GHANA EDUCATION SERVICE

(MINISTRY OF EDUCATION)

REPUBLIC OF GHANA

COMPUTING
COMMON CORE PROGRAMME CURRICULUM
(BASIC 7 - 10)

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NATIONAL COUNCIL FOR CURRICULUM & ASSESSMENT OF MINISTRY OF EDUCATION

Computing Curriculum for B7- B10

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Ministry of Education
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INTRODUCTION

In the first four years of high school education, learners are expected to take a Common Core Programme (CCP) that emphasizes a set of high, internationally-benchmarked career and tertiary education ready standards. Learners need to acquire these for post-secondary education, the workplace or both. The standards articulate what learners are expected to know, understand and be able to do by focusing on their social, emotional, cognitive and physical development. The (CCP) runs from Basic 7 through Basic 10.

The common core attributes of the learner, which describe the essential outcomes in the three domains of learning (i.e. cognitive, psychomotor and affective), are at the centre of the CCP (see Figure 1). Inspired by the values which are important to the Ghanaian society, the CCP provides an education of the heart, mind and hands in relation to on the learner's lifetime values, well-being, physical development, metacognition and problem-solving. Ultimately, this will produce character-minded learners who can play active roles in dealing with the increasing challenges facing Ghana and the global society.

The features that shape the common core programme are shown in Figure 1. These are

- learning and teaching approaches – the core competencies, 4Rs and pedagogical approaches
- learning context – engagement service and project
- learning areas – mathematics, science, computing, language and literacy, career technology, social studies, physical and health education, creative arts and design and religious and moral education.

These are elaborated subsequently:

Learning and teaching approaches

- *The core competences:* Describe the relevant *global skills for learning* that the CCP helps learners to develop in addition to the 4Rs. The global skills for learning allow learners to become critical thinkers, problem-solvers, creators, innovators, good communicators, collaborators, digitally literate, culturally and globally sensitive citizens who are life-long learners that have keen interest in their personal development.
- *Pedagogical approaches:* The CCP emphasises creative and inclusive pedagogies that are anchored on authentic and enquiry-based learning, collaborative and cooperative learning, differentiated learning, and holistic learning as well as cross disciplinary learning.
- *The 4Rs across the Curriculum:* The 4Rs refer to Reading, wRiting, aRithmetic and cReativity, which all learners must become fluent in.

Figure 1: Features of the CCP

Learning context

The CCP places emphasis on engagement of learners in the classroom activities, projects (in and outside the classrooms). These projects can involve individual or group tasks which all learners are required to complete by the end of Basic 10. The CCP project provides learners with contexts to demonstrate creativity and inventiveness in various areas of human endeavor. Community service offers opportunity for learners to nurture, love and care for their community and solve problems in the community.

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Learning Areas

The CCP comprises the following subjects:

1. Languages (English, Ghanaian Languages, French, Arabic)
2. Mathematics
3. Science
4. Creative Arts and Design
5. Career Technology
6. Social Studies
7. Computing
8. Religious and Moral Education (RME)
9. Physical and Health Education

This document sets out the standards for learning COMPUTING in the Common Core Programme (CCP). The standards in the document are posited in the expectation that CCP (B7 – B10) will offer quality education for all types of learners. The design of this curriculum is based on the features of the CCP as shown in Figure 1. It emphasizes a set of high internationally-benchmarked career and tertiary education ready standards. Learners need to acquire these competencies in COMPUTING for post-secondary education, the workplace training or both. The curriculum has been designed to be user friendly because it provides a detailed preamble that covers the rationale, philosophy, aims, profile of expected learning behaviours (i.e. knowledge, skills, attitudes and values), pedagogical approaches, core competencies and the 4Rs, assessment practices and instructional expectations.

RATIONALE FOR COMPUTING

To facilitate the implementation of a flexible, coherent and diversified curriculum for Basic Schools, the Ministry of Education is continuing with the implementation of the standard based curriculum for Basic 7 to 10 in the common core.

This Curriculum is designed to provide the rationale, philosophy and aims of the curriculum, followed by core competences, profile of the expected learning behaviours, attitudes, values and process skills.

The Curriculum encourages creative and inclusive pedagogies, extensive assessments, and learner centred experiences to achieve the instructional expectations.

Computing is one of the essential school subjects that permeates and can be applied to all areas of learning. This is because it provides students with access to important computing ideas, knowledge and skills that they can draw on in their personal and work lives, as well as their learning of other school subjects.
Computing learning provides the opportunity for learners to develop essential skills and competencies, and motivates them to become flexible problem solvers and life-long learners. In an increasingly technological age, the possession of problem-solving and decision-making skills is an essential pre-requisite and these are acquired in the learning of computing.

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PHILOSOPHY

TEACHING PHILOSOPHY

The teaching is focused around a supportive and inclusive learning environment by positively engaging teacher-learner relationships. Teachers/facilitators have the responsibility to create a cooperative learning environment where learners feel safe and secure. In addition, appropriate improvisation techniques would be used to represent the actual devices when they are not available.

Relevance, engagement and problem-solving best describe the computing teaching philosophy. In other words, teaching of computing adopts the hands-on approach that is, the tactile/kinesthetic approach. Students learn computing subject best when they are actively involved in the learning process, and that an engaging classroom best facilitates this. Learners should be engaged in computing by using diverse teaching methods, encouraging the use of a variety of their cognitive skills. The more learners process data, the more likely they would be able to apply, analyse, synthesise, and evaluate the information.
Teaching of computing should enable learners know how data can be used to understand themselves, explain situations they find themselves in, describe the why and how some things happened or predict what might happen in the future.

LEARNING PHILOSOPHY

Computing education develops a wide range of skills including problem solving, design construction, communication, critical thinking, analysis, synthesis and evaluation. The skills learnt can then be applied to other fields of endeavour. Learners should have freedom of expression and creativity. Learners should be able to experiment and to realize their strengths and weaknesses in the computing subject. Each learner's learning style should be tied into the learning of computing so as to enable learners grow and learn on their own. Learners should be given the chance to pose their own questions and try to answer them independently. Learners should be encouraged to find information in a variety of ways. Learners should also be encouraged to work on projects in groups to foster collaborative learning.

AIMS

The computing curriculum is designed to help learners to:

1. acquire basic ICT literacy
2. communicate effectively using ICT tools
3. develop interest and acquire skills in the use of the internet
4. develop basic ethics in using ICT tools
5. acquire basic programming and database skills.

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PROFILE OF EXPECTED LEARNING BEHAVIOURS

A central aspect of this curriculum is the concept of three integral learning domains that should be the basis for instruction and assessment. These are:

- Knowledge, Understanding and Application
- Process Skills
- Attitudes and Values

KNOWLEDGE, UNDERSTANDING AND APPLICATION

Under this domain, learners acquire knowledge through some learning experiences. They may also show understanding of concepts by comparing, summarising, re-writing etc. in their own words and constructing meaning from instruction. The learner may also apply the knowledge acquired in some new contexts. At a higher level of learning behaviour, the learner may be required to analyse an issue or a problem. At higher levels, the learner may be required to synthesize knowledge by integrating a number of ideas to formulate a plan, solve a problem, compose a story, or a piece of music. Further, the learners may be required to evaluate, estimate and interpret a concept. At the last level, which is the highest, learners may be required to create, invent, compose, design and construct. These learning behaviours "knowing", "understanding", "applying", "analysing", "synthesising", "evaluating" and "creating" fall under the domain "Knowledge, Understanding and Application".

In this curriculum, learning indicators are stated with action words to show what the learner should know and be able to do. For example, the learner will be able to describe something. Being able to "describe" something after teaching and learning has been completed means that the learner has acquired "knowledge". Being able to explain, summarise, and give examples etc. means that the learner has understood the concept taught.

Similarly, being able to develop, defend, etc. means that the learner can "apply" the knowledge acquired in some new context. You will note that each of the indicators in the curriculum contains an **"action word"** that describes the behaviour the learner will be able to demonstrate after teaching and learning has taken place. "Knowledge, Understanding and Application" is a domain that should be the prime focus of teaching and learning in schools. Teaching in most cases has tended to stress knowledge acquisition to the detriment of other higher level behaviours such as applying knowledge.

Each action word in any indicator outlines the underlying expected outcome. Each indicator must be read carefully to know the learning domain towards which you have to teach. The focus is to move teaching and learning from the didactic acquisition of "knowledge" where there is fact memorisation, heavy reliance on formulae, remembering facts without critiquing them or relating them to real world – ***surface learning*** – to a new position called – ***deep learning***.Learners are expected to deepen their learning by knowledge application to develop critical thinking skills, explain reasoning, and to generate creative ideas to solve real life problems in their school lives and later in their adult lives. This is the position where learning becomes beneficial to the learner.

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The keywords and explanation and the key words involved in the "Knowledge, Understanding and Application" domain are as follows:

Knowing: The ability to remember, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is the ability to remember or recall material already learned and this constitutes the lowest level of learning.

Understanding: The ability to explain, summarise, translate, rewrite, paraphrase, give examples, generalise, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some concepts that may be verbal, pictorial, or symbolic.

Applying: This dimension is also referred to as "Use of Knowledge". Ability to use knowledge or apply knowledge, apply rules, methods, principles, theories, etc. to situations that are new and unfamiliar. It also involves the ability to produce, solve, plan, demonstrate, discover etc.

Analysing: The ability to break down material/information into its component parts; to differentiate, compare, distinguish, outline, separate, identify significant points etc., ability to recognise unstated assumptions and logical fallacies; ability to recognise inferences from facts etc.

Synthesising: The ability to put parts or ideas together to form a new whole. It involves the ability to combine, compile, compose, devise, plan, revise, organise, create, generate new ideas and solutions.

Evaluating: The ability to appraise, compare features of different things and make comments or judgment, criticise, justify, support, discuss, conclude, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some material based on some criteria.

Creating: The ability to use information or materials to plan, compose, produce, manufacture or construct other products.

From the foregoing, creating is the highest form of thinking and learning and is therefore the most important behaviour. This, unfortunately, is the area where most learners perform poorly. In order to get learners to develop critical thinking, it is advised that you do your best to help your learners to develop analytical skills and processes as we have said already.

ATTITUDES, VALUES AND PROCESS SKILLS

To be effective, competent and reflective citizens, who will be willing and capable of solving personal and societal problems, learners should be exposed to situations that challenge them to raise questions and attempt to solve problems. Learners therefore need to acquire positive attitudes, values and psychosocial skills that will enable them participate in debates and take a stand on issues affecting them and others. The computing curriculum thus focuses on the development of attitudes and values.

The computing curriculum aims at helping learners to acquire the following:

1. **Commitment**: determination to contribute to national development.

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2. **Tolerance**: willingness to respect the views of others.
3. **Patriotism**: readiness to defend the nation.
4. **Flexibility** in ideas: willingness to change opinion in the face of more plausible evidence.
5. **Respectforevidence**: willingness to collect and use data on one's investigation, and also have respect for data collected by others.
6. **Reflection**: the habit of critically reviewing ways in which an investigation or observation has been carried out to see possible faults and other ways in which the investigation or observation can be improved upon.
7. **Comportment** conforming to acceptable societal norms.
8. **Co-operation** the ability to work effectively with others.
9. **Responsibility**: the ability to act independently and make decisions; morally accountable for one's action; capable of rational conduct.
10. **EnvironmentalAwareness**: being conscious of one's physical and socio-economic surroundings.
11. **Respect** for the Rule of Law: obeying the rules and regulations of the land.

The teacher should ensure that learners cultivate the above attitudes and skills as basis for living in the nation as effective citizens.

VALUES:

At the heart of this curriculum is the belief in nurturing honest, creative and responsible citizens. As such, every part of this curriculum, including the related pedagogy, should be consistent with the following set of values.

Respect: This includes respect for the nation of Ghana, its institutions and laws and the culture and respect among its citizens and friends of Ghana.

Diversity: Ghana is a multicultural society in which every citizen enjoys fundamental rights and responsibilities. Learners must be taught to respect the views of all persons and to see national diversity as a powerful force for nation development. The curriculum promotes social cohesion.

Equity: The socio-economic development across the country is uneven. Consequently, it is necessary to ensure an equitable distribution of resources based on the unique needs of learners and schools. Ghana's learners are from diverse backgrounds which require the provision of equal opportunities to all, and that, all strive to care for each other.

Commitment to achieving excellence: Learners must be taught to appreciate the opportunities provided through the curriculum and persist in doing their best in whatever field of endeavour as global citizens. The curriculum encourages innovativeness through creative and critical thinking and the use of contemporary technology.

Teamwork/Collaboration: Learners are encouraged to be committed to team-oriented working and learning environments. This also means that learners should have an attitude of tolerance to be able to live peacefully with all persons.

Truth and Integrity: The curriculum aims to develop learners into individuals who will consistently tell the truth irrespective of the consequences, be morally upright with the attitude of doing the right thing even when no one is watching. Also, be true to themselves and be willing to live the values of honesty and compassion. Equally

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important is the practice of positive values as part of the ethos or culture of the workplace, which includes integrity and perseverance. These values must underpin the learning processes to allow learners to apply skills and competences in the world of work.
The action words provided in the learning indicators in each content standard, should help you to structure your teaching and learning to achieve the desired learning outcomes. Check the learning indicators to ensure that you have given the required emphasis to each learning domain in your instruction and assessment

ASSESSMENT IN THE CCP

Assessment is a process of collecting and evaluating information about learners and using the information to make decisions to improve their learning. Assessment may be formative, summative, diagnostic, or evaluative depending on its purpose. It is integral to the teaching-learning process, promotes student learning and improves instruction. In CCP, it is suggested that assessment involves assessment for learning, assessment of learning and assessment as learning, which are described in the subsequent paragraphs.

Assessment for Learning (AfL)

Assessment for Learning (AfL) is the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learner is in their learning, where they need to be (the desired goal), and how best to get them there. AfL is one of the most suitable methods for improving learning and raising standards (Black and Wiliam, 1998)[1]. Assessment for Learning also refers to all their activities undertaken by teachers and/or by their learners, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. AfL can be achieved through processes such as sharing criteria with learners, effective questioning, and feedback.

AfL, therefore, provides timely feedback to ensure individual learners are assisted during the teaching and learning process using various strategies and questioning to measure the learning that has actually taken place. It is a continuous process that happens at all stages of the instructional process to monitor the progress of a learner and to offer feedback or change teaching strategies to achieve [performance standards of a lesson.

Assessment of Learning (AoL)

Assessment of learning provides a picture of the achieved standards of the teacher and students at the terminal stage of the learning process. This information provides data for and educational decisions such as grading, selection and placement, promotion and Through AoL, stakeholders such as parents and guardians are informed about the extent attained expected learning outcomes at the end of their grade or program.

performance of accountability certification. students have

Assessment as Learning (AaL)

Assessment as Learning develops and supports students' sense of ownership and efficacy learning through reflective practices. This form of self-assessment helps in building the

about their competencies

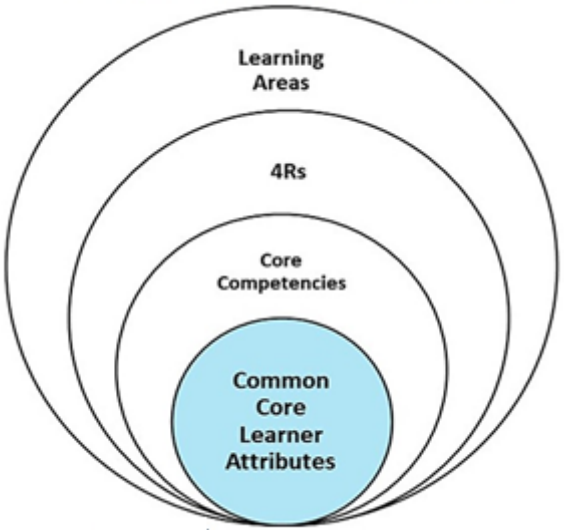

Figure 2 Essential Assessment Features

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of learners to achieve deeper understanding of what their own learning and what they are taught.

What do we assess?

Emphasis in assessment in the CCP is on the Common Core Learner Attributes, which are essential outcomes in the three domains of learning (i.e. cognitive, psychomotor and affective).

Knowledge and skills with emphasis on the 4Rs **in the learning areas**

Core competencies with emphasis on attitudes and values developed **through the learning and its context as well as the pedagogical approaches.** The Process is illustrated diagrammatically in Figure 2.

How do we monitor progress?

School Based Assessments (SBA) covers all forms/modes of assessment including AfL, AaL and AoL (see Table 1), that can be undertaken by any school-level actor (learner, teacher, head teacher) to monitor the learner's achievement over a period of time. Data collection and keeping records of the data are central to the conduct of SBA.

Table 1 Modes of Assessment

Assessment for Learning	Assessment of Learning	Assessment as Learning
Class exercises	Class Assessment Task (CAT)	Portfolio
Quizzes	End of term	Journal entries
Class tests (written, oral, aural and/or practical)	End of year	Project work
Class Assessment Task (CAT)		Checklist
		Questionnaire

The following are samples of relevant records that can be kept on the student's learning.

- Student's Progress Record (Cumulative Record)
- Student's Report Card
- School Based Assessment Termly Recording Register

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Details of guidelines on SBA can be found in the National Pre-tertiary Learning Assessment Framework (NPLAF) document (Ministry of Education, 2020a) and the School-Based Assessment Guidelines (Ministry of Education, 2020b).

Reporting School-Based Assessment (SBA) in the CCP

The CCP uses a criterion-referenced model of presenting and reporting school-based assessment data. School-based assessment throughout the four-year duration of CCP, is done against criteria linked to performance standards and not against the work of other learners. The CCP provides levels of proficiency to be attained and descriptors for all grade levels of the programme (see Table 2). These levels and descriptors cannot be changed by individual schools and are, therefore, common to all learners as well as learning areas nationwide. For each assessment criterion or (benchmark for the level of proficiency), a number of descriptors are defined as shown in Table 2.

Table 2 Benchmarks, levels of proficiency and the grade level descriptors

Level of Proficiency	Benchmark	Grade Level Descriptor
1: Highly proficient (HP)	80% +	Learnershows high level of proficiency inknowledge,skillsand values andcantransferthemautomaticallyandflexibly through authentic performancetasks.
2: Proficient (P)	68-79%	Learner demonstrates sufficient level of proficient knowledge, skills and core understanding; cantransfer them independently through authentic performance tasks
3: Approaching Proficiency (AP)	54-67%	Learner is approaching proficiency in terms of knowledge, skills and values with little guidance and can transfer understanding through authentic performance tasks
4: Developing (D)	40-53%	Learner demonstrates developing level of knowledge, skills and values but needs help throughout the performance of authentic tasks
5: Emerging (E)	39% and below	Learner is emerging with minimal understanding in terms of knowledge, skills, and values but needs a lot of help.

Thegradingsystempresented,showsthelettergradesystemandequivalentgradeboundaries.
Inassigninggradestopupils'testresults,oranyformofevaluation,theabovegradeboundaries and the descriptors may be applied. The descriptors (Highly Proficient [HP], Proficient [P], Approaching Proficiency [AP], Developing [D], Emerging [E]), indicate the meaning of eachgrade.
In addition to the school-based assessment (SBA), a national standards assessment test is conducted in Basic 8 to provide national level indicators on learners' achievement.

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CREATIVE AND INCLUSIVE PEDAGOGIES

The CCP emphasizes creative and inclusive pedagogies that are anchored on authentic and enquiry-based learning, collaborative and cooperative learning, differentiated learning, holistic learning, cross disciplinary learning (i.e. the 4Rs across the Curriculum) as well as developing the core competencies. This section describes some of the creative and inclusive pedagogies required for the CCP.

Core Competencies

The core competencies for computing describe a body of skills that teachers at the basic level should seek to develop in their learners. They are ways in which teachers and learners in computing engage with the subject matter as they learn the subject. The competencies describe a connected body of core skills that are acquired throughout the processes of teaching and learning. They are the relevant global skills for learning that allow learners to develop, in addition to the 4Rs, to become critical thinkers, problem-solvers, creators, innovators, good communicators, collaborators, culturally identified individuals, digitally literate and global citizens who are have keen interest in their personal development. In using this curriculum, we hope the core competencies will be developed in learners to help them develop our country, Ghana. These competencies include:

CRITICAL THINKING AND PROBLEM SOLVING (CP)

This skill develops learners' cognitive and reasoning abilities to enable them analyse and solve problems. Critical thinking and problem-solving skill enable learners to draw on their own experiences to analyse situations and choose the most appropriate out of a number of possible solutions. It requires that learners embrace the problem at hand, persevere and take responsibility for their own learning.

CREATIVITY AND INNOVATION (CI)

Creativity and innovationpromote the development of entrepreneurial skills in learners through their ability to think of new ways of solving problems and developing technologies for addressing the problem at hand. It requires ingenuity of ideas, arts, technology and enterprise. Learners having this skill are also able to think independently and creatively.

COMMUNICATION AND COLLABORATION (CC)

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This competence promotes in learners the skills to make use of languages, symbols and texts to exchange information about themselves and their life experiences. Learners actively participate in sharing their ideas. They engage in dialogue with others by listening to and learning from them. They also respect and value the views of others.

CULTURAL IDENTITY AND GLOBAL CITIZENSHIP (CG)

This competence involves developing learners to put country and service foremost through an understanding of what it means to be active citizens. This is done by inculcating in learners a strong sense of social and economic awareness. Learners make use of the knowledge, skills, competences and attitudes acquired to contribute effectively towards the socioeconomic development of the country and on the global stage. Learners build skills to critically identify and analyse cultural and global trends that enable them to contribute to the global community.

PERSONAL DEVELOPMENT AND LEADERSHIP (PL)

This competence involves improving self-awareness and building self-esteem. It also entails identifying and developing talents, fulfilling dreams and aspirations. Learners are able to learn from mistakes and failures of the past. They acquire skills to develop other people to meet their needs. It involves recognising the importance of values such as honesty and empathy and seeking the well-being of others. Personal development and leadership enable learners to distinguish between right and wrong. The skill helps them to foster perseverance, resilience and self-confidence. It helps them acquire the skill of leadership, self-regulation and responsibility necessary for lifelong learning.

DIGITAL LITERACY (DL)

Digital Literacy involvesdeveloping learners to discover, acquire, and communicate through ICT to support their learning. It also makes them use digital media responsibly

For effective lesson planning for teaching, learning and assessment, it is suggested that teachers refer to Appendix XX for details of the components of the core competencies. These details comprise the unpacked skills such as: listening, presenting and team work for collaboration.

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CREATIVE AND INCLUSIVE PEDAGOGIES

These are the approaches, methods, strategies, appropriate relevant teaching and learning resources for ensuring that every learner benefits from the teaching and learning process. The curriculum emphasises the:

1. creation of learning-centred classrooms through the use of creative approaches to ensure learner empowerment and independent learning;
2. positioning of inclusion and equity at the centre of quality teaching and learning;
3. use of differentiation and scaffolding as teaching and learning strategies for ensuring that no learner is left behind;
4. use of Information Communications Technology (ICT) as a pedagogical tool;
5. identification of subject specific instructional expectations needed for making learning in the subject relevant to learners;
6. integration of assessment as learning, for learning and of learning into the teaching and learning processes and as an accountability strategy; and
7. questioning techniques that promote deep learning..

INCLUSION

Inclusion is ensuring access and learning for all learners, especially, those disadvantaged. All learners are entitled to a broad and balanced curriculum in every school in Ghana. The daily learning activities to which learners are exposed should ensure that the learners' right to equal access and accessibility to quality education is met. The Curriculum suggests a variety of approaches that addresses learners' diversity and their special needs in the learning process. When these approaches are effectively used in lessons, they will contribute to the full development of the learning potential of every learner. Learners have individual needs and learning experiences and different levels of motivation for learning. Planning, delivery and reflection on daily learning experiences should take these differences into consideration.

The curriculum therefore promotes:

1. learning that is linked to the learner's background and to their prior experiences, interests, potential and capacities.
2. learning that is meaningful because it aligns with learners' ability (e.g. learning that is oriented towards developing general capabilities and solving the practical problems of everyday life); and
3. the active involvement of the learners in the selection and organisation of learning experiences, making them aware of their importance and also enabling them to assess their own learning outcomes.

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LEARNING-CENTRED PEDAGOGY

The learner is at the centre of learning. At the heart of the national curriculum for change and sustainable development is the learning progression and improvement of learning outcomes for Ghana's young people with a focus on the 4Rs – Reading, wRiting, aRithmetic and cReativity. It is expected that at each curriculum phase, learners would be offered the essential learning experiences to progress seamlessly to the next phase. Where there are indications that a learner is not sufficiently ready for the next phase a compensatory provision through differentiation should be provided to ensure that such a learner is ready to progress with their cohort.

The Curriculum encourages the creation of a learning-centred classroom with the opportunity for learners to engage in meaningful "hands-on" activities that bring home to the learner what they are learning in school and what they know from outside of school. The learning-centred classroom is a place for the learners to discuss ideas through the inspiration of the teacher. The learners then become actively engaged in looking for answers, working in groups to solve problems. They also research information, analyse and evaluate information. The aim of the learning-centred classroom is to enable learners to take ownership of their learning. It provides the opportunity for deep and profound learning to take place.

The teacher as a facilitator needs to create a learning environment that:

1. makes learners feel safe and accepted,
2. helps learners to interact with varied sources of information in a variety of ways,
3. helps learners to identify a problem suitable for investigation through project work,
4. connects the problem with the context of the learners' world so that it presents realistic opportunities for learning,
5. organises the subject matter around the problem, not the subject,
6. gives learners responsibility for defining their learning experience and planning to solve the problem,
7. encourages learners to collaborate in learning and
8. expects all learners to demonstrate the results of their learning through a product or performance.

It is more productive for learners to find answers to their own questions rather than teachers providing the answers and their opinions in a learning-centred classroom.

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DIFFERENTIATION AND SCAFFOLDING

Differentiation is a process by which differences (learning styles, interest and readiness to learn) between learners are accommodated so that all learners in a group have the best chance of learning. Differentiation could be by content, tasks, questions, outcome, groupings and support. Differentiation as a way of ensuring each learner benefits adequately from the delivery of the curriculum can be achieved in the classroom through (i) Task (ii) Support from the Guidance and Counselling Unit and (iii) Learning outcomes.

Differentiation by task involves teachers setting different tasks for learners of different abilities. E.g. in sketching the plan and shape of their classroom some learners could be made to sketch with free hand while others would be made to trace the outline of the plan.

Differentiation by support involves the teacher giving needed support and referring weak learners to the Guidance and Counselling Unit for academic support.

Differentiation by outcome involves the teacher allowing learners to respond at different levels. Weaker learners are allowed more time for complicated tasks.

Scaffolding in education refers to the use of a variety of instructional techniques aimed at moving learners progressively towards stronger understanding and ultimately greater independence in the learning process.

It involves breaking up the learning task, experience or concepts into smaller parts and then providing learners with the support they need to learn each part. The process may require a teacher assigning an excerpt of a longer text to learners to read and engaging them to discuss the excerpt to improve comprehension. The teacher goes ahead to guide them through the key words/vocabulary to ensure learners have developed a thorough understanding of the text before engaging them to read the full text.

Common scaffolding strategies available to the teacher are:

1. give learners a simplified version of a lesson, assignment, or reading, and then gradually increases the complexity, difficulty, or sophistication over time.
2. describe or illustrate a concept, problem, or process in multiple ways to ensure understanding;
3. give learners an exemplar or model of an assignment they will be asked to complete;
4. give learners a vocabulary lesson before they read a difficult text;
5. describe the purpose of a learning activity clearly and the learning goals they are expected to achieve; and
6. describe explicitly how the new lesson builds on the knowledge and skills learners were taught in a previous lesson

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SUGGESTED TIME ALLOCATION

A total of three periods a week, each period consisting of 50 minutes, is allocated to the teaching of computing from B7 – B10. It is recommended that the teaching periods be divided as follows:
One period per day (50-minutes per period)
INFORMATION COMMUNICATIONS TECHNOLOGY

Information Communications Technology (ICT) has been integrated into the computing curriculum as part of the core of education, alongside reading, writing and numeracy. Thus, the curriculum is designed to use ICT as a teaching and learning tool to enhance deep and independent learning. For instance, the teacher in certain instances is directed to use multimedia to support the teaching and learning process.

ICT has the potential to innovate, accelerate, enrich, and deepen skills. It also motivates and engages learners to relate school experiences to work practices. It provides opportunities for learners to fit into the world of work.

Some of the expected outcomes that this curriculum aims to achieve are:

1. improved teaching and learning processes;
2. improved consistency and quality of teaching and learning;
3. increased opportunities for more learner-centered pedagogical approaches;
4. improved inclusive education practices.;
5. improved collaboration, creativity, higher order thinking skills; and
6. enhanced flexibility and differentiated approach of delivery.

The use of ICT as a teaching and learning tool is to provide learners access to large quantities of information online and offline. It also provides the framework for analysing data to investigate patterns and relationships in the computing context. Once learners have made their findings, ICT can help them organize, edit and print the information in many different ways.

Learners need to be exposed to various ICT tools around them including calculators, radios, cameras, phones, television sets and computers and related software like Microsoft Office packages - Word, PowerPoint and Excel as teaching and learning tools. The exposure that learners are given from basic 7 – 10 to use ICT in exploiting learning will build their confidence and will increase their level of motivation to apply ICT use in later years, both within and outside of education. ICT use for teaching and learning is expected to enhance the quality and competence level of learners.

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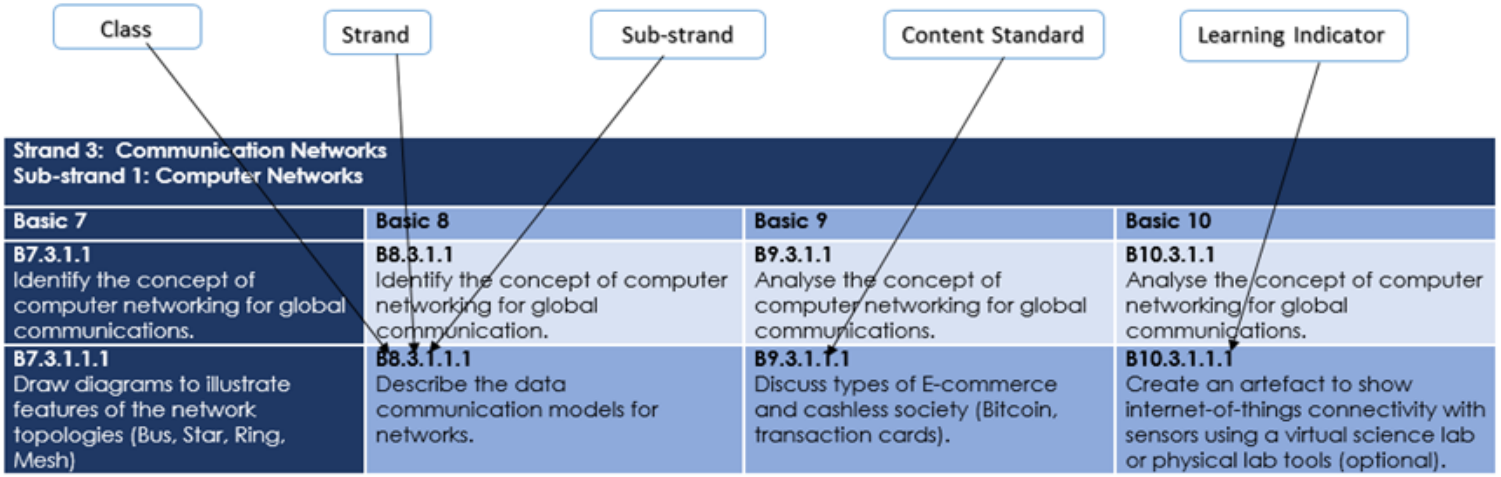
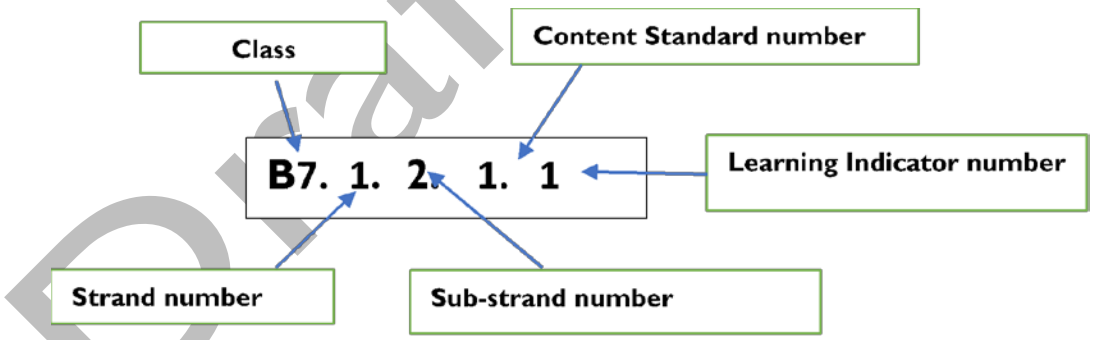


Strand 3: Communication Networks Sub-strand 1: Computer Networks			
Basic 7	**Basic 8**	**Basic 9**	**Basic 10**
B7.3.1.1 Identify the concept of computer networking for global communications.	**B8.3.1.1** Identify the concept of computer networking for global communication.	**B9.3.1.1** Analyse the concept of computer networking for global communications.	**B10.3.1.1** Analyse the concept of computer networking for global communications.
B7.3.1.1.1 Draw diagrams to illustrate features of the network topologies (Bus, Star, Ring, Mesh)	**B8.3.1.1.1** Describe the data communication models for networks.	**B9.3.1.1.1** Discuss types of E-commerce and cashless society (Bitcoin, transaction cards).	**B10.3.1.1.1** Create an artefact to show internet-of-things connectivity with sensors using a virtual science lab or physical lab tools (optional).



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ORGANIZATION AND STRUCTURE OF THE CURRICULUM(Basic 7 – 10)

The content standards in this document are organized by grade level. Within each grade level, the contents are grouped first by strands. Each strand is further subdivided into sub-strands of related indicators.

- **Indicators** are learning outcomes that define what learners should know and be able to do.
- **Content Standards** are groups of related indicators. Note that indicators from different standards may sometimes be closely related, because computing is a connected subject.
- **Sub-strands** are larger groups of related indicators (or computing topics to be studied). Indicators from different sub-strands may sometimes be closely related.
- **Strands** are the main branches of the computing content to be studied.

The Standards are organized under four strands as follows:

1. Introduction to Computing
2. Productivity Software
3. Communication Networks
4. Computational Thinking

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The table below shows the scope and sequence of the strands addressed at the B7 – B10 phase. The remaining part of the document presents the details of the standards and indicators for each grade level,

Strand	Sub-strand	B7	B8	B9	B10
Introduction to Computing	**Components of Computers and Computer Systems**	√	√	√	√
	TechnologyinTheCommunity	√	√	√	√
	HealthandSafetyinUsing ICT Tools	√	√	√	√
Productivity Software	**Introduction to Word Processing**	√	√	√	√
	Introduction to Presentation	√	√	√	√
	Introduction to Desktop Publishing			√	√
	Introduction to Electronic Spreadsheet	√	√	√	√
Communication Networks	**Computer Networks**	√	√	√	√
	Internet and Social Media	√	√	√	√
	Information Security	√	√	√	√
	Web Technologies	√	√	√	√
ComputationalThinking	**Introduction to Programming**	√	√	√	√
	Algorithm	√	√	√	√
	Robotics	√	√	√	√
	Artificial Intelligence	√	√	√	√

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Basic 7

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Strand 1: Introduction to computing
Sub-strand 1: Components of Computers and Computer Systems

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.1.1.1. Identify parts of a computer and their uses	**B7.1.1.1.1 Discuss the second and third generation of computers** Exemplar 1. Discuss the features of the second and third generation of computers 2. Identify major components on the motherboard. 3. Show pictures of parts of the system board and identify a transistor.	**Creativity and innovation.** Exhibit strong memory, intuitive thinking; and respond appropriately **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group
	B7.1.1.1.2 Demonstrate understanding of the use of input devices (wireless keyboard, and mouse, light pen, Touchscreen) Exemplar 1. Handle/watch video/pictures of wireless keyboard and mouse, touchscreen in class 2. Identify the input devices listed 3. Explore areas where different types of input devices are used.	**Creativity and innovation.** Exhibit strong memory, intuitive thinking; and respond appropriately **Communication and collaboration** Identify underlying themes, implications and issues when listening

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.1.1.2. Demonstrate the use of the features of the Windows Desktop	**B7.1.1.1.4 Describe Storage devices: full-sized external hard drives, Hard Drive Speed,Disk Caching)** Exemplar 1. Explore magnetic storage devices. 2. Bring storage devices or picture of items to class 3. Discuss features of magnetic storage devices Explore the differences in the various Hard Disk Drives (HDD)	**Creativity and innovation.** Exhibit strong memory, intuitive thinking; and respond appropriately **Communication and collaboration** Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech.
	B7.1.1.2.1 Discover the new Windows Operating System (Start screen, Use of tiles, Taskbar buttons, Preview thumbnails) Exemplar 1. Show the desktop, tiles, taskbar. 2. Demonstrate how to preview thumbnails	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
	B7.1.1.2.2 Practice file management techniques (file and folder management) Exemplar 1. Demonstrate file management techniques by following the naming conventions, organising files in folders and subfolders. 2. Explore the types and importance of file extensions.	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Creativity and innovation** Interpret and apply learning in new context

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Sub-strand 2: Technology in the community

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.1.2.1. Demonstrate the use of Technology in the community.	**B7.1.2.1.1. Describe and give examples of at least five technology tools for learning in eachsubject (e.g. spreadsheets, Encarta, virtual museum, scrabble, presentation, scratch etc.)** Exemplar 1. Explore the various technology tools that can be used for learning. **NB- Exploration can be done through pupils surfing the internet or guiding them to brainstorm the ICT tools**.	**Digital literacy.** Ability to find and consume digital content **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
	B7.1.2.1.2. Demonstrate the use of at least three technology tools identified in B7.1.2.1.1. Exemplar 1. Demonstrate the use of a technology tool in groups and present to the whole class how that tool works.	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Digital literacy** Ability to find and consume digital content
	B7.1.2.1.3. Discuss the benefits of using technology tools in learning. Exemplar 1. Discuss in pairs the benefits of using technology tools in learning (e.g. using spreadsheet to draw graphs)	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Digital literacy** Ability to find and consume digital content

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Sub-strand 3: Health and Safety in using ICT tools

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.1.3.1. Demonstrate how to apply Health and Safety measures in using ICT Tools	**B7.1.3.1.1 Describe Current Regulatory Requirements and Potential Computing-Related Disorders** Exemplar 1. Watch videos on the health hazards of prolonged use of computing devices or show pictures of bad postures and other hazards in using computing devices (e.g. radiation from mobile phones causing cancer, hearing impairment from loud volumes of Public Address (PA) Systems, vision impairment from the monitor, repetitive strain injury, Carpal tunnel syndrome, computer vision syndrome etc. 2. Identify the health hazards associated with each device. 3. Provide preventive measures of the stated health and safety issues.	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Digital literacy** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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Strand 2: Productivity Software
Sub-strand 1: Introduction to Word Processing

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.2.1.1 Demonstrate how to use Microsoft Word (Editing)	**B7.2.1.1.1. Demonstrate how to insert, select, delete, and move the text** Exemplar 1. Show projected examples of MS-Word interface with the aid of a computer, projector or pictures. 2. Explore tools for editing in MS Word 3. Explore the use of the overtype, or insert option by right-clicking the status bar.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B7.2.1.1.2. Demonstrate how to find and replace content and undo edited changes Exemplar 1. Make use of the Find and Replace toolin MS-Word under the Home tab 2. Explore the use of the Editing group under the Home tab	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B7.2.1.1.3. Demonstrate how to spell check, content translation, language setting Exemplar 1. Demonstrate the use of the Proofing and Language group under the Review tab 2. Show how to use the Language, Spelling & Grammar, Thesaurus and other tools in MS-Word under the Home tab. **NB. This is to help learners with software knowledge in office applications (word processing) to grasp the concept better.**	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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Sub-Strand 2: Introduction to Presentation

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.2.2.1 Demonstrate how to use Microsoft PowerPoint (Editing)	**B7.2.2.1.1. Explore features of MS PowerPoint's interface.** Exemplar 1. Show projected examples of MS-PowerPoint interface with the aid of a projector or pictures. 2. Explore MS-PowerPoint themes and templates 3. Explore the use of the Proofing and Language group under the Review tab 4. Demonstrate the use of the Language, Spelling & Grammar, Thesaurus and other buttons in MS-PowerPoint under the Review tab	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B7.2.2.1.2. Demonstrate how to use Special Characters. Authora 7-slide presentation in MS-PowerPoint using the tools of the Editing group. Exemplar 1. Explore the use of Special characters section under the Insert tab under the Symbol group 2. Present a prepared project or exercise using the editing group of the ribbons studied. 3. Use projected examples of PowerPoint interface with the aid of a projector or pictures. **NB: This is to help the learners with software knowledge in MS PowerPoint, office applications to grasp the concept better.**	**Creativity and innovation.** Ability to visualise alternatives, seeing possibilities, problems and challenges **Communication and collaboration** Ability to work with all group members to complete a task successfully

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Sub-strand 3: Introduction to Electronic Spreadsheet

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.2.3.1. Demonstrate how to use the Spreadsheet (Editing Worksheets).	**B7.2.3.1.1 Explore features of MS-Excel interface.** Exemplar 1. Show projected examples of MS-Excel interface with the aid of a projector or pictures. 2. Explore operations of inserting, selecting, deleting and moving data. 3. Demonstrate how to insert, select, delete and move data using a sample data set.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B7.2.3.1.2. Demonstrate how to set the cell datatype (General, Number, Currency etc.) Exemplar 1. Investigate how to set and modify the cell type of values and text. 2. Enter values, text, dates and time in worksheet cells and change the formats for presentation as General, Number, Currency, Accounting, Dates, Time etc.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B7.2.3.1.3. Demonstrate how to Align Text, Merge &Wrap, Borders and Shades. Exemplar 1. Demonstrate how to change text alignment (Horizontal & Vertical), merge cells and wrap text. 2. Investigate how to access border & shade features and format the appearance of a worksheet as group work.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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Strand 3: Communication Networks
Sub-strand 1: Computer Networks

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.3.1.1. Identify the concept of computer networking for global communications.	**B7.3.1.1.1 Draw diagrams to illustrate features of the network topologies (Bus, Star, Ring, Mesh)** Exemplar 1. Explore key hardware for setting up network systems **(such as server, client, hub, switch, cable etc.)** 2. Explain network topologies. 3. Discuss the features of each network topology. 4. Present in groups diagrams of well-elaborated network topologies. **NB: Watch any appropriate video on the above exemplars**	**Creativity and innovation.** Exhibit skill of inquisitiveness and curiosity **Digital literacy.** Communicate appropriately with digital tools

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT-SPECIFIC PPRACTICES AND CCORE COMPETENCIES
	B7.3.1.1.2 Describe types of networks [Personal Area Network (PAN), Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN)] Exemplar 1. Explain the various types of networks available (e.g. PAN, LAN, MAN, WAN, WLAN, INTERNET etc.) - A local area network (LAN) is the connection of two or more computer devices for networking within a relatively small area. A metropolitan area network (MAN) connects local networks across a larger geographical region.	**Creativity and innovation.** Use of skills of visualising alternatives, seeing possibilities, problems and challenges **Digital literacy.** **Exhibit understanding of skills in using digital devices**
	B7.3.1.1.3 Discuss the entrepreneurial opportunities in networking computing devices. Exemplar 1. Discuss the benefits and challenges of networking in different environments (school, business, health, etc.) 2. Identify different environments where the various types of networks can be applied Identify the business aspect of networking and how they can be turned into a lucrative business.	**Digital literacy.** **Exhibit understanding of skills in using digital devices**

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Sub-strand 2: Internet and Social Media

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.3.2.1 Demonstrate the use of Social Networking and Electronic Mail	**B7.3.2.1.1 Identify the various types and uses of Social Media sites such as Social Networking (Facebook, LinkedIn, WhatsApp), Microblogging (Twitter, Tumblr)** Exemplars 1. Illustrate the use of social networking sites such as Facebook, LinkedIn, WhatsApp etc. 2. Demonstrate the use of microblogging platforms such as Twitter, Tumblr etc.	**Creativity and innovation.** Ability to select the most effective creative tools for working and give reasons **Digital literacy.** Use synthetic and dynamic thinking abilities to create meaningful new combinations from existing information.
	B7.3.2.1.2 Demonstrate the use of the following features of Electronic mail: Attachment, and Address book. Exemplar 1. Demonstrate the steps in creating, sending and receiving of email 2. Demonstrate replying to and forwarding email **3.** Demonstrate with reasons for using From; To; cc; bcc; and subject features when sending an email.	**Creativity and innovation.** Ability to select the most effective creative tools for working and give reasons **Digital literacy.** Create and use digital content

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Sub-strand 3: Information Security

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.3.3.1. Recognise data threats and means of protection	**B7.3.3.1.1 Discuss the key principles of information security (confidentiality, integrity and availability).** Exemplar 1. Research in pairs the key principles of information security. 2. Discuss the three key principles of information security. 3. Research scenarios involving information security	**Digital literacy.** Recognition of societal issues raised by digital technologies **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group
	B7.3.3.1.2 Explore the legal issues about intellectual property rights (e.g. Copyright, Patent, Trademark, Piracy, Copyright Infringement). Exemplar 1. Discuss issues pertaining to copyright (e.g. freeware, shareware, crippleware). 2. Differentiate between the various legal issues mentioned. 3. Discuss consequences associated with breaking legal laws.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem. **Communication and collaboration** Anticipate different responses from the audience and plan for them.

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT-SPECIFIC PPRACTICES AND CORE COMPETENCIES
	B7.3.3.1.3 Evaluate information security forensic auditing and criminal laws against offenders. Exemplar 1. Watch a video of how offenders of data security breach are identified. 2. Discuss the laws protecting data and their appropriate sanctions. **Identify some common occurrence of data security breaches that people in the community overlook and their corresponding sanctions.**	**Digital literacy.** Knowledge and recognition of ethical use of information **Communication and collaboration** **Can see the importance of including all team members in discussions and actively encourage contributions from their peers in their team**

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Sub-strand 4: Web Technologies

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.3.4.1. Demonstrate the use of a Web Browser (Search engines)	**B7.3.4.1.1 Identify the importance of the web in learning [Virtual Learning Environments (VLEs)].** Exemplar 1. Explore the importance of VLEs for learning. - Allows self-paced learning, - Creates opportunity to learn new skills without having to travel	**Creativity and innovation.** Exhibit skill of inquisitiveness and curiosity **Digital literacy.** Communicate appropriately with digital tools
	B7.3.4.1.2 Explore the use of open learning websites in the classroom Exemplar 1. Explore the uses of open learning websites in the classroom e.g. Khan Academy, Coursera, Edx, Saylor etc.	**Creativity and innovation.** Use of skills of visualising alternatives, seeing possibilities, problems and challenges **Digital literacy.** Exhibit understanding of skills in using digital devices

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT-SPECIFIC PPRACTICES AND CCORE COMPETENCIES
	B7.3.4.1.3 Demonstrate techniques for evaluating web pages (Accuracy, Content, Current, functionality) Exemplars 1. Demonstrate techniques for evaluating web pages. - Accuracy: How true is the information? - Credibility: Who wrote the page? Is the person an expert in the subject matter? - Content: Is it on the correct subject matter? - Current: Is the content up-to-date? When was the last time it was updated? **- Functionality: Does the site work well?**	**Digital literacy.** **Exhibit understanding of skills in using digital devices**

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Strand 4: COMPUTATIONAL THINKING
Sub-Strand 1: Introduction to Programming

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.4.1.1. Show an understanding of the concept of programming	**B7.4.1.1.1 Demonstrate the correct use of programming terminologies.** Exemplar 1. List the terminologies in alphabetical order or grouping to aid recall 2. Explain each of the terminologies	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group **Digital literacy** Evaluate the quality and validity of information
	B7.4.1.1.2 Demonstrate understanding of the use of data types (e.g., float, integer, string, char etc.); Exemplar 1. Develop key questions around daily activities to identify the data type. Example: The first name of your best friend is written as a string data type.	**Critical thinking and problem solving** Ability to combine Information and ideas from several sources to reach a conclusion **Digital literacy** Recognition of societal issues raised by digital technologies
	B7.4.1.1.3 Demonstrate the use of constants and variables used in programming Exemplar 1. Show how constants and variables are used in programming. 2. Discuss the benefits of using variables over the constants.	**Communication and collaboration.** Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech.

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Sub-strand 2: Algorithm

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.4.2.1. Analyse correct step-by-step procedure in solving any real-world problem.	**B7.4.2.1.1 Understand the use of sequence, selection and iteration in writing a program. Describe the meaning of the terms algorithm, decomposition and abstraction.** Exemplar 1. Write numbers (1-10) in an orderly arrangement to represent sequence. Write your itinerary for a day in a logical order (Sequence). **NB: Should be linear with no branching statements.** 2. Present a case study where there are more than one options to choose from and yet achieve the same outcome. For example, tea with or without sugar options can still meet a beverage outcome (selection). 3. Develop a solution to a problem which uses iteration to control the flow of the program **(iteration).** **NB- Programs such as lightbot could be used for practical lessons.**	**Creativity and innovation.** Ability to effectively define goals towards solving a problem **Critical thinking and problem solving** Identify extra information to solve a problem. Ability to combine Information and ideas from several sources to reach a conclusion
	B7.4.2.1.2 Perform a linear search Exemplar 1. Locate a given value position out of listed values. 2. Arrange some given values or data in increasing and decreasing order.	**Critical thinking and problem solving** Ability to effectively define goals towards solving a problem

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Sub-strand 3: Robotics

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.4.3.1 Discuss Robot intelligence concepts.	**B7.4.3.1.1 Review the various applications of robotic machines in society** Exemplar 1. State applications and uses of robots in society (e.g. manufacturing, health, education, assembling and packing, transport, surgery, laboratory research, and mass production of consumer and industrial goods, taking pictures etc.) 2. Explore prospects and challenges of robots in their operations	**Digital literacy** Recognition of societal issues raised by digital technologies **Critical thinking and problem solving** Ability to understand features of a problem

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Sub-strand 4: Artificial Intelligence

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B7.4.4.1. Discuss Artificial intelligence concepts.	**B7.4.4.1.1 Discuss the application of various areas of artificial intelligence (Machine learning, Artificial Neural Networks, Virtual Reality, Augmented reality, Mixed Reality, Gamification)** Exemplar 1. Compare the key technologies: machine learning, Artificial Neural Networks (ANN), Reality, Augmented reality, Gamification, Deep learning, Artificial Data Mining and analytics 2. Discuss the uses and importance of Artificial Intelligence (AI) to Society. 3. Watch video/picture of the use of AI in society. (Intelligent robots)	**Digital literacy** Exhibit understanding of skills in using digital devices **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group

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BASIC 8

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Strand 1: Introduction to computing
Sub-strand 1: Components of Computers and Computer Systems

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.1.1.1.Examine the parts of a computer	**B8.1.1.1.1. Discuss the fourth generation computers** Exemplar 1. Discuss features of fourth generation computers 2. Identify a microchip 3. Explore the architecture of a processor	**Creativity and innovation.** Exhibit strong memory, intuitive thinking; and respond appropriately Recognise and generalise information and experience ; search for trends and patterns **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
	B8.1.1.1.2. Demonstrate understanding of the use of input devices (barcode, scanner etc.) Exemplar 1. Watch video or picture of input devices in use. 2. Demonstrate the use of input devices in a computer laboratory/classroom 3. Explore the advantages and disadvantages of input devices	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Digital literacy** Ability to find and consume digital content

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B8.1.1.1.3. Examine the uses of the output devices: Graphing plotter, Data and Multimedia Projectors, Pico projector Exemplar 1. Watch video or pictures of output devices in use. 2. Demonstrate the use of output devices in a computer laboratory/classroom 3. Explore the advantages and disadvantages of output devices	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Digital literacy** Ability to find and consume digital content
	B8.1.1.1.4 Examine Storage portable hard drives, Optical Discs and Drives. E. g. Read-Only Optical Discs: CD-ROM, DVD-ROM, and BD-ROM Discs Recordable Optical Discs: CD-R, DVD-R, DVD+R, and BD-R Discs Rewritable Optical Discs: CD-RW, DVD-RW, DVD+RW, and BD-RE Discs Exemplar 1. Identify portable hard drives/Optical Discs and Drives or picture of items to class 2. Discuss features of hard drives/Optical Discs storage media 3. Explore the maximum capacities of these storage devices 4. Explore the different write speeds of these storage devices	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Digital literacy** Ability to find and consume digital content.

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.1.1.2. Demonstrate the use of the features of a Desktop	**B8.1.1.2.1 Discover temporarily peeking into a window on a Taskbar.** Exemplar 1. Explore features of the Taskbar 2. Demonstrate the preview of windows on a Taskbar	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Digital literacy** Ability to find and consume digital content.
	B8.1.1.2.2 Practice file management techniques (Users & Accounts) Exemplar 1. Explore different account levels for users of computer systems. 2. Explore different permission levels applied to files and folders	**Digital literacy** Preparedness to make better decision with information at hand Ability to find and consume digital content
B8.1.1.3. Demonstrate the use of Data and identify sources of data	**B8.1.1.3.1 Learn Probabilistic Data Structures, and Distinct value Sketches** Exemplar 1. Demonstrate the use of logical statements with the use of counters for increasing and decreasing values. 2. Explore the use of counters in automated systems (e.g. hotel reservation, booking a flight etc.)	**Communication and collaboration** Apply appropriate diction and structure sentences correctly for narrative, persuasive, imaginative and expository purposes Understand and use interpersonal skills **Digital literacy** Preparedness to make better decision with information at hand Ability to find and consume digital content

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Sub-strand 2: Technology in the community (communication)

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.1.2.1. Demonstrate the use of Technology in the community.	**B8.1.2.1.1. Examine the negative impact of computers and computer use on the environment** Exemplar 1. Observe people who use and work with computers in the community. 2. Visit sites or watch videos/pictures of how computers including other electronic components aredisposed of. 3. Discuss the impact of computers and computer use on the environment.	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech. **Digital literacy** Recognition of societal issues raised by digital technologies
	B8.1.2.1.2. Propose environmentally responsible practices that can be used to reduce the negative impact of computer and computer use on the environment Exemplar 1. Brainstorm how the negative effects identified can be reduced. 2. Evaluate environmentally responsible practices. 3. Propose how e-waste in a particular environment (e.g. Agbogbloshie) can be managed.	**Cultural identity and global citizenship** Exhibit a sense of nationality and global identity **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Personal development and leadership** Recognise one's emotional state and preparedness to apply emotional intelligence **Critical thinking and problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT-SPECIFIC PPRACTICES AND CCORE COMPETENCIES
	B8.1.2.1.3. Create a component from disposed computer parts. Exemplar 1. Collect disposed computer/electronic parts from the community. 2. Watch a video/picture of recycling of computer parts. **3.** Develop a component from the collected electronic parts.	**Creativity and innovation** Ability to merge simple/ complex ideas to create novel situation or thing **Personal development and leadership** Recognise one's emotional state and preparedness to apply emotional intelligence Ability to manage and resolve conflict

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Sub-strand 3: Health and safety in using ICT tools

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.1.3.1. Demonstrate how to apply Health and Safety measures in Using ICT Tools	**B8.1.3.1.1 Examine Workstation Risk Assessments** Exemplar 1. Explore the risks associated with workstations and how to overcome them (e.g. furniture and sitting posture, wrist pains, eye problems, back and neck pains, faulty electrical connections etc.) 2. Identify measures that will help to eliminate workstation hazards and if it is not possible, how to minimize the risks. (e.g. evaluating display screen, adjusting the chair for comfort, avoiding potential slips and falls, positioning of devices etc.)	**Personal development and leadership.** Recognise one's emotional state and preparedness to apply emotional intelligence Ability to manage and resolve conflict **Critical thinking and problem solving** Provide new insight into controversial situation or task

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Strand 2: Productivity Software
Sub-strand 1: Introduction to Word Processing

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.2.1.1 Demonstrate how to use Microsoft Word (Formatting Text)	**B8.2.1.1.1. Demonstrate how to use text-decoration, change text case, text size and colour.** Exemplar 1. Explore the use of the Font group under the Home tab 2. Demonstrate the use ofsentence case, font size, colour and font decoration features in MS- Word 3. Show projected examples of MS-Word interface to learners with the aid of a projector or pictures.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Creativity and innovation.** Ability to visualise alternatives, seeing possibilities, problems and challenges
	B8.2.1.1.2. Demonstrate how to align text, indent paragraphs, bullet, line space and shade. Exemplar 1. Explore the use of the Paragraph group, using the align left, centre, right and justified in MS-Word under the Home tab 2. Explore the use of the Bullets, Decrease and Increase Indentation, under the Home tab 3. Identify the use of the Border Button and set line spacing using the dialogue Box Launcher button us under the Home tab	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Creativity and innovation.** Ability to visualise alternatives, seeing possibilities, problems and challenges

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CONTENT STANDARD	**INDICATORS AND EXEMPLARS**	**SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES**
	B8.2.1.1.3. Demonstrate how to set Tabs, and apply formatting Exemplar 1. Explore the Tab button to set the centre and right tabs **NB. This is to help learners with software knowledge in office applications (word processing) to grasp the concept better.**	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Creativity and innovation.** Ability to visualise alternatives, seeing possibilities, problems and challenges

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Sub-strand 2: Introduction to Presentation

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.2.2.1 Demonstrate how to use Microsoft PowerPoint (Formatting)	**B8.2.2.1.1. Demonstrate how to change text case, text size, text colour and decorate text** Exemplar 1. Explore the use of the Font group under the Home tab 2. Make use of the sentence case, font size, colour and font decoration features in MS-PowerPoint 3. Show projected examples of PowerPoint interface to learners with the aid of a projector or pictures.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges
	B8.2.2.1.2. Demonstrate how to align text, indent paragraphs, borders and shades. Exemplar 1. Explore the use of the Proofing and Language Sections under the Review tab 2. Use the Language, Spelling & Grammar, Thesaurus and other buttons in MS- PowerPoint under the Review tab	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B8.2.2.1.3. Demonstrate the use of the Slide Master, design template, and be able to give a 5-side presentation in MS-PowerPoint using the tools of the ribbons studied. Exemplar 1. Explore the use of Master Views group under the View Ribbon 2. Prepare and present a prepared project or exercise using what has been studied in Indicator 1 and 2. 3. Use projected examples of PowerPoint interface with the aid of a projector or pictures. **NB: This is to help the learners with software knowledge in MS-PowerPoint, Office Applications to grasp the concept well**	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges . **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

Draft Zero

Sub-strand 3: Introduction to Electronic Spreadsheet

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.2.3.1. Demonstrate how to use to Format a Worksheet	**B8.2.3.1.1 Demonstrate how to adjust margins, and set page orientation.** Exemplar 1. Demonstrate how to adjust margins and set page orientations for printing. 2. Perform margin adjustment on different page sizes 3. Explore the display of worksheets in different views as listed on the View tab.	**Digital literacy**. Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges
	B8.2.3.1.2. Demonstrate how to set upa header and a footer. Exemplar 1. Demonstrate how to setup up header and footer elements 2. Explore the use of page numbers, current date, time and file name in setting up headers and footers.	**Digital literacy**. Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B8.2.3.1.3. Demonstrate the use of the Autofill function in MS-Excel worksheet Exemplar 1. Demonstrate the use of the Autofill function E.g to generate the days of the week, months of the year, set of numbers (e.g. counting numbers, odd numbers, multiplication tables etc.)	**Digital literacy**. Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8 2.3.2 Demonstrate how to use Spreadsheet formula	**B8.3.2.1. Demonstrate how to create formulas** Exemplar 1. Create simple formulas starting with the equal sign (=)	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Critical thinking and problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

Draft Zero

Strand 3: Communication Networks
Sub-strand 1: Computer Networks

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.3.1.1. Identify the concept of computer networking for global communication.	**B8.3.1.1.1 Describe the data communication models for networks.** Exemplar 1. Identify the different layers in the Open System Interconnection (OSI) model. 2. Discuss the purpose of the communication protocols.	**Communication and collaboration** Demonstrate behaviour and skills of working towards group goals
	B8.3.1.1.2 Describe the Internet, world wide web (www) and Internet Protocol (IP) addresses. Exemplar 1. Describe the Internet and the classes of internet addresses. 2. Distinguish between IPv4 and IPv6. 3. Explore the difference between internet and www	**Communication and collaboration** Identify and analyse different points of views of speaker

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Sub-strand 2: Internet and Social Media

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.3.2.1 Demonstrate the use of Social Networking and Electronic Mail	**B8.3.2.1.1 Identify the various types of Social Media sites such as Photo sharing (Instagram, Snapchat, Pinterest) and Video sharing (YouTube, Facebook Live, Periscope, Vimeo)** Exemplars 1. Discuss the use of Photo sharing sites such as Instagram, Snapchat, Pinterest etc. 2. Demonstrate the use of video sharing platforms such as YouTube, Facebook Live, Periscope, Vimeo etc. 3. Illustrate the steps involved in attaching a document to an email. 4. Explore the use of the address book as a feature of email.	**Communication and collaboration.** Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech. **Digital literacy.** Recognition of societal issues raised by digital technologies

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Sub-strand 3: Information Security

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.3.3.1. Recognise data threats and security protections.	**B8.3.3.1.1 Describe the nature of four major data threats (Interruption, Interception, Modification, Fabrication)** Exemplar 1. Watch a video on threats to data security. 2. Discuss the threats that can prevent information from reaching its destination. 3. Discuss the threats that can cause data corruption. 4. Describe the nature of four major data threats.	**Communication and collaboration.** Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech. **Digital literacy.** Recognition of societal issues raised by digital technologies
	B8.3.3.1.2 Map the protection methods to each of the four identified data threats (e.g. Authorisation, Authentication, Encryption and Decryption etc.) Exemplar 1. Brainstorm the methods of protecting data against the four main threats. 2. Describe the threats to data security and the methods of preventing each threat.	**Communication and collaboration.** Demonstrate behaviour and skills of working towards group goals **Critical thinking and problem solving** Identify extra information to solve a problem.

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Sub-strand 4: Web Technologies

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.3.4.1. Demonstrate the use of a Web Browser (Search engines)	**B8.3.4.1.1 Demonstrate how to effectively search from a web browser.** Exemplars 1. Identify effective search techniques (e.g. using search phrases, with exact spelling, use of AND, OR, NOT etc. 2. Demonstrate how to search with any of the techniques or a combination of techniques	**Digital literacy.** Use digital tools to create novel things **Critical thinking and problem solving** Ability to look at alternatives in creating new things
	B8.3.4.1.2 Explore the use of more than one search engine Exemplar 1. Investigate the use of more than one search engine e.g. Ask, Google, yahoo! 2. Explore different search engines with the same search string/terms and observe the outcome **3.** Discuss the results of your findings in exemplar 2 above.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Critical thinking and problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

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Strand 4: Computational Thinking
Sub-strand 1: Introduction to Programming

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.4.1.1. Show an understanding ofthe concept of programming.	**B8.4.1.1.1 Describe the basic concepts in programming (Constants, Variables, Expressions, Statements /Instruction, logical and arithmetic operators, Operator precedence).** Exemplar 1. Create a table to compare how the same arithmetic notations are represented in coding and in classroom mathematics	**Critical thinking and problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

Draft Zero

Sub-strand 2: Algorithm

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.4.2.1. Analyse correctstep-by-step procedure in solving any real-world problem.	**B8.4.2.1.1 Apply variables, expressions, assignment statements and operator precedence order (BODMAS rule) to process, store numbers and text in a program.** Exemplar 1. Compute an expression following the BODMAS principle to exemplify how computers process input data to print out an answer.	**Critical thinking and problem solving** Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem
	B8.4.2.1.2 Describe and use sequence, selection and iteration statements in a program. Understand the difference between variables and constants and be able to choose appropriate naming conventions when writing statements. Exemplar 1. Draw the four basic symbols representing program start-stop; input-output; process and decision. 2. Identify a real case problem in the environment and arrange the symbols to represent a logical step-by-step sequence in solving that problem. (Example, illustrate the logical steps to prepare the land for a maize farm).	**Creativity and innovation.** Ability to look at alternatives in creating new things **Critical thinking and problem solving** Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem

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Sub-strand 3: Robotics

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.4.3.1. **Discuss Robot intelligence concepts.**	**B8.4.3.1.1 Describe the principles of operation of the components of a robot (Controller Mechanical, Sensors).** Exemplar 1. Explain the controller as the "brain" of the robot. 2. Demonstrate understanding of mechanical parts such as motors, pistons, grippers, wheels and gears that make the robot move, grab, turn around or lift. 3. Watch video/pictures of the various parts of the robot. 4. Describe how a range of sensors can be used to input data into a computer system, including light, temperature, magnetic field, gas, pressure, moisture, humidity, pH and motion 5. Describe how these sensors are used in real-life scenarios, for example: street lights, security devices, pollution control, games, and household and industrial applications **NB: Sensors are used to estimate a robot's condition and environment. The controller isrun by a computer program**	**Communication and collaboration.** Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech **Critical thinking and problem solving** Analyse and make distinct judgment about viewpoints expressed in an argument

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Sub-strand 4: Artificial Intelligence

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B8.4.4.1 Discuss Artificial intelligence concepts.	**B8.4.4.1.1 Discuss Artificial Neural Networks (ANN) and compare intelligence in human, animals and Machines** Exemplar 1. Compare intelligence in humans, animals and Machines. 2. Compare the limitations and capabilities of the three intelligences in processing information 3. Discuss the difference between strong and weak artificial intelligence.	**Communication and collaboration** Understand roles during group activities

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Strand 1: Introduction to computing
Sub-strand 1: Components of Computers and Computer Systems

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.1.1.1.Identify parts of a computer and technology tools	**B9.1.1.1.1. Discuss the fifth generation of computers.** Exemplar 1. Discuss the features of the fifth generation computers 2. Discuss parallel processing hardware and Artificial Intelligence (AI) software	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group
	B9.1.1.1.2. Demonstrate understanding of direct data entry devices (graphic tablet, Magnetic card reader, optical card reader, QR code reader, Radio Frequency Identification (RFID) Readers) Exemplar 1. Identify Graphic tablet, Magnetic card reader, optical card reader, QR code reader, Radio Frequency Identification (RFID) Readers from video or pictures. 2. Explore features of these input devices. 3. Explore how these input devices work in real life situations 4. Generate QR codes and link them to specific websites.	**Digital literacy** Ability to find and consume digital content

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B9.1.1.1.3. Examine the uses of the output devices: Braille printers, Impact, Inkjet, Thermal, Wax), 3D printers Exemplar 1. Identify Braille printers, Impact, Inkjet, Thermal, Wax, 3D printers from pictures or videos. 2. Explore features of these output devices. 3. Explore how these output devices work in real life situations	**Digital literacy.** Ability to find and consume digital content
	B9.1.1.1.4 Describe Storage devices: Flash Memory Storage Systems, Embedded Flash Memory Cards and Readers USB Flash Drives, Solid State Drives and Hybrid hard drives. Exemplar 1. Illustrate the use of flash memory Storage Systems, Embedded Flash Memory, Flash Memory Cards and Readers, USB Flash Drives, Solid State Drives and Hybrid hard drives. 2. Discuss features of Flash Memory Storage Systems, Embedded Flash Memory Flash Memory Cards and Readers	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group. **Digital literacy** Ability to find and consume digital content

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.1.1.2. Demonstrate the use of features of the Desktop.	**B9.1.1.2.1 Explore the use of the Charms bar.** Exemplar 1. Identify the icons in the Charms bar 2. Describe features of the Charms bar icons	**Digital literacy** Ability to find and consume digital content
	B9.1.1.2.2. Practice file management techniques (Drive Management) Exemplar 1. Demonstrate the file management techniques such as defragmentation, compression of files etc. 2. Explore ways of partitioning a hard disk.	**Digital literacy** Ability to find and consume digital content

Draft Zero

Sub-strand 2: Technology in the community

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.1.2.1. Demonstrate the use of Technology in the community.	**B9.1.2.1.1. Discuss technologies that help to improve computer accessibility (adaptive and assistive technologies).** Exemplar 1. Identify the categories of people with special needs. 2. Discuss technologies that can be used to help people with special needs (E.g. Computer software and hardware, such as voice recognition programs, screen readers, and screen enlargement applications, to help people with mobility and sensory impairments use computers and mobile devices etc.)	**Digital literacy.** Ability to find and consume digital content **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.
	B9.1.2.1.2. Describe how portable computing devices affect our everyday lives. Exemplar **1.** Discuss portable computing devices that we use daily e.g. Mobile phones, smart watches etc. **2.** Describe how these devices affect our daily lives.	**Leadership** Ability to set and maintain personal standards and values **Digital literacy** Ability to find and consume digital content **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group.

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B9.1.2.1.3. Explain the issues associated with online services (e.g. social media, wikis, blogs etc.) Exemplar 1. Identify the online services that learners normally use or have access to. 2. Evaluate issues that are associated with online service delivery.	**Digital literacy.** Ability to find and consume digital content

Sub-strand 3: Health and safety in using ICT tools

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.1.3.1. Demonstrate how to apply Health and Safety measures in Using ICT Tools	**B9.1.3.1.1 Discuss Risk Reduction at Workstations** Exemplar 1. Demonstrate the use of appropriate volumes when using speakers and earpieces. 2. Demonstrate the use of screen protectors/spectacles to control the amount of light received by our eyes. 3. discuss the importance of taking regular breaks from bulk work	**Personal development and leadership.** Ability to set and maintain personal standards and values **Digital literacy** Ability to find and consume digital content

Draft Zero

Strand 2: Productivity Software
Sub-strand 1: Introduction to Word Processing

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.2.1.1 Demonstrate how to use Microsoft Word (Tables and hyperlink Pages)	**B9.2.1.1.1. Demonstrate how to create a Table and hyperlinks.** Exemplar 1. Explore the use of the Tables group under the Insert tab 2. Create tables, columns and resize them in MS-Word 3. Explore the use of hyperlinks to create non-linear presentations.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B9.2.1.1.2. Demonstrate how to merge, split, add formula, borders and shades. Exemplar 1. Explore Merging, splitting, add formulas, borders and shades in MS-Word under the Insert tab 2. Explore the use of the Bullets, Decrease and Increase Indentation, under the Home tab 3. Explore the use of the Border Button and set line spacing (E.g. explore the use of the dialogue Box Launcher button under the Home tab)	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B9.2.1.1.3. Demonstrate how to format a page (e.g. page adjustment, Header and Footer, page numbers, breaks and orientations) Exemplar 1. Demonstrate how to format pages by adjusting the header, footer, page numbers, and page orientation **NB. This is to help the learners with software knowledge in office applications (word processing) to grasp the concept better.**	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

Draft Zero

Sub-strand 2: Introduction to Presentation

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.2.2.1 Demonstrate how to use Microsoft PowerPoint (Multimedia)	**B9.2.2.1.1. Demonstrate how to add pictures, screenshot, edit and format pictures.** Exemplar 1. Explore the use of the Images Group under the Insert tab 2. Demonstrate the use of ClipArt, Photo Album and Screenshot 3. Show projected examples of PowerPoint interface to learners with the aid of a projector or pictures.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Communication and collaboration** Ability to work with all group members to complete a task successfully
	B9.2.2.1.2. Demonstrate how to add a drawing canvas, shapes, and also edit, format and add text to shapes. Exemplar 1. Explore the use of the Illustrations group under the Insert tab 2. Illustrate the use of Shapesand SmartArt 3. Explore the use of the drawing canvas to group shapes	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B9.2.2.1.3. Demonstrate how to add text to shapes, arrange shapes. Exemplar 1. Explore the use of the Format Ribbon once the shape is selected 2. Explore editing features of the Insert Shapes and Shape Styles 3. Present a prepared project or exercise using what has been studied in Indicator 1 and 2. **NB: This is to help the learners with software knowledge in MS PowerPoint, Office Applications to grasp the concept well.**	**Communication and collaboration** Ability to work with all group members to complete a task successfully **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

Draft Zero

Sub-strand 3: Introduction to Desktop Publishing

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.2.3.1. Demonstrate how to use MS-Publisher	**B9.2.3.1.1 Create and save a new document from a blank or pre-designed template.** Exemplar 1. Open a desktop publishing software (e.g. MS-Publisher). 2. Create a new document from a blank publication 3. Create a new document from a pre-designed template. 4. Save the document with the appropriate name.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B9.2.3.1.2 Demonstrate the use of the commands in MS-Publisher ribbons under each tab (Home, Page Design, Mailings, Review, View) Exemplar 1. Explore the use of the commands in a desktop publishing software in pairs (e.g. MS-Publisher ribbons: Home, Page Design, Mailings, Review, and View).	**Communication and collaboration** Ability to work with all group members to complete a task successfully **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B9.2.3.1.3 Change the orientation and margins of a document. Exemplar 1. Explore and change the orientation and margins of your document in pairs	**Communication and collaboration** Ability to work with all group members to complete a task successfully **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem.
	B9.2.3.1.4 Add and modify pictures from different sources. Exemplar 1. Explore addition and modification of pictures from different sources to your document in pairs.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem.

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B9.2.3.1.5 Add and modify text. Exemplar 1. Explore addition and modification of text in your document.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem.
	B9.2.3.1.6 Create and present a publisher document (flyer, Advertisement, Invitation cards, business cards) Exemplar 1. Create a one-page publisher document e.g. flyer, Advertisement, Invitation cards, business cards. 2. Present documents to demonstrate creative abilities.	**Communication and collaboration** Ability to work with all group members to complete a task successfully **Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges**.** **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem.

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Sub-Strand 4: Introduction to Electronic Spreadsheet

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.2.4.1. Demonstrate how to use the Spreadsheet. (using functions and complex formulas)	**B9.2.4.1.1. Perform operations using functions and Built-in functions** Exemplar 1. Enumerate the difference between formulas and functions. 2. Access built-in functions to perform operations on sample data. 3. Demonstrate the use of common spreadsheet functions such as; SUM, AVERAGE, COUNT, COUNTA, COUNTIF, MAX and MIN.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B9.2.4.1.2 Demonstrate how to create complex formulas Exemplar 1. Create complex formulas (e.g. finding percentages, commissions, interest rates etc.)	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

Draft Zero

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B9.2.4.1.3. Demonstrate how to copy formulas, and references Exemplar 1. Present the ways of copying and pasting formulas in a worksheet. 2. Explore how to reference cells and ranges in a worksheet. 3. Demonstrate the use of relative references in creating formulas. 4. Explore how to correct common formula errors. 5. Complete a project that involves creating a set of formulas with common functions (e.g. simple interest formula)	**Digital literacy**. Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

Draft Zero

Strand 3: Communication Networks
Sub-strand 1: Computer Networks

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.3.1.1. Know the concept of computer networking for global communications.	**B9.3.1.1.1 Discuss types of E-commerce and cashless society (Bitcoin, transaction cards, Quick Response code (QR) payment system).** Exemplar 1. Explore the use of the Internet to engage in online business; selling, buying and paying for products online. 2. Discuss the use of online banking systems (e.g. using mobile money, bitcoin, the use of MasterCard, Visa card, QR code payment system etc.).	**Digital literacy.** Ability to find and consume digital content Use synthetic and dynamic thinking abilities to create meaningful new combinations from existing information
	B9.3.1.1.2 Justify eLearning potentials. Exemplar 1. Explain the concept of eLearning, its benefits and disadvantages. 2. Discuss projects on a collaborative platform (e.g. iBox network, the use of ad hoc network to share resources, wikis [Google Docs] etc.)	**Communication and collaboration.** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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Sub-strand 2: Internet and Social Media

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.3.2.1 Demonstrate the use of Social Networking and Electronic Mail	**B9.3.2.1.1 Identify the advantages and issues in using social media platforms** Exemplars 1. Illustrate the benefits of using social media sites 2. Discuss the issues surrounding the usage of social media platforms and how to avoid them. 3. Explore reply, reply all, forward and forward all features of emails	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem.

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Sub-strand 3: Information Security

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.3.3.1. Recognise data threats and means of protection	**B9.3.3.1.1 Discuss cyberbullying, cyberstalking, digital footprint, digital shadow on the Internet.** Exemplars 1. Watch a film or read on cyberbullying, cyberstalking, digital footprint, digital shadows. 2. Discuss the nature of cyberbullying, cyberstalking, digital footprint, digital shadows. 3. Identify examples of cyberbullying, cyberstalking, digital footprint, digital shadows.	**Digital literacy.** Understand sociological and emotional aspects of work in cyberspace **Critical thinking and Problem solving** Ability to identify important and appropriate criteria to evaluate each alternatives **Communication and collaboration** Can vary the level of detail and the language use when presenting to make it appropriate to the audience
	B9.3.3.1.2 Explain 10 information hacking techniques on the Internet environment. Exemplars 1. Brainstorm information hacking techniques on the internet environment. 2. Explain 10 information hacking techniques e.g. phishing, keyloggers, Denial of Service attack, eavesdropping etc.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem .

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Sub-strand 4: Web Technologies

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.3.4.1 Demonstrate the use of a Web Browser (Blogging)	**B9.3.4.1.1 Examine the importance of creating blogs.** Exemplar 1. Discuss the importance of creating blogs.	**Creativity and innovation** Being open-minded, adapting and modifying ideas to achieve creative results **Digital literacy.** Ability to find and consume digital content
	B9.3.4.1.2 Develop a blog for the school or a social club. Exemplars 1. Investigate the items to include in a school or social club blog. 2. Develop a blog for the school or a social club.	**Digital literacy.** Use digital tools to create novel things
	B9.3.4.1.3 Explore the steps in publishing a blog. Exemplar 1. Identify steps in publishing a blog. 2. Demonstrate publishing a blog and invite others to comment.	**Digital literacy.** Use digital tools to create novel things

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Strand 4: COMPUTATIONAL THINKING
Sub-strand 1: Introduction to programming

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.4.1.1. Show an understanding of the concept of programming.	**B9.4.1.1.1 Describe the conversion of decimal into binary data type forComputer-machine to recognise the meaning, process and store**. Exemplar 1. Convert decimal, binary and hexadecimal from one format to another. 2. Show the results of calculating two or more binary numbers using the mathematical notation or operators in the number base two rule.	**Critical thinking and Problem solving** Can effectively evaluate the success of solutions they have used to attempt to solve a complex problem
	B9.4.1.1.2 Identify the different tools which are accessible in Integrated Development Environment (IDE) to aid the development of codes. Exemplar 1. Explore programming languages e.g. Snap, Scratch, Python to explain the key terminologies (variables, operators, controls, events etc.) around the coding environment. 2. Explore a web development program to create a simple website.	**Creativity and innovation.** Ability to try alternatives and fresh approaches **Critical thinking and Problem solving** Preparedness to recognise and explain results after implementation of plans

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Sub-strand 2: Algorithm

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.4.2.1. Analyse correct step-by-step procedure in solving any real-world problem.	**B9.4.2.1.1 Write a program using flowchart and Pseudocode algorithm that includes sequence, selection and iteration choices in the problem-solving.** Exemplar 1. Discuss at least three ways or processes to do proper hand-washing, prepare beverage with or without sugar and/or milk as an ingredient. 2. Write an algorithm for exemplar 1 that focuses on procedure correctness and shortest time to execute.	**Creativity and innovation.** Exhibit strong memory, intuitive thinking; and respond appropriately **Critical thinking and Problem solving** Ability to identify important and appropriate criteria to evaluate each alternatives
	B9.4.2.1.2 Translate a Flowchart algorithm to Pseudocode format and vice versa Exemplar 1. Write an algorithm using flowchart format. Convert or translate the same flowchart algorithm into a Pseudocode format. (Do a vice versa translation example to enforce critical thinking analysis)	**Creativity and innovation.** Ability to visualise alternatives, seeing possibilities, problems and challenges

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Sub-strand 3: Robotics

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.4.3.1. Discuss Robot intelligence concepts.	**.1 Construct a robot artefact using available lab components and tools or Emulator/Simulator software pack.** Exemplar 1. Explain the three basic laws of robotics by Isaac Asimov 2. Demonstrate how a Robot is assembled using real robots' toolkit/video/pictures. 3. Explore a robotic software pack, e.g. Scratch, Webot, Snap, Mbot software, EV3. Mobile Applications such as lightbot	**Creativity and innovation.** Ability to select the most effective creative tools for working and preparedness to give explanations **Critical thinking and Problem solving** Generate hypothesis to help answer complex problems

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Sub-strand 4: Artificial Intelligence

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B9.4.4.1 Discuss Artificial intelligence concepts.	**B9.4.4.1.1. Describe the knowledge-based systems (Expert systems) as the classical Artificial intelligence** Exemplar 1. Illustrate the use of IF-THEN control structure for querying an expert system 2. Demonstrate how to input a request in any knowledge-based system to generate an output or results. (E.g. Telemedicine system, Microsoft 'Encarta' encyclopedia) 3. Demonstrate how to go onto the web and use Google's Teachable Machine demo to get a basic understanding of how machine learning works (e.g.Whatisit as an open-source cloud-based app which can identify the object in the image/photo) **NB: Demonstrate how data is collected and the extent to which information can be used and thoughts on machine learning.** **https://teachablemachine.withgoogle.com/**	**Communication and collaboration** Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech. **Critical thinking and Problem solving** Preparedness to recognise and explain results after implementation of plans

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Strand 1: Introduction to computing
Sub-strand 1: Components of Computers and Computer Systems

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.1.1.1Identify parts of a computer and technology tools	**B10.1.1.1.1. Discuss the trends in the next generation of computers.** Exemplar 1. Identify features expected in the next generation of computers.	**Communication and collaboration** Identify and analyse different points of views of speaker Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication
	B10.1.1.1.2. Examine the concept of Perceptual Computing. Exemplar 1. Discuss the features of Perceptual Computing.	**Communication and collaboration** Identify and analyse different points of views of speaker Provide feedback in areas of ideas, organisation, voice, word choice and sentence fluency in communication

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B10.1.1.1.3 Discuss the uses of the Output devices: Wearable Displays, E-Paper, E-Books, Kindle Exemplar 1. Describe Wearable Displays (e.g. Google Glass),E-Paper, E-Books (e.g. Kindle)	**Communication and collaboration** Identify and analyse different points of views of speaker
	B10.1.1.1.4 Describe Storage Systems: Network and Cloud Storage Systems, Smart Cards,Holographic Storage, Storage Systems for Large Computer Systems (home servers or media servers). Exemplar 1. Discuss Network and Cloud Storage Systems, Smart Cards, Holographic Storage, Storage Systems for Large Computer Systems (home servers or media servers). 2. Explore common cloud storage examples, Google drive, One Drive, etc. 3. Discuss the pros and cons of using cloud storage	**Digital literacy.** Ability to find and consume digital content **Communication and collaboration** Identify and analyse different points of views of speaker

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.1.1.2. Demonstrate the use of the Desktop	**B10.1.1.2.1 Explore personalisation of the computer.** Exemplar 1. Change desktop icons. 2. Change mouse pointers.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B10.1.1.2.2 Identify and use file management techniques (Drivers and hardware) Exemplar 1. Identify and explore the use of device drivers E. g. sound drivers, video graphic drivers 2. Explain plug-and-play devices 3. Demonstrate how to install, update or delete drivers.	**Communication and collaboration** Identify and analyse different points of views of speaker **Digital literacy.** Ability to find and consume digital content

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Sub-strand 2: Technology in the Community (communication)

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.1.2.1. Demonstrate the use of Technology in the community.	**B10.1.2.1.1. Evaluate problems in the community that can be solved with technology.** Exemplar 1. Discuss problems in the community that can be solved with technology in pairs.	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group Understand and use interpersonal skills **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion
	B10.1.2.1.2. Propose solutions to the problems identified. Exemplar 1. Present technological solutions to the problems identified in B10.1.2.1.1.	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion
	B10.1.2.1.3. Design the solution selected. Exemplar 1. Design the solution selected. 2. Present the solution designed.	**Creativity and innovation.** Putting forward constructive comments, ideas, explanations and new ways of doing things **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

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Sub-strand 3: Health and safety in using ICT tools

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.1.3.1. Demonstrate how to apply Health and Safety measures in Using ICT Tools	**B10.1.3.1.1 Evaluate Risk Reduction at Workstations** Exemplars: 1. Discuss the use of ergonomic tools such as ergonomic keyboard, paper stand.	**Communication and collaboration** • Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group

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Strand 2: Productivity Software
Sub-strand 1: Introduction to Word Processing

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.2.1.1 Demonstrate how to use Microsoft Word (Multimedia)	**B10.2.1.1.1. Demonstrate how to add Pictures, insert a screenshot and screen clipping, and print screen.** Exemplar 1. Explore the use of the clip art, screenshot and screen clipping in the Insert Ribbon. 2. Demonstrate the use of the print screen key in capturing and inserting pictures.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B10.2.1.1.2. Demonstrate the use of SmartArt Exemplar 1. Illustrate the use of SmartArt in the Illustrations group of the Insert Ribbon.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B10.2.1.1.3. Demonstrate how to add Multimedia (audios, videos, animations), Charts and Hyperlinks Exemplar 1. Explore the use of the clip art and screenshot in the Insert Ribbon.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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Sub-strand 2: Introduction to Presentation

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.2.2.1 Demonstrate how to use Microsoft PowerPoint (Multimedia)	**B10.2.2.1.1. Demonstrate how to add pictures and insert screenshots.** Exemplar 1. Explore the use of the clip art and screenshot in the Insert Ribbon.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B10.2.2.1.2. Demonstrate how to animate slides in a presentation Exemplar 1. Demonstrate the use of transitions and animations. 2. Create a seven-slide presentation with animations and transitions.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem
	B10.2.2.1.3. Demonstrate how to add Multimedia (audios,videos etc), tables and charts Exemplar 1. Explore the use of the Insert Ribbon tab to add multimedia (Eg audios, videos etc) 2. Demonstrate the use of tables and charts in slides.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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Sub-strand 3: Introduction to Desktop Publishing

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.2.3.1. Critique a desktop published document.	**B10.2.3.1.1 Create and present a desktop published document. (flyer, Advertisement, Invitation cards, business cards)** Exemplar 1. Create and present a four-page document with images and overflow e.g. flyer, Advertisement, storybook.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Communication and collaboration** Ability to work with all group members to complete a task successfully
	B10.2.3.1.2 Describe a desktop published document. Exemplar 1. Give out your document to another learner assigned to you. 2. Examine the document received in terms of the position of text and images, use of colour, mechanics, content accuracy etc.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion **Communication and collaboration** Ability to work with all group members to complete a task successfully

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B10.2.3.1.3Evaluate a desktop published document. Exemplar 1. Evaluate the assigned document using but not limited to the following criteria; position of text and images, general layout of the document, use of color, mechanics (punctuation, spelling, italics, capitalisation etc.), appropriateness of the design for the intended purpose.	**Communication and collaboration** Ability to work with all group members to complete a task successfully **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

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Sub-strand 4: Introduction to Electronic Spreadsheet

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.2.4.1. Demonstrate how to use Spreadsheet(Advanced Operations)	**B10.2.4.1.1 Perform data filtering, sorting, validation** Exemplar 1. Describe Fields (columns), Records (Rows) and Tables (Structured/unstructured). 2. Illustrate examples of structured and unstructured tables. 3. Construct a structured data table of class members (e.g. Data table may have the following fields: (Surname, First name, Date of Birth, Sex, Home Town, Region etc). 4. Apply validation rules to check for errors. 5. Convert data tables to a list in MS Excel. 6. Demonstrate the ease of entering data to a list. 7. Demonstrate the use of validation list in the Sex column (in exemplar 3) to provide options in a drop-down for data entry. 8. Demonstrate how to sort data in alphabetical order (ascending/descending) and filter data to display only selected data.	**Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion **Communication and collaboration** Ability to work with all group members to complete a task successfully

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B10.2.4.1.2. Demonstrate how to use styles, themes, templates and macros Exemplar 1. Describe the difference between templates and macros. 2. Create new spreadsheets documents from predefined templates in MS Excel. 3. Demonstrate the use of styles and themes on sample worksheets. 4. Complete a project of formatting a dataset by applying styles and themes. 5. Explore the use of macros.	**Creativity and innovation**. Ability to visualise alternatives, seeing possibilities, problems and challenges **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem **Communication and collaboration** Ability to work with all group members to complete a task successfully
	B10.2.4.1.3. Demonstrate the use of data tables, pivot tables, charts and pivot charts. Exemplar 1. Explore pivot tables and charts. 2. Explore the use of a pivot table to display a summary of the dataset (refer to indicator B10.2.4.1.1). 3. Insert a pivot chart to display the number of Males and Females in the class. 4. Demonstrate the use of the sort and filter features of the pivot table.	**Communication and collaboration** Ability to work with all group members to complete a task successfully **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

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Strand 3: Communication Networks
Sub-strand 1: Computer Networks

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.3.1.1. Know the concept of computer networking for global communications.	**B10.3.1.1 Create an artefact to show Internet of Things (IoT) connectivity with sensors using a virtual science lab or physical laboratory tools (optional).** Exemplars: 1. Explain the meaning of the Internet of Things (IoT). 2. Identify the use of IoT in the community. 3. Demonstrate simple examples that can be found in the home (e.g. using your smartphone to switch on your television or air conditioner, using smartwatches to track your daily activities. Use Raspberry-pi or Arduino board to set up IoT network.)	**Creativity and innovation.** Ability to look at alternatives in creating new things **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion **Digital literacy.** Ability to find and consume digital content
	B10.3.1.2 Describe cloud computing Exemplars: 1. Explain the meaning of cloud computing 2. Identify cloud computing systems in Ghana (e.g. https://www.epay.gov.gh, https://passport.mfa.gov.gh/) 3. Discuss types of cloud computing services (Software as a service-SaaS, Infrastructure as a service-IaaS and Platform as a service-PaaS)	**Digital literacy.** Evaluate the quality and validity of information

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B10.3.1.1.2 Demonstrate how to use google GPS map for vehicle services and Ghana's digital address system. Exemplars: 1. Demonstrate how to obtain digital address using the Ghana Post GPS system 2. Demonstrate how to obtain digital addresses anywhere in the world. 3. Explore the use of smartphones to find directions to a place and give practical examples (e.g. taxi drivers or drivers using google GPS map to find their directions etc.)	**Digital literacy.** Use digital tools to create novel things **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

Draft Zero

Sub-strand 2: Internet and Social Media

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.3.2.1 Demonstrate the use of Social Networking and Electronic Mail	**B10.3.2.1.1 Demonstrate the processes involved in creating accounts on social media platforms for both personal and corporate use.** Exemplars 1. Explore the creation of accounts on social networking, microblogging, Photo sharing and Video sharing platforms for personal academic usage.	**Digital literacy** Use digital tools to create novel things

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Sub-Strand 3: Information Security

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.3.3.1. Recognise data threats and means of protection	**B10 .3.3.1.1 Demonstrate the benefits of protecting data.** Exemplar 1. Discuss laws governing data protection in Ghana and beyond. 2. Explore the benefits of data protection in society.	**Personal development and leadership** Recognise one's emotional state and preparedness to apply emotional intelligence **Digital literacy** Adhere to behavioural protocols that prevail in cyberspace **Cultural identity and Global citizenship** Develop and express respect, recognition and appreciation of others' culture **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group
	B10.3.3.1.2. Demonstrate how to protect data using alphanumeric (e.g. username, passwording, passphrasing) and biometrics (e.g. facial, gait, voice, iris, and retina recognition. It is also called multi-nodal biometric features) Exemplar 1. Discuss how data is protected using the username and passwording, passphrasing, facial recognition, gait recognition, voice recognition, and iris recognition. 2. Demonstrate data protection using alphanumeric and/or biometrics. **3.** Watch video or image of data protection using biometrics.	**Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group Demonstrate behaviour and skills of working towards group goals **Digital literacy.** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem

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CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
	B10.3.3.1.3 Demonstrate an understanding of data protection and Software intellectual property rights Exemplar 1. Review data protection and Software intellectual property rights as studied in B7.3.3.1. 2. Report a community engagement on data protection and Software intellectual property rights.	**Digital literacy** Ability to find and consume digital content **Communication and collaboration** Demonstrate behaviour and skills of working towards group goals

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Sub-strand 4: Web Technologies

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.3.4.1 Demonstrate the use of a Web Browser (Creating a page)	**B10.3.4.1.1 Demonstrate the tools and steps to consider in creating a webpage** Exemplar 1. Explore the tools and steps in creating a webpage e.g HTML, Content Management Systems (CMS)	**Creativity and innovation** Identification of requirements of a given situation and justification of more than one creative tool that will be suitable **Digital literacy** Ability to find and consume digital content
	B10.3.4.1.2 Demonstrate how to add an image and text to a webpage Exemplar 1. Demonstrate how to add images and text to a webpage	**Creativity and innovation** Identification of requirements of a given situation and justification of more than one creative tool that will be suitable **Digital literacy** Ability to find and consume digital content.
	B10.3.4.1.3 Explore the steps in publishing a webpage Exemplars 1. Show steps involved in publishing a webpage 2. Demonstrate publishing a web page created in B10.3.4.1.2.	**Creativity and innovation** Identification of requirements of a given situation and justification of more than one creative tool that will be suitable **Digital literacy** Ability to find and consume digital content

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Strand 4: Computational Thinking
Sub-strand 1: Introduction to Programming and Algorithm

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.4.1.1. Show an understanding of the concept of programming.	**B10.4.1.1.1 Identify errors in programming and how to debug them (e.g. Syntax, run-time and semantic error)** Exemplar 1. Explain how to detect semantic and syntax errors in any human language. 2. Use code snippets to identify errors in programming. 3. Explore how to debug the errors in programming.	**Critical thinking and Problem solving** Demonstrate a thorough understanding of a generalised concept and facts specific to task or situation **Digital literacy** Ability to find and consume digital content
	B10.4.1.1.2 Demonstrate simple coding task on a selected Integrated Development Environment (IDE) Exemplar 1. Write simple programmes using IDEs such as Scratch, Kodu, Visual Studio, online App inventor platforms etc.	**Creativity and innovation** Ability to merge simple/ complex ideas to create novel situation or thing **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion **Digital literacy** Ability to find and consume digital content

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Sub-strand 2: Algorithm

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.4.2.1 Analyse correct step-by-step procedure in solving any real-world problem.	**B10.4.2.1.1 Use a trace table to follow a pseudocode algorithm** Exemplar 1. Create a trace table for a simple pseudocode algorithm. 2. Use trace tables to follow other pseudocode algorithms.	**Creativity and innovation** Ability to merge simple/ complex ideas to create novel situation or thing **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion **Digital literacy** Ability to find and consume digital content
	B10.4.2.1.2 Demonstrate understanding for using logical gates in programming. Exemplar 1. ***AND gate:*** Draw the symbol, the switching arrangement and derive the truth table (binary 0, 1) using the switching arrangement. 2. ***OR gate***: Draw the symbol, the switching arrangement and derive the truth table (binary 0, 1) using the switching arrangement. 3. ***NOT gate:*** Draw the symbol, the switching arrangement and derive the truth table (binary 0, 1) using the switching arrangement.	**Creativity and innovation** Ability to merge simple/ complex ideas to create novel situation or thing **Critical thinking and Problem solving** Ability to combine Information and ideas from several sources to reach a conclusion

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Sub-strand 3: Robotics

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.4.3.1. Discuss the flying Robot (Drone)	**B10.4.3.1.1 Discuss the principle of operation of the flying robot (Drones/ Unmanned Aerial Vehicle) and various productive applications in society** Exemplar 1. Watch videos/pictures of drones as an example of emergent robots (flying robots). Illustrate how drones work. (e.g. Drones being used in Ghana's health service delivery). 2. Explore different types of Drones and their specific applications in society. 3. Describe how the Unmanned Aerial Vehicle (UAV/Drone) is used for multimedia image coverage (photography). **NB: This is to help learners appreciate the importance of drones in our Ghanaian society.**	**Critical thinking and Problem solving** Provide new insight into controversial situation or task **Digital literacy** Ability to find and consume digital content

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Sub-strand 4: Artificial Intelligence

CONTENT STANDARD	INDICATORS AND EXEMPLARS	SUBJECT SPECIFIC PRACTICES AND CORE COMPETENCIES
B10.4.4.1 Discuss Artificial intelligence concepts.	**B10.4.3.1.1 Discuss the principle of operation of the flying robot (Drones/ Unmanned Aerial Vehicle) and various productive applications in society** Exemplar 1. Watch videos/pictures of drones as an example of emergent robots (flying robots). Illustrate how drones work. (e.g. Drones being used in Ghana's health service delivery). 2. Explore different types of Drones and their specific applications in society. 3. Describe how the Unmanned Aerial Vehicle (UAV/Drone) is used for multimedia image coverage (photography). **NB: This is to help learners appreciate the importance of drones in our Ghanaian society.**	**Critical thinking and Problem solving** Ability to effectively define goals towards solving a problem Ability to explain plans for attaining goals **Digital literacy** Ability to ascertain when information is needed and be able to identify, locate, evaluate and effectively use them to solve a problem Preparedness to make better decision with information at hand **Communication and collaboration** Speak clearly and explain ideas. Share a narrative or extended answer while speaking to a group Explain ideas in a clear order with relevant detail, using conjunctions to structure and speech

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COMPUTING SUBJECT PANEL MEMBERS

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