with <b>most</b> potentials to positively change the image of the school and <b>mostly</b> captivating and <b>partially</b> convincing to attract students to want to enrol at the school. | • The video clip <b>somewhat</b> captures the essence of vital messages of the new and competent management with <b>some</b> potentials to positively change the image of the school and <b>almost</b> captivating and <b>less</b> convincing to attract students to want to enrol at the school. | 3/3 |
| Video Clip Submission Time | • Video clip submitted <b>well before</b> the assessment deadline for presentations                                                                                                                                                                                                                 | • Video clip submitted <b>just before</b> the assessment deadline for presentations                                                                                                                                                                                                                  | • Video clip submitted <b>within</b> the assessment time for presentations                                                                                                                                                                                                                        | 2/3 |
| 11/15                      |                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                   |     |

## How to Grade using the rubric

### Grading Rubrics:

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

## How to Report using the rubric

## 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<br>A                                                                                                                                                                                                                                                                                                                                      | Progressing<br>B                                                                                                                                                                                                                                                                                                                                      | Novice<br>C                                                                                                                                                                                                                                                                                                                                       |
| Video Script Write up      | Innovative and well organised paper with <b>clarity</b> of video <u>script</u> writing procedures                                                                                                                                                                                                                                                  | <b>Well</b> organised paper with <b>clarity</b> of video <u>script</u> writing procedures                                                                                                                                                                                                                                                             | Organised paper with some <b>clarity</b> of video <u>script</u> writing procedures                                                                                                                                                                                                                                                                |
| Video Development          | <b>Appropriately considered details</b> for the video are <b>well</b> corresponded to the 2-minutes script and illustrates a well-coordinated teamwork                                                                                                                                                                                             | <b>Considered details</b> for the video are <b>mostly</b> corresponded to the 2-minutes script and illustrates a coordinated teamwork                                                                                                                                                                                                                 | <b>Some details</b> considered for the video are <b>partial-ly</b> corresponded to the 2-minutes script and illustrates a less coordinated teamwork                                                                                                                                                                                               |
| Video Clip Content         | <ul style="list-style-type: none"> <li>The short video clip <b>fully</b> embraces the core ideas of school rules, motto, and mission and vision statements.</li> </ul>                                                                                                                                                                             | <ul style="list-style-type: none"> <li>The short video clip <b>mostly</b> embraces the core ideas of school rules, motto, and mission and vision statements.</li> </ul>                                                                                                                                                                               | <ul style="list-style-type: none"> <li>The short video clip <b>somewhat</b> embraces the core ideas of school rules, motto, and mission and vision statements.</li> </ul>                                                                                                                                                                         |
| Video Presentation         | <ul style="list-style-type: none"> <li>The video clip <b>fully</b> captures essence of vital messages of the new and competent management with <b>necessary</b> potentials to positively change the image of the school and <b>really</b> captivating and <b>totally</b> convincing to attract students to want to enrol at the school.</li> </ul> | <ul style="list-style-type: none"> <li>The video clip <b>mostly</b> captures the essence of vital messages of the new and competent management with <b>most</b> potentials to positively change the image of the school and <b>mostly</b> captivating and <b>partial-ly</b> convincing to attract students to want to enrol at the school.</li> </ul> | <ul style="list-style-type: none"> <li>The video clip <b>somewhat</b> captures the essence of vital messages of the new and competent management with <b>some</b> potentials to positively change the image of the school and <b>almost</b> captivating and <b>less</b> convincing to attract students to want to enrol at the school.</li> </ul> |
| Video Clip Submission Time | <ul style="list-style-type: none"> <li>Video clip submitted <b>well before</b> the assessment deadline for presentations</li> </ul>                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>Video clip submitted <b>just before</b> the assessment deadline for presentations</li> </ul>                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>Video clip submitted <b>within</b> the assessment time for presentations</li> </ul>                                                                                                                                                                                                                        |

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                   |
|----------------------------------------|---------------------------------------------|
| Arts (Theatre Arts)                    | 9.2.2.2                                     |
| Christian Civic Value Education (CCVE) | 9.3.1.3                                     |
| Character Social Development (CSD)     | 9.1.5.1, 9.1.5.2, 9.1.5.3, 9.1.5.4, 9.1.5.5 |
| English                                | 9.2.2.1                                     |
| Social Science (History)               | 9.2.2.3, 9.2.2.4                            |
| Social Science (Political Science)     | 9.3.3.1, 9.3.3.2                            |

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

## Appendices #: Sampled Assessment

### SUBJECT: COMPUTER TECHNOLOGY:

#### Appendices #: Steps in Developing a Rubric

- List the Main parts of the Unit Of Work for the Rubric
- Derive the purpose of Assessing the TASK in the Topic (Benchmark)
- List the Lesson Title and Objective of the assessment task
- Organise how the Assessment Task would be done: Individually or in Groups
- Derive the Performance Standard from the Benchmark
- Describe the Minor Tasks under the Main Task Description
- Rephrase the Minor Tasks to create the Categories
- List Task Descriptions and Categorise them
- Unpack the Essential KSAV to be assessed from Task Descriptions
- Design the Rubric type and decide the point-scale rubric for the assessment task
- Re-word the Task Descriptions including KSAVs and create the Descriptors
- Use Appropriate Qualifiers for Descriptors for each Achievement Level

## Unit: COMPUTER ARCHITECTURE

**Topic:** Simulation Models

**Content Standard:** 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.

**Benchmark 12.5.1.1:** Identify different types of models used for simulations

**Learning Objective:** By the end of the topic, students will be able to identify different types of simulation models

**Purpose of Assessment:** To assess whether the students can use their programming skills to simulate real world.

**Assessment Strategy:** Two to three students sharing one device and swapping ideas and the device back and forth.

**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 recognise that a model is made up of multiple variables that work together.

**Performance Tasks:** Students will;

- Do a write up on Simulation models
- Do a model of a real world

**Performance Assessment Criteria:**

- Do a write up on Simulation models
- Do a model of a real world

**Assessment Scoring:** 45 marks

**Scoring Tool:**

| Criteria                                       | Excellent                                                                                    | Proficient                                                                     | Adequate                                                                                | Score |
|------------------------------------------------|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------|
| Write Up                                       | <b>Innovative and well</b> organised paper with <b>clarity on the usefulness of models</b>   | <b>Well</b> organised paper with <b>clarity on the usefulness of models</b>    | Organised paper with some <b>clarity on the usefulness of models</b>                    | /15   |
| Model a real world<br>(STEAM Project Criteria) | <b>Appropriately considered details</b> on the illustration of the model based on real world | <b>Considered details</b> on the illustration of the model based on real world | <b>Some details</b> considered for on the illustration of the model based on real world | / 30  |
| Total Score                                    |                                                                                              |                                                                                |                                                                                         | /45   |

## Appendices #: Scoring Rubrics

### Write Up:

| Criteria | Excellent | Proficient | Adequate | Score |
|----------|-----------|------------|----------|-------|
|----------|-----------|------------|----------|-------|

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                    |                                                                                      |    |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----|
| Brainstorming examples of Models                                                                    | <b>Significant evidence</b> of relevant ideas presented to show examples of models                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Relevant</b> ideas presented to show usefulness of models                                       | <b>Vague</b> ideas presented to show usefulness of models                            | /3 |
| Justify the usefulness of models                                                                    | <b>Comprehensive</b> ideas presented to show usefulness of models                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Sufficient</b> ideas presented to show usefulness of models                                     | <b>Incomplete</b> ideas presented to show usefulness of models                       | /3 |
| State the difference about a model and the world and state reason why models can be valuable tools. | <b>Innovative</b> and <b>well</b> organised paper with clear difference about a model and the world and <b>well stated</b> reason on why models can be valuable tools.<br><br><b>Effective</b> organised paper with clear difference about a model and the world and <b>appropriate</b> reason on why models can be valuable tools.<br><br><b>Workable</b> organised paper with clear difference about a model and the world <b>with no</b> reason on why models can be valuable tools. |                                                                                                    |                                                                                      | /3 |
| Teamwork                                                                                            | Completed required individual tasks that contributed to the success of the team.                                                                                                                                                                                                                                                                                                                                                                                                        | Contributed to the success of the team, but could have been more engaged to complete tasks sooner. | or did the project alone without relying on others to do their share of the project. | /3 |
| Submit on Time                                                                                      | Submitted well before deadline                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Submitted on time                                                                                  | Submitted late                                                                       | /3 |

## STEAM Project Assessment

### Rubric on Model a Real World:

| Category                    | innovative                                                                                                                                                                      | effective                                                                                                                                                                                       | workable                                                                                                                          |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
|                             | 3                                                                                                                                                                               | 2                                                                                                                                                                                               | 1                                                                                                                                 |
| <b>Quality/ Workmanship</b> | 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. |

|                                  |                                                                                                                                                                                                      |                                                                                                                                                                                                                |                                                                                                                                                                                   |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Creativity/<br/>Design</b>    | <p>Project reflects many fundamental elements of design and creativity.</p> <p>Project demonstrates an advanced understanding of creative thinking and attention to aesthetics and presentation.</p> | <p>Project reflects some of the elements of design and creativity, but lacks attention to aesthetics and presentation.</p>                                                                                     | <p>Project was completed, but does not reflect the acceptable levels of design and creativity.</p> <p>Effort was minimal and project is mediocre at best.</p>                     |
| <b>Functionality</b>             | <p>Project meets or exceeds the design requirements of purpose and functionality.</p> <p>All elements of the design have been met and the project does what it was designed to do.</p>               | <p>Project meets some of the design requirements of purpose and functionality.</p> <p>Not all elements of the design have been met, but the project does what it was designed to do.</p>                       | <p>Project is somewhat functional, but reflects minimal effort. It is intermittent and doesn't always do what it was designed to do.</p>                                          |
| <b>Design Process</b>            | <p>Project reflects a clear understanding and application of design process including evidence of research, brainstorming, design and problem solving, prototyping and testing.</p>                  | <p>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.</p> | <p>Project reflects minimal understanding and application of design process.</p>                                                                                                  |
| <b>Criteria/<br/>Constraints</b> | <p>Project was completed with all constraints and criteria met or exceeded.</p> <p>Reflects attention to detail and quality.</p>                                                                     | <p>Project was completed with some of the constraints and criteria met.</p> <p>Reflects some attention to detail, but quality is minimal.</p>                                                                  | <p>Project was completed with a few of the constraints and criteria met.</p> <p>Reflects minimal effort and lacks detail or quality.</p>                                          |
| <b>Time Management</b>           | <p>Project completed and turned in on time.</p> <p>Student worked diligently when project time was available.</p> <p>Student was on task most of the time.</p>                                       | <p>Project was completed, but had notable errors.</p> <p>Student utilised project time somewhat efficiently, but spent time socializing.</p> <p>Student was on task 70% - 80% of the time.</p>                 | <p>Project was not turned in on time and/or complete.</p> <p>The student was on task less than 60% of the time.</p>                                                               |
| <b>Resource Management</b>       | <p>Always takes responsibility for use and care of all building components and resources.</p> <p>Always returns building components and materials to proper storage compartments.</p>                | <p>Consistently takes responsibility for use and care of building components and resources.</p> <p>Somewhat consistent in returning building components to proper storage compartments.</p>                    | <p>Sometimes takes responsibility for use and care of building components and resources.</p> <p>Inconsistent in returning building components to proper storage compartments.</p> |
| <b>Teamwork</b>                  | <p>Notable teamwork shown with a determination to participate/contribute to team success. Completed required individual tasks that contributed to the success of the team.</p>                       | <p>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.</p>                      | <p>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.</p>                     |

|                                |                                                                                                                                                                                                |                                                                                                                                                                      |                                                                                                                                                                                  |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Writing/<br/>Reflection</b> | <p>Writing/reflection is very well organised and explained. Student includes all details in design process.</p> <p>Document has almost no grammatical errors.</p>                              | <p>Writing/reflection is somewhat organised and explained. Student includes most details in design process.</p> <p>Document has very few grammatical errors.</p>     | <p>Writing/reflection is not organised and explained. Student includes only a few details in design process.</p> <p>Document has many grammatical errors.</p>                    |
| <b>Presentation</b>            | <p>Presentation was well organised and presented in a logical sequence.</p> <p>Presentation reflects a full knowledge of the topic with clear answers and explanations to questions asked.</p> | <p>Presentation was fairly organised and most information presented in a logical sequence.</p> <p>Answers to questions were vague or lacked clarity or accuracy.</p> | <p>Presentation was unorganised and lacked a logical sequence.</p> <p>Presentation reflected little attention to detail. Answers to questions were inaccurate and confusing.</p> |

# GLOSSARY

| Term                 | Definition                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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<br><br>(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).<br><br>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 ‘refresh’ 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.<br><br>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 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 off.                                                                                                                                                         |
| Search engine | A search engine enables a computer user to search information on the internet. It is a type of software 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   | <p>Wired equivalent privacy (WEP) is a security protocol used in wi-fi networks. It is designed to provide a wireless local area network (LAN)</p> <p>with a level of security similar to that of a regular wired LAN. WEP- secured networks are usually protected by passwords.</p> |
| Wi-Fi | <p>Wi-Fi is a technology that allows computers and other devices to communicate via a wireless signal. Essentially it means one can browse</p> <p>the internet without tripping over phone cords.</p>                                                                                |
| WPA   | <p>Wi-Fi protected access(WPA) is a security protocol used in wi-fi networks.</p> <p>It is an improvement on WEP because it offers greater protection through more sophisticated data encryption.</p>                                                                                |
| Zip   | <p>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.</p>                                                                                              |

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- ict for gcse Tim Roderick and Geoff Rush book, Oxford

# APPENDICES

## (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.

### 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.

### 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.

### 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.

### 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 1: BLOOM'S TAXONOMY

| LEVEL OF UNDERSTANDING                                                 | KEY VERBS                                                                                                                                                          |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CREATING<br><br>Can the student create a new product or point of view? | Construct, design, and develop, generate, hypothesise, invent, plan, produce, compose, create, make, perform, plan, produce, assemble, formulate,                  |
| EVALUATING<br><br>Can the student justify a stand or decision?         | Appraise, argue, assess, choose, conclude, critique, decide, defend, evaluate, judge, justify, predict, prioritise, provoke, rank, rate, select, support, monitor, |

|                                                                                  |                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ANALYSING</b><br><br>Can the student distinguish between the different parts? | Analysing, characterise, classify, compare, contrast, debate, criticise, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organise, outline, relate, research, separate, experiment, question, test, |
| <b>APPLYING</b><br><br>Can the student use the information in a new way          | Apply, change, choose, compute, dramatise, implement, interview, prepare, produce, role play, select, show, transfer, use, demonstrate, illustrate, interpret, operate, sketch, solve, write,                               |
| <b>UNDERSTANDING</b><br><br>Can the student comprehend ideas or concepts?        | Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report, translate, describe, classify,                                                         |
| <b>REMEMBERING</b><br><br>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

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>WAYS OF THINKING</b> | Creativity and innovation <ul style="list-style-type: none"> <li>• Think creatively</li> <li>• Work creatively with others</li> <li>• Implement innovations</li> <li>• Critical thinking, problem solving and decision making</li> <li>• Reason effectively and evaluate evidence</li> <li>• Solve problems</li> <li>• Articulate findings</li> <li>• Learning to learn and meta-cognition</li> <li>• Self-motivation</li> <li>• Positive appreciation of learning</li> <li>• Adaptability and flexibility</li> </ul> |
| <b>WAYS OF WORKING</b>  | Communication <ul style="list-style-type: none"> <li>• Competency in written and oral language</li> <li>• Open minded and preparedness to listen</li> <li>• Sensitivity to cultural differences</li> </ul> Collaboration and teamwork <ul style="list-style-type: none"> <li>• Interact effectively with others</li> <li>• Work effectively in diverse teams</li> <li>• Prioritise, plan and manage projects</li> </ul>                                                                                               |

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TOOLS FOR WORKING</b>   | <p>Information literacy</p> <ul style="list-style-type: none"> <li>• Access and evaluate information</li> <li>• Use and manage information</li> <li>• Apply technology effectively</li> </ul> <p>ICT literacy</p> <ul style="list-style-type: none"> <li>• Open to new ideas, information, tools and ways of thinking</li> <li>• Use ICT accurately, creatively, ethically and legally</li> <li>• Be aware of cultural and social differences</li> <li>• Apply technology appropriately and effectively</li> </ul>                                                                                                                                                                                                            |
| <b>LIVING IN THE WORLD</b> | <p>Citizenship – global and local</p> <ul style="list-style-type: none"> <li>• Awareness and understanding of rights and responsibilities as a global citizen</li> <li>• Preparedness to participate in community activities</li> <li>• Respect the values and privacy of others</li> </ul> <p>Personal and social responsibility</p> <ul style="list-style-type: none"> <li>• Communicate constructively in different social situations</li> <li>• Understand different viewpoints and perspectives</li> </ul> <p>Life and career</p> <ul style="list-style-type: none"> <li>• Adapt to change</li> <li>• Manage goals and time</li> <li>• Be a self-directed learner</li> <li>• Interact effectively with others</li> </ul> |

### APPENDIX 3: TEACHING AND LEARNING STRATEGIES

| STRATEGY                                                                                                | TEACHER                                                                                                                                                                                                                              | STUDENTS                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>CASE STUDY</b></p> <p>Used to extend students' understanding of real life issues</p>              | <p>Provide students with case studies related to the topic of the lesson and allow them to analyse and evaluate.</p>                                                                                                                 | <p>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.</p>                                      |
| <p><b>DEBATE</b></p> <p>A method used to increase students' interest, involvement and participation</p> | <p>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.</p> | <p>Conduct researches to gather supporting evidence about the selected topic and summarising the points.</p> <p>They are engaged in collaborative learning by delegating and sharing tasks to group members.</p> <p>When debating, they improve their communication skills.</p> |

|                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>DISCUSSION</b></p> <p>The purpose of discussion is to educate students about the process of group thinking and collective decision.</p>                                                                                                                                                                                                    | <p>The teacher opens a discussion on certain topic by asking essential questions.</p> <p>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.</p> <p>Use how and why follow-up questions to guide the discussion toward the objective of helping students understand the subject and summarise main ideas.</p> | <p>Students ponder over the question and answer by providing ideas, experiences and examples.</p> <p>Students participate in the discussion by exchanging ideas with others.</p>                                                                                                                                                                                                                                                                                                                              |
| <p><b>GAMES AND SIMULATIONS</b></p> <p>Encourages motivation and creates a spirit of competition and challenge to enhance learning</p>                                                                                                                                                                                                           | <p>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 prizes.</p>                                                                                                                                                                                                                                                 | <p>Go into groups and organize.</p> <p>Follow the instructions and play to win</p>                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <p><b>OBSERVATION</b></p> <p>Method used to allow students to work independently to discover why and how things happen as the way they are. It builds curiosity.</p>                                                                                                                                                                             | <p>Give instructions and monitor every activity students do</p>                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>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. Students</p> <ul style="list-style-type: none"> <li>• Observe and ask essential questions</li> <li>• Record</li> <li>• Interpret</li> </ul> |
| <p><b>PEER TEACHING &amp; LEARNING</b></p> <p><i>(power point presentations, pair learning)</i></p> <p>Students teach 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.</p> | <p>Distribute topics to groups to research and teach others in the classroom.</p> <p>Go through the basics of how to present their peer teaching.</p>                                                                                                                                                                                                                                                                                                                                    | <p>Go into their established working groups.</p> <p>Develop a plan for the topic.</p> <p>Each group member is allocated a task to work on.</p> <p>Research and collect information about the topic allocated to the group. Outline the important points from the research and present their findings in class.</p>                                                                                                                                                                                            |
| <p><b>PERFORMANCE-RELATED TASKS</b></p> <p><i>(dramatization, song/lyrics, wall magazines)</i></p> <p>Encourages creativity and take on the overarching ideas of the topic and are able to recall them at a later date</p>                                                                                                                       | <p>Students are given the opportunity to perform the using the main ideas of a topic.</p> <p>Provide the guidelines, expectations and the set criteria</p>                                                                                                                                                                                                                                                                                                                               | <p>Go into their established working groups.</p> <p>Being creative and create dramas, songs/lyrics or wall magazines in line with the topic.</p>                                                                                                                                                                                                                                                                                                                                                              |

|                                                                                                     |                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROJECT<br>(individual/group)<br><br>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 <u>depending on the age of the students</u> | Show a full movie, an animated one, a few episodes form documentaries, you tube movies and others depending on the lesson.<br><br>Provide questions for students to answer before viewing | Viewing can provoke questions, debates, critical thinking, emotion and reaction.<br><br>After viewing, students engage in critical thinking and debate                                                                                                                                     |

## APPENDIX 4: 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; |
| <ul style="list-style-type: none"> <li>.....</li> <li>.....</li> </ul>    |
| Essential Questions;                                                      |
| <ul style="list-style-type: none"> <li>.....</li> <li>.....</li> </ul>    |
| Knowledge;                                                                |
| <ul style="list-style-type: none"> <li>.....</li> <li>.....</li> </ul>    |
| Skills;                                                                   |
| <ul style="list-style-type: none"> <li>.....</li> <li>.....</li> </ul>    |
| Values;                                                                   |
| <ul style="list-style-type: none"> <li>.....</li> <li>.....</li> </ul>    |
| Attitudes;                                                                |
| <ul style="list-style-type: none"> <li>.....</li> <li>.....</li> </ul>    |

| Teacher will .....                    | Student will .... |
|---------------------------------------|-------------------|
| <b>Introduction (time in minutes)</b> |                   |
|                                       |                   |
| <b>Body (time in minutes)</b>         |                   |
| <b>Modelling</b>                      |                   |

|                                     |  |
|-------------------------------------|--|
| -                                   |  |
| -                                   |  |
| <b>Guided Practice</b>              |  |
|                                     |  |
| <b>Independent Practice</b>         |  |
|                                     |  |
| <b>Conclusion (time in minutes)</b> |  |
|                                     |  |
| <b>Assessment</b>                   |  |
|                                     |  |

## APPENDIX 5: ASSESSMENT STRATEGIES

| STRATEGY                       | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ANALOGIES</b>               | 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.                                                                                                                                                                    |
| <b>CLASSROOM PRESENTATIONS</b> | A classroom presentation is an assessment strategy that requires students to verbalise their knowledge, select and present samples of finished work, and organise 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.                                                 |
| <b>CONFERENCES</b>             | 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 |
| <b>DISCUSSIONS</b>             | 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.                                                                                                             |

|                                     |                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ESSAYS</b>                       | 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.                                                                                                       |
| <b>EXHIBITIONS/DEMONSTRATIONS</b>   | 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.                                                                                                                                                                  |
| <b>INTERVIEWS</b>                   | 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. |
| <b>LEARNING LOGS</b>                | 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.                                                                                                                                                           |
| <b>OBSERVATION</b>                  | 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.                                                             |
| <b>PEER ASSESSMENT</b>              | 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.                                                                                                                                                                                                                    |
| <b>PERFORMANCE TASKS</b>            | 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.                                                                                                                                             |
| <b>PORTFOLIOS</b>                   | 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.                                                                                              |
| <b>QUESTIONS AND ANSWERS (ORAL)</b> | 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.                                                                  |
| <b>QUIZZES, TESTS, EXAMINATIONS</b> | 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.                                      |
| <b>QUESTIONNAIRES</b>               | 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.                                                                                                                                                                                |
| <b>RESPONSE JOURNALS</b>            | 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.                                                                                                                                              |
| <b>SELECTED RESPONSES</b>           | 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.             |
| <b>STUDENT SELF-ASSESSMENTS</b>     | 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 6: TIME ALLOCATION FOR JUNIOR AND SENIOR HIGH

| Grade 9 & 10 |            | Gr 11 & 12      |           | Gr 11 & 12  |          |
|--------------|------------|-----------------|-----------|-------------|----------|
| Lessons/wk   | Min/ week  | Lessons/ wk     | Min/ week | Lessons/ wk | Min/week |
| English      |            | Applied English |           | HPE         |          |
| 6            | 6 x 40=240 | 6               | 6x40=240  | 6           | 6x40=240 |

|                     |              |                 |              |                  |           |
|---------------------|--------------|-----------------|--------------|------------------|-----------|
| Math                |              | L &L            |              | PE               |           |
| 5                   | 8 x 40 = 320 | 6               | 6x40=240     | 6                | 6x40=240  |
| Science             |              | Advance Math    |              | RE               |           |
| 5                   | 5 x 40 =200  | 8               | 8 x 40 = 320 | 1                | 1 x 60=60 |
| Social Science      |              | Gen Math        |              | Business Studies |           |
| 5                   | 5 x 40 =200  | 6               | 6x40=240     | 6                | 6x40=240  |
| PD                  |              | Physics         |              | Accounting       |           |
| 5                   | 5 x 40 =200  | 6               | 6x40=240     | 6                | 6x40=240  |
| Business Studies    |              | Biology         |              | Economics        |           |
| 5                   | 5 x 40 =200  | 6               | 6x40=240     | 6                | 6x40=240  |
| Design & Technology |              | Chemistry       |              | Design & Tech    |           |
| 5                   | 5 x 40 =200  | 6               | 6x40=240     | 6                | 6x40=240  |
| Arts                |              | Applied Science |              | Computer Studies |           |
| 5                   | 5 x 40 =200  | 6               | 6x40=240     | 6                | 6x40=240  |
| CCVE                |              | Geology         |              | ICT              |           |
| 3                   | 3 x 40=120   | 6               | 6x40=240     | 6                | 6x40=240  |
| RI                  |              | Geography       |              | CCVE             |           |
| 1                   | 1x60=60      | 6               | 6x40=240     | 2                | 3x40=120  |
| Agriculture         |              | History         |              | ANRM             |           |
| 5                   | 5 x 40=200   | 6               | 6x40=240     | 6                | 6x40=240  |
|                     |              | Legal Studies   |              |                  |           |
|                     |              | 6               | 6x40=240     |                  |           |
|                     |              |                 |              |                  |           |
|                     |              |                 |              |                  |           |
| Totals:             |              | Total:          |              | Total:           |           |

## Topic 1: Simulation Models

**Content Standard:** 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.

**Benchmark 12.5.1.1:** Identify different types of models used for simulations

**Learning Objective:** By the end of the topic, students will be able to identify different types of simulation models

### Essential questions:

1. What are simulation models?
2. Explain the purpose of simulation models
3. What are the different types of simulation models?

### Skills, Knowledge, Attitudes and Values:

#### Key Concepts(SKAV)

|                  |                                                                |
|------------------|----------------------------------------------------------------|
| <b>Skills</b>    | Identify different types of simulation models                  |
| <b>Knowledge</b> | Simulation Models                                              |
| <b>Attitudes</b> | Creativity in designing different types of simulation modeling |
| <b>Values</b>    | Rationality                                                    |

## Lesson 1: Simulation Modeling

**Lesson Objective:** By the end of the lesson the student will recognise that a model is made up of multiple variables that work together.

### Lesson Procedure:

| Teacher will .....                                                                                                                                                                                                                                        | Student will ....                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Introduction (time in minutes)</b>                                                                                                                                                                                                                     |                                                                                                                                                                                          |
| <p>Ask students to brainstorm what they think a “model” is in science and examples of models they know of.</p> <p>Explain that a model is a representation of something in the real world that can't be experienced directly, such as climate change.</p> | <ul style="list-style-type: none"> <li>Note their ideas in their exercise books.</li> <li>Recognise that the models can represent an idea, an object, a process, or a system.</li> </ul> |
| <b>Body (time in minutes)</b>                                                                                                                                                                                                                             |                                                                                                                                                                                          |
| <b>Modelling</b>                                                                                                                                                                                                                                          |                                                                                                                                                                                          |
| <p>Give examples of Simulation models</p> <ul style="list-style-type: none"> <li>Computer Model</li> <li>Play Grow a Tree</li> <li>Illustrate how the gravitational force controls the motion of the planets</li> </ul>                                   | Discuss their ideas on different simulation models using the examples given.                                                                                                             |
| <b>Guided Practice</b>                                                                                                                                                                                                                                    |                                                                                                                                                                                          |
| Guide students to Illustrate how the gravitational force controls the motion of the planets.                                                                                                                                                              | Using the program, they are familiar with, they draw, code and simulate the gravitational force that controls the motion of the planets.                                                 |
| <b>Independent Practice</b>                                                                                                                                                                                                                               |                                                                                                                                                                                          |
| Allow students to explore the different motions that a group of planetary bodies can have.                                                                                                                                                                | Using the online program explore the different motions that a group of planetary bodies can have.                                                                                        |
| <b>Conclusion (time in minutes)</b>                                                                                                                                                                                                                       |                                                                                                                                                                                          |
| What are computer models good for?                                                                                                                                                                                                                        | To computer models are good for illustrating ideas, process or system that represent real world.                                                                                         |
| <b>Assessment</b>                                                                                                                                                                                                                                         |                                                                                                                                                                                          |

Confirm students understanding on models with the following;

- Why are models useful?
- How can computer models be used to learn about the real world?
- What can be different about a model vs. the world?

Affirm understanding on models by;

4. Justify the usefulness of models
5. Model a real world
6. State the difference about a model and the world.

## Appendices 9: Sampled Assessment

### SUBJECT: COMPUTER TECHNOLOGY

| Appendices #: Steps in Developing a Rubric                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• List the Main parts of the Unit Of Work for the Rubric</li> <li>• Derive the purpose of Assessing the TASK in the Topic (Benchmark)</li> <li>• List the Lesson Title and Objective of the assessment task</li> <li>• Organise how the Assessment Task would be done: Individually or in Groups</li> <li>• Derive the Performance Standard from the Benchmark</li> <li>• Describe the Minor Tasks under the Main Task Description</li> <li>• Unpack the Essential KSAV to be assessed from Task Descriptions</li> </ul> |
| <ul style="list-style-type: none"> <li>• Design the Rubric type and decide the point-scale rubric for the assessment task</li> <li>• Re-word the Task Descriptions including KSAVs and create the Descriptors</li> <li>• Use Appropriate Qualifiers for Descriptors for each Achievement Level</li> </ul>                                                                                                                                                                                                                                                       |

## Unit 1: Computer Architecture

### Topic: Simulation Models

**Content Standard:** 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.

**Benchmark 12.5.1.1:** Identify different types of models used for simulations

**Learning Objective:** By the end of the topic, students will be able to identify different types of simulation models

**Purpose of Assessment:** To assess whether the students can use their programming skills to simulate real world.

**Assessment Strategy:** Two to three students sharing one device and swapping ideas

and the device back and forth.

**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 recognise that a model is made up of multiple variables that work together.

**Performance Tasks:** Students will

- Do a write up on Simulation models
- Do a model of a real world

**Performance Assessment Criteria:**

- Do a write up on Simulation models
- Do a model of a real world

**Assessment Scoring:** 45 marks

**Scoring Tool:**

| Criteria                                               | Excellent                                                                             | Proficient                                                              | Adequate                                                                         | Score |
|--------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------|
| <b>Write Up</b>                                        | Innovative and well organised paper with clarity on the usefulness of models          | Well organised paper with clarity on the usefulness of models           | Organised paper with some clarity on the usefulness of models                    | /15   |
| <b>Model a real world<br/>(STEAM Project Criteria)</b> | Appropriately considered details on the illustration of the model based on real world | Considered details on the illustration of the model based on real world | Some details considered for on the illustration of the model based on real world | / 30  |
| <b>Total Score</b>                                     |                                                                                       |                                                                         |                                                                                  | / 45  |

Appendices 10: Scoring Rubrics

Write Up

| Criteria | Excellent | Proficient | Adequate | Score |
|----------|-----------|------------|----------|-------|
|----------|-----------|------------|----------|-------|

|                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                    |                                                                                      |    |
|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----|
| 4. Brainstorming examples of Models                                                                    | Significant evidence of relevant ideas presented to show examples of models                                                                                                                                                                                                                                                                                                                                                                                                                        | Relevant ideas presented to show usefulness of models                                              | Vague ideas presented to show usefulness of models                                   | /3 |
| 5. Justify the usefulness of models                                                                    | Comprehensive ideas presented to show usefulness of models                                                                                                                                                                                                                                                                                                                                                                                                                                         | Sufficient ideas presented to show usefulness of models                                            | Incomplete ideas presented to show usefulness of models                              | /3 |
| 6. State the difference about a model and the world and state reason why models can be valuable tools. | <ul style="list-style-type: none"> <li>• Innovative and well organised paper with clear difference about a model and the world and well stated reason on why models can be valuable tools.</li> <li>• Effective organised paper with clear difference about a model and the world and appropriate reason on why models can be valuable tools.</li> <li>• Workable organised paper with clear difference about a model and the world with no reason on why models can be valuable tools.</li> </ul> |                                                                                                    |                                                                                      | /3 |
| 7. Teamwork                                                                                            | Completed required individual tasks that contributed to the success of the team.                                                                                                                                                                                                                                                                                                                                                                                                                   | Contributed to the success of the team, but could have been more engaged to complete tasks sooner. | or did the project alone without relying on others to do their share of the project. | /3 |
| 8. Submit on Time                                                                                      | Submitted well before deadline                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Submitted on time                                                                                  | Submitted late                                                                       | /3 |

## STEAM Project Assessment

### Rubric on Model a Real World:

| Category                    | innovative                                                                                                                                                                                                                                            | effective                                                                                                                                                                                       | workable                                                                                                                                                                                                       |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             | 3                                                                                                                                                                                                                                                     | 2                                                                                                                                                                                               | 1                                                                                                                                                                                                              |
| <b>Quality/ Workmanship</b> | 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.                                                                              |
| <b>Creativity/ Design</b>   | <ul style="list-style-type: none"> <li>• Project reflects many fundamental elements of design and creativity.</li> <li>• Project demonstrates an advanced understanding of creative thinking and attention to aesthetics and presentation.</li> </ul> | Project reflects some of the elements of design and creativity, but lacks attention to aesthetics and presentation.                                                                             | <ul style="list-style-type: none"> <li>• Project was completed, but does not reflect the acceptable levels of design and creativity.</li> <li>• Effort was minimal and project is mediocre at best.</li> </ul> |

|                             |                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                               |                                                                                                                                                                                       |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Functionality</b>        | <ul style="list-style-type: none"> <li>Project meets or exceeds the design requirements of purpose and functionality.</li> <li>All elements of the design have been met and the project does what it was designed to do.</li> </ul> | <ul style="list-style-type: none"> <li>Project meets some of the design requirements of purpose and functionality.</li> <li>Not all elements of the design have been met, but the project does what it was designed to do.</li> </ul>         | Project is somewhat functional, but reflects minimal effort. It is intermittent and doesn't always do what it was designed to do.                                                     |
| <b>Design Process</b>       | 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.                                                                                                             |
| <b>Criteria/Constraints</b> | <ul style="list-style-type: none"> <li>Project was completed with all constraints and criteria met or exceeded.</li> <li>Reflects attention to detail and quality.</li> </ul>                                                       | <ul style="list-style-type: none"> <li>Project was completed with some of the constraints and criteria met.</li> <li>Reflects some attention to detail, but quality is minimal.</li> </ul>                                                    | <ul style="list-style-type: none"> <li>Project was completed with a few of the constraints and criteria met.</li> <li>Reflects minimal effort and lacks detail or quality.</li> </ul> |
| <b>Time Management</b>      | <ul style="list-style-type: none"> <li>Project completed and turned in on time.</li> <li>Student worked diligently when project time was available.</li> <li>Student was on task most of the time.</li> </ul>                       | <ul style="list-style-type: none"> <li>Project was completed, but had notable errors.</li> <li>Student utilised project time somewhat efficiently, but spent time socialising.</li> <li>Student was on task 70% - 80% of the time.</li> </ul> | <ul style="list-style-type: none"> <li>Project was not turned in on time and/or complete.</li> <li>The student was on task less than 60% of the time.</li> </ul>                      |
| <b>Resource Management</b>  | <p>Always takes responsibility for use and care of all building components and resources.</p> <p>Always returns building components and materials to proper storage compartments.</p>                                               | <p>Consistently takes responsibility for use and care of building components and resources.</p> <p>Somewhat consistent in returning building components to proper storage compartments.</p>                                                   | <p>Sometimes takes responsibility for use and care of building components and resources.</p> <p>Inconsistent in returning building components to proper storage compartments.</p>     |
| <b>Teamwork</b>             | 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.                                |
| <b>Writing/Reflection</b>   | <p>Writing/reflection is very well organised and explained. Student includes all details in design process.</p> <p>Document has almost no grammatical errors.</p>                                                                   | <p>Writing/reflection is somewhat organised and explained. Student includes most details in design process.</p> <p>Document has very few grammatical errors.</p>                                                                              | <p>Writing/reflection is not organised and explained. Student includes only a few details in design process.</p> <p>Document has many grammatical errors.</p>                         |

|                     |                                                                                                                                                                                                |                                                                                                                                                                      |                                                                                                                                                                                  |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Presentation</b> | <p>Presentation was well organised and presented in a logical sequence.</p> <p>Presentation reflects a full knowledge of the topic with clear answers and explanations to questions asked.</p> | <p>Presentation was fairly organised and most information presented in a logical sequence.</p> <p>Answers to questions were vague or lacked clarity or accuracy.</p> | <p>Presentation was unorganised and lacked a logical sequence.</p> <p>Presentation reflected little attention to detail. Answers to questions were inaccurate and confusing.</p> |
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